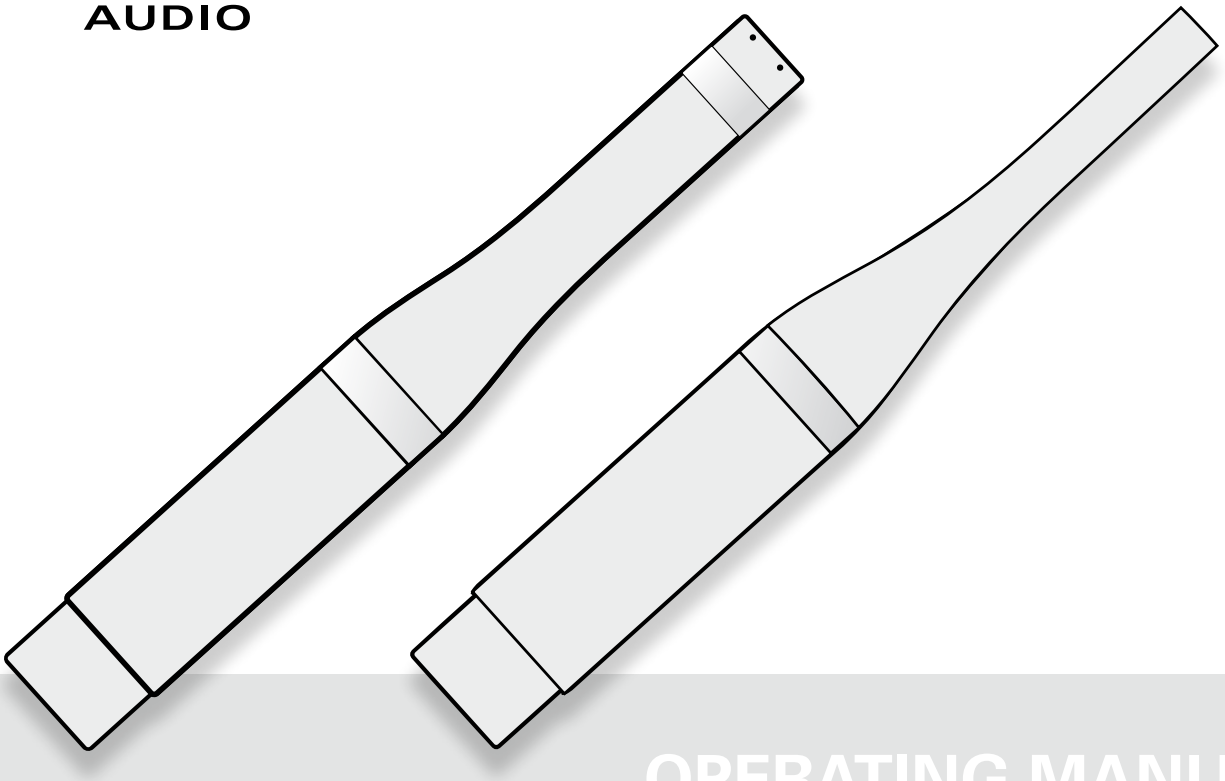
NTi AUDIO



OPERATING MANUAL

MEASUREMENT MICROPHONES

Contact NTi Audio at

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Liechtenstein, Europe

is an ISO 9001:2015 certified company.

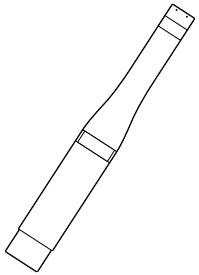
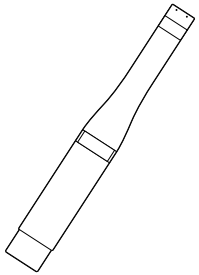
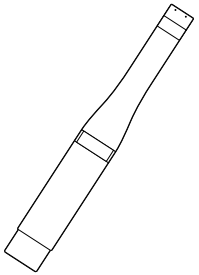
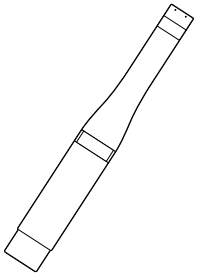
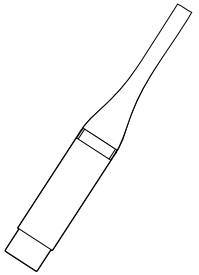
Version May 2021

Made in Switzerland

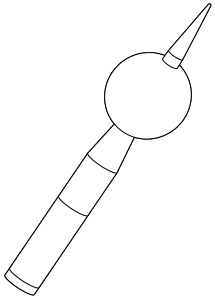
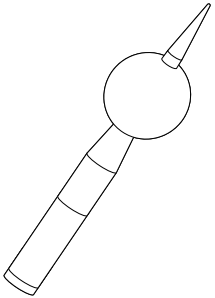
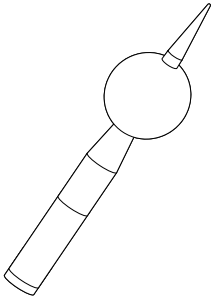
Table of Contents

Overview

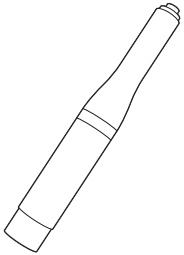
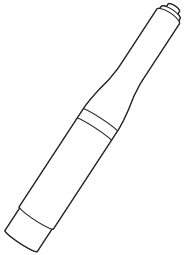
Measurement Microphones

M2230	M2340	M2211	M2215	M4261
				
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) enabled	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 and service of audio-acoustic installations
consists of MA220 PreAmplifier and MC230 or MC230A capsule	consists of MA230 PreAmplifier and MC230A capsule	consists of MA220 PreAmplifier and 7052 capsule	consists of MA220 PreAmplifier and 7056 capsule	with permanently-installed capsule

Outdoor Measurement Microphones

M2230-WP Outdoor Microphone	M2340-WP Outdoor Microphone	M4261-WP Outdoor Microphone
		
Certified outdoor measurement microphone, class 1 in accordance with IEC 61672	Outdoor measurement microphone, class 1 in accordance with IEC 61672, system self-test (CIC) enabled	Outdoor measurement microphone, class 2 in accordance with IEC 61672
consists of M2230 Measurement Microphone + WP30 Weather Protection	consists of M2340 Measurement Microphone + WP30 Weather Protection	consists of M4261 Measurement Microphone + WP61 Weather Protection

Microphone Preamplifiers

MA220 PreAmplifier	MA230 PreAmplifier
	
Microphone preamplifier compatible with 1/2″ pre-polarized capsules	Microphone preamplifier compatible with 1/2″ pre-polarized capsules, system self-test (CIC) enabled

Scope of Delivery

M2230	• Measurement Microphone consisting of - MA220 Microphone PreAmplifier - Microphone Capsule MC230 or MC230A • Dust Cap • 50 mm Windscreen • Microphone-holder MH01 with Adapter 5/8“ - 3/8“ • Operating Manual • Individual Frequency Response Chart
M2340	• Measurement Microphone consisting of - MA230 Microphone PreAmplifier - Microphone Capsule MC230A • Dust Cap • 90 mm Windscreen • Microphone-holder MH01 with Adapter 5/8“ - 3/8“ • Operating Manual • Individual Frequency Response Chart
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	• 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
M4261	• Measurement Microphone • 33 mm Windscreen • Microphone-holder with Adapter 5/8“ - 3/8“ • Operating Manual

WP30	• WP30 Weather Protection for M2230 - 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
WP61	• WP61 Weather Protection for M4261 - 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
MA220	• PreAmplifier • Dust Cap • Microphone-holder with Adapter 5/8“ - 3/8“ • Operating Manual
MA230	• PreAmplifier • Dust Cap • Microphone-holder with Adapter 5/8“ - 3/8“ • Operating Manual

Description

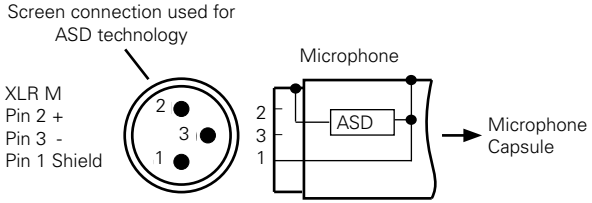
The plug-on measurement microphones combined with the XL2 Analyzer form a comprehensive sound level meter and acoustic analyzer. The microphones are 48 VDC phantom-powered and include an electronic data sheet.

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 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).

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.

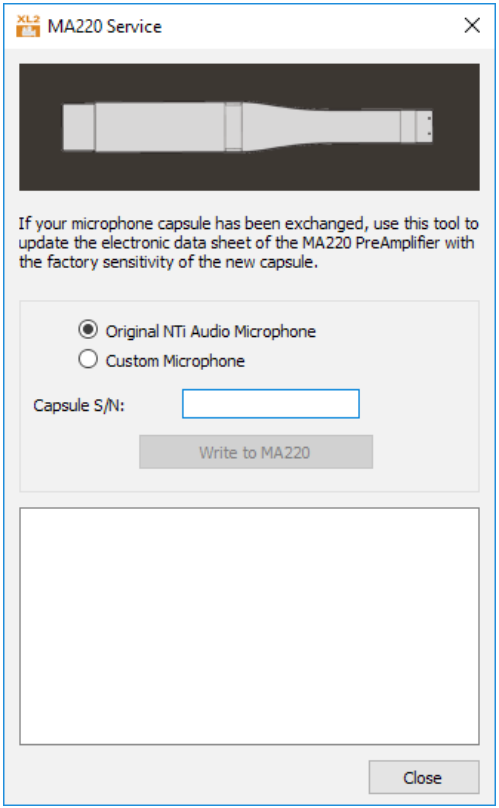
Alternatively connect the microphone first directly to the Analyzer. The XL2 reads the sensitivity and remembers this value. Afterwards connect the audio cable.

Capsule Replacement Instruction

The microphones for the XL2 Analyzer 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. 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: 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: 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.

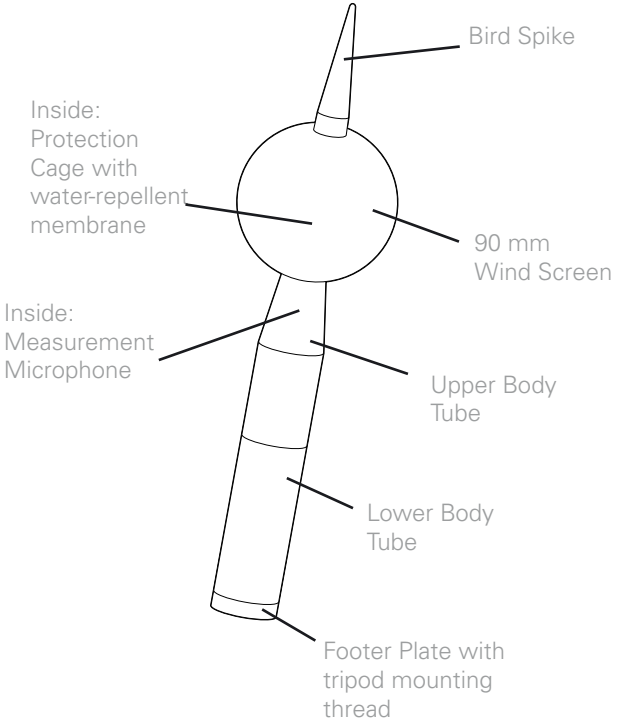
Outdoor Microphones

The Outdoor Measurement Microphones offer a weather-protected measurement 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.

Outdoor Measurement Microphone Types

- M2230-WP: M2230 Measurement Microphone + WP30 Weather Protection
- M2340-WP: 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.



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 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 by 3 mm. The top part of the capsule has to be 13 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 Sound Level Meter.

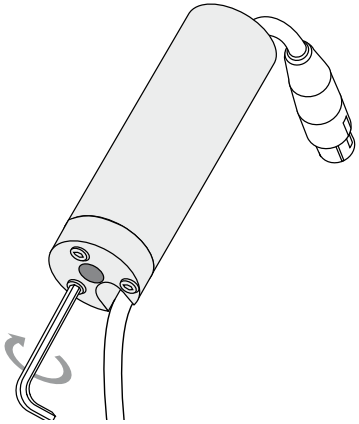
Always activate the applicable frequency correction filter in the XL2. The filter ensures that the measurements accuracy meets the class 1 requirements of IEC 61672 and ANSI S1.4.

Assembling

This chapter describes how to install the Measurement Microphone into the weather protection kit:

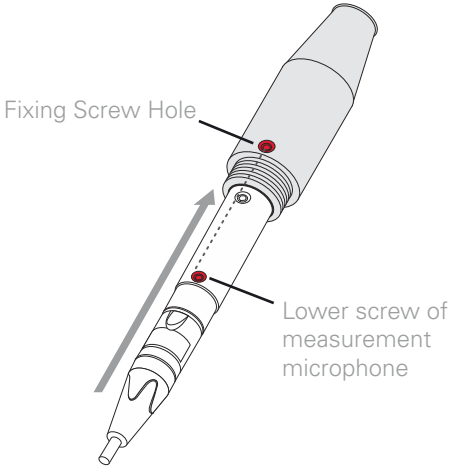
Install ASD Cable

- 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 Measurement Microphone

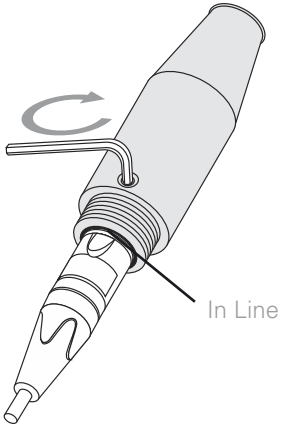
- Connect the measurement microphone to the female XLR of the ASD Cable.
- Insert the measurement microphone into the upper body tube so that the bottom end of the microphone is in line with the bottom end of the upper body tube. Align the fixing screw hole of the upper body tube with the lower screw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



Attach the Microphone to the Upper Body Tube

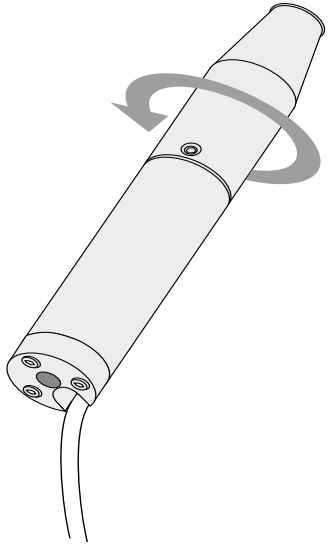
Attaching the fixing screw of the upper body tube onto the lower screw of the measurement microphone ensures that the microphone housing is not scratched.

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



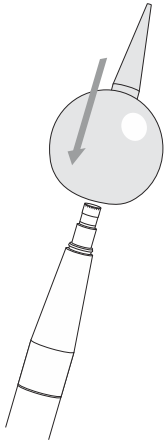
Assemble the Weather Protection Body

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 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.

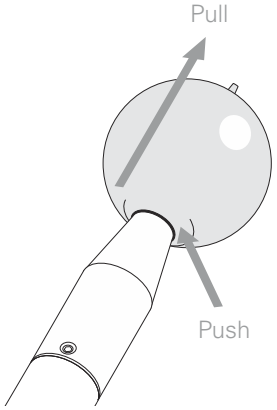


You have successfully assembled the Outdoor Measurement Microphone.

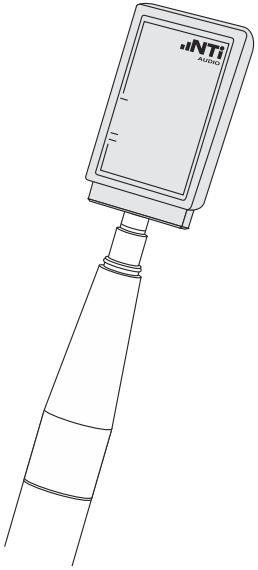
Calibration

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 user manual using the NTi Audio Precision Calibrator.



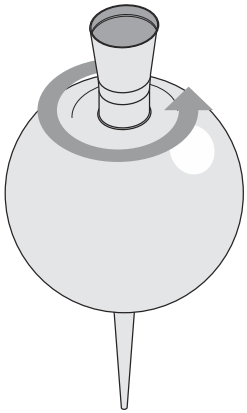
- Snap the top section back into position on the body tube.

You have successfully calibrated the Outdoor Measurement Microphone.

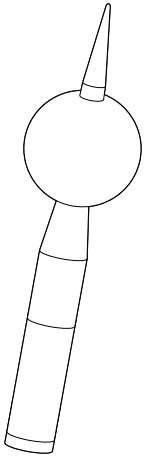
- The outdoor windscreen is recommended to be replaced annually. The "WP30/WP61 Windscreen Replacement" includes two spare windscreens, NTi Audio # 600 040 061.
- The water-repellent membrane in the top section is mounted with two O-Rings. Inspect these O-Rings (13x1 mm) and the membrane annually for proper seating and good condition. Do not touch the water-repellent membrane.

Disassembling the Top Section

- The top section is snapped on to 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.



Accessories



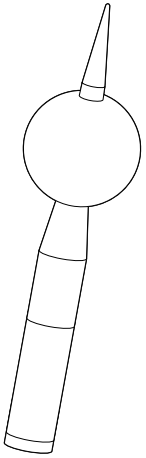
WP30 Weather Protection for M2230

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

- 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 sturdy outdoor carrying case available

NTi Audio # 600 040 060



WP61 Weather Protection for M4261

Protect your M4261 microphone from rain, wind, dust and perching birds with this professional outdoor weather protection kit.

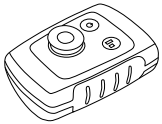
Features

- 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 sturdy outdoor carrying case available

NTi Audio # 600 040 080

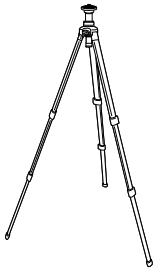
Class 1 Sound Calibrator
The battery-operated Class 1 Sound Calibrator is classified for the calibration of class 1 measurement microphones, sound level meters and other acoustic measurement equipment. This precision microphone calibrator delivers 94 or 114 dB at a frequency of 1 kHz.
NTi Audio #: 600 000 388

The optional 1/4" adapter ADP-1/4-P is required to fit 1/4" measurement microphones.
NTi Audio #: 600 000 391

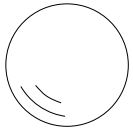


Class 2 Sound Calibrator
The battery-operated Class 2 Sound Calibrator is classified for the calibration of class 2 measurement microphones, sound level meters and other acoustic measurement equipment. This microphone calibrator delivers 114 dB at a frequency of 1 kHz.
NTi Audio #: 600 000 394

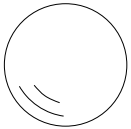
Manufacturer Calibration Certificate
The calibration certificate lists the individual product data with serial number. The calibration and adjustment procedures follow the documentation and traceability requirements of the EN ISO / IEC 17025 standard. Annual re-calibration of the instrument is recommended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



Lightweight Tripod
Retractable, lightweight tripod with 1/4" ball head and 3/8" mounting thread. The flexible ball head mounts the XL2 Analyzer at any angle. The tripod is suitable for all measurement microphones, the outdoor microphone M2230-WP and the TalkBox.
NTi Audio #: 600 000 397

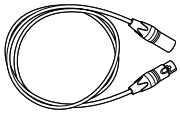


1/2" Windscreen 90mm
for M2211, M2215 and M2230 measurement microphone
NTi Audio #: 600 040 109



WP30 Windscreen Replacement

The replacement package contains two spare windscreens for the outdoor measurement microphone M2230-WP or WP30. The outdoor windscreen is recommended to be replaced annually.
NTi Audio #: 600 040 061

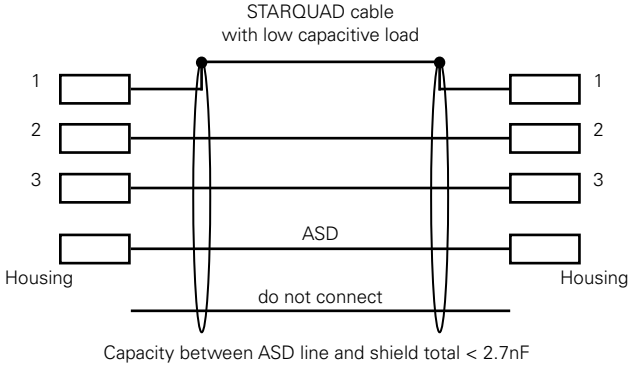


ASD Cable

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).



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 "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".

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, Im alten Riet 102, 9494 Schaan, Liechtenstein, do hereby declare that the measurement microphones M2230, M2211, M2215, M4261, the preamplifier MA220 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: 31. July 2019

M. Becker

Position: COO

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

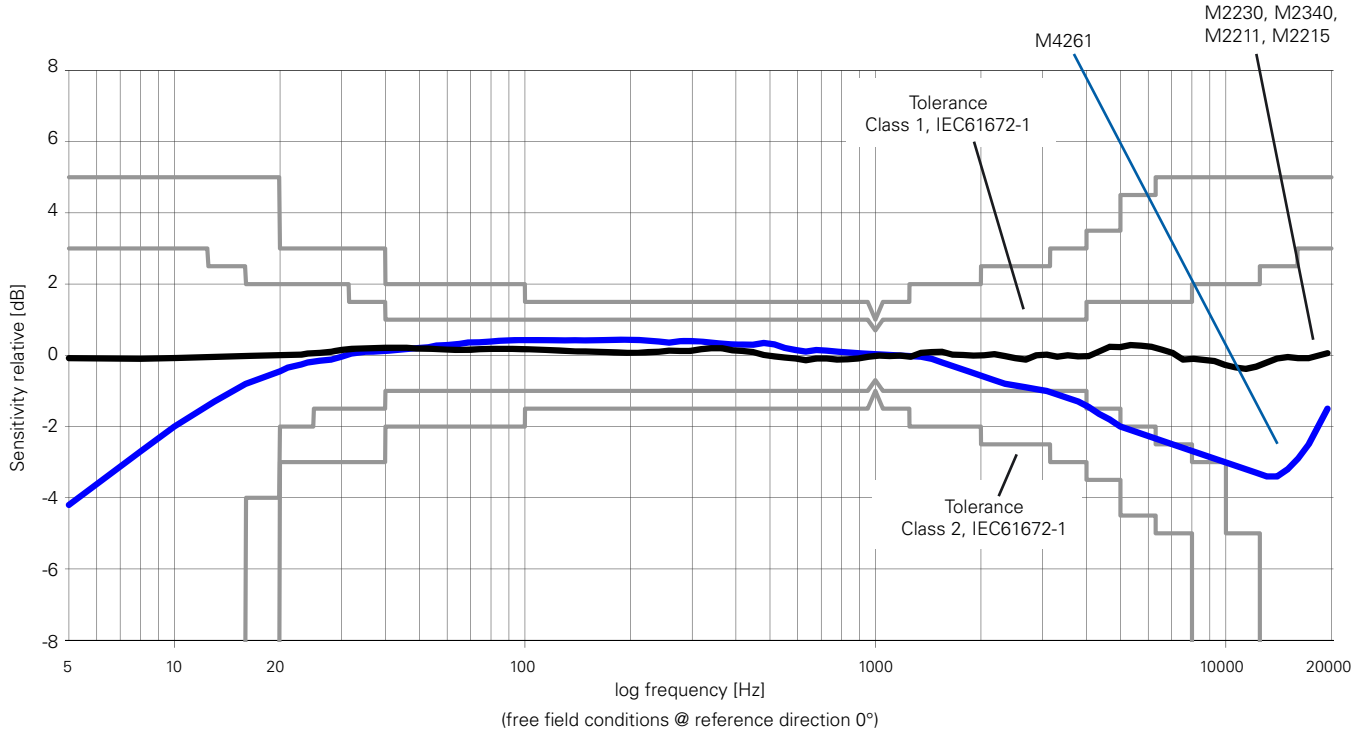
	M2230	M2340 (with self-test)	M2211	M2215 (high levels)	M4261
Classification with XL2 according to IEC 61672, ANSI S1.4	Class 1 Certified	Class 1	Frequency Response Class 1		Class 2
Consisting of	PreAmplfier MA220 + MC230 or MC230A Capsule	PreAmplfier MA230 + MC230A Capsule	PreAmplfier MA220 + Capsule 7052	PreAmplfier MA220 + Capsule 7056	M4261 microphone with permanently installed capsule
Microphone Type	Omnidirectional, pre-polarized condenser, free field microphone				
Capsule / Transducer	1/2" detachable with 60UNS2 thread, type WS2F according IEC 61094-4				1/4" permanently installed
PreAmplifier Type	MA220	MA230	MA220		-
System Self-test (CIC)	-	enabled	-		
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
Actual Frequency Response	freely available as Excel-data, register microphone at My NTi Audio and contact info@nti-audio.com				
Frequency Range	5 Hz - 20 kHz				
Residual Noise Floor typical	16 dB(A)	17dB(A)	21 dB(A)	25 dB(A)	27 dB(A)
Maximum SPL @ THD 3%, 1 kHz, S_typical	137 dBSPL	138 dBSPL	144 dBSPL	153 dBSPL	142 dBSPL

	M2230	M2340 (with self-test)	M2211	M2215 (high levels)	M4261
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)	-36 dBV/Pa ±3 dB (16 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				-
Power Supply	48 VDC phantom power				
Current Consumption typical	2.3 mA	0.8 mA	2.3 mA		1.7 mA
Electronic Data Sheet	NTi Audio ASD in accordance with IEEE P1451.4 V1.0, Class 2, Template 27				
Output Impedance	100 Ohm balanced				
Connector	Balanced 3-pole XLR				
Diameter Dimensions	20.5 mm (0.8")				
Length Dimensions	154 mm (6.1")		150 mm (5.9")		
Weight	100 g, 3.53 oz				83 g, 2.93 oz
Environmental Protection	IP51				
NTi Audio #	600 040 050	600 040 230	600 040 022	600 040 045	600 040 070

Outdoor Measurement Microphones

	M2230-WP (M2230+WP30)	**M2340-WP (M2340+WP30)**	**M4261-WP (M4261+WP61)**
Classification with XL2 according to IEC 61672, ANSI S1.4	Class 1 Certified	Class 1	Class 2
System Self-test (CIC)	-	enabled	-
Diameter Dimensions	36 mm (1.4”)	36 mm (1.4”)	36 mm (1.4”)
Length Dimensions	378 mm (14.9”)	378 mm (14.9”)	378 mm (14.9”)
Weight	430 g, 15.17 oz	430 g, 15.17 oz	413 g, 14.57 oz
Environmental Protection	IP54 in vertical position	IP54 in vertical position	IP54 in vertical position
NTi Audio #	600 040 050 + 600 040 060	600 040 230 + 600 040 060	600 040 070 + 600 040 080

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, M2340 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:

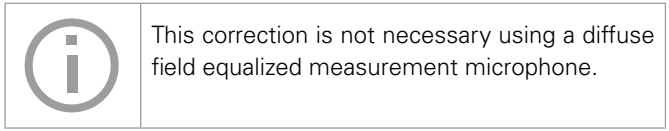
Type	Correction Value	Calibration Frequency	Calibration Level
NTi Audio CAL200	-0.1	1 kHz	114 dB
B&K 4231	-0.2	1 kHz	114 dB
Norsonic Nor-1251	-0.2	1 kHz	114 dB

Diffuse Field Correction Factors

A diffuse sound field is characterized by the sound arriving at the receiver from all directions with more or less equal probability. The M2230, M2211, M2215 and M4261 are free-field equalized measurement microphones. The default frequency response refers to a 0° sound incidence. The diffuse-field frequency response is calculated by averaging the 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:

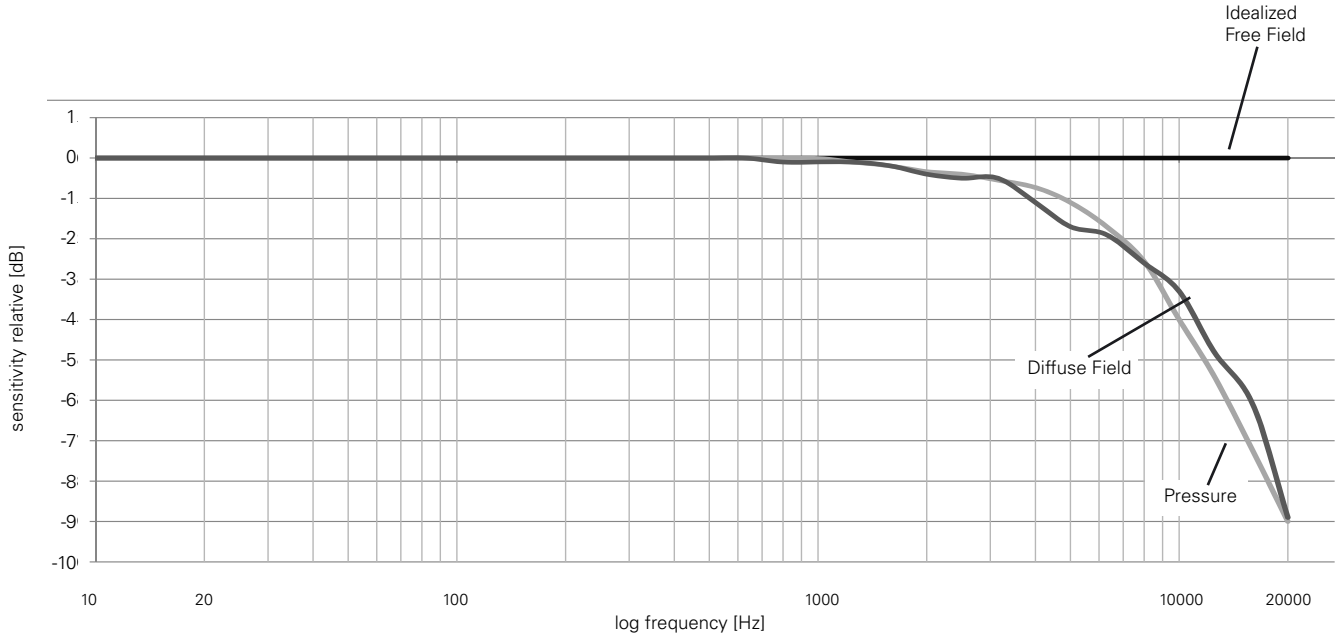
- The sound pressure level in a diffuse sound field shall be determined. The display of the XL2 with the M2230 reads 80.0 dBA for the 20 kHz third-octave band.
- The diffuse sound level is now calculated from the sum of the XL2 measurement value and the correction value (80.0 dB + 8.7 dB = 88.7 dB).



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

Nominal Frequency [Hz]	1/2" Microphone M2230, M2340, M2211, M2215 [dB]	1/4" Microphone M4261 [dB]
<63	0.0	0.0
63	0.0	0.0
80	0.0	0.0
100	0.0	0.0
125	0.0	0.0
160	0.0	0.0
200	0.0	0.0
250	0.1	0.0
315	0.1	0.0
400	0.1	0.0
500	0.1	0.1
630	0.1	0.1
800	0.2	0.1
1000	0.2	0.1
1250	0.3	0.1
1600	0.4	0.1
2000	0.5	0.1
2500	0.6	0.2
3150	0.8	0.2
4000	1.1	0.3
5000	1.4	0.5
6300	1.9	0.7
8000	2.5	1.0
10000	3.4	1.4
12500	4.6	1.9
16000	6.4	2.5
20000	8.7	3.2

M2230 Frequency Response for Free Field, Diffuse Field and Pressure



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]	
	1/3 Octave	1/1 Octave	1/3 Octave	1/1 Octave
<800	0.0	0.0	0.0	0.0
800 1000 1250	0.0 0.0 0.1	0.0	0.0 0.0 0.0	0.0
1600 2000 2500	0.2 0.3 0.7	0.4	0.2 0.3 0.8	0.4
3150 4000 5000	1.3 2.0 2.7	2.0	1.4 2.1 2.5	2.0
6300 8000 10000	2.9 3.3 3.9	3.4	2.3 2.4 2.8	2.5
12500 16000 20000	4.6 6.4 6.8	5.9	3.0 3.1 3.1	3.0

Technical Data PreAmplifier

	MA220 PreAmplifier	MA230 PreAmplifier with Charge Injection Check CIC
Microphone PreAmplifier	Compatible with 1/2" microphone capsules type WS2F in accordance with IEC61094-4	
Frequency Range (-3dB)	4 Hz - 100 kHz	1.3 Hz - 50 kHz
Residual Noise Floor typical	1.6 µV(A) at C_in 18 pF ≙ 5.6 dBA @ 42 mV/Pa	2.4 µV(A) at C_in 15 pF ≙ 9.1 dBA @ 42 mV/Pa
Frequency Response Flatness	±0.2 dB	±0.1 dB, 10 Hz - 20 kHz
Phase Linearity	< 1° @ 20 Hz - 20 kHz	
Maximum Output Voltage @THD 3%, 1 kHz	21 Vpp ≙ 7,4 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 GOhm // 0.26 pF, Output: 100 Ohm balanced	
Power Supply	48 VDC phantom power, 2.3 mA typical	48 VDC phantom power, 0.8 mA typical
Attenuation	< 0.17 dB (Rphantom 2x 6.8 kOhm)	< 0.07 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	600 040 200

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