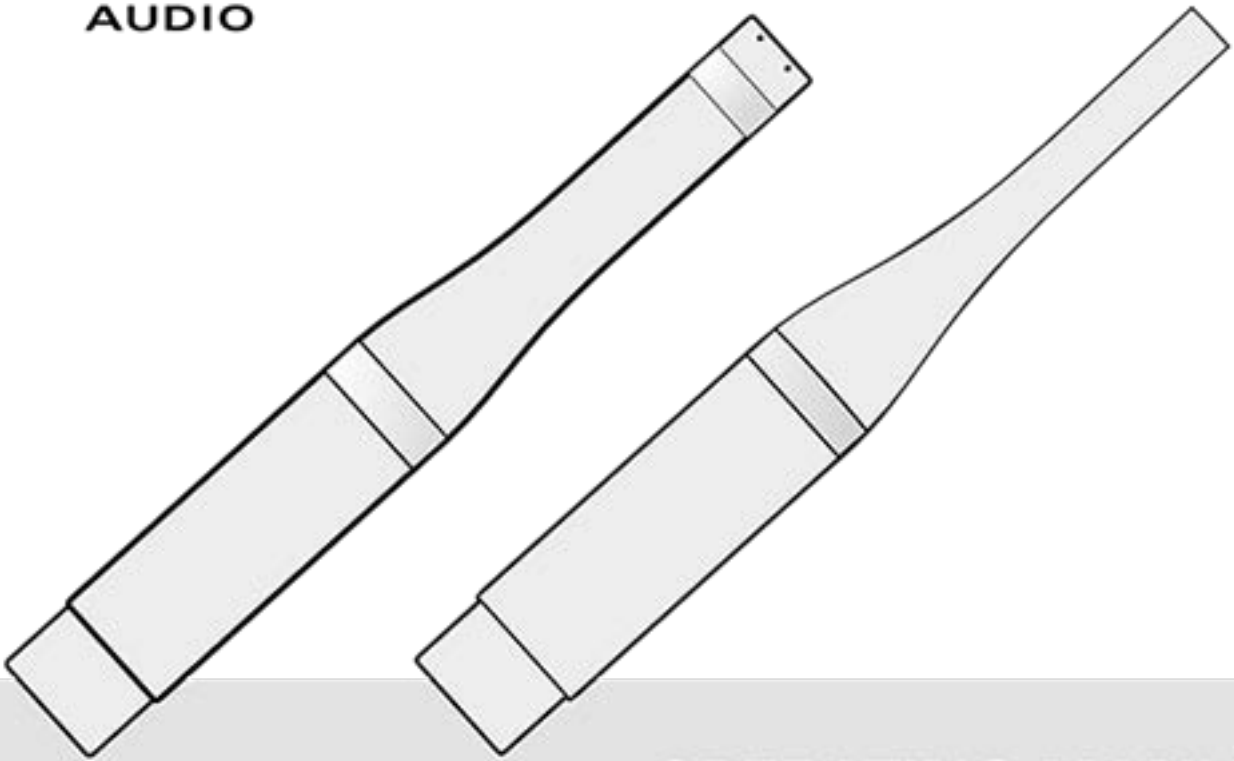
NTi AUDIO



OPERATING MANUAL

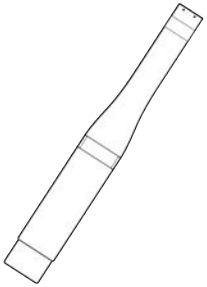
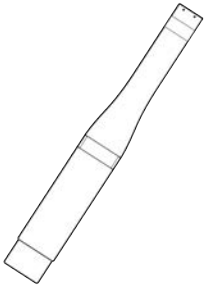
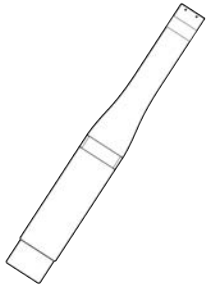
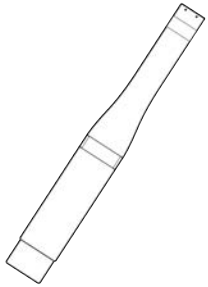
MEASUREMENT MICROPHONES

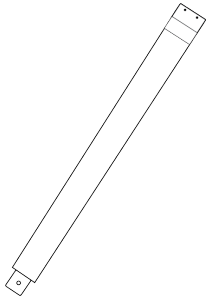
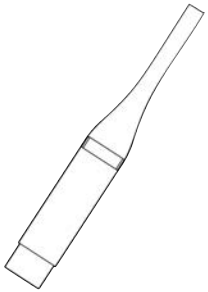
Version: V 2.0 2023-07-03

Table of Contents

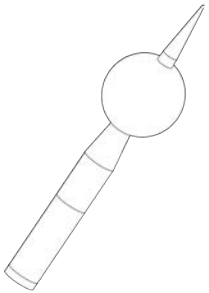
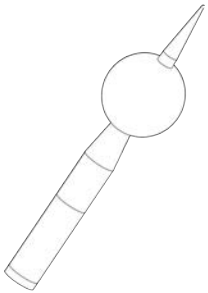
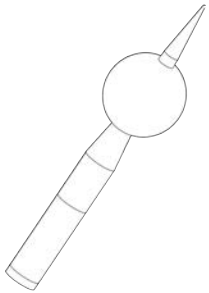
1 Overview

1.1 Measurement Microphones

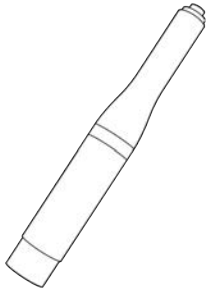
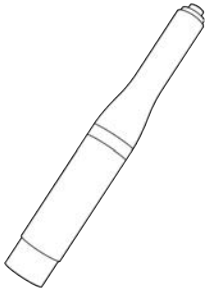
M2211	M2215	M2230	M2340
			
General purpose measurement microphone class 1 frequency response, metal diaphragm	Measurement microphone for high sound levels (up to 153 dB), class 1 frequency response, metal diaphragm	Certified Class 1 measurement microphone in accordance with IEC 61672, metal diaphragm	Class 1 measurement microphone in accordance with IEC 61672, metal diaphragm, system self-test (CIC) with XL2 or XL3
consists of MA220 PreAmplifier and 7052 capsule	consists of MA220 PreAmplifier and 7056 capsule	consists of MA220 PreAmplifier and MC230 or MC230A capsule	consists of MA230 PreAmplifier and MC230A capsule

M2914	M4261
	
High-performance microphone for acoustic measurements of very low sound pressure levels	Cost-effective class 2 measurement microphone for general sound level testing and service of audio-acoustic installations
requires ICP Adapter ASD	with permanently-installed capsule

1.2 Outdoor Measurement Microphones

M2230-WP-90/-150	M2340-WP-90/-150	M4261-WP
		
Certified outdoor measurement microphone, class 1 in accordance with IEC 61672	Certified outdoor measurement microphone, class 1 in accordance with IEC 61672, system self-test (CIC) with XL2 or XL3	Outdoor measurement microphone, class 2 in accordance with IEC 61672
consists of M2230 Measurement Microphone + WP30 Weather Protection with 90 mm or 150 mm windscreen	consists of M2340 Measurement Microphone + WP30 Weather Protection with 90 mm or 150 mm windscreen	consists of M4261 Measurement Microphone + WP61 Weather Protection with 90 mm windscreen

1.3 Microphone Preamplifiers

MA220	MA230
	
Microphone preamplifier compatible with 1/2” pre-polarized capsules	Microphone preamplifier compatible with 1/2” pre-polarized capsules, system self-test (CIC) with XL2 or XL3

1.4 Scope of Delivery

M2211	• Measurement Microphone consisting of
	  • Microphone PreAmplifier MA220
	  • Microphone Capsule 7052
	• Dust cap
	• 33 mm Windscreen
	• Microphone-holder with Adapter 5/8" – 3/8"
	• Operating Manual

M2215	• Measurement Microphone consisting of
	  • Microphone PreAmplifier MA220
	  • Microphone Capsule 7056
	• Dust cap
	• 33 mm Windscreen
	• Microphone-holder with Adapter 5/8" – 3/8"
	• Operating Manual

M2230	• Measurement Microphone consisting of
	  • Microphone PreAmplifier MA220
	  • Microphone Capsule MC230 or MC230A
	• Dust cap
	• 50 mm Windscreen
	• Microphone-holder MH01with Adapter 5/8" – 3/8"
	• Operating Manual
	• Individual Frequency Response Chart

M2340	• Measurement Microphone consisting of
	  • Microphone PreAmplifier MA230
	  • Microphone Capsule MC230A
	• Dust cap
	• 90 mm Windscreen
	• Microphone-holder with Adapter 5/8" – 3/8"
	• Operating Manual
	• Individual Frequency Response Chart

M4261	• Measurement Microphone • 33 mm Windscreen • Microphone-holder with Adapter 5/8" – 3/8" • Operating Manual

WP30-90	• Bird spike BS01 • 90 mm Windscreen • Protection cage • Upper body tube with Allen key mount • Lower body tube • Footer plate with tripod mounting thread (incl. 3 Allen screws) • Allen key

WP30-150	• Bird spike BS02 • 150 mm Windscreen • Protection cage • Upper body tube with Allen key mount • Lower body tube • Footer plate with tripod mounting thread (incl. 3 Allen screws) • Allen key
WP61	• Bird spike BS01 • 90 mm Windscreen • Protection cage • Upper body tube with Allen key mount • Lower body tube • Footer plate with tripod mounting thread (incl. 3 Allen screws) • Allen key

2 Description

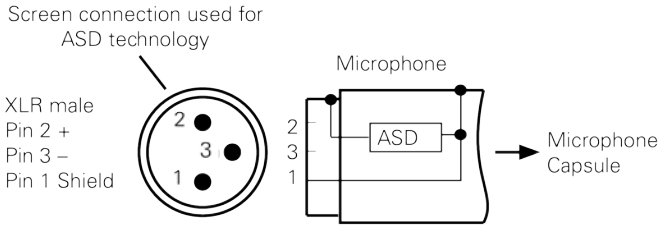
The plug-on measurement microphones combined with the XL2 or XL3 Analyzer form a comprehensive sound level meter and acoustic analyzer.

2.1 Integrated PreAmplifier

The microphone bodies contain a PreAmplifier and require 48 VDC Phantom power supply for operation. They combine high dynamic range and wide frequency range with low noise. The measurement microphones can also be connected with an ASD Cable to the XL2 or XL3 Analyzer for measurements at remote locations or for reduction of acoustic reflections.

2.2 Electronic Data Sheet

The microphones include an electronic data sheet. The Automated Sensor Detection (ASD) of the XL2 or XL3 Analyzer automatically reads this data, i.e. the microphone model and calibration data. This promotes faster setup and ensures accurate measurements.



Connection diagram of measurement microphones with electronic data sheet

2.3 Connecting to XL2 or XL3

2.3.1 Microphone plugs directly into the XL2 or XL3

The XL2 and XL3 automatically read the electronic data sheet of the connected microphone as follows:

- Connect the measurement microphone to the XL2/XL3.
- Switch on the XL2/XL3.

The XL2 and XL3 read the electronic data sheet of the connected microphone during a brief initialization process prior to the first measurement.

2.3.2 Microphone Connection via the ASD Cable

The NTi Audio measurement microphones can be connected with an ASD Cable to the XL2 or XL3 Analyzer for measurements at remote locations or for reducing acoustic reflections. The electronic data sheet is transmitted via the XLR connector's housing. Do not touch this during the brief initialization period to ensure the complete data sheet is recognized by the XL2 or XL3. The automated sensor detection does not disturb any measurements. You may join 5- or 10-meter ASD Cables together in series. The ASD technology supports accurate data communication up to a combined cable length of 20 meters (= 65 feet), which is also the maximum cable length for CIC operation.

2.3.3 Microphone Connection via a professional Audio Cable

For distances longer than 20 meter (= 65 feet) use a high quality, low capacitance standard professional audio cable (NOTE: CIC operation not possible with this configuration!).

The microphone sensitivity has to be entered manually into the XL2 or XL3 Analyzer – Or, alternatively, connect the microphone first directly to the XL2 or XL3, whereby the analyzer reads the sensitivity and remembers this value. Afterwards, connect the audio cable between the analyzer and the microphone.

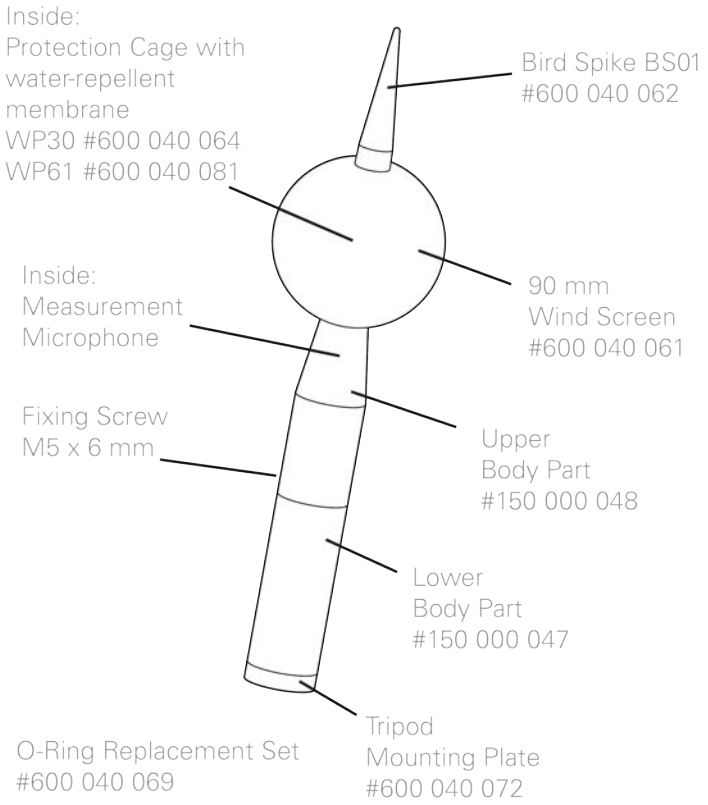
3 Outdoor Microphones

The Outdoor Measurement Microphones offer a weather-protected measurement solution for the XL2 or XL3 Sound Level Meter allowing acquisition of environmental noise data in outdoor applications. The corrosion-free polymer housing, wind screen, water-repellent membrane and bird spike provide excellent protection from rain, wind, dust and perching birds.

Outdoor Measurement Microphone Types

- M2230-WP-90/-150: M2230 Measurement Microphone + WP30 Weather Protection
- M2340-WP-90/-150: M2340 + WP30 Weather Protection
- M4261-WP: M4261 + WP61 Weather Protection

- Do not install the Outdoor Measurement Microphones in horizontal direction. Raindrops may damage the measurement microphone.
- The snap mechanism works only at temperatures above –15°C / 5°F (as the O-Ring stiffens). In colder conditions we suggest you warm up the housing first, e.g. with your hands.


Inside:
Protection Cage with
water-repellent
membrane
WP30 #600 040 064
WP61 #600 040 081
Bird Spike BS01
#600 040 062
Inside:
Measurement
Microphone
90 mm
Wind Screen
#600 040 061
Fixing Screw
M5 x 6 mm
Upper
Body Part
#150 000 048
Lower
Body Part
#150 000 047
Tripod
Mounting Plate
#600 040 072
O-Ring Replacement Set
#600 040 069

The Outdoor Measurement Microphones M2230-WP and M2340-WP fulfill the Class 1 requirements according to IEC 61672 and ANSI S1.4 for vertical sound incidence. For compliance with horizontal sound incidence a spectral correction is employed in the associated XL2 or XL3 Sound Level Meter.

Alternatively the Measurement Microphone M2211 or M2215 can be fitted into the Weather Protection WP30. These microphones have to be pushed further into the upper body. The top part of the capsule has to be 17 mm above the upper body housing of the WP30. This is required because the M2211 and M2215 capsule is 3 mm shorter than the default M2230 microphone capsule.

The Outdoor Measurement Microphone M4261-WP fulfills the Class 2 requirements according to IEC 61672 and ANSI S1.4. It consists of an M4261 Microphone and the WP61 Weather Protection. For compliance with horizontal sound incidence a spectral correction is employed in the associated XL2 or XL3 Sound Level Meter.

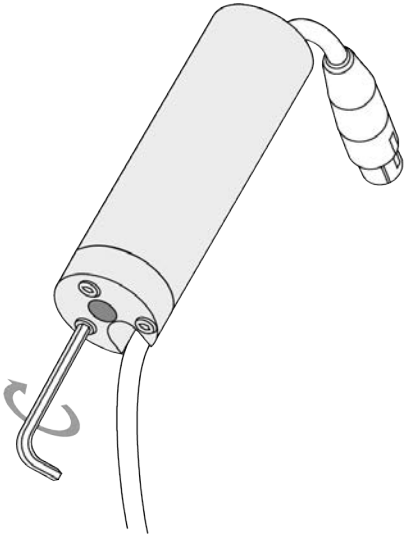
Always activate the applicable frequency correction filter in the XL2 or XL3. The filter ensures that the measurements accuracy meets the class 1 requirements of IEC 61672 and ANSI S1.4.

3.1 Assembling

This chapter describes how to install the Measurement Microphone into the Weather Protection kit.

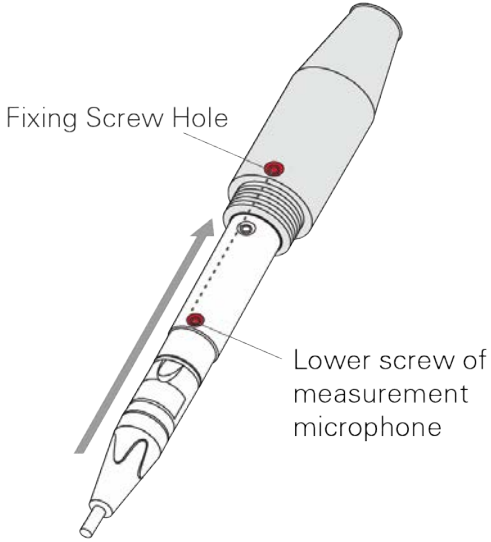
3.1.1 Install ASD Cable

- Feed the female XLR of the ASD Cable through the bottom of the lower body tube.
- Attach the footer plate to the lower body tube using the three Allen screws, feeding the cable through the side slot of the footer plate.



3.1.2 Insert Measurement Microphone

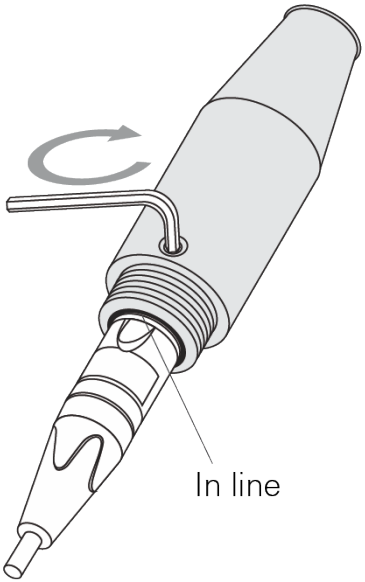
- Connect the measurement microphone to the female XLR of the ASD Cable.
- Insert the measurement microphone into the upper body tube so that the bottom end of the microphone is in line with the bottom end of the upper body tube. Align the fixing screw hole of the upper body tube with the lower screw of the measurement microphone (remove the fixing screw to see the lower screw head through the fixing screw hole).



3.1.3 Attach the Microphone to the Upper Body Tube

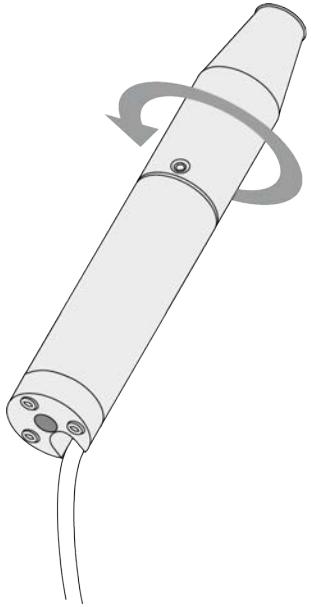
Attaching the fixing screw of the upper body tube onto the lower screw of the measurement microphone ensures that the microphone housing is not scratched.

- Insert and gently tighten the fixing screw while jiggling the microphone. You will feel the fixing screw center in the head of the lower screw of the microphone. Do not over tighten the fixing screw.
- Again verify that the bottom end of the inserted M2230/M2340 microphone is in line with the bottom end of the upper body tube.



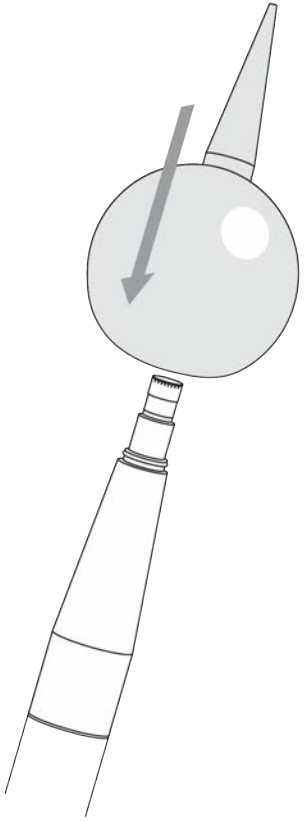
3.1.4 Assemble the Weather Protection Body

Retract the ASD cable through the lower body tube and screw the lower body tube to the upper tube, ensuring that the cable does not twist during this operation.



3.1.5 Mount the Top Section

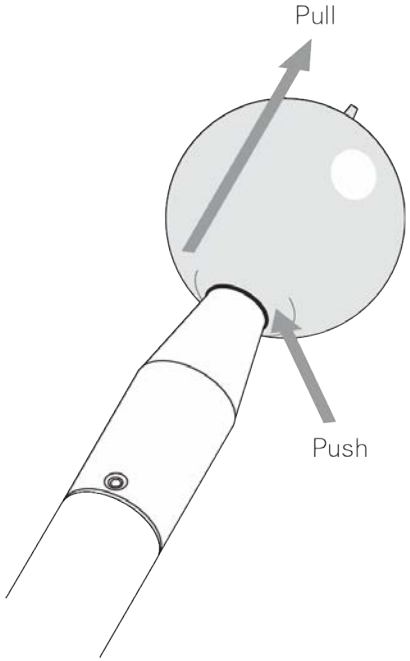
The top section of the weather protection kit consists of the wind screen, the enclosed protection cage with water-repellent membrane and the bird spike. Gently slide the top section over the microphone tip and on to the upper body tube. You will feel a slight increase in resistance approximately 3 mm before the top section's final position. Slightly increase the pressure until the top section snaps into the final position with an audible click.



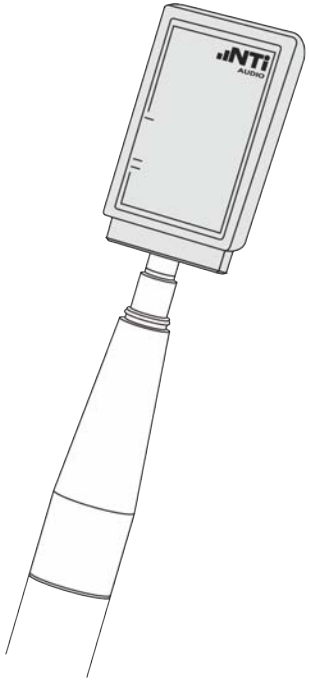
3.2 Calibration

The design of the Outdoor Measurement Microphone supports easy calibration of the microphone. To calibrate, follow the procedure below:

- The top section of the Outdoor Microphone is snapped on to the body tube. Remove the top section of the Outdoor Microphone by gently pulling the bird spike upwards. At the same time gently push up on the cage inside the wind screen with two fingers of your other hand. You will feel when the snap mechanism is released. Gently remove the top section.



- Calibrate the microphone as described in the XL2 or XL3 user manual using the NTi Audio Precision Calibrator.
- Snap the top section back into position on the body tube.



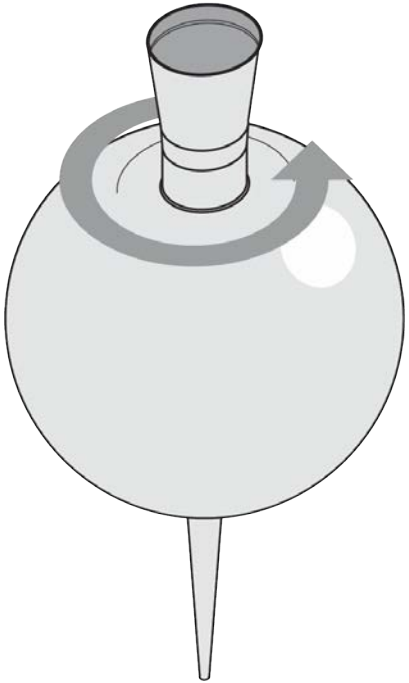
- The outdoor windscreen is recommended to be replaced annually.

  The "WP30-90 / WP61 Windscreen Replacement" includes two 90 mm spare windscreens, NTi Audio # 600 040 061.

- The "WP30-150 Windscreen Replacement" includes two 150 mm spare windscreens, NTi Audio # 600 040 095.
- The water-repellent membrane in the top section is mounted with two O-rings. Inspect the O-rings (13 x 1 mm) and the membrane annually for proper seating and good condition. Do not touch the water-repellent membrane.

3.3 Disassembling the Top Section

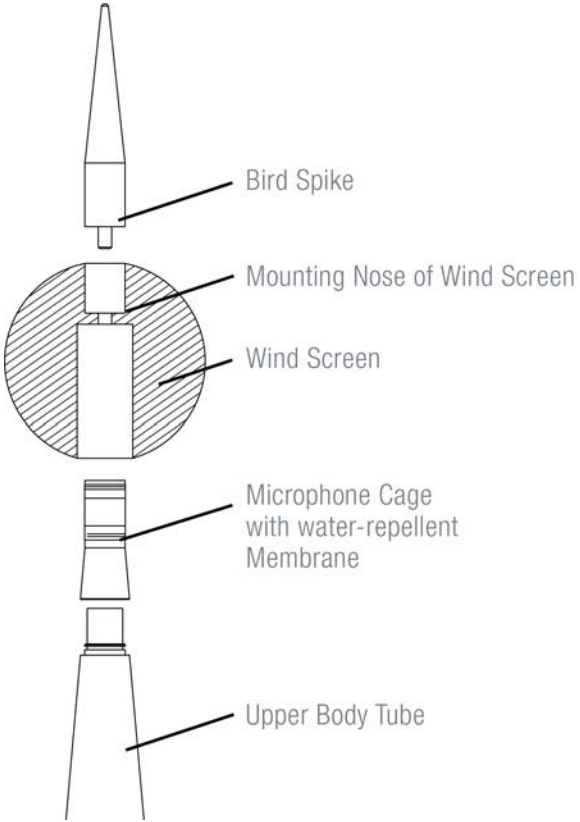
- The top section is snapped onto the body tube. Remove the top section by gently pulling the bird spike upwards. At the same time gently push up on the cage inside the wind screen with two fingers of your other hand. You will feel when the snap mechanism is released.
- Gently remove the top section and turn the top section upside down and hold it by the bird spike.
- Gently unscrew the cage from the hole of the wind screen. Do not touch the water-repellent membrane!
- Assemble in reverse order.



3.4 Handle Wind Screen with Care

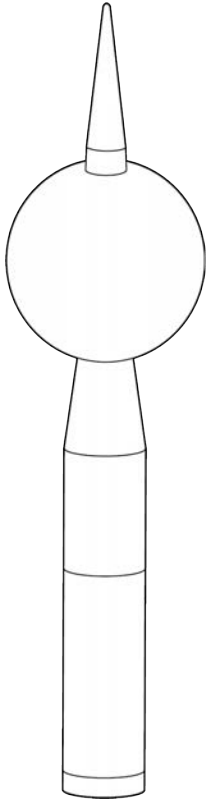
- The wind screen is fixed between the bird spike and the microphone cage.

> Do not apply any force onto the wind screen in order to prevent damage!
>
> Do not touch the water-repellent membrane!



4 Accessories

4.1 WP30-90/-150 Weather Protection



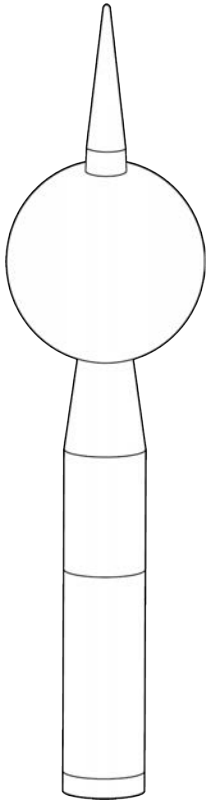
Protect your measurement microphones M2230 and M2340 from environmental impacts with this professional outdoor weather protection kit. Ideal for precise acquisition of environmental noise data in outdoor applications.

- Class 1 compliant with IEC 61672 and ANSI S1.4 for vertical and horizontal sound incidence
- Protection from rain and dust (IP54), wind and perching birds
- Built from corrosion-free materials
- Removable top section for easy microphone calibration
- Standard 3/8” tripod mount
- Weight: 270 g (9.5 oz.)
- Optional Pole Mount Adapter
- Optional sturdy outdoor carrying case available

WP30-90: NTi Audio # 600 040 060

WP30-150: NTi Audio # 600 040 090

4.2 WP61 Weather Protection for M4261

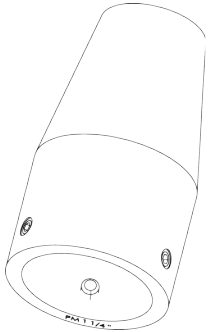


Protect your M4261 microphone from environmental impacts with this professional outdoor weather protection kit.

- Class 2 compliant with IEC 61672 and ANSI S1.4 for vertical and horizontal sound incidence
- Protection from rain and dust (IP54), wind and perching birds
- Built from corrosion-free materials
- Removable top section for easy microphone calibration
- Standard 3/8” tripod mount
- Weight: 270 g (9.5 oz.)
- Optional Pole Mount Adapter
- Optional sturdy outdoor carrying case available

NTi Audio # 600 040 080

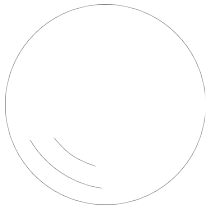
4.3 Pole Mount Adapter



The outdoor measurement microphone may be installed on a pole using this adapter. The microphone is connected to the sound level meter by the ASD cable, which runs through the pole and the adapter to the microphone. The adapter is available in two different sizes.

- NTi Audio # 600 040 067, Pole Mount Adapter PM 1”, supports pole diameter 25 – 33 mm (1 – 1.3”)
- NTi Audio # 600 040 068, Pole Mount Adapter PM 1 ¼”, supports pole diameter 32 – 44 mm (1.25 – 1.75”)

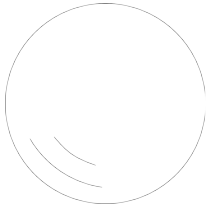
4.4 WP30-90 / WP61 Windscreen Replacement



The replacement package contains two 90 mm spare windscreens for outdoor measurement microphones. The outdoor windscreen is recommended to be replaced annually.

NTi Audio # 600 040 061

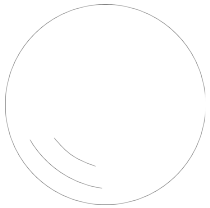
4.5 WP30-150 Windscreen Replacement



The replacement package contains two 150 mm spare windscreens for outdoor measurement microphones. The outdoor windscreen is recommended to be replaced annually.

NTi Audio # 600 040 095

4.6 ½" Windscreen 90 mm



for M2230, M2340, M2211 and M2215 measurement microphone

NTi Audio # 600 040 109

4.7 Class 1 Sound Calibrator

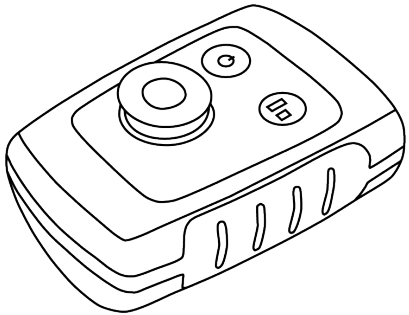
The battery-operated Class 1 Sound Calibrator is classified for the calibration of class 1 measurement microphones, sound level meters and other acoustic measurement equipment. This precision microphone calibrator delivers 94 or 114 dB at a frequency of 1 kHz.

NTi Audio # 600 000 388

The optional ¼" adapter ADP-1/4-P is required to fit ¼" measurement microphones.

NTi Audio # 600 000 391

4.8 Class 2 Sound Calibrator



The battery-operated Class 2 Sound Calibrator is classified for the calibration of class 2 measurement microphones, sound level meters and other acoustic measurement equipment. This microphone calibrator delivers 114 dB at a frequency of 1 kHz.

NTi Audio # 600 000 394

4.9 Manufacturer Calibration Certificate

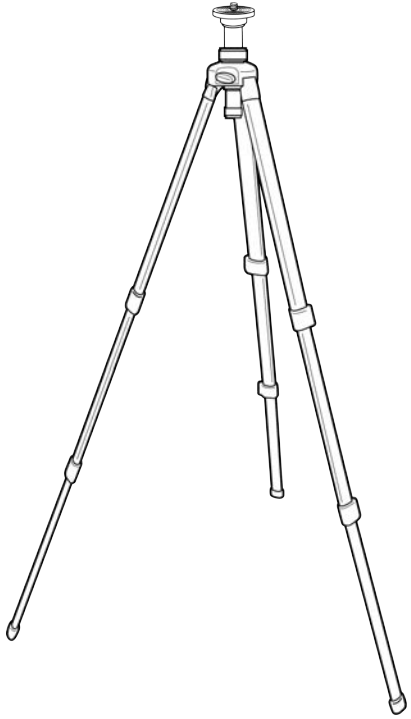
The calibration certificate lists the individual product data with serial number. The calibration and adjustment procedures follow the documentation and traceability requirements of the EN ISO / IEC 17025 standard. Annual re-calibration of the instrument is recommended ensuring accurate measurements.

NTi Audio # 600 000 018

4.10 Lightweight Tripod

Retractable, lightweight tripod with 1/4” ball head and 3/8” mounting thread. The flexible ball head mounts the XL2 or XL3 Analyzer at any angle. The tripod is suitable for all measurement microphones, outdoor measurement microphones and the TalkBox.

NTi Audio # 600 000 397

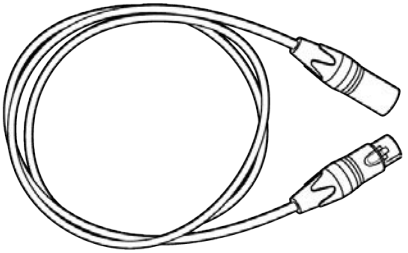


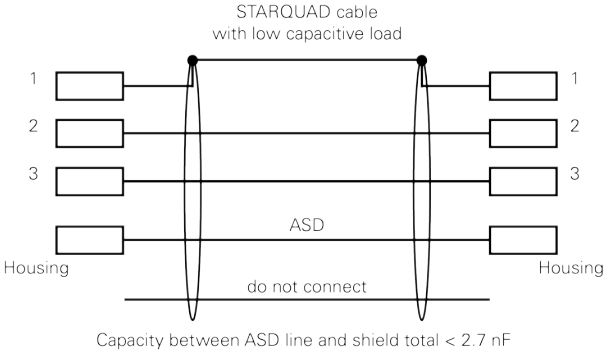
4.11 ASD Cable

The ASD Cable allows for extended connections of the NTi Audio measurement microphones. It supports the transfer of the electronic data sheet from the microphone to the XL2 or XL3 Analyzer, as well as the CIC feature.

- 5 m (16 ft): NTi Audio # 600 000 336
- 10 m (32 ft): NTi Audio #600 000 364
- 20 m (64 ft): NTi Audio # 600 000 365

The ASD technology for the electronic data sheet transfer is applicable for cable length until 20 m (64 ft).





5 Further Information

5.1 My NTi Audio

Register your instruments at My NTi Audio and benefit from the following possibilities:

- Free updates for your instruments
- Activation of optional product functions
- Premium access to downloads
- Receive application and product news
- Faster worldwide support
- Tracing support in case of loss or theft
- Calibration support

How to Register

- Open the web page “https://my.nti-audio.com”.
- You are prompted to login or create your My NTi Audio account.
- The web page “My NTi Audio Products” opens.
- Select the product type and enter the serial number.
- Confirm with “Register”.
- Now your product is listed in the table “My Products“.

- Use the microphone for the intended purpose only.
- Protect the microphone from contamination by always using the supplied windscreen.
- Never use the microphone in a damp or wet environment.
- Do not jar or drop the microphone.
- Do not remove the microphone protective grid.
- Do not touch the microphone membrane.
- Remove the black dust cap of the 1/2” measurement microphones prior to use.
- In an outdoor environment, ensure that you install protection against lightning strikes.

5.2 Calibration Certificate

The NTi Audio measurement microphones have been carefully tested during production and corresponds to the specifications listed in “Technical Data”. Calibration certificates for new products are optional.

NTi Audio recommends annual calibration of the products after the purchase. The calibration provides documented and traceable measurement accuracy and confirms that your NTi Audio product meets or exceeds the published specifications. The calibration and adjustment procedures follow the documentation and traceability requirements of the standard EN ISO / IEC 17025.

For calibrations follow the service guidelines at https://www.nti-audio.com/en/support/calibration-service.

5.3 Service and Repairs

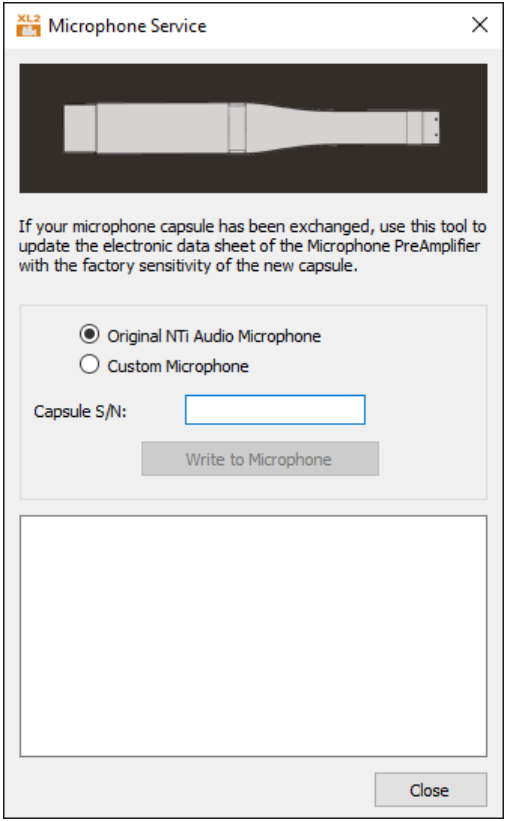
If your product is not functioning correctly or is damaged, please contact the local NTi Audio partner for assistance. If the product needs to be returned for service, kindly follow the service guidelines at https://www.nti-audio.com/en/support/calibration-service.

5.4 Capsule Replacement Instructions

The microphones for the XL2 and XL3 Analyzer include an electronic data sheet. The Automated Sensor Detection (ASD) of the XL2 and XL3 Analyzer automatically reads this data, i.e. the microphone model and calibration data. This promotes faster setup and ensures accurate measurements. In case of a capsule replacement, the electronic data sheet needs to be updated with the data of the new capsule.

Step-by-step instruction

- Install the new capsule on the microphone preamplifier.
- Plug the measurement microphone directly into the XL2.
- Install the latest firmware in the XL2, available at https://my.nti-audio.com/support/xl2.
- Start the XL2 Projector PRO Software. The computer requires online connection to the web.
- Connect the XL2 with the USB cable to the Projector PRO software, thus you see the XL2 display live on the computer monitor (if prompted select **COM-Port** on the XL2).
- Press the computer keyboard keys “Ctrl + Shift + F5” at the same time (alternatively “Ctrl + Alt + F5”)



- Select Original NTi Audio Microphone or Custom microphone.
- Case A): Original NTi Audio Microphone

  Enter the serial number of the new capsule

  Confirm by clicking **Write to MA220**.

  Now XL2 reads the factory sensitivity of the new capsule from the NTi Audio server and stores the new data into the electronic data sheet of the preamplifier. You will be prompted if all is in good order.

- Case B): Custom microphone

  Enter the microphone sensitivity

  Confirm by clicking **Write to MA220**.

  Now XL2 stores the microphone sensitivity as factory sensitivity in the electronic data sheet of the MA220 PreAmplifier.

- Verify the setting in the “CALIBRATE” screen of the XL2 and perform a user calibration to verify if the new capsule works in good order.

5.5 Warranty Conditions

5.5.1 International warranty

NTi Audio guarantees the function of its products and the individual components for a period of one year from the date of sale. During this period, defective products will either be repaired free of charge or replaced.

5.5.2 Limitations

These guarantee provisions do not cover damage caused by accidents, transportation, incorrect use, carelessness, non-original accessories, the loss of parts, operation with non-specified input voltages, adapter types or incorrectly inserted batteries. NTi Audio accepts no responsibility for subsequent damage of any kind. The warranty will be voided by carrying out repairs or services by third parties who are not part of an approved

NTi Audio Service Centre.

5.5.3 Statutory Rights

Consumers may have legal (statutory) rights under applicable national laws relating to the sale of consumer products. This warranty does not affect your statutory rights. You may assert any legal rights you have at your sole discretion.

5.6 CE Declaration of Conformity

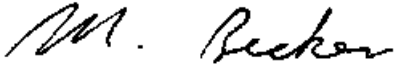
We, the manufacturer NTi Audio AG, Im alten Riet 102, 9494 Schaan, Liechtenstein, do hereby declare that the measurement microphones M2230, M2340, M2211, M2215, M2914, M4261, the preamplifiers MA220, MA230 and accessories, comply with the following standards or other standard documents:

- EMC: 2014/30/EU
- Harmonized standards: EN 61326-1
- Explosive atmospheres (ATEX): 2014/34/EU
- Directive 2011/65/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).
- Directive 2012/34/EU on waste electrical and electronic equipment (WEEE).

This declaration will become invalid if modifications to the instrument are carried out without the written approval of

NTi Audio.

Date: 07. July 2023



CE

Position: CEO

5.7 Information for Disposal and Recycling

Dispose of the instrument in accordance with the legal environmental regulations in the country.

5.7.1 Regulations for the EU and other European countries with corresponding laws

The instrument must not be disposed of in the household garbage. At the end of its service life, bring the instrument to a collecting point for electrical recycling in accordance with the local legal regulations.

5.7.2 Other countries outside the EU

Contact the respective authorities for the valid environmental regulations in the country.

6 Technical Data Measurement Microphones

6.1 Certified Class 1 Measuring Microphones

	M2340 Class 1 certified with self-examination	M2230 class 1 certified
Scope of delivery	MA230 preamplifier + MC230A micro-phone capsule	MA220 preamplifier + MC230A micro-phone 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

	M2340 Class 1 certified with self-examination	M2230 class 1 certified
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	

	M2340 Class 1 certified with self-examination	M2230 class 1 certified
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	
Output connector	balanced 3-pin XLR	
Diameter	20.5 mm (0.8")	
Length	154 mm (6.1")	
Weight	100 g, 3.53 oz	

	M2340 Class 1 certified with self-examination	M2230 class 1 certified
Protection class	IP51	
NTi Audio #	600 040 230	600 040 050

6.2 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 according to IEC 61672 and ANSI S1.4	Frequency response class 1		Class 2
Microphone capsule	1/2" removable with thread 60UNS2 type WS2F according to IEC 61094-4		1/4" fixed mounted

	M2211 frequency response class 1	M2215 for high sound levels, frequency response class 1	M4261 class 2
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 ±45 dB @ >10 kHz – 16 kHz ±5 dB @ >16 kHz – 20 kHz
Individual frequency response freely available as Excel file,	Freely available as Excel file: register the microphone on my.nti-audio.com and contact info@nti-audio.com		
Frequency range	5 Hz – 20 kHz		
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)

	M2211 frequency response class 1	M2215 for high sound levels, frequency response class 1	M4261 class 2
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		

	M2211 frequency response class 1	M2215 for high sound levels, frequency response class 1	M4261 class 2
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

	M2914 Low-Noise
Microphone type	Omnidirectional, pre-polarized condenser, free field microphone
Capsule / transducer	1/2” detachable with 60UNS2 thread, type WS2F according IEC 61094-4 matched with preamplifier

	M2914 Low-Noise
Preamplifier type	MA214
Flatness tolerance bands typical	±2 dB @ 10 Hz – 16 kHz ±3 dB @ 5 Hz – 20 kHz
Sensitivity typical @ 1 kHz	320 mV/Pa
Residual noise floor typical	6.5 dB(A)
Maximum SPL @ THD 3%, 1 kHz, S_ typical	Peak 103 dB / RMS 100 dB
Temperature coef-ficient	< ±0.01 dB / °C
Temperature range	–20°C to +60°C (–4°F to 140°F)
Pressure coefficient	–0.00001 dB/Pa
Humidity	< 90% R.H., non-condensing
Power supply	ICP

	M2914 Low-Noise
Current consumption	4 – 20 mA typical
Output impedance	< 100 Ω
Connector	BNC
Diameter	12.7 mm (0.5"), protection grid 13.2 mm (0.52")
Length	135 mm (5.3”)
Weight	250 g (8.8 oz)
Windscreen diameter	50 mm (2")
NTi Audio #	600 040 240

7 Technical Data Microphone Preamplifiers

	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	< 1° @ 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 M-Series Microphones Analyzer • NTi Audio ASD according to IEEE P1451.4 V1.0, class 2, template 27	
Self-check	Yes	No

	MA230	MA220
Humidity	5% to 90% RH, non-condensing	
Power supply	48 VDC phantom power	
Power consumption	0.76 mA typical	2.3 mA typical
Electronic data sheet	NTi Audio ASD according to IEEE P1451.4 V1.0, class 2, template 27	
Output impedance	100 Ω symmetrical	
Output connector	balanced 3-pin XLR	
Diameter	20.5 mm (0.8")	
Length	154 mm (6.1")	
Weight	100 g, 3.53 oz	
Protection class	IP51	
NTi Audio #	600 040 200	600 040 050

7.1 Outdoor Measurement Microphones

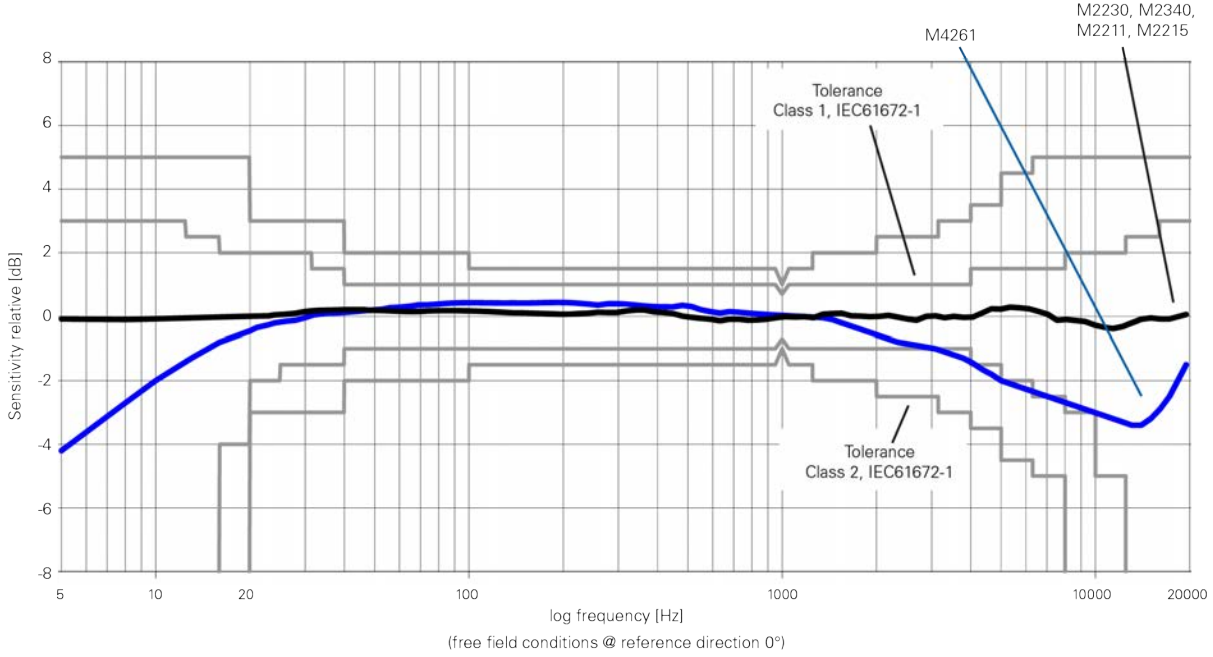
	M2230-WP-90 (M2230+WP30)	M2230-WP-150 (M2230+WP30)	M4261-WP (M4261+WP61)
Classification with XL2 or XL3 according to IEC 61672, ANSI S1.4	Class 1	Class 1	Class 2
Certifications	LNE, PTB	–	–
System Self-test (CIC)	–	–	–
Diameter Dimensions	36 mm (1.4")	36 mm (1.4")	36 mm (1.4")
Length Dimen-sions	378 mm (14.9")	378 mm (14.9")	378 mm (14.9")
Weight	430 g (15.17 oz)	430 g (15.17 oz)	430 g (15.17 oz)
Environmental Protection	IP54 in vertical position	IP54 in vertical position	IP54 in vertical position

	M2230-WP-90 (M2230+WP30)	M2230-WP-150 (M2230+WP30)	M4261-WP (M4261+WP61)
NTi Audio #	600 040 050 + 600 040 060	600 040 050 + 600 040 090	600 040 070 + 600 040 080

	M2340-WP-90 (M2340+WP30)	M2340-WP-150 (M2340+WP30)
Classification with XL2 or XL3 according to IEC 61672, ANSI S1.4	Class 1	Class 1
Certifications	LNE, PTB	LNE
System Self-test (CIC)	with XL2 or XL3	
Diameter Dimensions	36 mm (1.4")	
Length Dimensions	378 mm (14.9")	378 mm (14.9")
Weight	430 g (15.2 oz)	450 g (15.9 oz)

	M2340-WP-90 (M2340+WP30)	M2340-WP-150 (M2340+WP30)
Environmental Protection	IP54 in vertical position	
NTi Audio #	600 040 230 + 600 040 060	600 040 230 + 600 040 090

7.2 Typical Frequency Response of Measurement Microphones



7.3 Free Field - Pressure Correction Factors

If a measurement microphone is located in a free-field environment, then the microphone capsule acts like a reflector at high frequencies, as the sound pressure increases in front of the membrane. M2211, M2215, M2230, M2340 and M4261 are free-field equalized measurement microphones, they compensate for the increased pressure internally. The calibration of the measurement microphones M2230 and M2340 with the B&K 4226 requires the accessory Adapter Ring MXR01, NTi Audio # 600 040 105. Please note, never touch the diaphragm of the measurement microphone capsule.

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

Example:

- During the calibration, the XL2 or XL3 measures the sound level in the calibrator. If the B&K 4226 calibrator is used and is set to 16 kHz, then the XL2 or XL3 + M2230 reads just 86.7 dBA.
- The free-field sound level is calculated by summing the XL2 or XL3 measurement value and the correction value (86.7 dB + 7.3 dB = 94.0 dB).

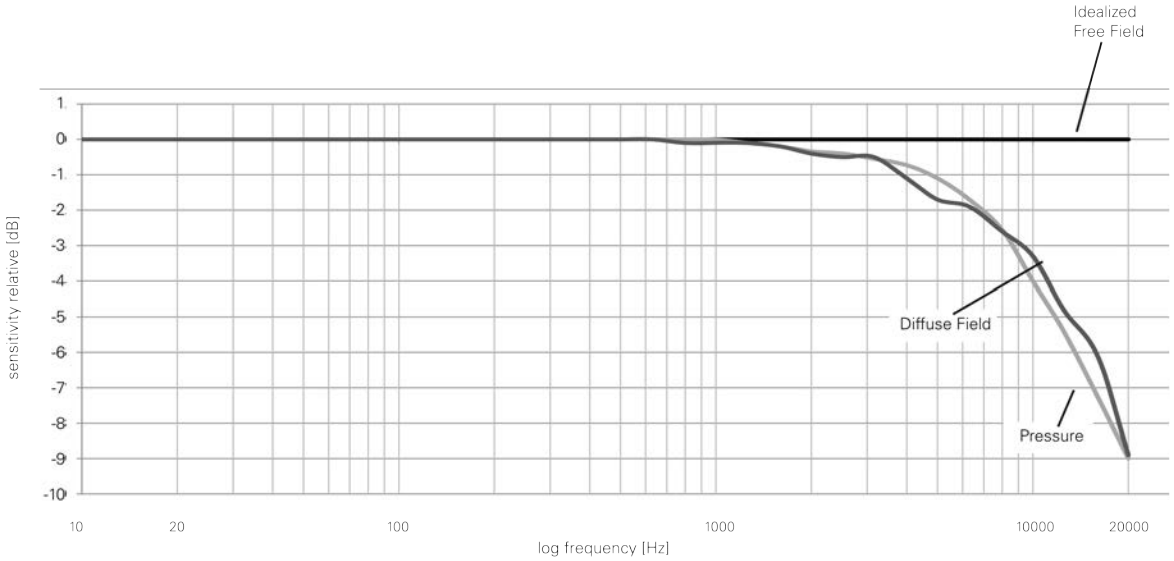
The following corrections apply with the B&K 4226 calibrator.

Nominal Frequency [Hz]	M2230, M2340 with MXR01 Adapter [dB]	M2230, M2340 [dB]	M2211 [dB]	M2215 [dB]	Measurement Uncertainty U [dB]
31.5	–0.3	0.0	–0.2	0.0	0.3
63	0.0	0.0	0.0	0.0	0.3
125	–0.2	0.0	–0.1	–0.1	0.3
250	–0.2	0.0	–0.1	–0.1	0.3
500	–0.2	0.0	–0.1	–0.1	0.3
1000	0.0	0.0	0.0	0.0	0.3
2000	0.1	0.3	0.1	0.0	0.3
4000	0.7	0.7	0.7	0.4	0.3
8000	2.7	2.6	4.5	4.7	0.4
12500	7.2	6.0	5.8	6.1	0.7
16000	7.3	7.3	7.9	7.9	0.8

Correction values for other calibrators for M2230 and M2340.

Type	Correction value	Calibration Frequency	Calibration Level
NTi Audio CAL200	–0.1	1 kHz	114.0 dB
B&K 4231	–0.2	1 kHz	114.0 dB
Norsonic Nor-1251	–0.2	1 kHz	114.0 dB

7.4 Free-field and Diffuse-field Sensitivity of M2230 and M2340



7.5 Spectral Correction for horizontal Sound Incidents using the Outdoor Microphone

The outdoor microphone M2230-WP fulfills Class 1 requirements of IEC 61672 and ANSI S1.4 for vertical sound incidence. For compliance with horizontal sound incidence a spectral correction is employed in the associated XL2 Sound Level Meter.

.

Nominal Frequency [Hz]	WP30 Weather Protection [dB]		WP61 Weather Protection [dB]	
	1/3rd Octave	1/1 Octave	1/3rd Octave	1/1 Octave
< 800	0.0	0.0	0.0	0.0
800	0.0	0.0	0.0	0.0
1000	0.0		0.0	
1250	0.1		0.0	
1600	0.2	0.4	0.2	0.4
2000	0.3		0.3	
2500	0.7		0.8	
3150	1.3	2.0	1.4	2.0
4000	2.0		2.1	
5000	2.7		2.5	
6300	2.9	3.4	2.3	2.5
8000	3.3		2.4	
10000	3.9		2.8	

Nominal Frequency [Hz]	WP30 Weather Protection [dB]		WP61 Weather Protection [dB]	
	1/3rd Octave	1/1 Octave	1/3rd Octave	1/1 Octave
12500	4.6	5.9	3.0	3.0
16000	6.4		3.1	
20000	6.8		3.1	

7.6 Technical Data PreAmplifier

	MA220 PreAmplifier	MA230 PreAmplifier with self-test (CIC)
Microphone PreAmplifier	Compatible with 1/2" microphone capsules type WS2F in accordance with IEC61094-4	
Frequency Range [–3 dB]	4 Hz – 100 kHz	1.3 Hz – 50kHz
Residual Noise Floor typical	1.9 µV(A) @ C_in = 15 pF ≙ 5.6 dBA @ 42 mV/Pa	2.4 µV(A) @ C_in = 15 pF ≙ 9.1 dBA @ 42 mV/Pa
Frequency Response Flatness	±0.2 dB	±0.1 dB, 10 Hz – 20 kHz

	MA220 PreAmplifier	MA230 PreAmplifier with self-test (CIC)
Phase Linearity	< 1° @ 20 Hz – 20 kHz	
Maximum Output Voltage @ THD 3%, 1 kHz	21 Vpp ≙ 0.4 Vrms ≙ 138.9 dBSPL @ 42 mV/Pa	22 Vpp ≙ 7.8 Vrms ≙ 139.3 dBSPL @ 42 mV/Pa
Electronic data Sheet	Containing user calibration data; default factory sensitivity = 4.9 V/Pa Read/write by XL2 Audio and Acoustic Analyzer NTi Audio ASD in accordance with IEEE P1451.4 V1.0, Class 2, Template 27	
Impedance	Input: 20 GΩ // 0.26 pF, Output: 100 Ω balanced	
Power Supply	48 VDC Phantom power, 2.3 mA typical	48 VDC Phantom power, 0.8 mA typical
Attenuation	< 0.17 dB (R_Phantom 2 x 6.8 kΩ)	< 0.07 dB (R_Phantom 2 x 6.8 kΩ)
Connector	Balanced 3-pole XLR	
Thread for Cap-sule	60 UNS2	
Weight	90 g (3.17 oz)	
Dimensions	Length 142.5 mm (5.6”), diameter 20.5 mm (0.8”)	
Temperature Range	–10°C to +50°C (14°F to 122°F)	

	MA220 PreAmplifier	MA230 PreAmplifier with self-test (CIC)
Humidity	5 – 90% RH, non-condensing	
NTi Audio #	600 040 040	600 040 200

The product specifications may vary based on the mounted microphone capsule type.

8 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.

NOTE! Operating conditions

Unless equipped with a Weather Protection kit, 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.