
NTi AUDIO
08:56:45
TA
96%
Sound Level Meter
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 1.26.0 Rev. 2024-01-15

Firmware: V 1.26

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.

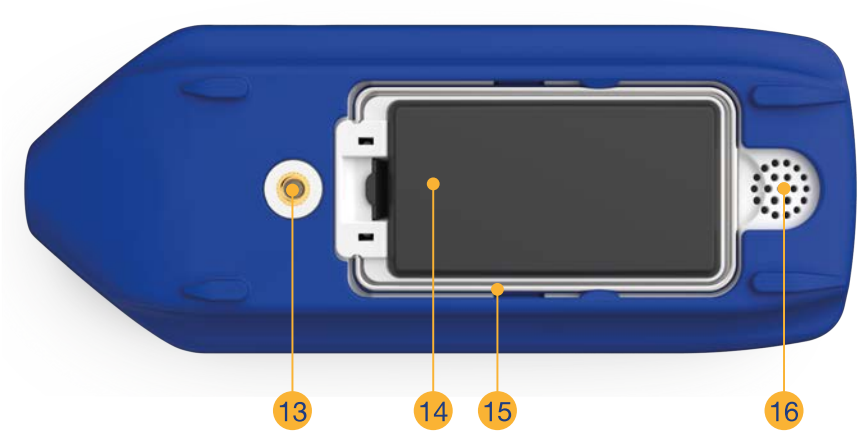
1.1 Interfaces

These here are the interfaces and controls of the XL3.

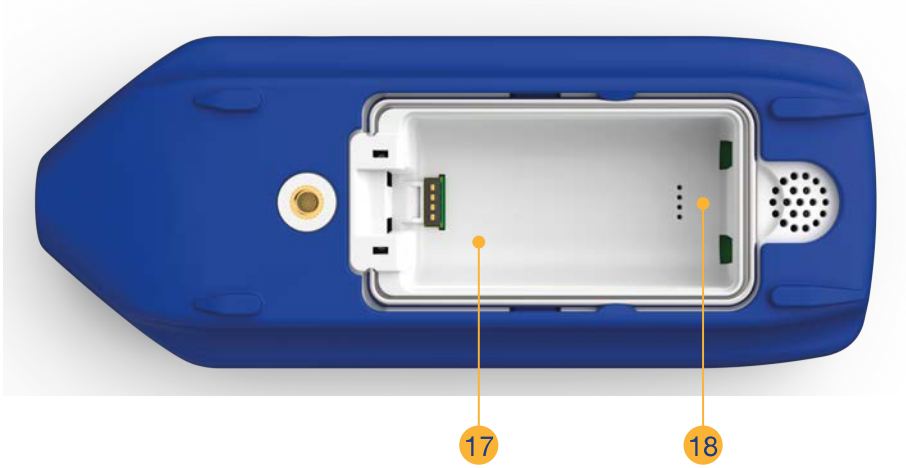
1	Balanced XLR microphone or audio input. The XLR input has an automatic sensor detection ASD, i.e. as soon as an NTi Audio microphone is connected, the XL3 automatically switches on the 48 V Phantom power and reads the calibration data of the measurement microphone.
2	Programmable digital input/output interface for controlling external devices (e.g 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: ● No charger / power supply unit is connected; ● The charger is connected and the battery is fully charged; ● The power supply unit supplies the device with power and charges the battery; ● (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. Do NOT press this button unless instructed by the NTi Audio support.

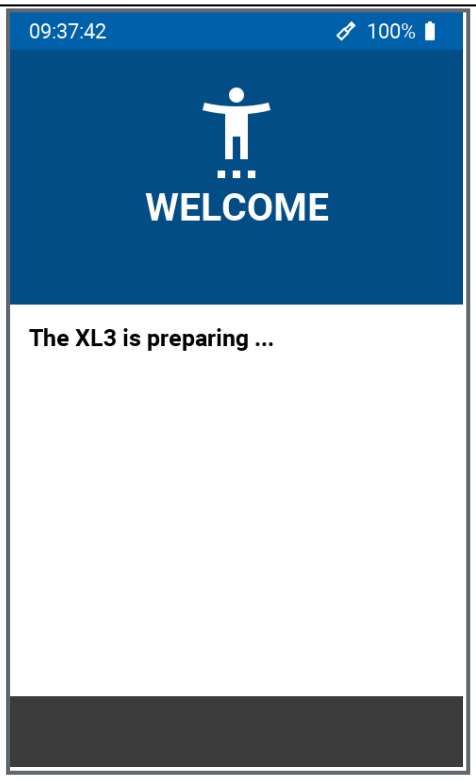
19	The built-in light sensor will allow the XL3 to automatically adjust the brightness of the display and LEDs to the ambient conditions if desired (planned).
20	● (dark) no network connection; ● (yellow) Network detected, but no connection established yet; ○ (white) Connection to the internet established; ● (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:

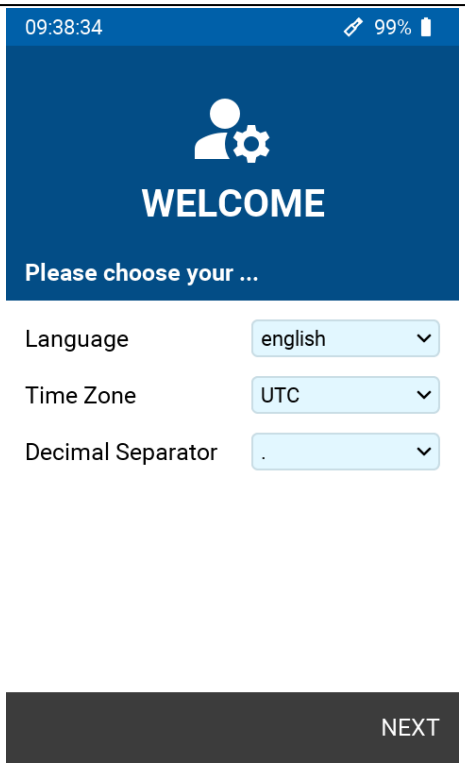
a. When you switch the instrument ON the for the first time;

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.



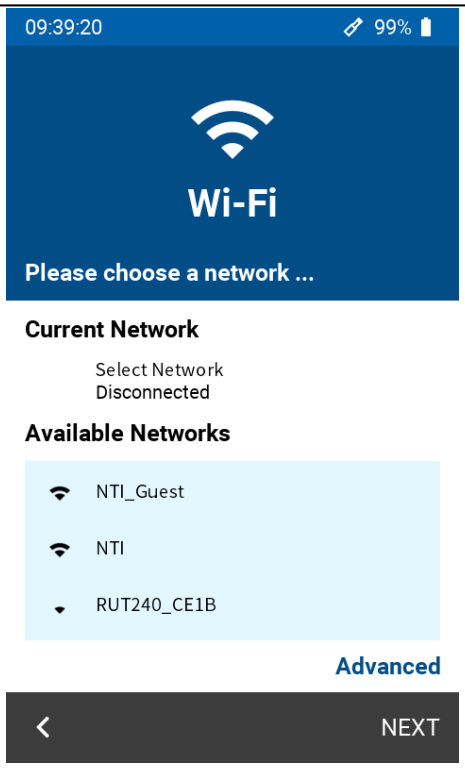
Step 2

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).

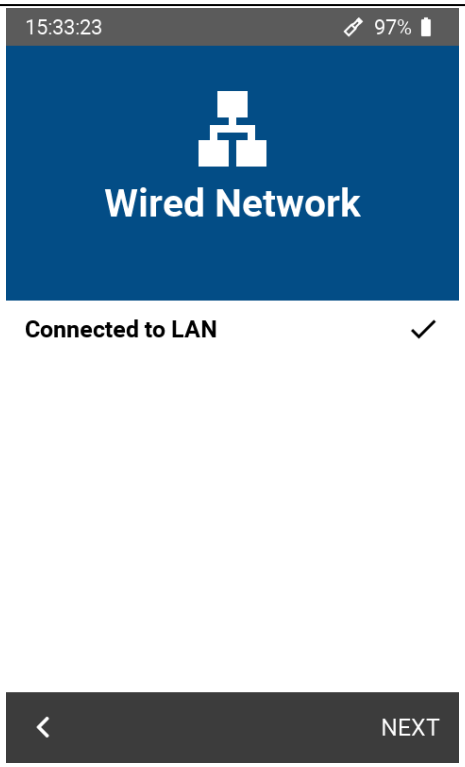
Tap on "**NEXT**" to proceed.



Step 3

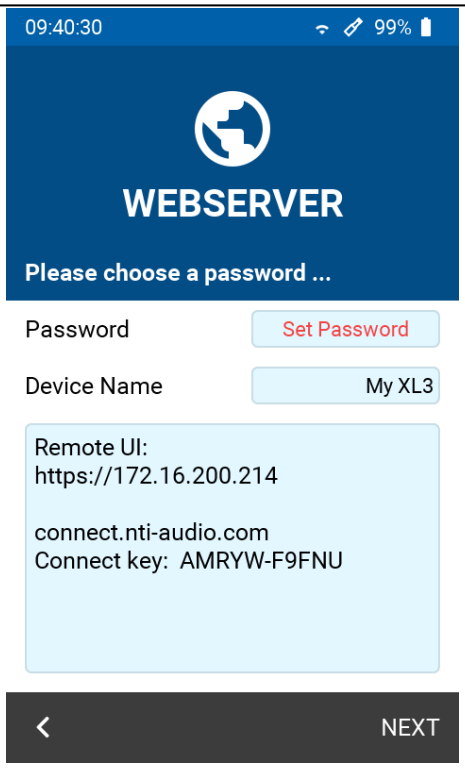
Select the preferred Wi-Fi network from the list and enter the applicable password.

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.

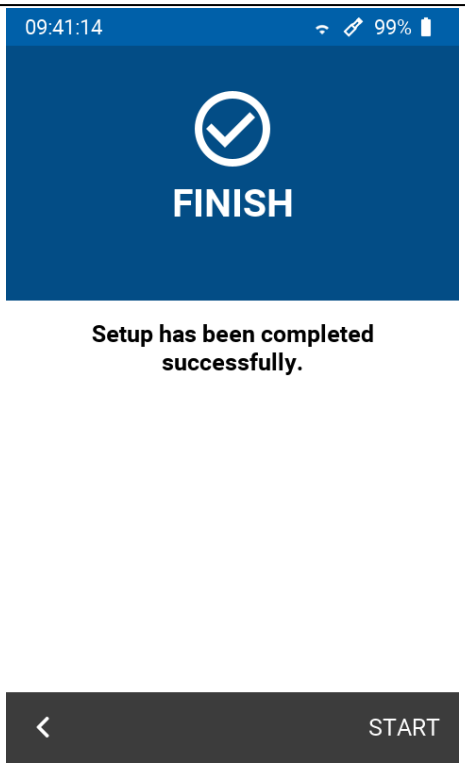


Step 4

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 touch-screen.

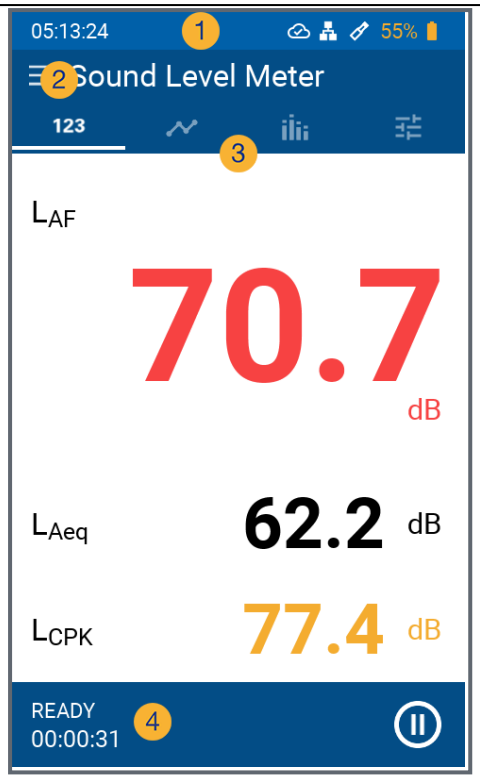
	Press the On/Off key for approx. 2 seconds to switch ON the XL3. During operation, press the On/Off key briefly to switch the display ON or OFF (but not the meter). When the display is switched OFF, the key shows the state of the instrument: • Pulsing slowly – XL3 is ON; • Flashing – Measurement is running; • 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).
	
	The ESC key terminates any selection and closes the open window. The cursor returns to the main menu.
	By pressing the OK button you confirm the current cursor selection, as for instance the measurement function or the parameters.
	Starts a measurement.
	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:

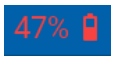


1	The status bar displays general information such as the time of day, network status, microphone connection and battery status. Swipe down to expand this area.
2	Tap on the Main Menu to select the required measurement function (available measurement functions depend on the installed options).
3	Display 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

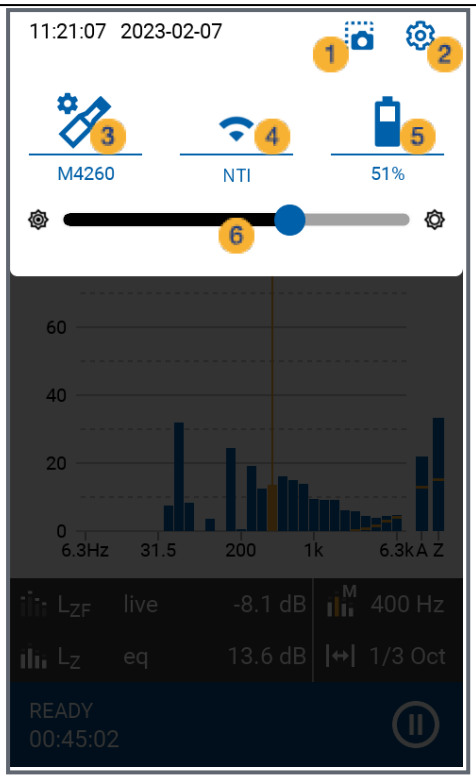
Always shows the current time of the device on the left. The time is automatically synchronized with the internet via the NTP protocol when there is a network connection.

		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.
		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.
		The XL3 has pushed (i.e uploaded) all the files from its internal memory to the cloud drive.
		An error has occurred during the uploading process, or the service is incorrectly configured; check the log file for more information.

	Icon	Animation	Meaning
		Static	Current charge status of the Li-Ion battery (100% = full); an animated icon indicates that the battery is charging.
		Static	Standard discharge
		Static	Low battery level
		Blinking	Critical battery level
		Slow charge level animation (every 1s)	Slow charge (Could happen if used a 5V USB connection)
		Fast charge level animation (every 0.5s)	Fast charge (With a USB-PD charger or through the DC jack)
		Slow charge level animation (every 1s)	Connected to power supply but unable to charge
		Blinking	Temperature error while charging or discharging
		Static	Battery error (e.g battery has been removed during operation)
		Static	No battery detected
		Blinking	Critical error
		Static	(red) WARNING – Battery failure! Observe the error message (see chapter Commissioning) or contact the NTi Audio support.
		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.	

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;
- The battery must not be operated with reversed polarity;
- 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.

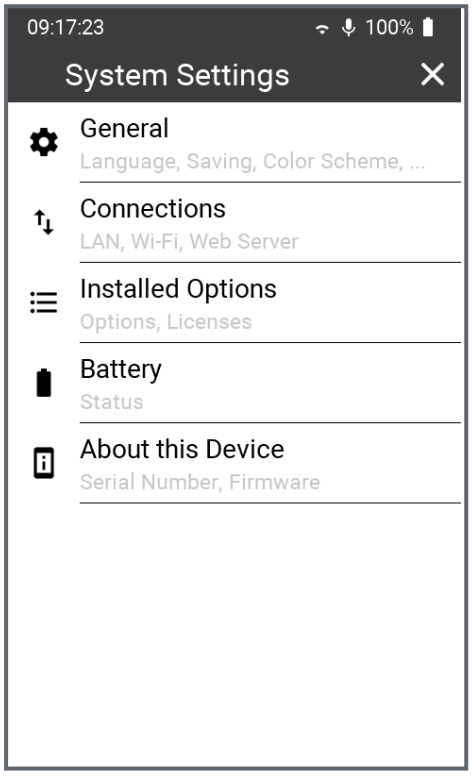
3.4 Acoustic measurements

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.

manually	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. Therein, you may edit the **Folder**, **Name** and **Comment**. After that, tap on **CANCEL** to abandon or on **OK** to save a report. Manual saving is useful, for example, if you are performing trial measurements and do not always want to save all the results. Measured values that are not saved yet, are retained even when the XL3 is switched OFF. You can still save them by tapping on 
prompt	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**. 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.
automatic	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. Select this mode if you want to be sure that all measurement data are always stored.

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:

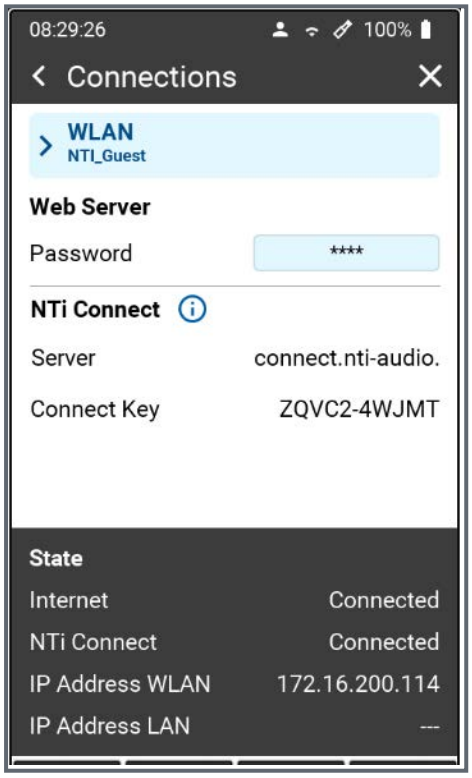
a. Directly via the built-in Wi-Fi transmitter / receiver;

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 established yet
○	(white) Connection to the internet established
●	(blue) Connected to connect.nti-audio.com



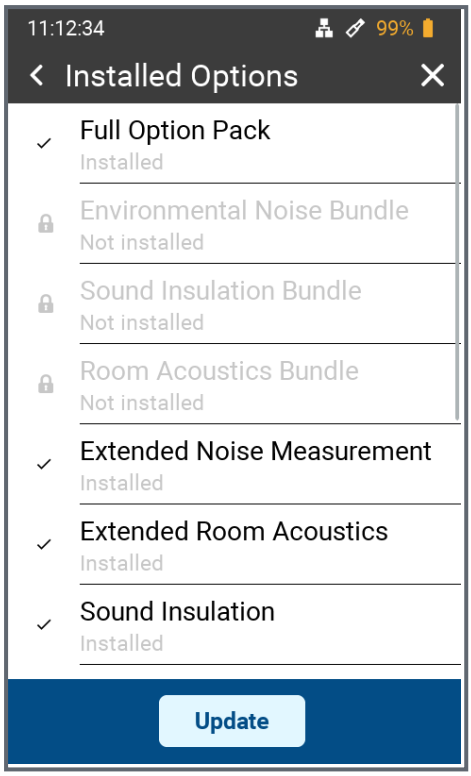
This setup shows the current status of the Wi-Fi connection and the assigned IP address of the device. The IP address is important for the connection with the web server. Under NTi Connect you may see the URL of the connection server and the unique connection key of your XL3. This key and the to be defined 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 Fair Use Principle for NTi Connect 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.

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 online 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.

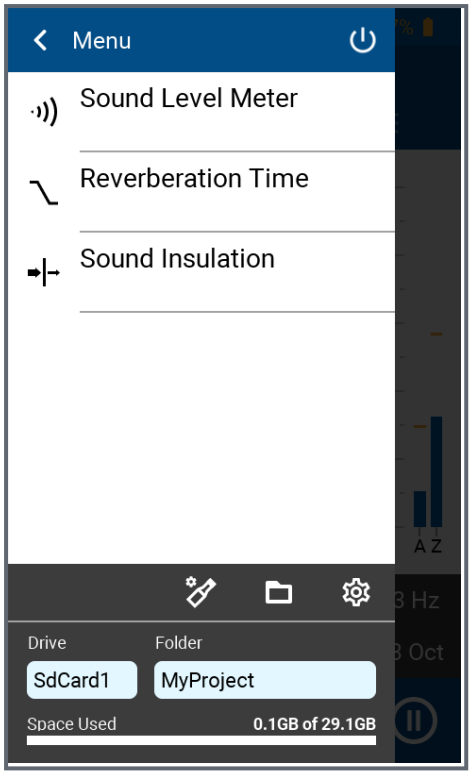
3.6.5 About this device

Under this menu item you will find:

- The serial number of the device;
- The selectable device name (factory setting: "My XL3");
- The 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.

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 Advanced 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.

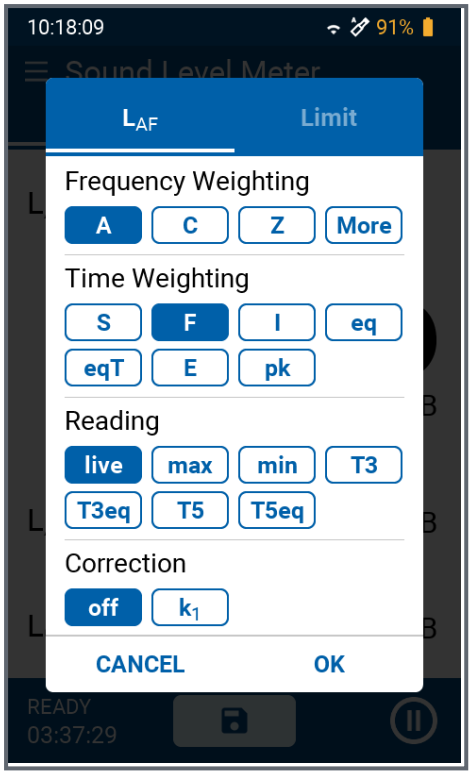
The Level-Time graph.

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.

4.1.3 Numerical level display

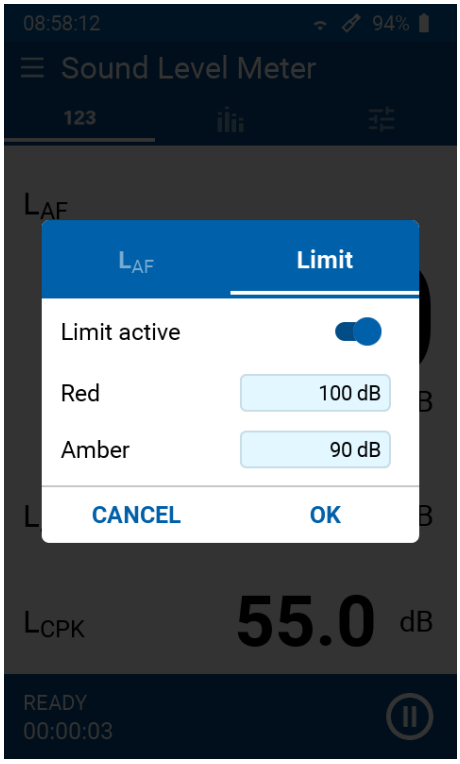
This page shows a freely configurable selection of sound levels. You can adjust the page layout under Display layout.



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.

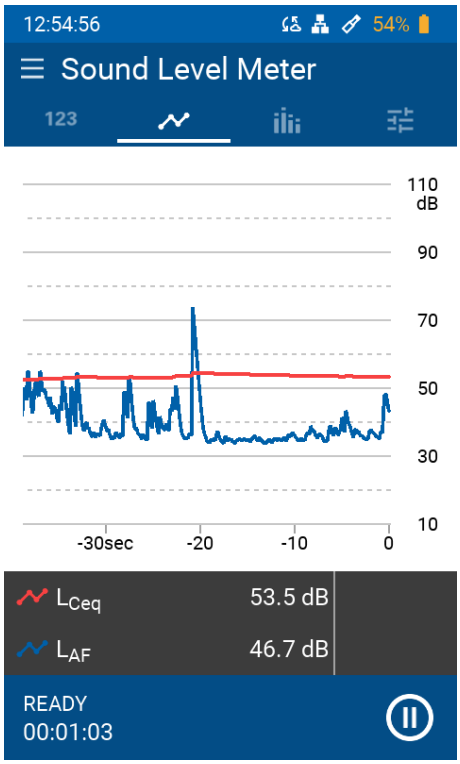
Spectral values as well as percentile values can be found at **More.**

> 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.

4.1.4 Level-time history



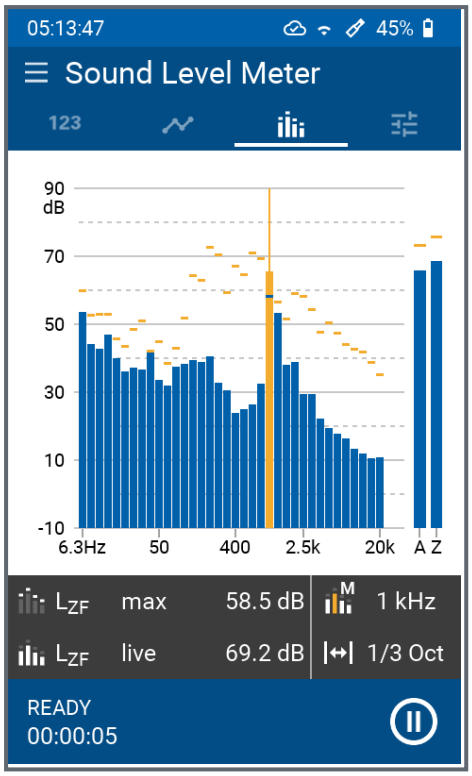
In level-time history display, two selectable level values are plotted over time, while the measurement is running. Tap on the red (or blue) curve icon to open the pop-up panel where you can select the corresponding levels. If you amend a level during a measurement, the corresponding curve will re-start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



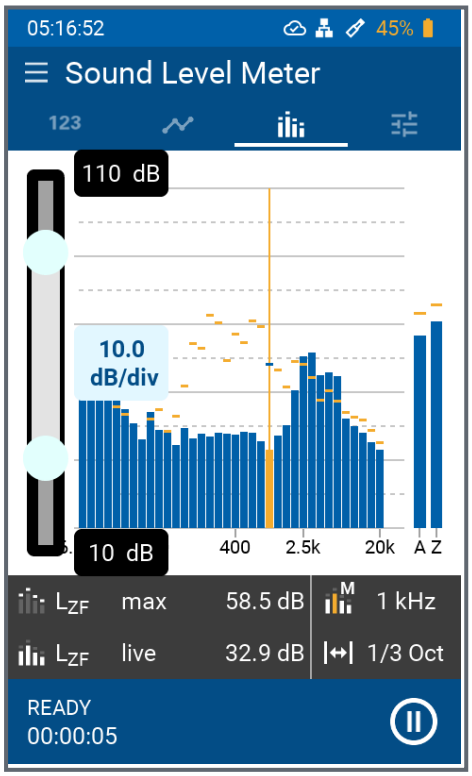
In the spectral display up to 2 spectra as well as the A- and Z-weighted broadband levels are displayed simultaneously.

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



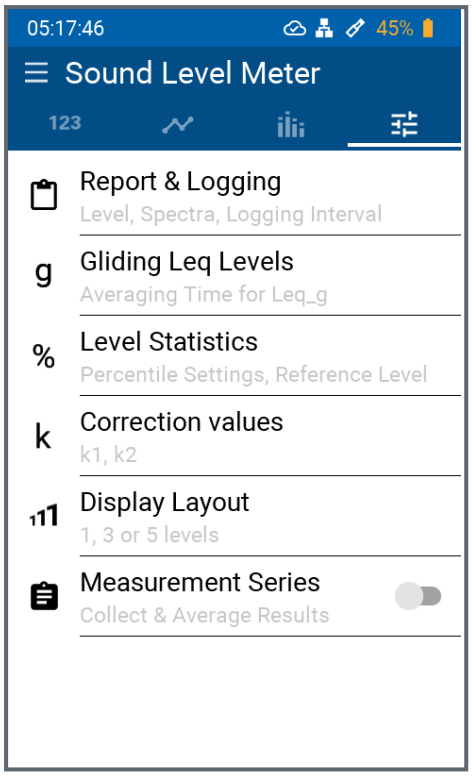
By long tapping on the X or Y axis, you can change the corresponding scale.

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:

- Selection of sound levels and measurement parameters to be recorded;
- Averaging duration (length of time windows) of the moving Leq levels;
- the parameters of the percentile statistics;
- Input of correction values for offset level measurements;
- the layout of the numeric display;
- (De)activation of measurement series.

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.

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.

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).

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.

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. The level of the WAV file is automatically controlled and optimized for good audibility.

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.

Memory consumption of WAV files

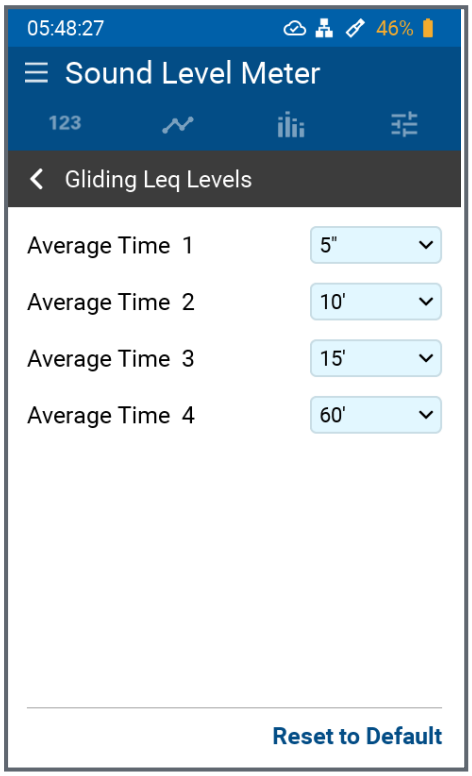
The following table shows the memory consumption of all possible combinations.

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

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 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

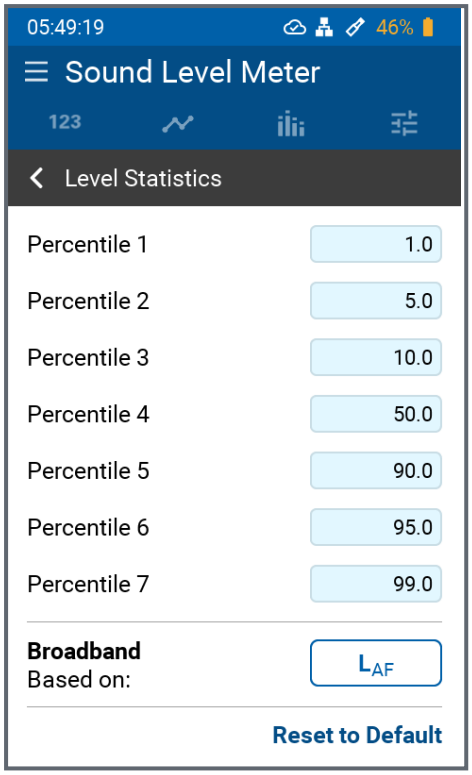
10:00:06 Leq5" = Leq of the time window from 10:00:01 to 10:00:06

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;

4.1.6.3 Level statistics

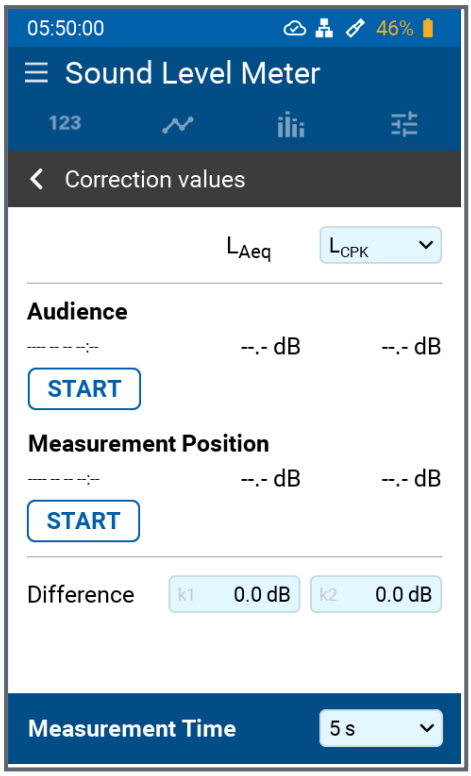


The instrument calculates up to 7 different percentile levels for broadband and spectral measurements. These data represent the statistical sound level distribution, and are typically used for environmental noise measurements. Here, for example, LAFxx% corresponds to a noise level exceeded during xx% 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 1/3rd Octave spectral resolution: in 1 dB class width.

4.1.6.4 Define K-values

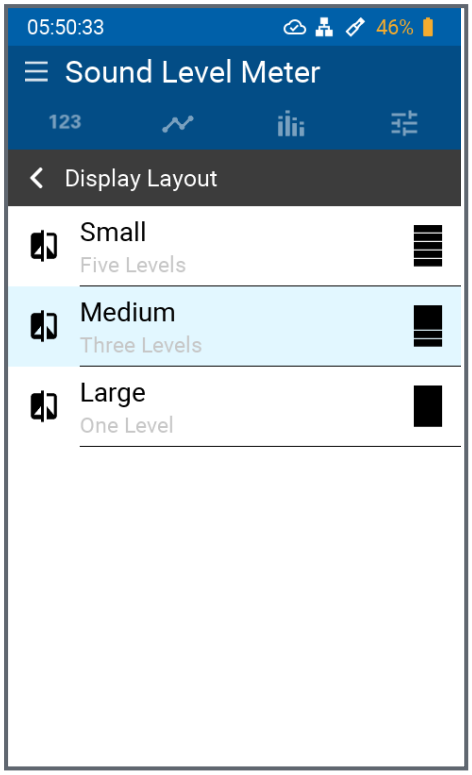


At live concerts, you often cannot place the meter directly at the loudest measurement location (**Audience**), but must place it at an alternate location (**Measurement Position**). This leads to differences between the A- and C-weighted levels measured at the substitute location and those prevailing 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.

4.1.6.5 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**".

4.1.7 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).

4.2 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 5 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.

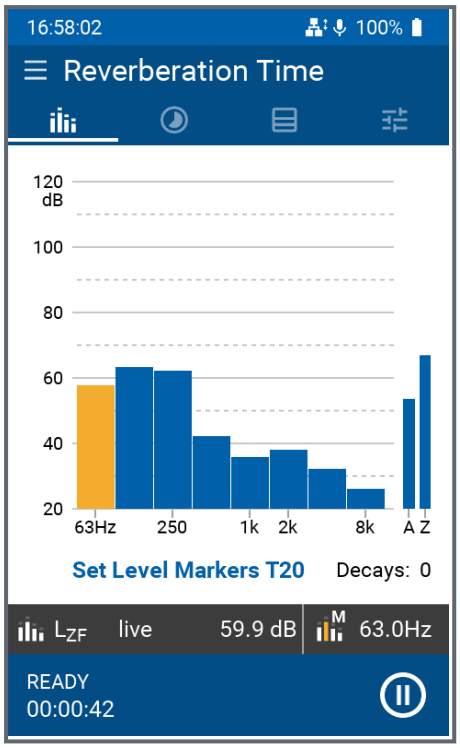
Displays the current spectrum in octave or third octave band resolution. Below the spectrum you will find the information about the measurement mode and the number of recorded measurement cycles.

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

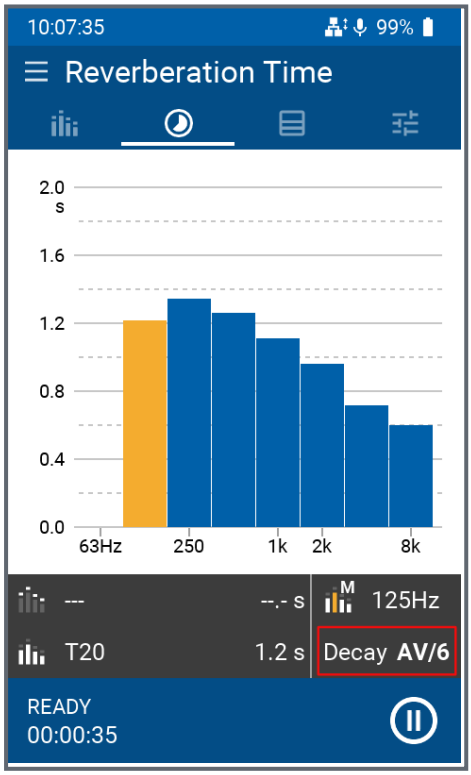


Here the spectrum of the current level is displayed in the selected resolution (octave or third octave bands).

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

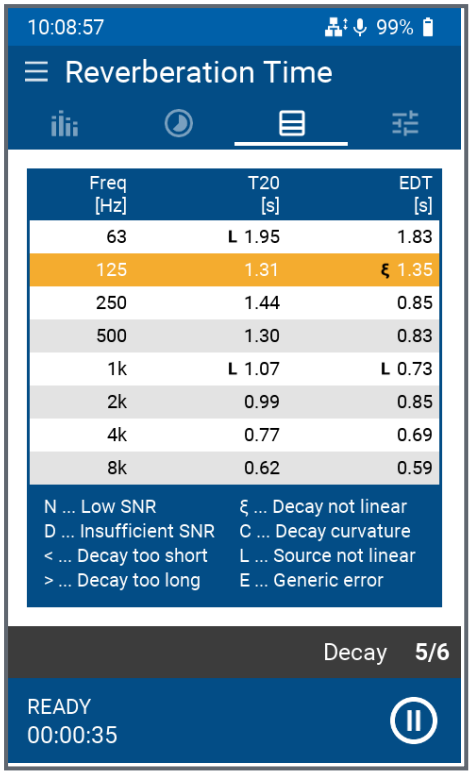


As soon as an initial measurement of the reverberation time has been performed, the device displays the spectral mean values. The single result of the yellow marked band appears below - you can select it with the arrow keys.

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.

4.2.3 Perform reverberation time measurement

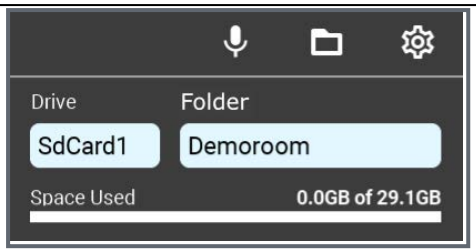
Place the XL3 in the room according to the standards and install the source for the sound signal (e.g. DS3 dodecahedron loudspeaker). The measuring device must not be in the near field of the source, otherwise measurement errors will occur. Also note that measuring reverberation time at low frequencies 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 .



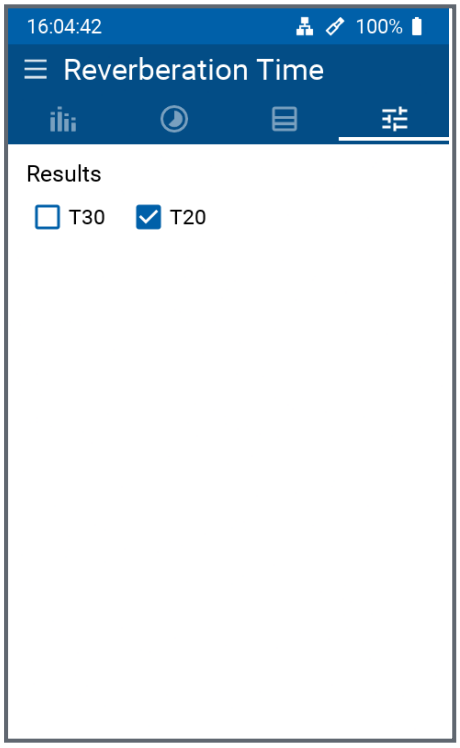
Tap at the bottom left under Drive to select the desired storage and then define the folder where you want to store the results.

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).

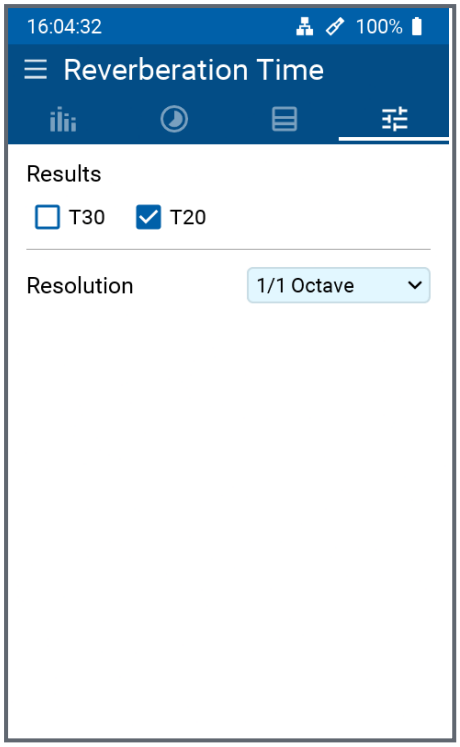


Selectable parameters (base version):

- 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).

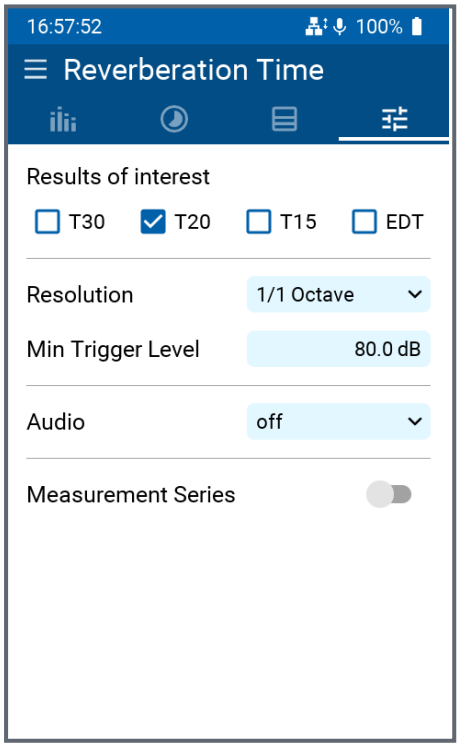


Selectable parameters, available with the **Sound Insulation** option:

- 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;
- Min. trigger level: adjustable from 50 to 100 dB. This is the minimum signal level required for triggering a reverberation time measurement;
- 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.

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.

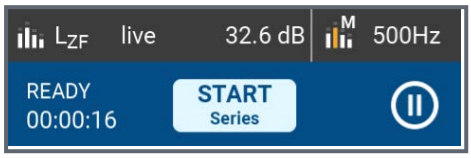
Press STOP last to complete the single measurement and save the averaged results in an ASCII text file on the device.

Measurement series

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

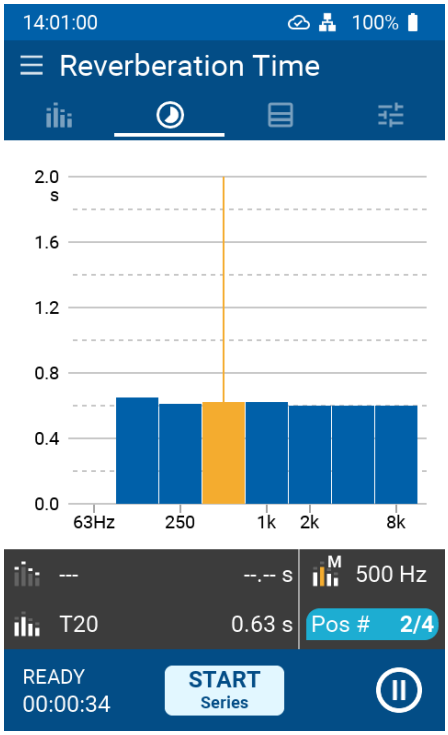
urements are made at different locations in the room and their results are averaged to produce an overall reverberation time result.

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.

Now you can select and view the results of the individual measurements (e.g. "2/4") as well as the averaged total value ("AV") by tapping on "Pos #".

4.2.3.4 Measurement file

Below you can see another example of a file with the results of a reverberation time measurement series. The formatting of this file is such that it can also be imported into MS EXCEL.

```
XL3 RT Report:
--------------

# Hardware Configuration
        Device Info:            XL3, SNo. A3A-00220-C0, FW0.90.4063
        Mic Type:               NTi Audio M4261, S/N 1786, Calibrated 2020-09-15 11:27
        Mic Sensitivity:        20.44 mV/Pa
        Time Zone:              Etc/Etc - UTC (UTC +01:00 DST)

# Measurement Setup
        Resolution:             1/1 Octave

# Time
        Start:                  2022-06-23, 10:04:28
        Stop:                   2022-06-23, 10:06:20

# RT Cycle Results
                                        Start Time      Band [Hz]       63                                      125
        Comment                 Cyc     Offset                          T20     EDT     Status          T20
                                        [hh:mm:ss]                      [s]     [s]                     [s]
                                01      00:00:03                        1.90    1.92    LL              1.35
                                02      00:00:06                        2.03    1.78    L-              1.24
                                03      00:00:11                        1.69    1.70    L~              1.09
                                04      00:00:18                        2.16    1.64    LL              1.21
                                05      00:00:20                        1.95    1.83    L-              1.31
                                06      00:00:26                        1.73    1.75    L~              1.14
                                av                                      -.--    1.81    --              1.22


#CheckSum
        dx/1xxN+8OExTRXFsRvumIFFxgXjcggdx/y4kVU4uqxSyT8WMKwhtTwu07/6bBakrY82RGp+sAyIWMhHM8aX4uAh/9uRexqn6Sgr
```

4.3 Sound insulation

The XL3 supports the measurement of sound insulation, i.e.:

- Airborne sound insulation;
- Impact sound insulation (planned);
- Facade sound insulation (planned).

Activate this measurement function by tapping the menu icon  in the upper left corner and then "Soundproofing". The instrument supports the continuous recording and display of the various individual measurements required to determine the desired sound attenuation.

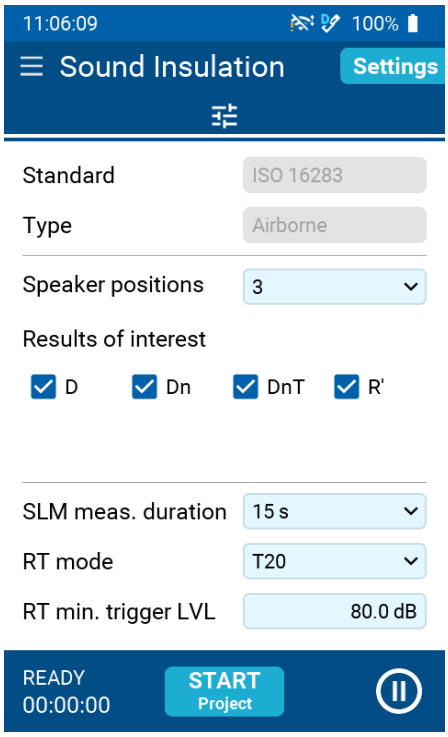
4.3.1 Measurement sequence & page selection

To determine the sound attenuation, first place the noise source in the transmitting room, and then measure in both the transmitting and receiving rooms those parameters that are necessary for calculating the result. For this purpose, the XL3 shows on the display either the necessary settings, or the sound level spectrum in the transmitting or receiving room, i.e.:

- L1: Level in the transmitter room;
- L2: Level in the receiving room;

- B2: Background level in the receiving room;
- T2: Reverberation time in the reception room.

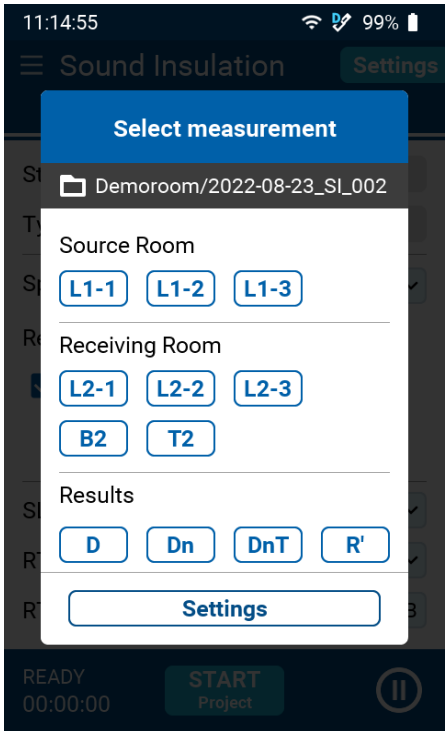
To select the desired page, tap the corresponding button at the top right of each page.



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

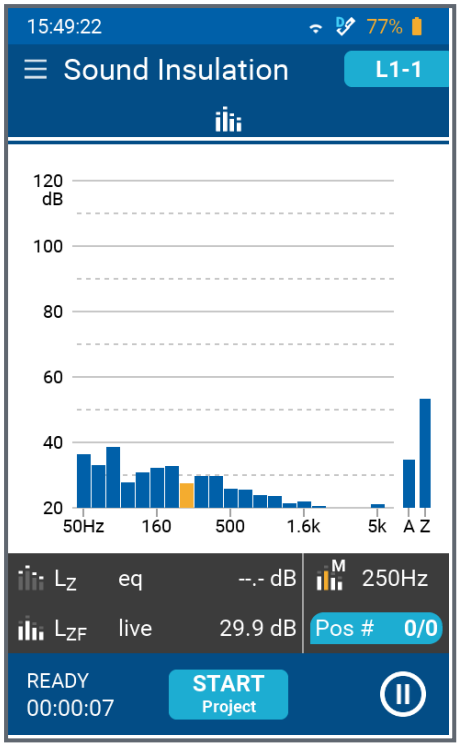
- Standard: ISO16283;
- Type: Airborne sound;
- Speaker positions: 1, 2, 3 or 4;
- Results of interest: D, Dn, DnT and/or R';
- SLM measurement duration: 6, 15, 30 or 60 seconds;
- RT Mode: T20 or T30;
- RT min. Trigger level: 80 dB.

> Select the appropriate settings before starting the measuring procedure!



On the "**Select measurement**" page, you can select the measurement to be performed next.

- Transmitting room: L1-x = position of the noise source in the transmitting room (number of available positions depends on the above-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';
- Settings: Return to the "**Settings**" page (see above).



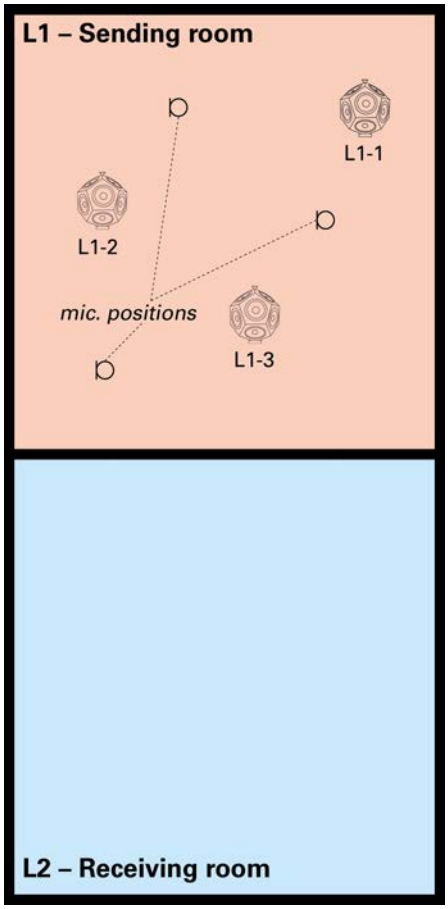
If you now tap e.g. on L1-1, the page with the current sound level spectrum in octave band resolution appears.

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

Furthermore, you can tap the button Pos # 0/0 at the bottom right at any time to view the results measured up to that point or their average value "AV".

Place the noise source in the transmitter room at position #1 and tap the button START Project to start the measurement cycle.

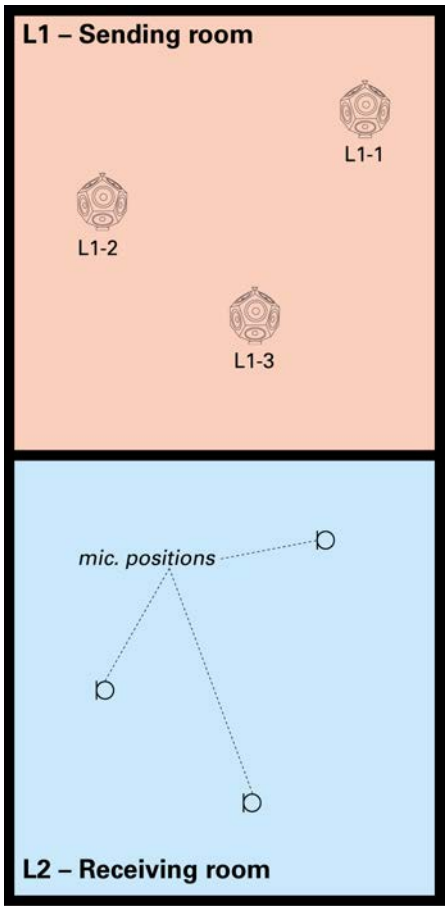
> Put on suitable hearing protection before switching on the sound source!



Switch on the noise source (e.g. dodecahedron loudspeaker DS3) and move to the desired measurement position. Now press the START key to start 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 transmitter room.

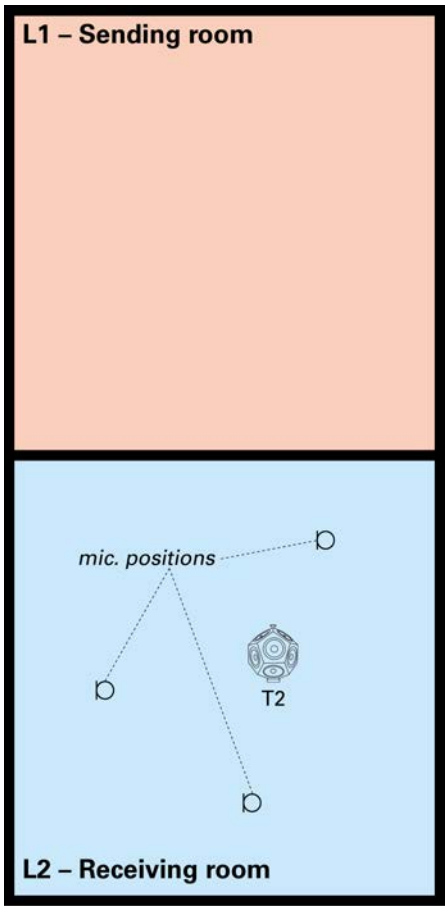
Once you have taken enough individual measurements for L1-1, press the STOP key.



Now go to the L2 receiving room and select L2-1 on the "Select measurement" page.

Turn on the sound source (still located at position #1 in the transmitting room) and press the START button to start the first sound level measurement in the receiving room.

Then carry out the other measurements in the receiving room for data set L2-1 and finally press the STOP key.



Select L1-2 on the Select Measurement page and place the noise source in the transmitter room at position #2.

Repeat the above Measurements in the transmit and receive room for noise source position #2.

Continue in this manner until you have completed all L1-x and L2-x measurements for the various positions of the noise source in the transmitter room.

Now place the dodecahedron loudspeaker in the receiving room to determine the reverberation time T2.

Select T2 on the "Select measurement" page.

START

Press to start the reverberation time measurement and switch the speaker On and Off again several times.

STOP

Then press .

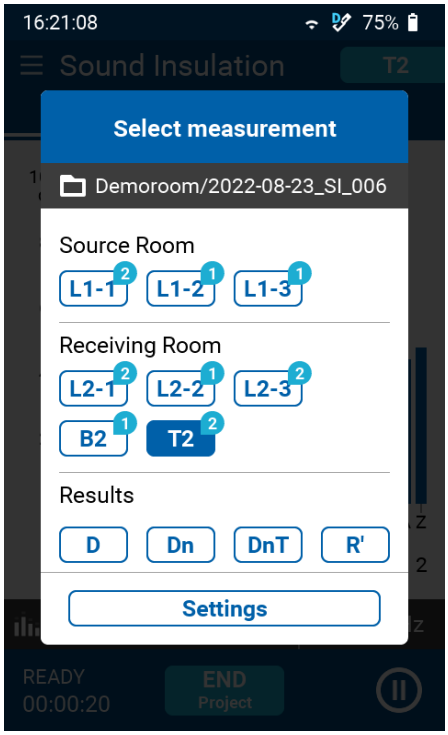
Finally, measure the background sound level B2 in the receiving room (i.e. with the noise source switched off).

To do this, select B2 on the **"Select measurement"** page and press the START key.

End the measurement series by first pressing the STOP key and then tapping END Project.

Now you can view the measurement results D, Dn, DnT or R' individually by tapping the corresponding button under "**Results**".

NOTE: At any time during an ongoing measurement series, you can view how many individual measurements have been performed in the transmitting or receiving room at the various positions of the sound source on the "**Select measurement**" page.



5 Data transfer

XL3 offers several ways to transfer the stored measurement data:

5.1 MTP (Media Transfer Protocol) over USB-C

The instrument is connected directly to the computer using a USB cable. The instrument then acts like a thumbdrive and folders and files can be accessed directly with drag and drop.

Please note that software running on the computer cannot directly access the instruments data via the MTP protocol. Therefore, copy the measurement data to your computer prior accessing them by SW.

MTP is not supported by MacOS.

5.2 Remote access via XL3 website

You will find detailed instructions on how to activate the web server and how to transfer the data of the XL3 in this mode to your PC at Remote control via web server.

5.3 SFTP access

Free choose any of the availble sFTP Client software like WinSCP, FileZilla or WatchFTP for accessing the stored measurement data. The neccessary parameter are:

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

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

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

6 How to connect a router or gateway

A router can be connected directly to any USB port of the XL3 if it supports the NDIS protocol. The Teltonika router TRB140 suits this application very well.

Routers, like the Teltonika RUT240, not supporting NDIS protocol, shall be connected via an Ethernet connection using a recommended USB to Ethernet adapter.

Please note that the Teltonika gateway TRB140 cannot be operated in USA, Japan and China due to missing approvals. Alternatively you may then use the Teltonika RUT240 router as it has worldwide approvals.

7 Remote control via 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.

7.1 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.

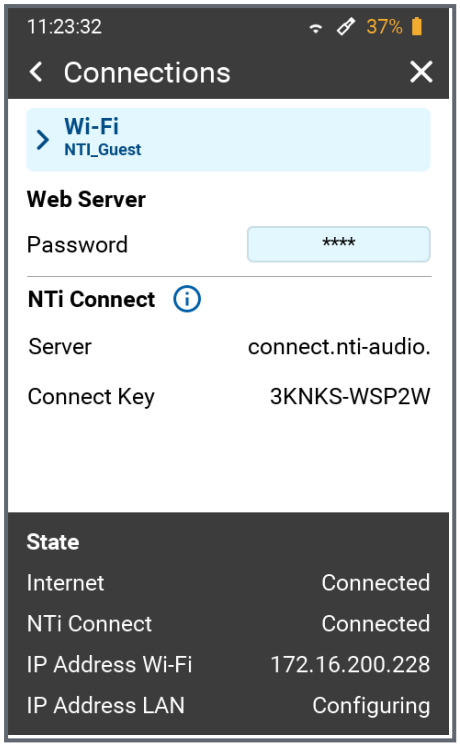
7.2 Response of the device in the internal network

If the meter is connected in the same sub-net as the query computer, you may access the meter via the internal IP address, since in this case there is no firewall in between.

⇨ Select your preferred web browser (e.g. Chrome, FireFox or Edge) and type in the IP address (e.g. 192.174.xxx.xxxx) of the network connection of the XL3. You will find it in the current network settings of the XL3.

7.3 Addressing the device from an external network

If the device is connected to the Internet somewhere, the internal IP address of the measuring device is usually not visible, because one or more firewalls are connected in between. In this configuration you may establish connection via the **connect.nti-audio.com** service that is free of costs for fair use.



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.

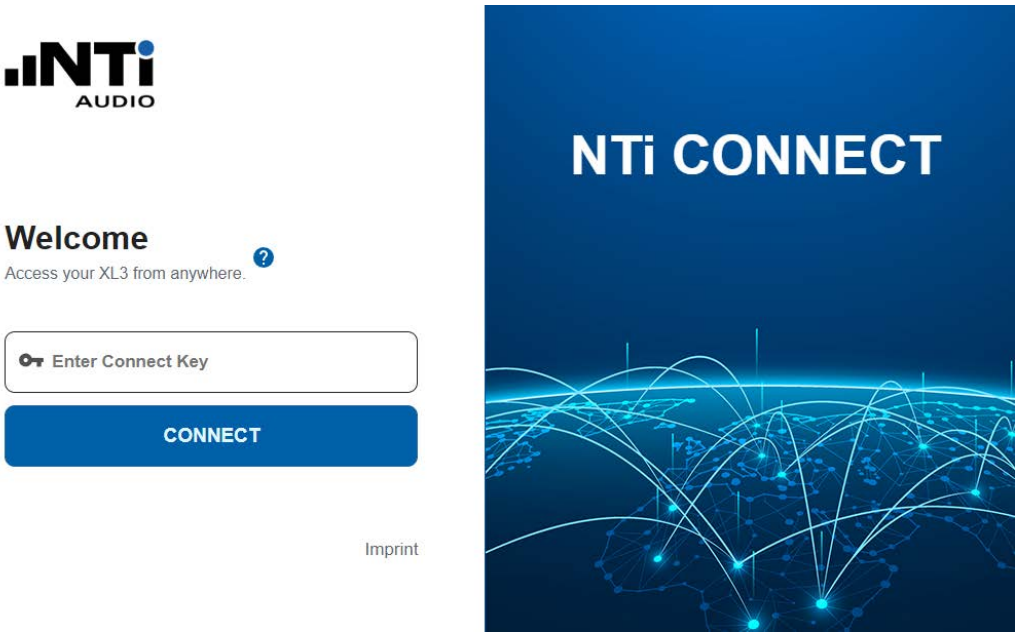
The Connect Key is the unique key to access your XL3 in the cloud.

7.4 Access to NTi Connect service

The NTi Connect service connect.nti-audio.com provides worldwide and secure access to the webpage, data files and APIs of XL3s.

⇨ Open a browser and type connect.nti-audio.com.

A web page opens



⇨ Now type in your Connect Key key and click connect.

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

The NTi Connect Server now creates the connection via the server and connects your PC to the device. The XL3 will then automatically provide you with its web server page.

7.4.1 XL3 web server

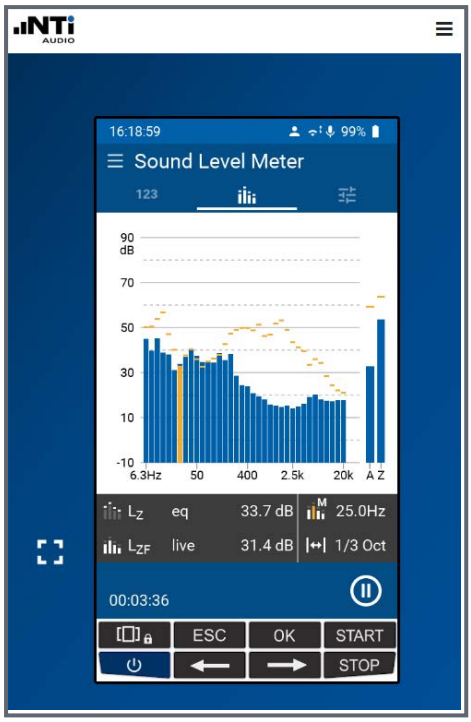
The web page will prompt you to enter the password previously defined in XL3. After that the overview screen of the web server opens.

You now have direct access to all measurement data stored in XL3 and can download each individual file.

In the top menu, you can access the live screen of the meter via **SCREEN**.

> The use of the NTi Connect service requires that all data traffic to and from XL3 is handled via the server. NTi Connect provides free usage for data volumes up to 2 GB per month. For data consumption beyond this threshold, the download speed will be reduced. Opting for the "NTi Connect Open Data 365" subscription ensures uninterrupted communication at full speed.

7.4.2 Remote control via the web user interface



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

The website is responsive; i.e. it can be scaled as desired. The icon scales the device screen to the maximum screen size. You can exit this mode at any time by pressing **ESC** on the PC keyboard.

7.4.3 Fair Use Principle for NTi Connect

7.4.3.1 Free Data Volume

Monthly, NTi Audio provides a free data volume of 2 GB to each XL3 device on the Connect Server (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. The consumed data volume can be found in Connections.

7.4.3.2 Throttling upon Exceeding

Once the data volume is exceeded, the transmission rate of the XL3 is throttled to about 40 KBytes/s. This throttling is lifted on the first day of each new month, and the data volume starts counting anew.

7.4.3.3 Effects of Throttling

Despite throttling, remote control of the XL3 via the browser remains feasible. Additionally, downloading reports and short log files continues to function. However, during a download, the browser user interface responds only with limitations. Significantly more pronounced limitations occur during the transmission of large log files and audio recordings, as well as when using the Streaming API. This may lead to longer waiting times or even timeouts.

7.4.3.4 Recommended Option

To circumvent these limitations, we recommend acquiring the “NTi Connect Open Data 365” Option. This option removes the throttling of the transmission rate.

7.4.3.5 File Push Service

The File Push Service transfers files directly to the target server. Data usage isn't counted towards NTi Connect, and there's no throttling applied.

7.4.3.6 Reserved Rights

We reserve the right further to restrict the fair use of the Connect Server.

8 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;
- Heavy-Duty outdoor case, NTi # 600 000 704 (IP43) or # 600 000 705 (IP65);
- Weather station (see below);
- GPS Mouse (see below);
- ASD flat ribbon cable for passing closed windows or doors, NTi # 600 000 367.

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

8.1 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), NTi # 600 000 736;
- Vaisala WXT533 (wind speed, wind direction, rain fall), NTi # 600 000 737;
- Vaisala WXT 536 (wind speed, wind direction, rain fall, temperature, air pressure, humidity), NTi # 600 000 738;
- LCJ Capteurs LCJ-CV7 SA-SDI_T (wind speed, wind direction).

Connect the weather station to the XL3 either via the 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.

8.2 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 Calibration

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

9.1 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.

9.2 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**.

9.3 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.

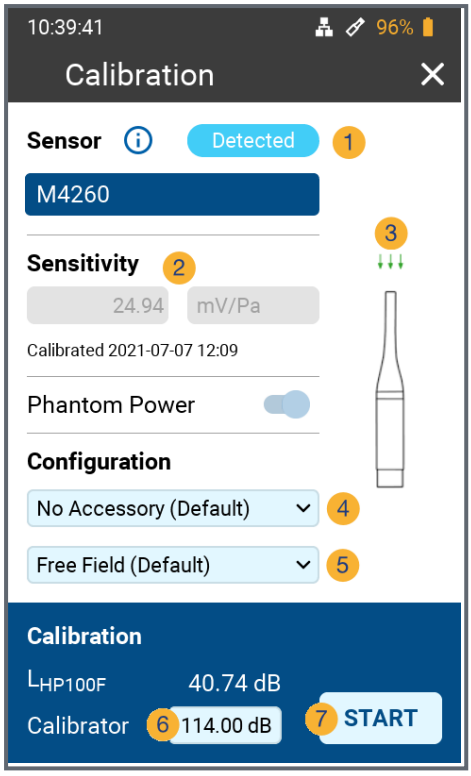
9.4 Ambient noise

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

9.5 Calibration screen

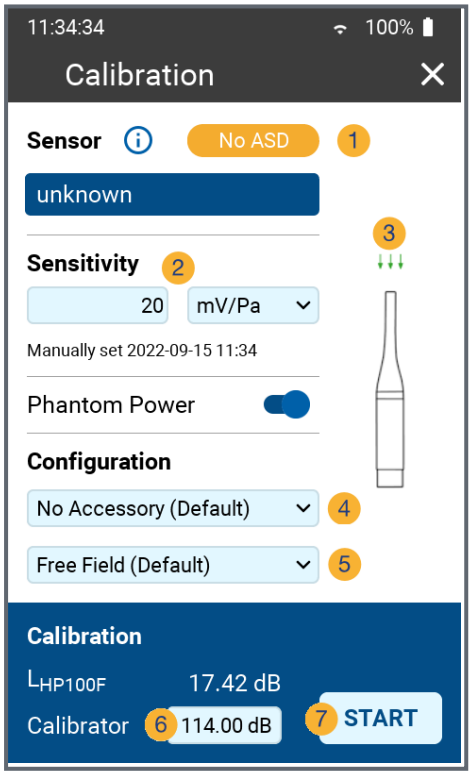
Swipe the touchscreen from top to bottom and tap the  icon to open the calibration screen.

9.5.1 Calibration menu with ASD measuring microphone connected

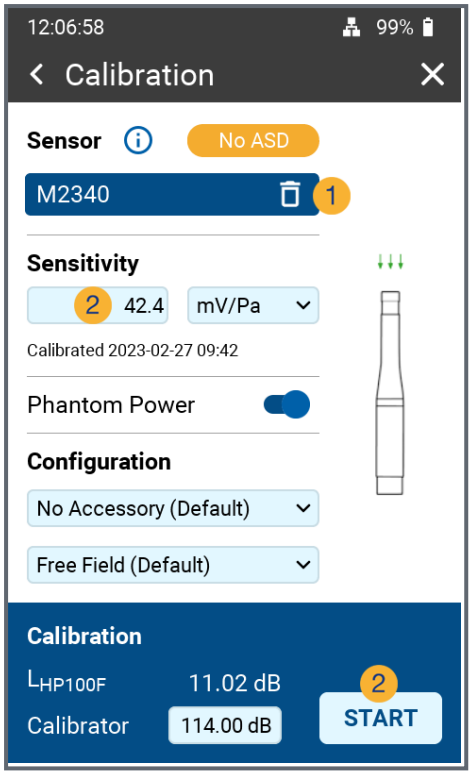


1. The blue status message "**Detected**" indicates that the connected microphone has been detected and its ASD data read.
2. The microphone sensitivity according to the ASD data sheet.
3. Visualizes the microphone configuration according to the settings 4 and 5.
4. The list allows the selection of any 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.

9.5.2 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.

9.6 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.

9.6.1 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.

9.7 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.

M2230 / M2340 Configuration	Sound calibrator		
	NTi CAL200	B&K 4231	Nor 1251
No accessories	93.88 / -0.12	93.85 / -0.15	93.85 / -0.15
ASD cable + windscreen 90 mm	93.53 / -0.47	93.50 / -0.50	93.50 / -0.50
Windscreen 90 mm	93.69 / -0.31	93.66 / -0.34	93.66 / -0.34
WP30 vertically (90°)	93.69 / -0.31	93.66 / -0.34	93.66/ -0.34
WP30 horizontally (0°)	93.69 / -0.31	93.66 / -0.34	93.66/ -0.34

9.7.1 Application example

Configuration:

- XL3 + M2340 measurement microphone + WP30 vertically;
- NTi Audio CAL200 class 1 sound calibrator with 94.0 dB;

Setting for calibration:

- Open the Calibration screen;
- Adjust the **Calibrator** level to 93.69 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.

9.8 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.

9.8.1 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.

9.8.1.1 Calibration details

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

9.8.2 Accessories

9.8.2.1 Complainant key

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

10 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; • XL3 with M2211 / M2215 measurement microphone class 1 frequency response according to IEC 61672 and ANSI S1.4. 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; • China: GB/T 3785:2010, GB/T 3241, GB 3096-2008, GB 50526, GB-T 4959; • Germany: DIN 15905-5, DIN 45657:2014, DIN 45657:2005, DIN 45645-2, optional: DIN 45645-1; • Japan: JIS C1509-1:2005, JIS C 1513 class 1, JIS C 1514 class 0; • Switzerland: V-NISSG, NAO; • UK: BS 4142:2014, BS 5969, BS 6698; • USA: ANSI S1.4-2014, ANSI S1.43, ANSI S1.11-2014; • 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); • Time ratings: Fast, Slow, Impulse[1] (simultaneously).
Level details	• Measurement bandwidth (–3 dB): 4.4 Hz – 23.0 kHz; • Level resolution: 0.1 dB; • 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; • XL3 + M2230: 17.1 dB(A) – 137.8 dB @ 42 mV/Pa; • XL3 + M2215: 25 dB(A) – 153 dB @ 8 mV/Pa; • XL3 + M2211: 21 dB(A) – 144 dB @ 20 mV/Pa; • XL3 + M2914: 6.5 dB(A) – 103 dB @ 320 mV/Pa; • 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; • XL3 + M2230: 24 dB(A) – 137 dB | 27 dB(C) – 137 dB @ 42 mV/Pa; • XL3 + M2215: 33 dB(A) – 153 dB @ 8 mV/Pa; • XL3 + M2211: 29 dB(A) – 144 dB @ 20 mV/Pa; • XL3 + M2914: 14 dB(A) – 103 dB @ 320 mV/Pa; • XL3 + M4261: 33 dB(A) – 146 dB @ 16 mV/Pa.
Stabilization time	< 10 s.
Integration times	• Minimum: 1 second (default) or 100 ms (with Extended Noise Measurement option); • Maximum: 24 hours.
Intrinsic noise typical without measuring microphone @ S = 42 mV/Pa	• Frequency weighting A: 5.1 dBA; • Frequency weighting C: 4.1 dBC; • Frequency weighting Z: 8.0 dBZ.

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

Reverberation Time	

	• Conforms with ISO 3382 and ASTM E2235 based on Schroeder's backwards integration;
	• Octave bands results from 63 Hz - 8 kHz;
	• Measurement parameters: T20, T30;
	• Impulse and gated noise source;
	• Automatic averaging for each position;
	• Chart and table representation of results;
	• Fixed minimum trigger level: 80 dB LAPK;
	• Warning indicators according to ISO 3382;
	• Range: 10 ms - 60 seconds;
	• Minimum reverberation time (typical):
	  ◦ < 100 Hz: 0.3 second;
	  ◦ 100 - 200 Hz: 0.2 second;
	  ◦ > 200 Hz: 0.1 second.

With the "Extended Room Acoustics" Option	• 1/3 octave band: 50 Hz - 10 kHz; • T20, T30, T15, EDT simultaneously; • Calculating spatial room average (Measurement Series) up to 99 positions; • Audio recording (32-bit float); • 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. • Automated data averaging; • Results as chart and table.

	Airborne Sound Insulation:
	• Sound Sources: Speaker.
	• Standards:
	  • ISO16283-1:2014;
	  • ISO 717-1: 2021;
	  • England/Wales: Approved Document E (2003).
	• Results:
	  • Dw | Dn,w | DnT,w | R'w;
	  • Spectrum adaption terms C, Ctr;

	Impact Sound Insulation:
	• Sound Sources: Tapping Machine, Rubber Ball;
	• Standards:
	  • ISO16283-2:2018;
	  • ISO 717-2:2020;
	  • England/Wales: Approved Document E (2003).
	• Results:
	  • With Tapping Machine: L'n,w | L'nT,w;
	  • With Rubber Ball: L'IA,Fmax | L'iA, Fmax,V,T;
	  • Spectrum adaption terms CI.

	Facade Sound Insulation:
	• Sound Sources: Element Loudspeaker, Global Loudspeaker;
	• Standards:
	  • ISO16283-3:2016;
	  • ISO 717-1: 2021.
	• Results:
	  • With Element Loudspeaker: Dw | R'45°,w;
	  • With Global Loudspeaker: Dls,2m,w | Dls,2m,n,w | Dls,2m,nT,w;
	  • Spectrum adaption terms C, Ctr—.

Calibration	
Free-field correction	• NTi Audio class 1 sound calibrator: M2340 / M2230 / M2215 / M2211: –0.10 dB; • NTi Audio class 1 sound calibrator with 1/4" calibrator adapter, type: ADP 1/4-P: M4260: +0.10 dB; M4261: +0.20 dB.
Windscreen correction **@ 1 kHz**	• 50 mm windscreen: +0.03 dB; • 90 mm windscreen: –0.04 dB; • 150 mm windscreen: –0.04 dB; • WP30: –0.03 dB.
Calibration	• Recommended calibration interval: 1 year; • Microphone calibration with external sound calibrator possible; • Calibration certificate for a new sound level meter is optionally available.

Input / output interfaces	

Audio input	• XLR balanced:
	  • Input impedance 200 kΩ;
	  • Phantom power: +48 V switchable; with maximum output current of 10 mA according to IEC 61938;
	  • Automatic Sensor Detection (ASD) for NTi Audio measuring microphones and preamplifier MA230 / MA220;
	• Internal speech microphone for recording voice memos.

Audio output	• Built-in speaker; • 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.
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: • USB-C to LAN adapter, NTi # 600 000 535; • 4G/LTE gateways with RNDIS protocol; • Mass storage like USB stick, SSD; • Vaisala or LCJ Capteurs 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) Supported formats: FAT32 and NTFS

Input / output interfaces	

Power supply	• Rechargeable Li-Ion battery:
	  • Typ. 3.6 V / 6'000 mAh;
	  • 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);
	  • Energy density = 339 Wh/l;
	  • Typical battery life @ 25 °C (77 °F) with microphone M2340: with display active: >8 h; with display switched off: >12 h.
	  • Operating temperature: –20 to +60 °C (–4 to +140 °F);
	  • 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-shutdown, the XL3 stops the current measurement and saves the present results.
	• Linear external power supply 9 VDC / 2 A:
	  • Range: 7.0 – 17.0 VDC @ minimum 4 W;
	  • Charges Li-Ion battery in operation; charging time from 10% to 80%: typ. 140 min;
	  • Maximum charging power 15 W.
	• 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;
	• 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.

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

Weather station	
Vaisala	• WXT532; • WXT533; • WXT536.
LCJ Capteurs	LCJ-CV7 SA-SDI_T.

General	
Clock	Real-time clock with own lithium battery; drift < 1.7 s per 24 hrs.
Mechanics	• 1/4" tripod connection and fold-out stand on rear side; • Display: 480 x 800 pixels, 4.3" IPS; • Entry: 8 buttons, capacitive multitouch-display; • Dimensions L x W x H: 210 x 85 x 45 mm (8.3 x 3.4 x 1.8 "); • 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.
ATEX	• For applications in Zone 2 hazardous areas according to IEC 60079; • Compliant with 2014/34/EU.

11 Technical data measurement microphones

11.1 Calibrateable measuring microphones

	M2340 class 1 certified with self-test	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 ±1 dB @ >20 Hz – 4 kHz ±1.5 dB @ >4 kHz – 10 kHz ±2 dB @ >10 kHz – 16 kHz ±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	< –0.01 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	
Long-term stability	> 250 years / dB	
Power supply	48 VDC Phantom power	
Power consumption	0.76 mA typical	2.3 mA typical

	M2340 class 1 certified with self-test	M2230 class 1 certified
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

11.2 Non-calibratable measuring microphones

	M2211 frequency response class 1	M2215 for high sound levels, frequency response class 1	M4261 class 2
Includes	MA220 preamplifier + M2211 microphone capsule	MA220 preamplifier + M2215 microphone capsule	M4261 with fixed microphone capsule
Microphone type	Omnidirectional, condenser free-field microphone with continuous polarization		Electret capsule
Classification acc. 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	no	no
Frequency response tolerance typical	±1 dB @ 5 Hz – 20 Hz ±1 dB @ >20 Hz – 4 kHz ±1.5 dB @ >4 kHz – 10 kHz ±2 dB @ >10 kHz – 16 kHz ±3 dB @ >16 kHz – 20 kHz		+1/–4.5 dB @ 5 Hz – 20 Hz ±1.5 dB @ >20 Hz – 4 kHz ±3 dB @ >4 kHz – 10 kHz ±4.5 dB @ >10 kHz – 16 kHz ±5 dB @ >16 kHz – 20 kHz
Individual frequency response	freely available as MS Excel file: register the microphone on my.nti-audio.com and contact info@nti-audio.com		
Frequency range	5 Hz – 20 kHz		

	M2211 frequency response class 1	M2215 for high sound levels, frequency response class 1	M4261 class 2
Sensitivity typical @ 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)
Intrinsic noise typical	21 dB(A) @ 20 mV/Pa	25 dB(A) @ 8 mV/Pa	27 dB(A) @ 16 mV/Pa
Maximum sound pressure level @ distortion factor 3%, 1 kHz	144 dBSPL	153 dBSPL	142 dBSPL
Temperature coefficient	< ±0.015 dB / °C		< ±0.02 dB / °C
Temperature range	–10°C to +50°C (14°F to 122°F)		0°C to +40°C (32°F to 104°F)
Influence of air pressure	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 consumption	2.3 mA typical		1.7 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	150 mm (5.9")		
Weight	100 g (3.53 oz)		83 g (2.93 oz)
Protection class	IP 51		
NTi Audio #	600 040 022	600 040 045	600 040 070

12 Technical data microphone preamplifier

	MA230	MA220
Microphone preamplifier	Compatible with 1/2" microphone capsules type WS2F according to IEC61094-4	
Frequency range	1.3 Hz – 49.5 kHz	4 Hz – 100 kHz
Frequency response	±0.1 dB, 10 Hz – 20 kHz	±0.2 dB
Phase linearity	± 5° @ 20 Hz – 20 kHz	± 5° @ 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 • Original NTi Audio sensitivity = 4.9 V/Pa • Save and read data with XL3 Analyzer • NTi Audio ASD according to IEEE P1451.4 V1.0, class 2, template 27	
Self-check	Yes	No
Individual frequency response	freely available as Excel file, register the microphone on my.nti-audio.com and contact info@nti-audio.com	
Frequency response tolerance typical	±1 dB @ 5 Hz – 20 Hz ±1 dB @ >20 Hz – 4 kHz ±1.5 dB @ >4 kHz – 10 kHz ±2 dB @ >10 kHz – 16 kHz ±3 dB @ >16 kHz – 20 kHz	
Frequency range	5 Hz – 20 kHz	
Sensitivity typical @ 1 kHz	27.5 dBV/Pa ±2 dB (42 mV/Pa)	
Temperature coefficient	< –0,01 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	
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	

	MA230	MA220
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 #	600 040 200	600 040 050

12.1 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.

M2230 / M2340 Configuration	Sound calibrator		
	NTi CAL200	B&K 4231	Nor 1251
No accessories	93.88 / -0.12	93.85 / -0.15	93.85 / -0.15
ASD cable + windscreen 90 mm	93.53 / -0.47	93.50 / -0.50	93.50 / -0.50
Windscreen 90 mm	93.69 / -0.31	93.66 / -0.34	93.66 / -0.34
WP30 vertically (90°)	93.69 / -0.31	93.66 / -0.34	93.66/ -0.34
WP30 horizontally (0°)	93.69 / -0.31	93.66 / -0.34	93.66/ -0.34

12.1.1 Application example

Configuration:

- XL3 + M2340 measurement microphone + WP30 vertically;
- NTi Audio CAL200 class 1 sound calibrator with 94.0 dB;

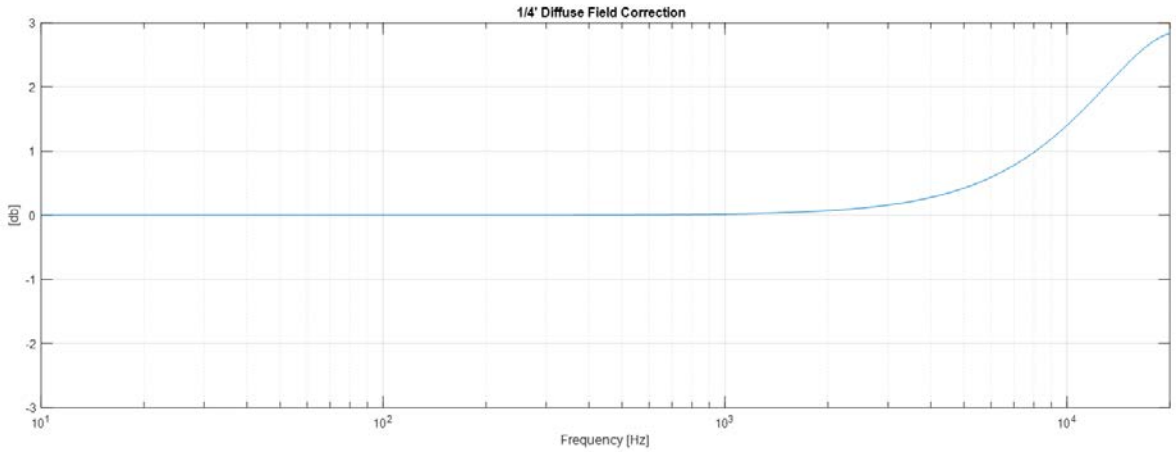
Setting for calibration:

- Open the Calibration screen;
- Adjust the **Calibrator** level to 93.69 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.

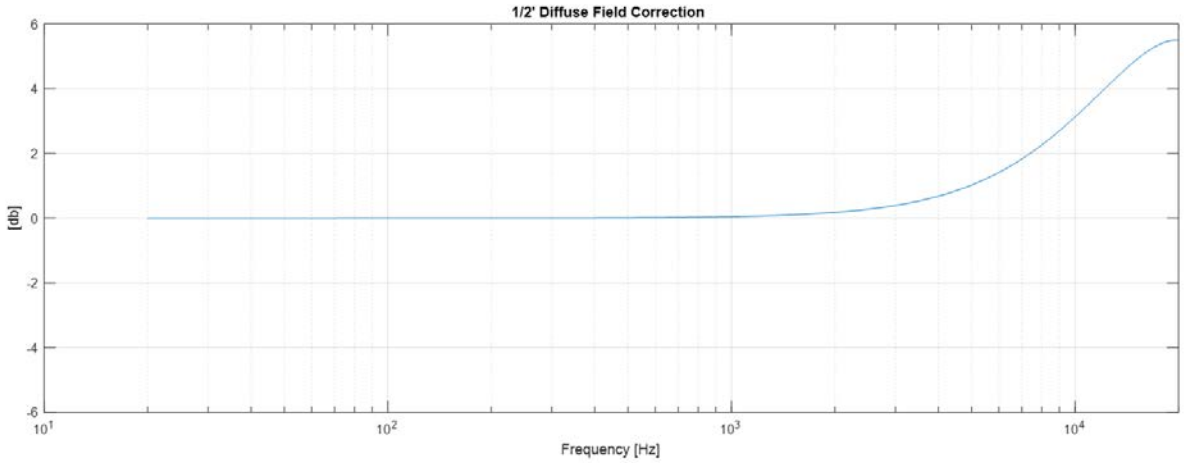
12.2 Diffuse field correction

12.2.1 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				

12.2.2 M2340 1/2" microphone

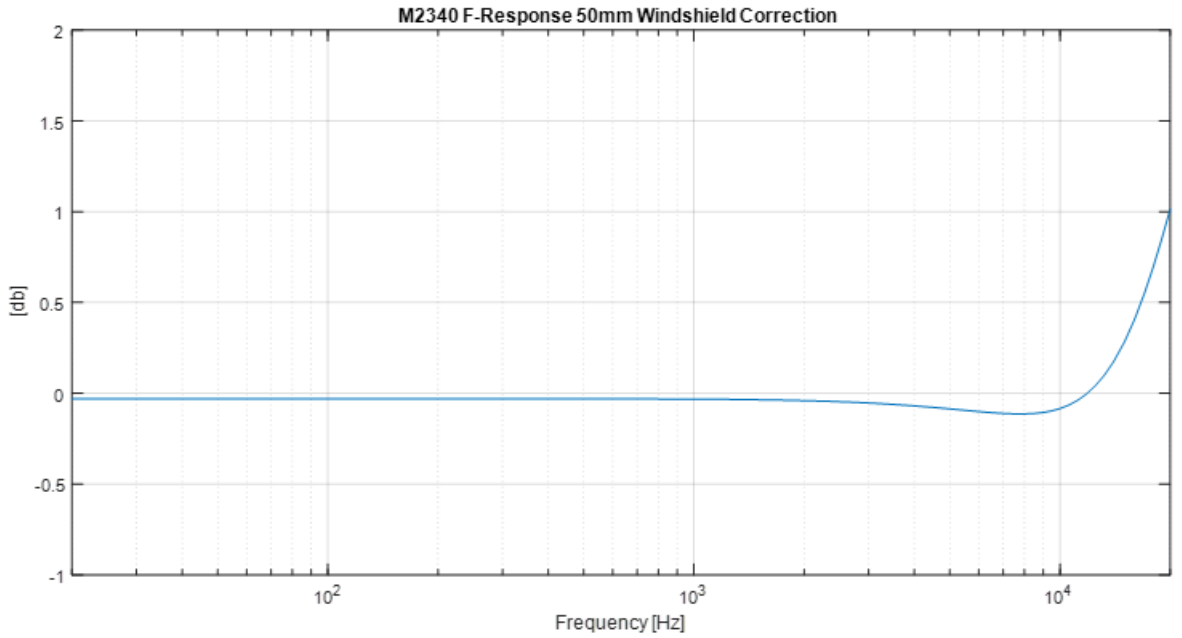


Frequency [Hz]	200	250	315	400	500	630	800	1000
Correction [dB]	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.05
Frequency [Hz]	1060	1120	1180	1250	1320	1400	1500	1600
Correction [dB]	0.05	0.06	0.06	0.07	0.08	0.09	0.10	0.12
Frequency [Hz]	1700	1800	1900	2000	2120	2240	2360	2500
Correction [dB]	0.13	0.15	0.16	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.

12.3 Windscreen corrections

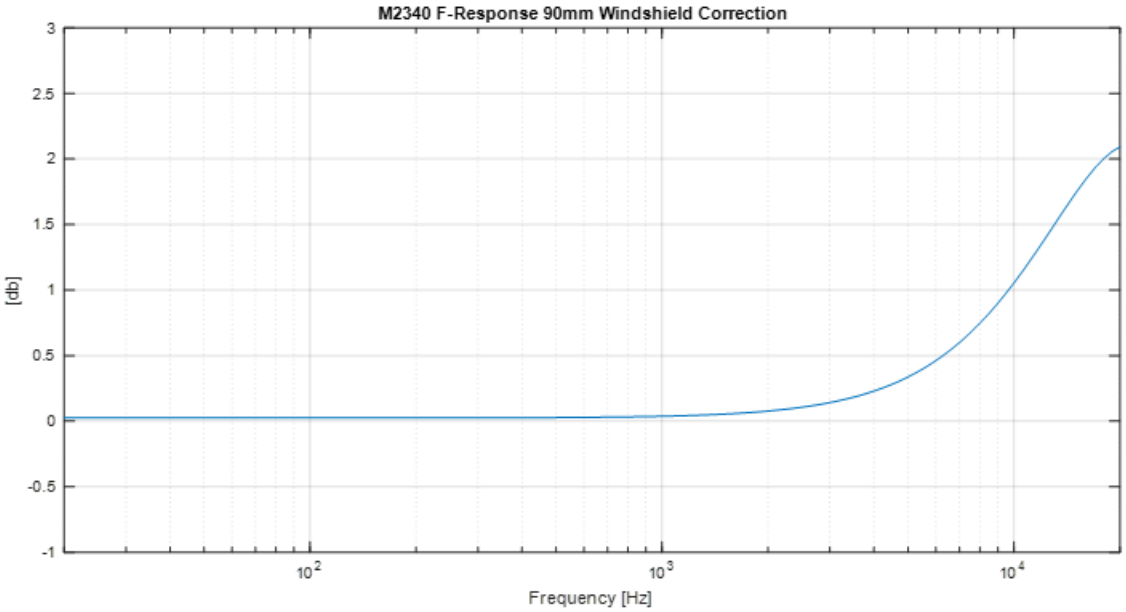
12.3.1 Windscreen 50 mm correction (1/2")



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				

12.3.2 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

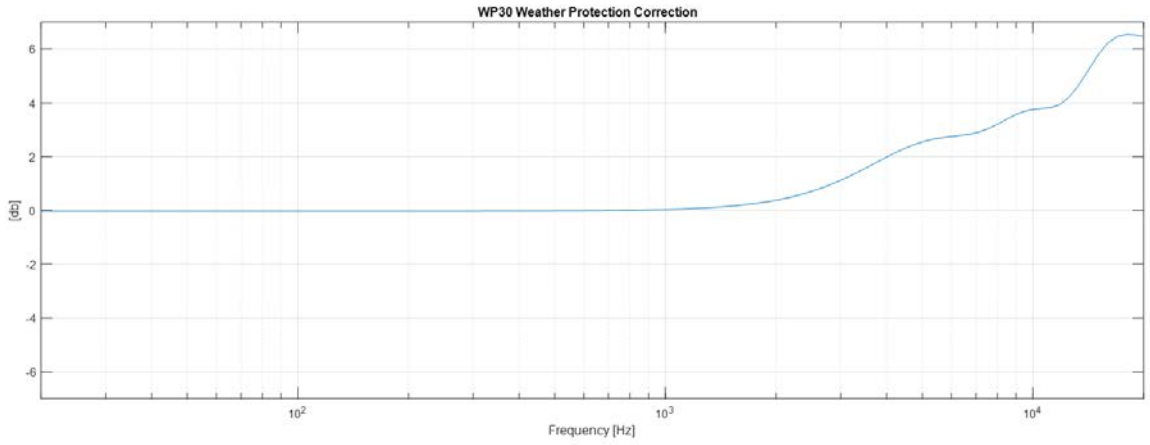
Frequency [Hz]	6700	7100	7500	8000	8500	9000	9500	10000
Correction [dB]	0.56	0.61	0.67	0.75	0.82	0.9	0.98	1.05
Frequency [Hz]	10600	11200	11800	12500	13200	14000	15000	16000
Correction [dB]	1.15	1.24	1.33	1.43	1.52	1.63	1.74	1.85
Frequency [Hz]	17000	18000	19000	20000				
Correction [dB]	1.93	2.00	2.06	2.09				

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

12.4 Correction weather protection WP30-90/-150

The following correction data apply for the WP30 weather protection with either 90 mm or 150 mm windscreen.

12.4.1 Horizontal sound incidence (ambient noise)



Frequency [Hz]	200	250	315	400	500	630	800	1000
Correction [dB]	0.00	0.00	0.00	0.01	0.01	0.02	0.04	0.07
Frequency [Hz]	1060	1120	1180	1250	1320	1400	1500	1600
Correction [dB]	0.08	0.09	0.10	0.12	0.13	0.16	0.19	0.22
Frequency [Hz]	1700	1800	1900	2000	2120	2240	2360	2500
Correction [dB]	0.26	0.31	0.36	0.41	0.48	0.55	0.64	0.74
Frequency [Hz]	2650	2800	3000	3150	3350	3550	3750	4000

Correction [dB]	0.86	0.98	1.15	1.29	1.47	1.64	1.81	2.02
Frequency [Hz]	4250	4500	4750	5000	5300	5600	6000	6300
Correction [dB]	2.20	2.35	2.48	2.58	2.67	2.73	2.78	2.81
Frequency [Hz]	6700	7100	7560	8000	8500	9000	9500	10000
Correction [dB]	2.86	2.94	3.05	3.24	3.43	3.60	3.72	3.79
Frequency [Hz]	10600	11200	11800	12500	13200	14000	15000	16000
Correction [dB]	3.82	3.86	3.96	4.22	4.62	5.15	5.79	6.26
Frequency [Hz]	17000	18000	19000	20000				
Correction [dB]	6.50	6.57	6.55	6.50				

Measurement uncertainty 63 Hz – 4 kHz ±0.2 dB

Measurement uncertainty 4 kHz – 20 kHz ±0.3 dB

12.4.2 Vertical sound incidence (e.g aircraft noise)

For 0° vertical sound incidences (e.g. aircraft noise during overflight) no correction is needed.

12.5 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

Rated frequency [Hz]	Frequency weighting [dB]		
	A	C	Z
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
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

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 80°C, burn or disassemble the battery. Follow the manufacturer's instructions. Only charge with a suitable charger. 2.4 A maximum charging current. 4.1 V maximum charging voltage.

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.