1 Technical Data Measurement Microphones

1.1 Certified Class 1 Measuring Microphones

	M2340 Class 1 certified with self-examination	M2230 class 1 certified
Scope of delivery	MA230 preamplifier + MC230A microphone capsule	MA220 preamplifier + MC230A microphone capsule
Microphone type	Omnidirectional, condenser free-field microphone with continuous polarization	
Classification according to IEC 61672 and ANSI S1.4	Class 1 certified	
Microphone capsule	½" removable with thread 60UNS2 type WS2F according to IEC 61094-4	
Preamplifier type	MA230	MA220
Self-check	Yes	No

	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)	

	M2340 Class 1 certified with self-examination	M2230 class 1 certified
Temperature coefficient	< –0.015 dB / °C	
Temperature range	–10°C to +50°C (14°F to 122°F)	
Influence of air pressure	0.005 dB / kPa	
Influence of humidity (non-condensing)	< ±0.05 dB	
Humidity	5% to 90% RH, non-condensing	
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")	

	M2340 Class 1 certified with self-examination	M2230 class 1 certified
Length	154 mm (6.1")	
Weight	100 g, 3.53 oz	
Protection class	IP51	
NTi Audio #	600 040 230	600 040 050

1.2 Measuring Microphones

	M2211 frequency response class 1	M2215 for high sound levels, frequency response class 1	M4261 class 2 (Legacy)	M4262 class 2
Includes	MA220 preamplifier + M2211 microphone capsule	MA220 preamplifier + M2215 microphone capsule	M4261 (Legacy) with fixed microphone capsule	M4262 with fixed microphone ECM capsule
Microphone type	Omnidirectional, condenser free-field microphone with continuous polarization		Electret capsule	

	M2211 frequency response class 1	M2215 for high sound levels, frequency response class 1	M4261 class 2 (Legacy)	M4262 class 2
Classification according to IEC 61672 and ANSI S1.4	Frequency response class 1		Class 2	
Microphone capsule	1/2" removable with thread 60UNS2 type WS2F according to IEC 61094-4		1/4" fixed mounted	
Preamplifier type	MA220		-	
Self-check	No			
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	+1/-5 dB @ 5 Hz – 20 Hz ±1.5 dB @ 20 Hz - 4 kHz ±3 dB @ 4 kHz – 20 kHz

	M2211 frequency response class 1	M2215 for high sound levels, frequency response class 1	M4261 class 2 (Legacy)	M4262 class 2
Individual frequency response freely available as Excel file	Freely available as Excel file: register the microphone on my.nti-audio.com and contact info@nti-audio.com			
Frequency range	5 Hz – 20 kHz			10 Hz – 30 kHz
Typical sensitivity @ 1 kHz	- 34 dBV/Pa ±3 dB (20 mV/Pa)	- 42 dBV/Pa ±3 dB (8 mV/Pa)	- 36 dBV/Pa ±3 dB (16 mV/Pa)	-36 dBV/Pa ±3 dB (16 mV/Pa)
Intrinsic noise typical	21 dB(A) SPL @ 20 mV/Pa	25 dB(A) SPL @ 8 mV/Pa	27 dB(A) SPL @ 16 mV/Pa	32 dB(A) SPL @ 16 mV/Pa
Maximum sound pressure level @ distortion factor 3%, 1 kHz	144 dBSPL	153 dBSPL	142 dBSPL	140 dB SPL
Temperature coefficient	< ±0.015 dB / °C		< ±0.02 dB / °C	< ±0.03 dB / °C
Temperature range	–10°C to +50°C (14°F to 122°F)		0°C to +40°C (32°F to 104°F)	

	M2211 frequency response class 1	M2215 for high sound levels, frequency response class 1	M4261 class 2 (Legacy)	M4262 class 2
Pressure coefficient	0.02 dB / kPa		-0.04 dB / kPa	
Influence of humidity (non-condensing)	< ±0.05 dB		< ±0.4 dB	
Humidity	5% to 90% RH, non-condensing			
Long-term stability	> 250 years / dB		-	
Power supply	48 VDC phantom power			
Power supply current	2.3 mA typical		1.7 mA typical	1.4 mA idle, 5 mA @ clip level
Electronic data sheet	NTi Audio ASD according to IEEE P1451.4 V1.0, Class 2, Template 27			
Output impedance	100 Ω symmetrical			
Output connector	balanced 3-pin XLR			

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

M2914 Low-Noise	
Microphone type	Omnidirectional, pre-polarized condenser, free field microphone
Capsule / transducer	1/2” detachable with 60UNS2 thread, type WS2F according IEC 61094-4 matched with preamplifier
Preamplifier type	MA214

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

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

1.3 Technical Data Microphone Preamplifiers

	MA230	MA220
Microphone preamplifier	Compatible with 1/2" microphone capsules type WS2F according to IEC61094-4	
Typical Frequency range	1.3 Hz – 50.0 kHz	2.5 Hz – 50 kHz
Frequency Response flatness	±0.2 dB, 10 Hz - 20 kHz	±0.2 dB, 10 Hz - 20 kHz

	MA230	MA220
Phase linearity	<±5° @ 20 Hz - 20 kHz	<±10° @ 20 Hz - 20 kHz
Intrinsic noise typical	2.4 µV(A) @ C_{in} 15 pF ≙9.1 dBA @ 42 mV/Pa	1.6 µV(A) @ C_{in} 18 pF ≙5.6 dBA @ 42 mV/Pa
Maximum output voltage	22 Vpp ≙7.78 Vrms ≙139.3 dBSPL @ 42 mV/Pa	21 Vpp ≙7.4 Vrms ≙138.9 dBSPL @ 42 mV/Pa
Electronic data sheet	• Contains calibration data • 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
Humidity	5% to 90% RH, non-condensing	
Power supply	48 VDC phantom power	
Power supply current	0.76 mA typical	2.3 mA typical
Electronic data sheet	NTi Audio ASD according to IEEE P1451.4 V1.0, class 2, template 27	
Output impedance	100 Ω symmetrical	
Output connector	balanced 3-pin XLR	

	MA230	MA220
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

1.4 Outdoor Measurement Microphones

1.4.1 WP40 Specifications / WP62 Specifications

	M2230 + WP40-90	M2340 + WP40-90	M4261 (Legacy) + WP62-90	M4262 + WP62-90
Classification with XL2 or XL3 according to IEC 61672 and ANSI S1.4	Class 1	Class 1	Meets the Class 2 Frequency Response requirements	Meets the Class 2 Frequency Response requirements
Certifications	PTB	LNE, PTB, METAS	-	-

	M2230 + WP40-90	M2340 + WP40-90	M4261 (Legacy) + WP62-90	M4262 + WP62-90
Self-Check (CIC)	-	With XL2, with XL3 only with API	-	-
Environmental Protection	Rainfall with Wind Proofing under extreme conditions: **Test A – *PASSED – Duration 4 hours:*** • Rainfall intensity Rate/ Distribution: 1200 mm/h, Uniform water coverage from 45° to WP40 • Wind Speed / Direction: 30kmh (18.6 mph) / 90 ° to WP40 **Test B – *PASSED – Duration 40 minutes:*** • Rainfall intensity Rate/ Distribution: 1200 mm/h, Uniform water coverage from 45° to WP40 • Wind Speed / Direction: 110kmh (68.4 mph) / 90 ° to WP40			
Mounting	Standard 3/8'' tripod adapter included			
Windscreen Diameter	90 mm (3.54'')			
Housing Diameter	36 mm (1.41'')			

	M2230 + WP40-90	M2340 + WP40-90	M4261 (Legacy) + WP62-90	M4262 + WP62-90
Housing Length	366 mm (14.4'')			
Weight (incl Micro-phone)	300g (10.6 oz)			
Protection class	IP64			
NTi Audio Article #	600 040 050 + 600 040 140	600 040 230 + 600 040 140	600 040 070 + 600 040 140	600 040 075 + 600 040 140
Optional Pole Mount Adapter	• Pole Mount Adapter PM 1" for Pole Diameter 25–33 mm (1–1.3") NTi Audio # 600 040 067 • Pole Mount Adapter PM 1 1/4" for Pole Diameter 32–44 mm (1.25–1.75") NTi Audio # 600 040 068			

1.4.2 WP30 / WP61 Specifications (Legacy)

	M2230 + WP30-90	M2340 + WP30-90	M4261 (Legacy) + WP61
Classification with XL2 or XL3 according to IEC 61672 and ANSI S1.4	Class 1	Class 1	Meets the Class 2 Frequency Response requirements
Certifications	PTB	LNE, PTB	-
Self-Check (CIC)	-	With XL2, with XL3 only with API	-
Mounting	Standard 3/8'' tripod adapter included		
Windscreen Diameter	90 mm (3.54'')		
Housing Diameter	36 mm (1.41'')		
Housing Length	363 mm (14.3'')		
Weight (incl Microphone)	300g (10.6 oz)		
Protection class	IP54		

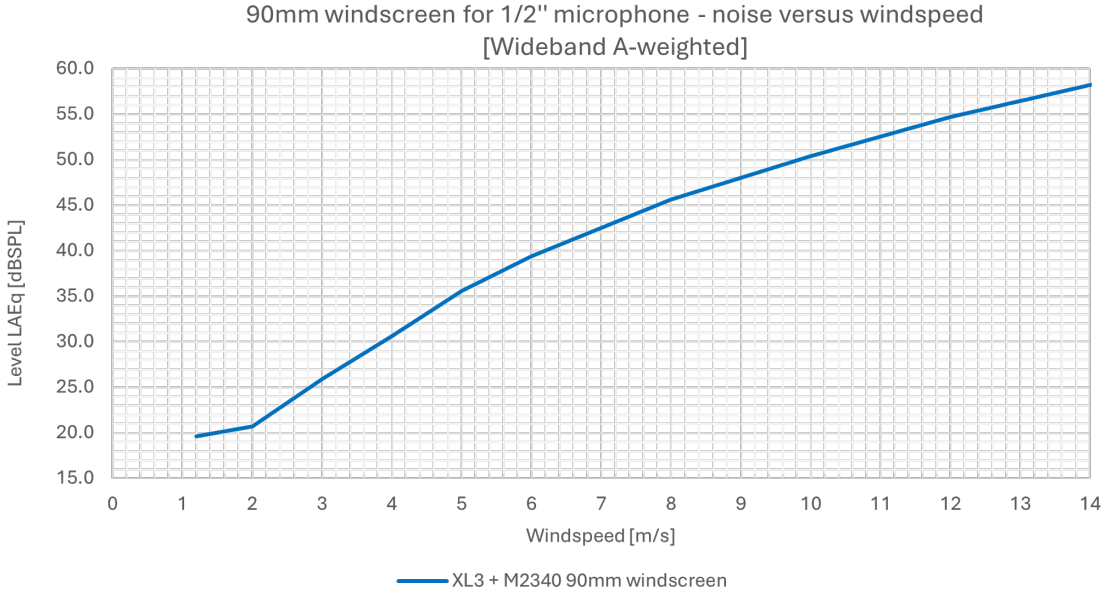
	M2230 + WP30-90	M2340 + WP30-90	M4261 (Legacy) + WP61
NTi Audio Article #	600 040 050 + 600 040 060	600 040 230 + 600 040 060	600 040 070 + 600 040 060
Optional Pole Mount Adapter	• Pole Mount Adapter PM 1” for Pole Diameter 25–33 mm (1–1.3”) NTi Audio # 600 040 067 • Pole Mount Adapter PM 1 1/4” for Pole Diameter 32–44 mm (1.25–1.75”) NTi Audio # 600 040 068		

1.4.3 Influence of Wind

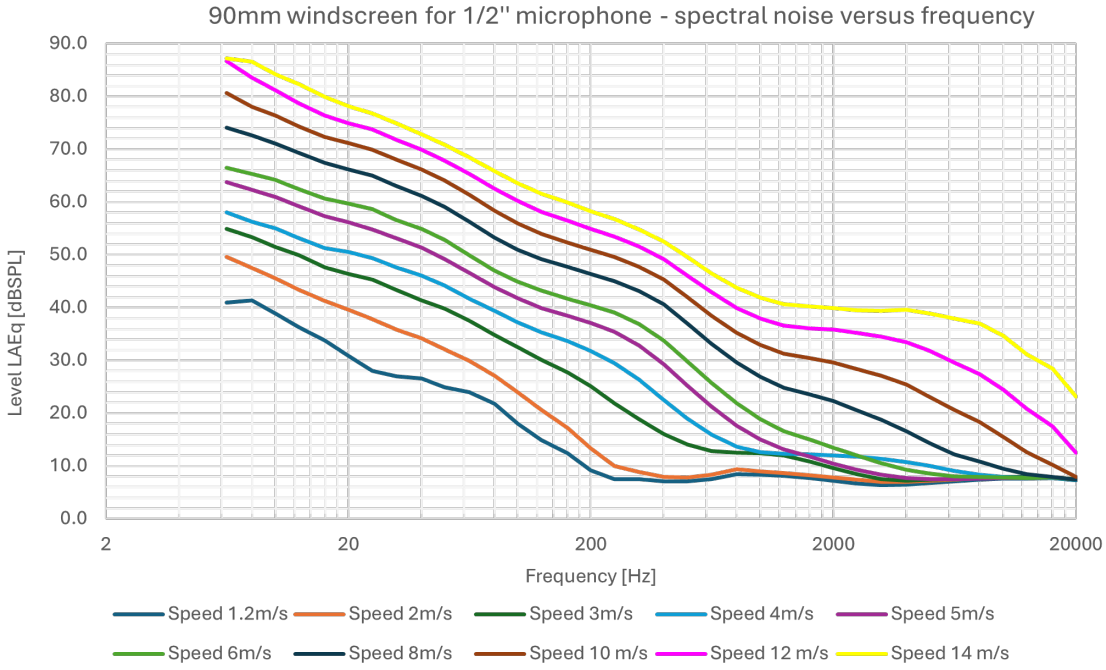
1.4.3.1 Windscreen 90 mm

The attenuation of wind noise provided by the 90 mm windscreen depends on wind speed. The absolute noise level measured with the 90 mm windscreen at wind speeds of up to 14 m/s is shown in the diagrams below:

- Absolute Noise Level with the XL3 + M2340/M2230 + 90mm Windscreen at different wind speeds with A-Weighting Filter active:



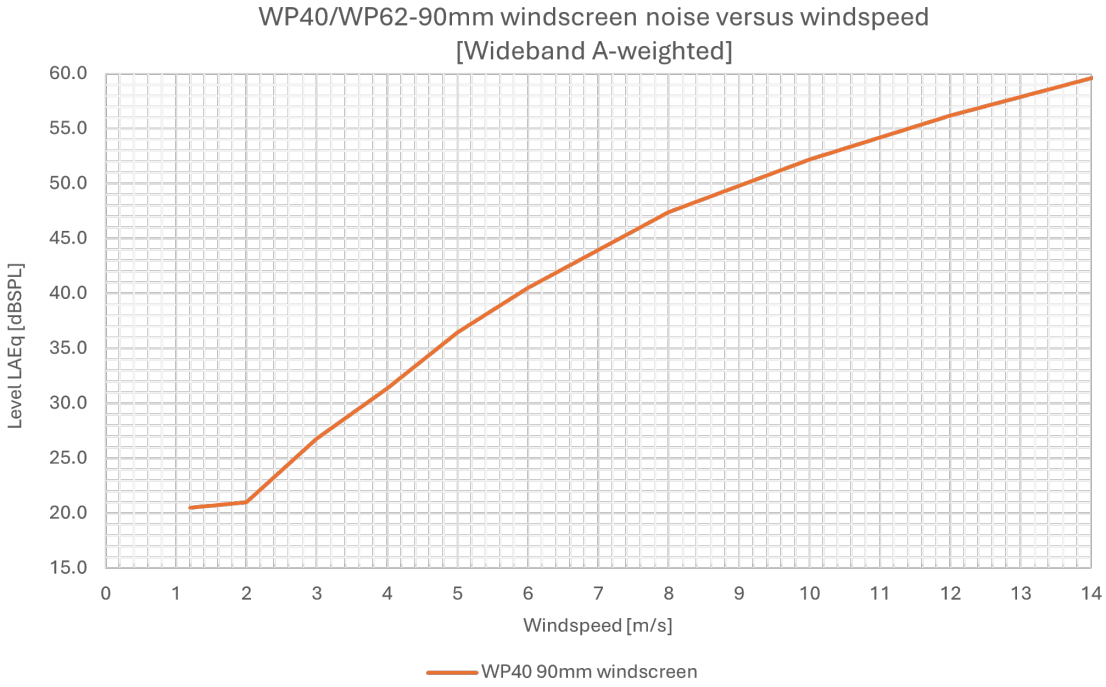
- Absolute Noise Level with the XL3 + M2340/M2230 + 90mm Windscreen for different frequencies at different wind speeds:



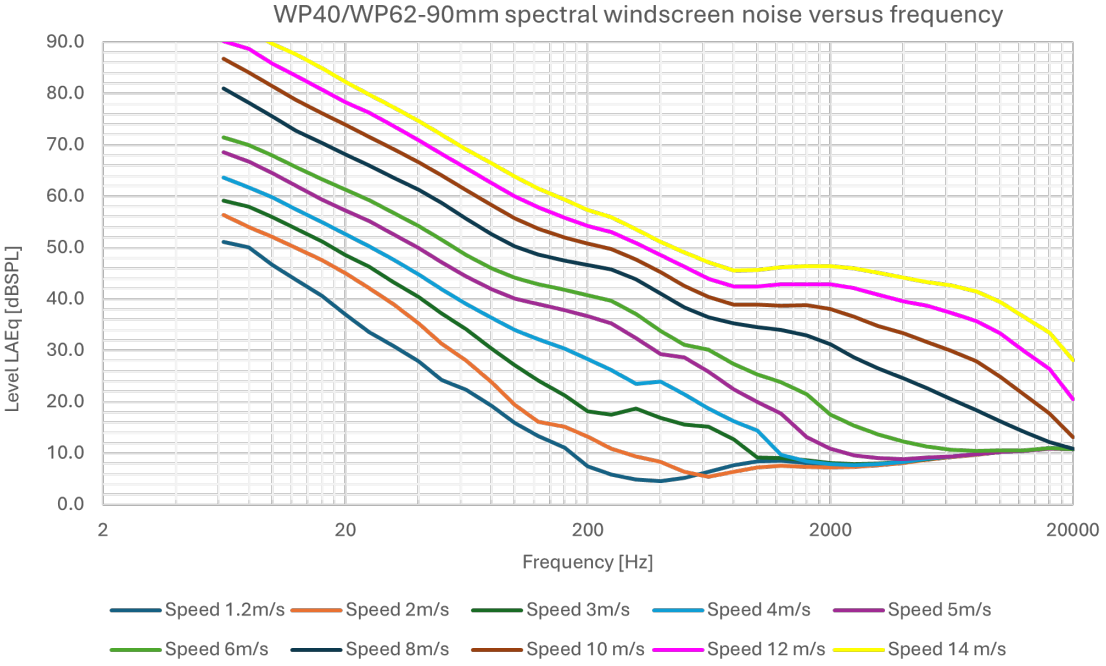
1.4.4 WP40/WP62 90mm Windscreen

The attenuation of wind noise provided by the WP40/WP62 90 mm Windscreen depends on wind speed. The absolute noise level measured with the WP40/WP62 90 mm Windscreen at wind speeds of up to 14 m/s are shown in the diagrams below:

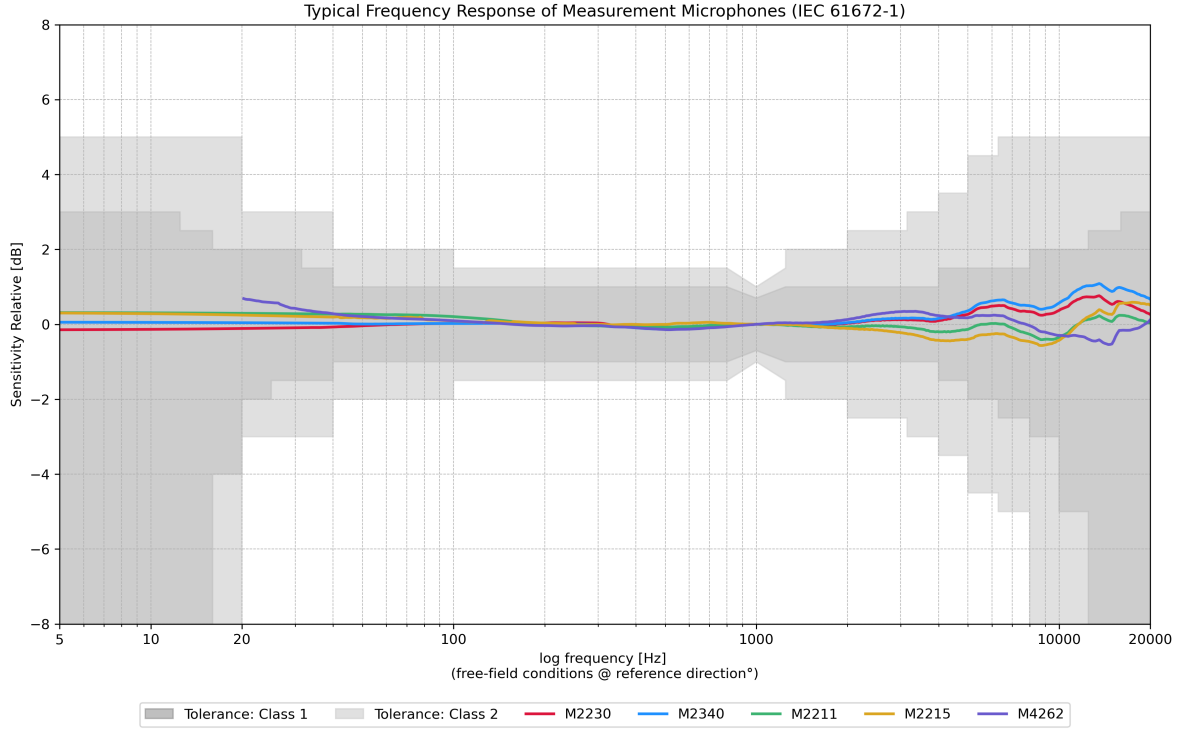
- Absolute Noise Level with the WP40/WP62 - 90mm Windscreen at different wind speeds with A-Weighting Filter active:



- Absolute Noise Level with the WP40/WP62 - 90mm Windscreen for different frequencies at different wind speeds:



1.5 Typical Frequency Response of Measurement Microphones



Our Class 2 microphones have a flat frequency response under standard conditions (1013.25 mbar, 23°C, 50% RH), just like our Class 1 microphones. However, their sensitivity may vary more with changes in these environmental conditions compared to the stricter limits of Class 1. Please keep this in mind when choosing the right microphone for your needs.

Here are NTi Audio's recommendations for each application:

Class / Type	Microphone Model	Applications
Class 1 / Type 1 Certified	M2230 (1/2" detachable)	• Noise Measurements • Building Acoustics • Legal Applications
	M2340 (1/2" detachable)	• Noise Monitoring with system self-test (CIC) • Legal Applications

Class / Type	Microphone Model	Applications
Class 1 / Type 1	M2211 (1/2" detachable)	• Noise Measurements • Cinema Calibration • PA Rental
	M2215 (1/2" detachable)	• High-Level Noise Measurements
	M2914 (1/2")	• Low Noise Measurement
Class 2 / Type 2	M2010 (1/2" detachable)	• Industrial Manufacturing • Quality Control • R&D
	M2015 (1/2" detachable)	• Industrial Manufacturing • Quality Control • High-Level Measurements
	M4262 (1/4" fixed)	• Live Sound • Installations • Broadcast • Occupational Health

1.6 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, M4261 (Legacy) and M4262 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]	M2211 [dB]	M2215 [dB]	Measurement Uncertainty U [dB]
31.5	–0.3	–0.2	0.0	0.3
63	0.0	0.0	0.0	0.3
125	–0.2	–0.1	–0.1	0.3
250	–0.2	–0.1	–0.1	0.3
500	–0.2	–0.1	–0.1	0.3
1000	0.0	0.0	0.0	0.3
2000	0.1	0.1	0.0	0.3
4000	0.7	0.7	0.4	0.3
8000	2.7	4.5	4.7	0.4
12500	7.2	5.8	6.1	0.7
16000	7.3	7.9	7.9	0.8

Correction values for other calibrators for M2230 and M2340.

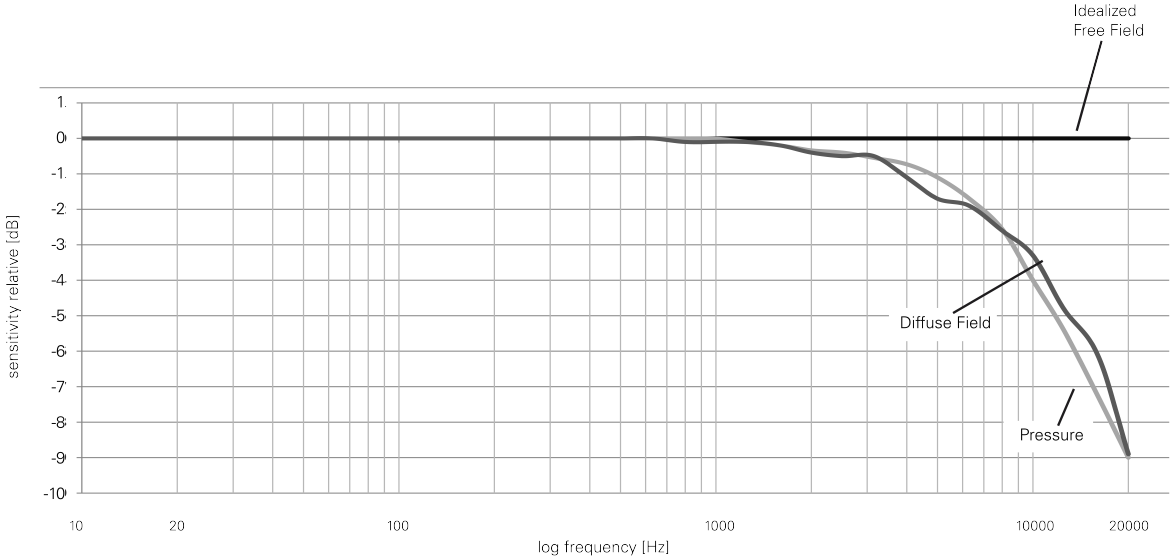
Calibration	

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

Calibration						
	M2230 / M2340 Configuration	**Sound Calibrator**				
		NTi CAL200	**B&K 4231**	**Nor 1251**	**Nor 1256**	**Cirrus CR:515**
Windscreen correction @ 1 kHz	No Accessory; Windscreen 90mm[1]; Windscreen 50mm[1]; WP40 Community[1](horizontal); WP40 Aircraft[1](vertical).	93.88 / -0.12	93.85 / -0.15	93.85 / -0.15	93.85 / -0.15	93.70 / -0.30
	WP30 vertical (Legacy)	93.69 / -0.31	93.66 / -0.34	93.66 / -0.34	93.66 / -0.34	93.51 / -0.49
	WP30 horizontal (Legacy)	93.69 / -0.31	93.66 / -0.34	93.66 / -0.34	93.66 / -0.34	93.51 / -0.49
Manufacturer calibration	• Recommended calibration interval: 1 year; • Calibration certificate for a new sound level meter is optionally available.					

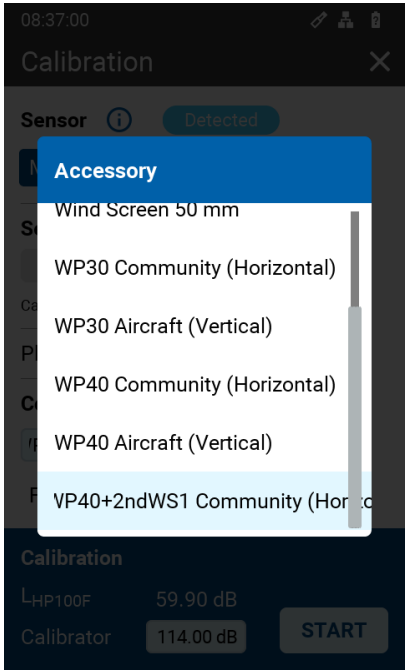
[1]All required additional correction is handled by the instrument.

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



1.8 Spectral Correction for horizontal and vertical 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 Sound Level Meter.



Nominal Frequency [Hz]	WP40 Weather Protection [dB] (Horizontal)		WP40 Weather Protection [dB] (Vertical)		WP40 WS1 Secondary Windshield [dB] (Horizontal)	
	1/3rd Octave	1/1 Octave	1/3rd Octave	1/1 Octave	1/3rd Octave	1/1 Octave
< 800	0.00	0.00	0.00	0.00	0.15	0.15
800	0.06	0.15	-0.31	-0.35	0.37	0.56
1000	0.13		-0.37		0.56	
1250	0.25		-0.39		0.81	
1600	0.47	0.86	-0.28	0.04	1.20	1.65
2000	0.80		0.00		1.65	
2500	1.32		0.40		2.21	
3150	2.05	2.79	0.70	0.81	2.92	3.79
4000	2.88		0.82		3.79	
5000	3.44		0.92		4.45	
6300	3.70	3.69	0.81	0.62	4.68	5.03
8000	3.80		0.61		5.03	
10000	3.57		0.45		4.74	

Nominal Frequency [Hz]	WP40 Weather Protection [dB] (Horizontal)		WP40 Weather Protection [dB] (Vertical)		WP40 WS1 Secondary Windshield [dB] (Horizontal)	
	1/3rd Octave	1/1 Octave	1/3rd Octave	1/1 Octave	1/3rd Octave	1/1 Octave
12500	4.94	6.18	1.85	3.98	5.31	5.59
16000	6.72		4.31		5.59	
20000	6.87		5.79		5.63	

Nominal Frequency [Hz]	WP30 Weather Protection [dB] (Legacy)		WP61 Weather Protection [dB] (Legacy)	
	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	

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