

# Manufacturer Calibration Certificate

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The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3. All tests are traceable in accordance with ISO/IEC 17025.

No pattern approval is available for this sound level meter configuration.

## Sound Level Meter

Manufacturer	NTi Audio		
Type	XL2	S/N	A2A-15449-E0
Firmware	V4.84		
Reference Level Range	mid		
Microphone Model	M4261	S/N	2193

Performance class	Class 2
Customer Inventory Nr.	

## Customer

Elma Instruments

**Date** 14 February 2023

**Certificate** DE-23-051

**Results** **PASSED**  
(for detailed report see next pages)

Operator

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Dipl.-Ing. Benedikt Dohmen

## Measurement equipment

### Test System

Model	NTi Audio FX100, S/No. 11347
Last Calibration	01 September 2022
Cal Certificate	FX100 Cal #6958
Next Calibration	01 September 2023

### Reference Microphone

Model	M2230 S/N #10485, Mic Capsule MC230A S/No. #A22089
Last Calibration	29 November 2022
Cal Certificate	44894-10485-M2230
Next Calibration	29 November 2023

### Sound Calibrator

Model	CAL4000 S/No. #32519
Reference Level	114,14 dB
Calibration Frequency	1000,3 Hz
Last Calibration	08 September 2022
Cal Certificate	D-K-15008-01-00 2022-09
Next Calibration	07 September 2024

## Environmental conditions

Temperature	20,4 °C
Humidity	44 %
Pressure	1022 hPa

## Notes

- This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the international Systems of Units (SI).
- The user is obliged to have the object recalibrated at appropriate intervals.
- This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature are not valid.
- All limits listed in this report are acceptance limits in accordance with IEC61672.
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with the regulations of the GUM.
- All electrical tests are performed by feeding the test signal directly into the Sound Level Meter.

## 1. Indication at the calibration check frequency

The indication of the sound level meter at the calibration check frequency is checked by application of the sound calibrator and adjusted, if necessary, to indicate the required sound level for the environmental conditions under which the tests are performed. All levels in [dB].

Sensitivity before calibration	Sensitivity after calibration	Meas level	Limit -	Limit +	Uncert.	Status
17,9 mV/Pa	17,8 mV/Pa	114,2	113,14	115,14	0,2	Passed

## 2. Self-generated noise

### 2.1 XL2 Sound Level Meter with Measurement Microphone

The self-generated noise is measured in the most-sensitive level range as a time-averaged sound pressure level with frequency-weighting A and an averaging time of 30 seconds. All levels in [dB].

Weight- ing	Meas level	Limit +	Uncert.	Status
A	27,0	30,0	0,1	Passed

### 2.2 Sound Level Meter without Measurement Microphone

The self-generated noise is measured in the most-sensitive level range as a time-averaged sound pressure level for all frequency-weightings and an averaging time of 30 seconds. All levels in [dB] referenced to  $S = 42 \text{ mV/Pa}$ .

Weight- ing	Meas level	Limit +	Uncert.	Status
A	4,0	13,0	0,1	Passed
C	2,7	16,0	0,1	Passed
Z	6,6	24,0	0,1	Passed

## 3. Acoustic signal tests of a frequency weighting

The frequency weighting is tested for frequency-weighting A, using an acoustic test facility. The sound level meter is set to a fast time-weighted sound level in the reference level range. All levels in [dB].

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
125	69,8	70,5	0,7	-1,5	1,5	0,4	Passed
250	77,4	77,7	0,3	-1,5	1,5	0,4	Passed
500	82,8	83,0	0,2	-1,5	1,5	0,4	Passed
1000	86,0	86,0	0,0	-1,0	1,0	0,4	Passed
2000	87,2	87,1	-0,1	-2,0	2,0	0,4	Passed
4000	86,9	86,3	-0,6	-3,0	3,0	0,4	Passed
8000	84,9	84,2	-0,7	-5,0	5,0	0,4	Passed

## 4. Electric signal tests of frequency weightings

Frequency weightings are determined relative to the response at 1 kHz using steady sinusoidal electrical input signals. The sound level meter is set to display F-time-weighted sound level in the reference level range. All available frequency weightings provided in the sound level meter are verified. All levels in [dB].

### 4.1 A-Weighting

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
1000	80,0	80,0	0,0	-0,7	0,7	0,1	Passed
63	106,2	80,0	0,0	-1,0	1,0	0,1	Passed
125	96,1	79,9	-0,1	-1,0	1,0	0,1	Passed
250	88,6	79,9	-0,1	-1,0	1,0	0,1	Passed
500	83,2	80,0	0,0	-1,0	1,0	0,1	Passed
2000	78,8	80,0	0,0	-1,0	1,0	0,1	Passed
4000	79,0	79,9	-0,1	-1,0	1,0	0,1	Passed
8000	81,1	79,9	-0,1	-2,5	1,5	0,1	Passed
12500	84,3	79,8	-0,2	-2,5	1,5	0,1	Passed
16000	86,6	79,7	-0,3	-2,5	1,5	0,1	Passed

### 4.2 C-Weighting

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
1000	80,0	80,0	0,0	-0,7	0,7	0,1	Passed
63	80,8	80,0	0,0	-1,0	1,0	0,1	Passed
125	80,2	80,0	0,0	-1,0	1,0	0,1	Passed
250	80,0	80,0	0,0	-1,0	1,0	0,1	Passed
500	80,0	80,0	0,0	-1,0	1,0	0,1	Passed
2000	80,2	80,0	0,0	-1,0	1,0	0,1	Passed
4000	80,8	79,9	-0,1	-1,0	1,0	0,1	Passed
8000	83,0	79,8	-0,2	-2,5	1,5	0,1	Passed
12500	86,2	79,8	-0,2	-2,5	1,5	0,1	Passed
16000	88,5	79,7	-0,3	-2,5	1,5	0,1	Passed

### 4.3 Z-Weighting

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
1000	80,0	80,0	0,0	-0,7	0,7	0,1	Passed
63	80,0	80,0	0,0	-1,0	1,0	0,1	Passed
125	80,0	80,0	0,0	-1,0	1,0	0,1	Passed
250	80,0	80,0	0,0	-1,0	1,0	0,1	Passed
500	80,0	80,0	0,0	-1,0	1,0	0,1	Passed
2000	80,0	80,0	0,0	-1,0	1,0	0,1	Passed
4000	80,0	79,9	-0,1	-1,0	1,0	0,1	Passed
8000	80,0	79,9	-0,1	-2,5	1,5	0,1	Passed
12500	80,0	79,9	-0,1	-2,5	1,5	0,1	Passed
16000	80,0	79,9	-0,1	-2,5	1,5	0,1	Passed

## 5. Frequency and time weightings at 1kHz

While injecting a constant steady signal at the reference frequency of 1 kHz the F-time-weighted sound level, S-time-weighted sound level and time-averaged sound level are verified with frequency weighting A. Additionally the F-time-weighted sound level for frequency weightings C and Z is measured. The first measurement serves as reference and differences in the reading with respect to this first one are determined. All levels in [dB].

Level	Exp level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
LAF	114,0	114,0	0,0	-0,7	0,7	0,1	Passed
LAS	114,0	113,7	-0,3	-0,7	0,7	0,1	Passed
LAeq	114,0	114,0	0,0	-0,7	0,7	0,1	Passed
LCF	114,0	114,0	0,0	-0,7	0,7	0,1	Passed
LCeq	114,0	114,0	0,0	-0,7	0,7	0,1	Passed
LZF	114,0	114,0	0,0	-0,7	0,7	0,1	Passed
LZeq	114,0	114,0	0,0	-0,7	0,7	0,1	Passed

## 6. Level linearity on the reference level range

The level linearity on the reference level range is determined by applying steady sinusoidal electrical signals at a frequency of 8 kHz with the sound level meter set for frequency-weighting A and fast time-weighting. All levels in [dB].

Exp abs level	Meas. level	Abs dev	Abs Limit -	Abs Limit +	Exp rel level	Rel dev	Rel Limit -	Rel Limit +	Uncert.	Status
114,0	114,0	0,0	-1,1	1,1	0,0	0,0	-0,5	0,5	0,1	Passed
119,0	119,0	0,0	-1,1	1,1	119,0	0,0	-0,5	0,5	0,1	Passed
124,0	124,0	0,0	-1,1	1,1	124,0	0,0	-0,5	0,5	0,1	Passed
125,0	125,0	0,0	-1,1	1,1	125,0	0,0	-0,5	0,5	0,1	Passed
126,0	126,0	0,0	-1,1	1,1	126,0	0,0	-0,5	0,5	0,1	Passed
127,0	127,0	0,0	-1,1	1,1	127,0	0,0	-0,5	0,5	0,1	Passed
128,0	128,0	0,0	-1,1	1,1	128,0	0,0	-0,5	0,5	0,1	Passed
129,0	129,0	0,0	-1,1	1,1	129,0	0,0	-0,5	0,5	0,1	Passed
130,0	130,0	0,0	-1,1	1,1	130,0	0,0	-0,5	0,5	0,1	Passed
114,0	114,0	0,0	-1,1	1,1	0,0	0,0	-0,5	0,5	0,1	Passed
109,0	109,0	0,0	-1,1	1,1	109,0	0,0	-0,5	0,5	0,1	Passed
104,0	104,0	0,0	-1,1	1,1	104,0	0,0	-0,5	0,5	0,1	Passed
99,0	99,0	0,0	-1,1	1,1	99,0	0,0	-0,5	0,5	0,1	Passed
94,0	94,0	0,0	-1,1	1,1	94,0	0,0	-0,5	0,5	0,1	Passed
89,0	89,0	0,0	-1,1	1,1	89,0	0,0	-0,5	0,5	0,1	Passed
84,0	84,0	0,0	-1,1	1,1	84,0	0,0	-0,5	0,5	0,1	Passed
79,0	79,0	0,0	-1,1	1,1	79,0	0,0	-0,5	0,5	0,1	Passed
74,0	74,0	0,0	-1,1	1,1	74,0	0,0	-0,5	0,5	0,1	Passed
69,0	69,0	0,0	-1,1	1,1	69,0	0,0	-0,5	0,5	0,1	Passed
64,0	64,0	0,0	-1,1	1,1	64,0	0,0	-0,5	0,5	0,1	Passed
59,0	59,0	0,0	-1,1	1,1	59,0	0,0	-0,5	0,5	0,1	Passed
54,0	54,0	0,0	-1,1	1,1	54,0	0,0	-0,5	0,5	0,1	Passed
49,0	49,0	0,0	-1,1	1,1	49,0	0,0	-0,5	0,5	0,1	Passed
44,0	44,1	0,1	-1,1	1,1	44,0	0,1	-0,5	0,5	0,1	Passed
39,0	39,2	0,2	-1,1	1,1	39,1	0,1	-0,5	0,5	0,1	Passed
38,0	38,2	0,2	-1,1	1,1	38,2	0,0	-0,5	0,5	0,1	Passed

## 7. Level linearity including the level range control

The test is performed with steady sinusoidal electrical input signals at a frequency of 1 kHz and with the sound level meter set for frequency weighting A and fast time weighting. With the input signal level kept constant, the indicated signal level is recorded for all level ranges where the applied signal level is displayed. All levels in [dB].

Starting Range	Source level	Low Range		Mid Range		High Range		Uncert.	Status
		Dev	Limit +/-	Dev	Limit +/-	Dev	Limit +/-		
Low	94	0,0	0,55	0,0	0,25	-0,1	0,25	0,1	Passed
Mid	114			0,0	0,55	0,0	0,25	0,1	Passed
High	134					0,0	0,55	0,1	Passed
Low	40	0,0	0,55					0,1	Passed
Mid	45			0,0	0,55			0,1	Passed
High	66					0,1	0,55	0,1	Passed

## 8. Toneburst response

The response of the sound level meter to short-duration signals is tested on the reference level range with 4 kHz tonebursts that start and stop at zero crossings and are extracted from steady 4 kHz sinusoidal electrical input signals. The sound level meter is set for frequency weighting A. All levels in [dB].

The continuous signal level is 122 dB.

Burst signal	Burst duration [ms]	Exp level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
LAF	200	121,0	120,9	-0,1	-1,0	1,0	0,2	Passed
LAF	2	104,0	103,9	-0,1	-2,5	1,0	0,2	Passed
LAF	0,25	95,0	94,8	-0,2	-5,0	1,5	0,2	Passed
LAS	200	114,6	114,5	-0,1	-1,0	1,0	0,2	Passed
LAS	2	95,0	94,9	-0,1	-5,0	1,0	0,2	Passed
LAeq10s	200	105,0	104,9	-0,1	-0,5	0,5	0,2	Passed
LAeq10s	2	85,0	84,9	-0,1	-0,5	0,5	0,2	Passed
LAeq10s	0,25	76,0	75,8	-0,2	-0,5	0,5	0,2	Passed

## 9. C-weighted peak sound level

The sound level meter is tested on the least-sensitive level range with fast time weighting and C frequency weighting. The test signals are a single complete cycle of an 8 kHz sinusoid starting and stopping at zero crossings and positive and negative half cycles of a 500 Hz sinusoid that also start and stop at zero crossings. All levels in [dB].

Burst signal	Source level	Exp LCp-LCF	Meas LCp-LCF	Dev	Limit -	Limit +	Uncert.	Status
8kHz	114,0	3,4	3,1	-0,3	-3,0	3,0	0,2	Passed
500Hz +	134,0	2,4	2,2	-0,2	-2,0	2,0	0,2	Passed
500Hz -	134,0	2,4	2,2	-0,2	-2,0	2,0	0,2	Passed

## 10. Overload Indication

Overload indication is tested on the least-sensitive level range with the sound level meter set to A-weighted, time-averaged sound level. Positive and negative one-half-cycle sinusoidal electrical signals at a frequency of 4 kHz are used. All levels in [dB].

Start level	OV +	OV -	Dev	Limit -	Limit +	Uncert.	Status
139,1	147,3	147,3	0,0	-1,5	1,5	0,3	Passed