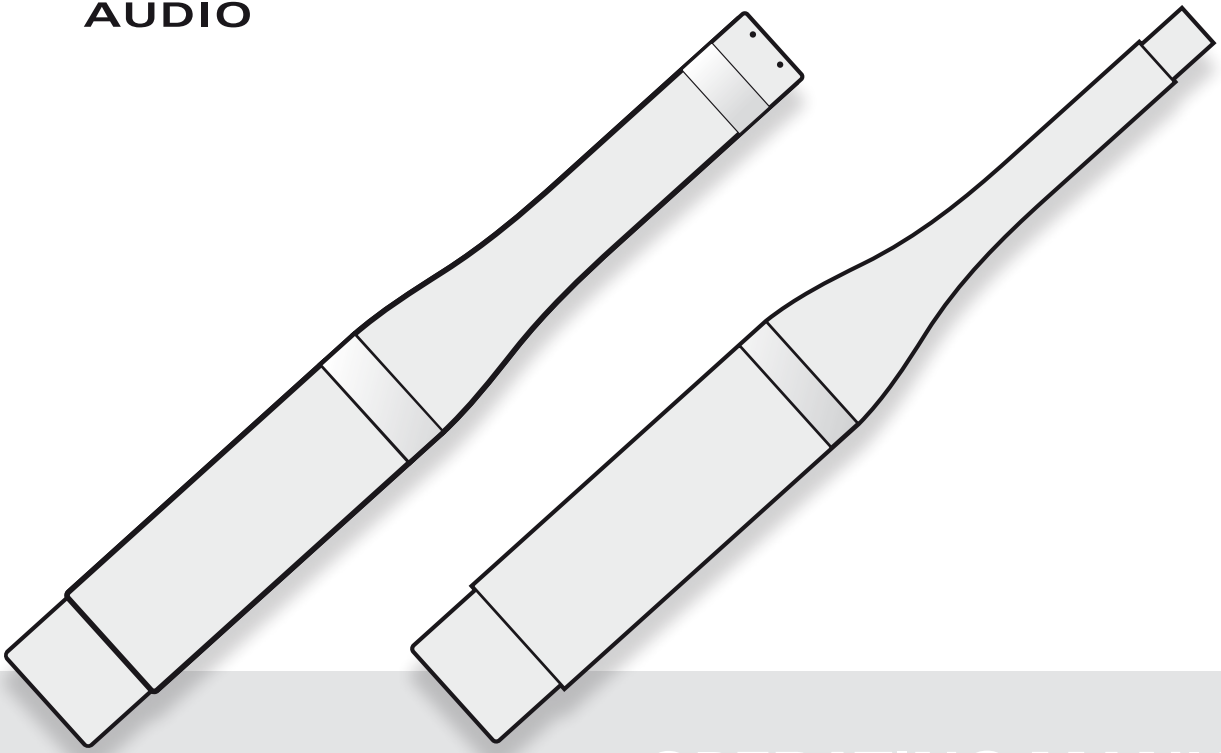
NTi AUDIO



OPERATING MANUAL

MEASUREMENT MICROPHONES

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NTi Audio is an ISO 9001:2008 certified company.

Version 1.08 / Oct. 2015

Made in Switzerland

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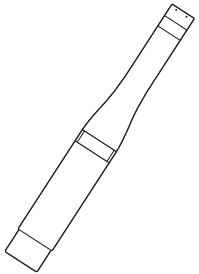
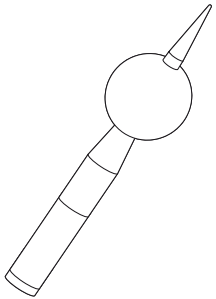
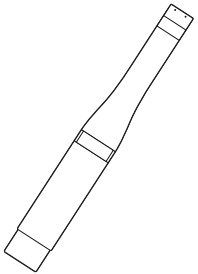
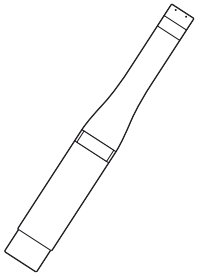
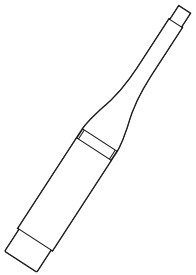
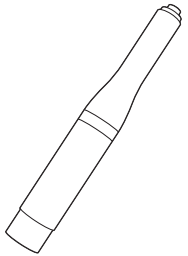
					
Certified Class 1 measurement microphone in accordance with IEC 61672. Metal diaphragm.	Outdoor measurement microphone. Class 1 in accordance with IEC 61672. Metal diaphragm.	General purpose measurement microphone. Class 1 frequency response. Metal diaphragm.	Measurement microphone for high sound levels (up to 153 dB). Class 1 frequency response. Metal diaphragm.	Cost-effective class 2 measurement microphone for general sound level testing, commissioning and service of audio-acoustic installations.	Microphone preamplifier compatible with 1/2″ pre-polarized capsules.

Scope of Delivery

M2230	• Measurement Microphone consisting of - MA220 Microphone PreAmplifier - Microphone Capsule for M2230 • Dust Cap • 50 mm Windscreen • Microphone-holder MH01 with Adapter 5/8“ - 3/8“ • Operating Manual • Individual Frequency Response Chart
M2230-WP	• M2230 Measurement Microphone • WP30 Weather Protection - Bird spike - 90mm Wind screen - Protection cage - Upper body tube with allen key mount - Lower body tube - Footer plate with tripod mounting thread (incl. 3 allen screws) - Allen key

M2211	• Measurement Microphone consisting of - MA220 Microphone PreAmplifier - Microphone Capsule for M2211 • Dust Cap • 33 mm Windscreen • Microphone-holder with Adapter 5/8“ - 3/8“ • Operating Manual
M2215	• M2215 Measurement Microphone consisting of - MA220 Microphone PreAmplifier - Microphone Capsule for M2215 • Dust Cap • 33 mm Windscreen • Microphone-holder with Adapter 5/8“ - 3/8“ • Operating Manual

M4260	• Measurement Microphone • 33 mm Windscreen • Microphone-holder with Adapter 5/8“ - 3/8“ • Operating Manual
MA220	• PreAmplifier • Dust Cap • Microphone-holder with Adapter 5/8“ - 3/8“ • Operating Manual

Description

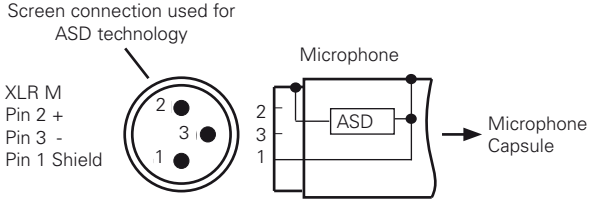
The plug-on measurement microphones combined with the XL2 Analyzer form a comprehensive sound level meter and acoustic analyzer. The microphones are 48 VDC phantom-powered and include an electronic data sheet.

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 Audio and Acoustic Analyzer for measurements at remote locations or for reduction of acoustic reflections.

Electronic Data Sheet

The microphones include an electronic data sheet. The Automated Sensor Detection (ASD) of the XL2 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

Connecting to XL2

Microphone plugs directly into the XL2

The XL2 automatically reads the electronic data sheet of the connected microphone as follows:

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

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

Microphone Connection via the ASD Cable

The NTi Audio measurement microphones can be connected with an ASD Cable to the XL2 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. The automated sensor detection does not disturb any measurements. You may join up to 4x ASD Cables together in series. The ASD technology supports accurate data communication up to a combined cable length of 20 meters (= 65 feet).

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. The microphone sensitivity has to be entered manually into the XL2 Analyzer.

Alternatively connect the microphone first directly to the Analyzer. The XL2 reads the sensitivity and remembers this value. Afterwards connect the audio cable.

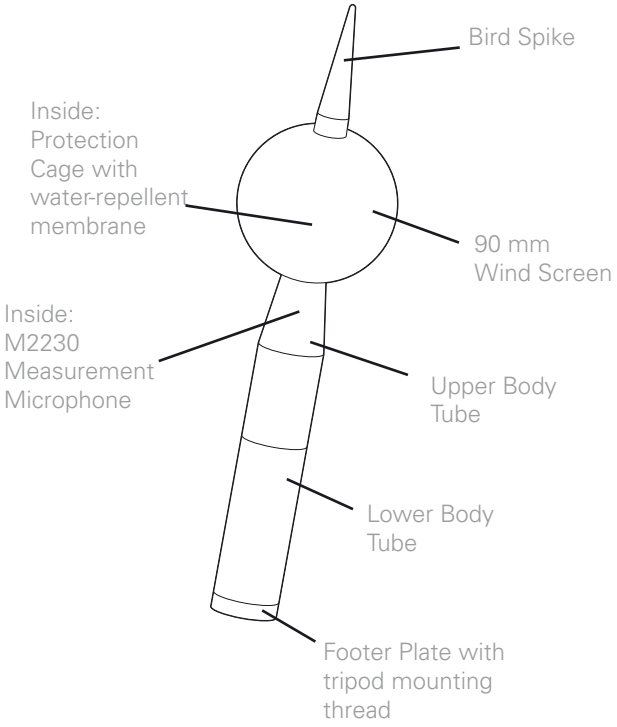
Outdoor Microphone M2230-WP

Introduction

The M2230-WP is a weather-protected microphone solution for the XL2 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.

The frequency response of the M2230-WP fulfills the IEC 61672 class 1 as well as the ANSI S1.4 type 1 requirements for vertical sound incidence. For compliance with horizontal sound incidence a frequency compensation is employed in the associated XL2 Sound Level Meter.

The M2230-WP consists of an M2230 measurement microphone enclosed in a WP30 weather protection kit.



- Always activate the frequency correction filter in the XL2 when measuring a horizontal sound incidence (sound source from the side) with the M2230-WP. The filter ensures that the measurements accuracy meets the requirements of IEC 61672 class 1 and ANSI S1.4 type 1.
- Deactivate the filter only if you are measuring a vertical sound incidence (sound source from above e.g. airplane noise) with the M2230-WP.

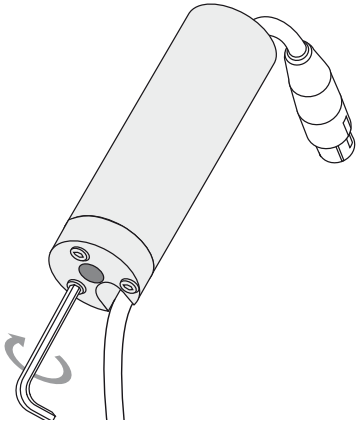
Do not use the M2230-WP in a horizontal position. Raindrops may reach and damage the M2230 measurement microphone.

Assembling

This chapter describes how to assemble the M2230 Measurement Microphone into the WP30 weather protection kit:

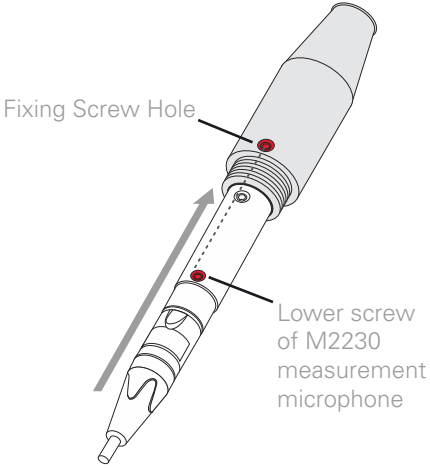
Install ASD Cable

- 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.



Insert M2230 Measurement Microphone

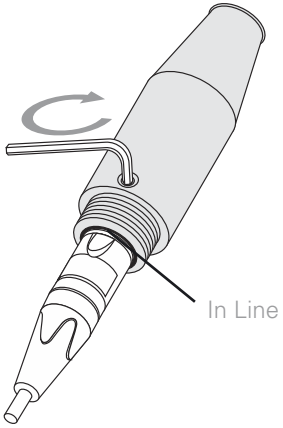
- Connect the M2230 measurement microphone to the female XLR of the ASD Cable.
- Insert the M2230 measurement microphone into the upper body tube so that the bottom end of the microphone is in line with the bottom end of the upper body tube. Align the fixing screw hole of the upper body tube with the lower screw of the M2230 measurement microphone (remove the fixing screw to see the lower screw head through the fixing screw hole).



Attach the M2230 to the Upper Body Tube

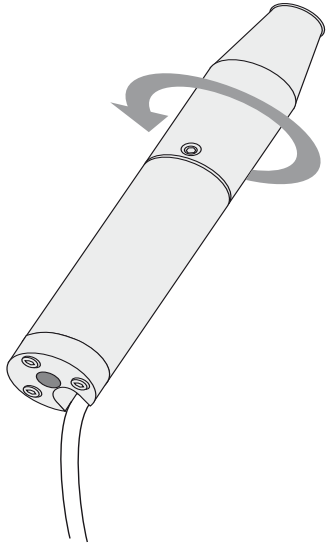
Attaching the fixing screw of the upper body tube onto the lower screw of the M2230 measurement microphone ensures that the microphone housing is not scratched.

- 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 microphone is in line with the bottom end of the upper body tube.



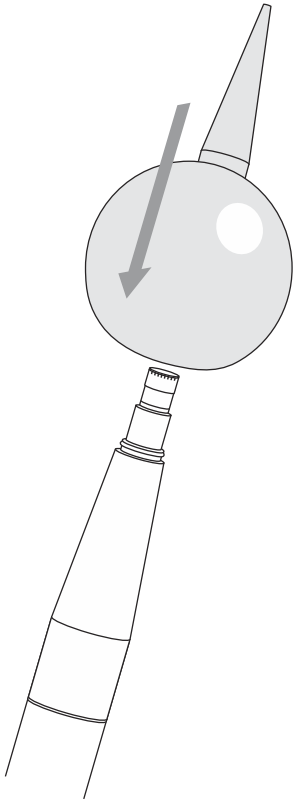
Assemble the Weather Protection Body

- 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.



Mount the Top Section

- The top section of the WP30 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.



You have successfully assembled the M2230-WP Outdoor Measurement Microphone.

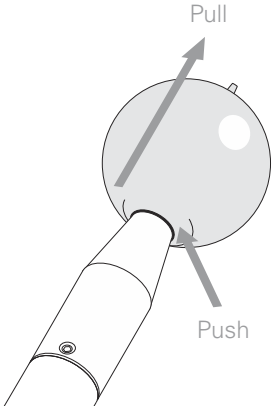
Calibration

The design of the M2230-WP Outdoor Measurement Microphone supports easy calibration of the microphone. To calibrate, follow the procedure below:

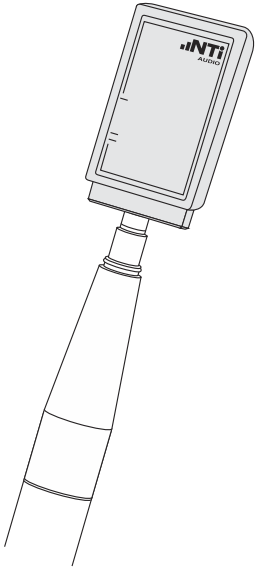
- The top section of the M2230-WP is snapped on to the body tube. Remove the top section of the M2230-WP by gently pulling the bird spike upwards. At the same time gently push up on the cage inside the wind screen with two fingers of your other hand. You will feel when the snap mechanism is released.

⚠	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.

- Gently remove the top section.



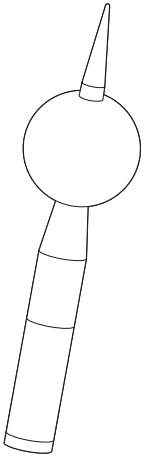
- Calibrate the microphone as described in the XL2 user manual using the NTi Audio Precision Calibrator.



- Snap the top section back into position on the body tube.

You have successfully calibrated the M2230-WP Outdoor Measurement Microphone.

Accessories



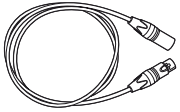
WP30 Weather Protection for M2230
Protect your M2230 microphone from rain, wind, dust and perching birds with this professional outdoor weather protection kit. Ideal for precise acquisition of environmental noise data in outdoor applications.

Features
- Compliant with IEC 61672 Class 1 and ANSI S1.4 Type 1 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 sturdy outdoor carrying case available

NTi Audio # 600 040 060

Precision Calibrator 94/114 dB, Class 1
The precision calibrator is used to ensure accurate sound level measurements. It generates 94 or 114 dBSPL reference tones @ 1kHz for calibration of 1/2" and 1/4" measurement microphones.
NTi Audio #: 600 000 390

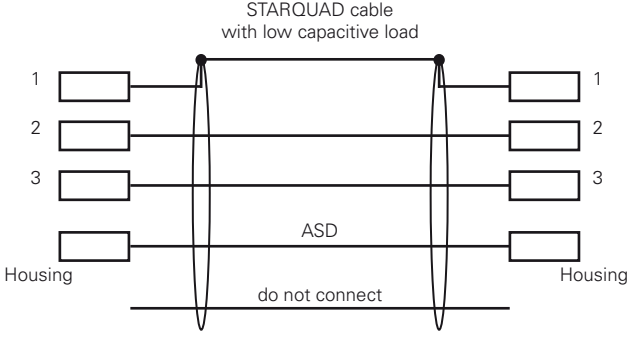
Manufacturer Calibration Certificate
The calibration certificate lists the individual product data with serial number. The calibration and adjustment procedures follow the documentation and traceability requirements of the EN ISO / IEC 17025 standard. Annual re-calibration of the instrument is recommended ensuring accurate measurements.
NTi Audio # 600 000 018



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 Analyzer.
NTi Audio #:
5 meter (16 feet): 600 000 336
10 meter (32 feet): 600 000 364
20 meter (64 feet): 600 000 365

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



Capacity between ASD line to shield total < 2.7nF

Further Information

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 "http://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".

Congratulations, your NTi Audio product is registered.

Notes

- 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.

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 kindly follow the service guidelines at www.nti-audio.com/service.

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 www.nti-audio.com/service.

Warranty Conditions

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.

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.

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.

Declaration of Conformity

CE

CE / FCC Compliance Statement

We, the manufacturer NTi Audio AG do hereby declare that the measurement microphones M2230, M2211, M2215, M4260, the preamplifier MA220 and accessories, comply with the following standards or other standard documents:

- EMC: 89/336, 92/31, 93/68
- Harmonized standards: EN 61326-1
- Explosive atmospheres (ATEX): 94/9/EG
- Directive 2011/65/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).
- Directive 2002/96/EC 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: 1. February 2013

M. Becker

Position: Technical Director

Information for Disposal and Recycling

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

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.

Other countries outside the EU

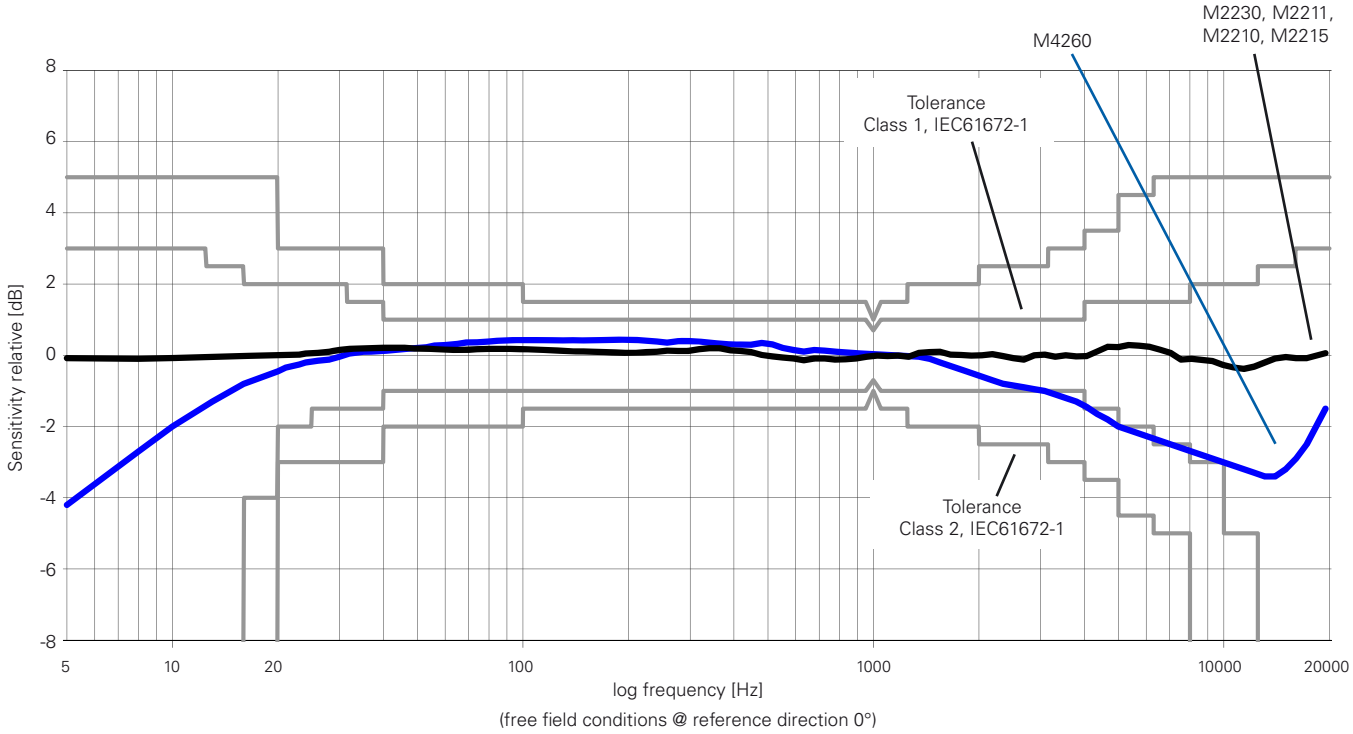
Contact the respective authorities for the valid environmental regulations in the country.

Technical Data Measurement Microphones

	M2230 Class 1 Certified	**M2230-WP Class 1 Outdoor Microphone (M2230+WP30)**	**M2211 Frequency Response Class 1**	**M2215 High SPL Frequency Response Class 1**	**M4260 Class 2**
Consisting of	PreAmplfier MA220 + MC230 Capsule	PreAmplfier MA220 + MC230 Capsule + WP30	PreAmplfier MA220 + M2211 Capsule	PreAmplfier MA220 + M2215 Capsule	M4260 microphone with permanently installed capsule
Microphone Type	Omnidirectional, pre-polarized condenser, free field microphone				
Classification according IEC 61672 and ANSI S1.4	Class 1 / Type 1 Certified	Class 1 / Type 1	Frequency Response Class 1 / Type 1		Class 2 / Type 2
Capsule / Transducer	1/2" detachable with 60UNS2 thread, type WS2F according IEC 61094-4				1/4" permanently installed
PreAmplifier Type	MA220				-
Flatness tolerance bands 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
Frequency Range	5 Hz - 20 kHz				
Residual Noise Floor typical	16 dB(A)		21 dB(A)	25 dB(A)	29 dB(A)
Maximum SPL @ THD 3%, 1 kHz	139 dBSPL		144 dBSPL	153 dBSPL	144 dBSPL

	M2230 Class 1 Certified	M2230-WP Class 1 Outdoor Microphone (M2230+WP30)	M2211 Frequency Response Class 1	M2215 High SPL Frequency Response Class 1	M4260 Class 2
Sensitivity typical @ 1 kHz	-27.5 dBV/Pa ±2 dB (42 mV/Pa)		-34 dBV/Pa ±3 dB (20 mV/Pa)	-42 dBV/Pa ±3 dB (8 mV/Pa)	-31.7 dBV/Pa ±3 dB (26 mV/Pa)
Temperature Coefficient	< -0.01 dB / °C		< ±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)
Pressure Coefficient	-0.005 dB / kPa		-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				-
Electronic Data Sheet	NTi Audio ASD in accordance with IEEE P1451.4 V1.0, Class 2, Template 27				
Output Impedance	100 Ohm balanced				
Power Supply	48 VDC phantom power, 3 mA typical				
Connector	Balanced 3-pole XLR				
Diameter Dimensions	20.5 mm (0.8")	36 mm (1.4")	20.5 mm (0.8")		
Length Dimensions	154 mm (6.1")	378 mm (14.9")	150 mm (5.9")		
Weight	100 g, 3.53 oz	430 g, 15.17 oz	100 g, 3.53 oz		83 g, 2.93 oz
Environmental protection	IP51	IP54 in vertical position	IP51		
NTi Audio #	600 040 050	600 040 055	600 040 022	600 040 045	600 040 025

Typical Frequency Response of Measurement Microphones



Free Field - Pressure Correction Factors

If a measurement microphone is held in a free-field environment, then the measurement microphone acts at high frequencies like a reflector. The sound pressure increases in front of the microphone capsule membrane. M2230, M2211 and M2215 are free-field equalized measurement microphones, they compensate for the increased pressure internally.

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

Example:

- During the calibration, the XL2 measures the sound level in the calibrator. If the B&K4226 calibrator is used and it is set to 16 kHz, then the XL2+M2230 reads just 86.7 dBA.
- The free-field sound level is calculated by summing the XL2 measurement value and the correction value (= 86.7 dB + 7.3 dB = 94.0 dB).

The following corrections apply with the B&K4226 calibrator:

Nominal Frequency [Hz]	M2230 Measurement Microphone [dB]	M2211 Measurement Microphone [dB]	M2215 Measurement Microphone [dB]	Measurement Uncertainty U [dB]
31.5	0.0	0.0	0.0	0.3
63	0.0	0.0	0.0	0.3
125	0.0	0.0	0.0	0.3
250	0.0	0.0	0.0	0.3
500	0.0	0.1	0.0	0.3
1000	0.0	0.1	0.0	0.3
2000	0.3	0.6	0.2	0.3
4000	0.7	1.7	1.2	0.3
8000	2.6	4.2	3.9	0.4
12500	6.0	7.3	6.7	0.7
16000	7.3	9.2	9.0	0.8

Correction values for other calibrators for M2230:

Type	Correction Value	Calibration Frequency	Calibration Level
NTi Audio CAL200	0.1	1 kHz	114 dB
B&K 4231	0.2	1 kHz	114 dB
Norsonic Nor-1251	0.2	1 kHz	114 dB

Diffuse Field Correction Factors

A diffuse sound field is characterized that the sound arrives at the receiver from all directions with more or less equal probability. The M2230 is a free-field equalized measurement microphone. The default frequency response refers to a 0° sound incidence. The diffuse-field frequency response is calculated by averaging the M2230-directional characteristics; this results in a reduction at the high frequencies. The individual third-octave band correction values for diffuse-field conditions are documented in the following table. The directional response of the M2230 is described in the appendix.

Example:

- The sound pressure level in a diffuse sound field shall be determined. The display of the XL2 with the M2230 reads 80.0 dBA for the 20 kHz third-octave band.
- The diffuse sound level is now calculated from the sum of the XL2 measurement value and the correction value (= 80.0 dB + 8.9 dB = 88.9 dB).

This correction is not necessary using a diffuse field equalized measurement microphone.

Nominal Frequency [Hz]	M2230 Microphone [dB]
50	0.0
63	0.0
80	0.0
100	0.0
125	0.0
160	0.0
200	0.0
250	0.0
315	0.0
400	0.0
500	0.0
630	0.0
800	0.1
1000	0.1
1250	0.1
1600	0.2
2000	0.4
2500	0.5
3150	0.5
4000	1.1
5000	1.7
6300	1.9
8000	2.6
10000	3.3
12500	4.8
16000	6.1
20000	8.9

Technical Data PreAmplifier

	MA220 PreAmplifier
Microphone PreAmplifier	Compatible with 1/2" microphone capsules type WS2F in accordance with IEC61094-4
Frequency Range	4 Hz - 100 kHz
Residual Noise Floor typical	1.6 µV(A) at C_in 18pF ≙ 12 dBA @ 20 mV/Pa
Frequency Response Flatness	±0.2 dB
Phase Linearity	< 1° @ 20 Hz - 20 kHz
Maximum Output Voltage	21 Vpp ≙ 7.4 Vrms ≙ 145 dBSPL @ 20 mV/Pa, THD 3%, 1 kHz
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 GOhm // 0.26 pF, Output: 100 Ohm balanced
Power Supply	48 VDC phantom power, 3 mA typical
Attenuation	< 0.17 dB (Rphantom 2x 6.8 kOhm)
Connector	Balanced 3-pole XLR
Thread for Capsule	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)
Humidity	5% to 90% RH, non-condensing
NTi Audio #	600 040 040

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