Product Data

AEM-01

½” IEPE Measurement Microphone

1 Description

The AEM-01 is a ½” omnidirectional free-field electret condenser IEPE[1] sound measurement microphone, intended to be used as a cost-effective solution for situations that demand accurate measurement results, but do not require type approved measurement equipment. Typical use is in the fields of research, investigation, education and monitoring under non-extreme conditions.

Each AEM-01 microphone is traceably calibrated against a reference microphone, being the Brüel & Kjær Microphone Unit Type 4189-A-021. The supplied calibration data includes pressure field, free field, and random incidence responses in twelfth, third and full octave frequency bands ranging from 20 Hz through 20 kHz.

By applying the calibration data, measured sound pressure levels have an uncertainty of only 0.2 dB with respect to the reference microphone, in each third octave frequency band from 20 Hz through 10 kHz.

The AEM-01 is perfectly suited for parameters based on relative sound energies, which applies to the vast majority of acoustic parameters, such as in room and building acoustics.

The AEM-01 fits a standard ½” sound level calibrator commonly used with sound level meters, to compensate for individual sensitivity dependence and to check the signal chain before each measurement session.

The low impedance IEPE interface of the AEM-01 allows the use of long cables without affecting the frequency response.

[1] Integrated Electronics Piezo-Electric, also known as CCLD (Constant Current Line Drive), ICP® (Integrated Circuit Piezoelectric) or DeltaTron®.

2 Features

- Cost-effective solution for typical measurement situations
- Pressure field, free field and random incidence response calibration data included
- Low response uncertainty re reference: 0.2 dB (20 Hz – 10 kHz third octave bands)
- Perfectly suitable for parameters based on relative energies
- Full audio frequency range: 20 Hz – 20 kHz
- Equivalent noise floor: 14 dB SPL (A-weighted)
- Maximum input level: 119 dB (1 kHz)
- Fits standard ½” sound level calibrator
- IEPE compatible, equipped with BNC connector
- Low impedance allows use of long cables

3 Applications

- Room acoustical measurements
- Building acoustical measurements
- Road traffic noise barrier measurements
- Measuring sound pressure levels under normal conditions
- Multi-channel acoustical measurements
- Speech intelligibility and speech privacy measurements
- Acoustical measurements requiring calibrated sound levels

4 Application Information

In critical cases, reported sound pressure levels (SPL’s) should be measured using type approved equipment as prescribed by a standard. Most practical situations however allow for less stringent equipment requirements, and here the AEM-01 can be used.

4.1 Measuring SPL

Its high accuracy[2] allows the AEM-01 to be used in many SPL measurement situations, such as with investigative measurements prior to the final reported ones, with survey measurements, or when monitoring the effect of modifications.

4.2 Measuring other acoustic parameters

The AEM-01 is particularly suitable for measuring acoustic parameters that rely on sound energy differences, such as parameters derived from impulse responses, or in successive measurements. This covers most acoustical measurements and measurement situations:

[2] With the use of the supplied calibration data, the AEM-01 has a response uncertainty below 0.2 dB in addition to that of the calibration reference microphone over the third octave frequency bands ranging from 20 Hz through 10 kHz, within the SPL range from 14 dB (A-weighted) and 119 dB (1 kHz).

- Room acoustical measurements of concert hall, studio, or stage parameters[3]
- Building acoustical measurements of sound insulation[4]
- Speech intelligibility measurements, f.i. in lecture halls, on platforms or in trains[5]
- Microphone array measurements, such as of road traffic noise barriers[6]

4.3 Using the WS01 windscreen

For outdoor measurements, the use of a windscreen may be required to avoid wind noise in the microphone. A windscreen will however affect the microphone response at the higher frequencies, which can be corrected for, using the supplied windscreen correction data.

The WS01 windscreen contributes up to 1.2 dB to the SPL measurement uncertainty of the AEM-01 responses over the third octave frequency range from 20 Hz to 5 kHz. This increases to 2.6 dB when the frequency range is extended to 10 kHz. For accurate sound pressure levels up to 10 kHz, the WS01 may therefore not be suitable.

Above 10 kHz, the uncertainty of SPL measurements using the WS01 windscreen increases further, which implies that the AEM-01 is normally not the optimum microphone for outdoor absolute SPL measurements above 10 kHz under windy conditions.

In case of acoustic parameters relying on sound energy differences, which is the case with most acoustic parameters, the acoustic properties of a windscreen play no significant role.

[3] All omnidirectional microphone based parameters according to (among others) the following standards:
- ISO 3382: Acoustics - Measurement of room acoustic parameters
- ISO 18233: Acoustics - Application of new measurement methods in building and room acoustics

[4] According to a.o. the following standards:
- NEN-EN-ISO 16283-1: Acoustics - Field measurement of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation
- ISO 18233: Acoustics - Application of new measurement methods in building and room acoustics

[5] Parameters according to a.o. the following standards:
- IEC 60268-16: Sound system equipment – Part 16: Objective rating of speech intelligibility by speech transmission index
- ISO 3382-3: Acoustics - Measurement of room acoustic parameters - Part 3: Open plan offices

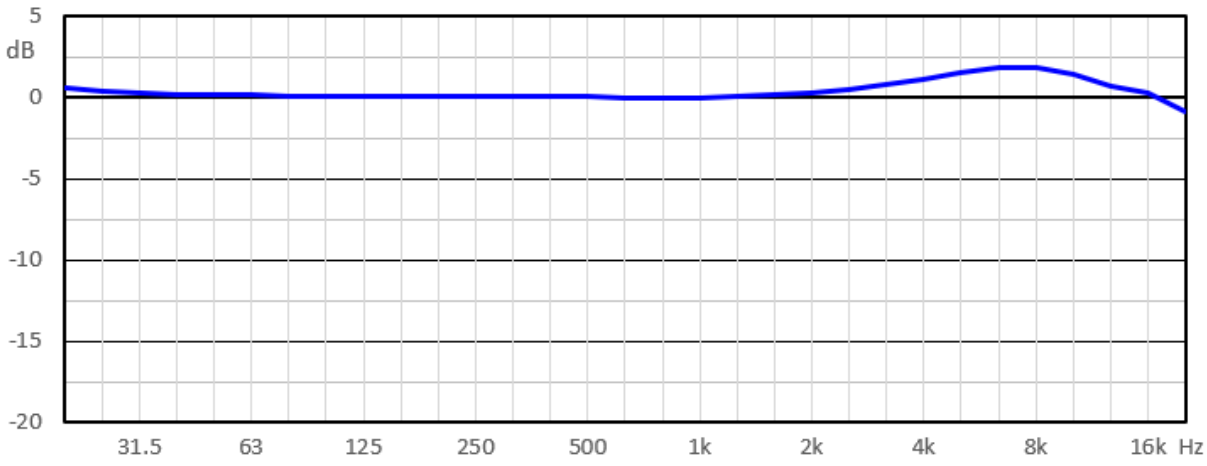
[6] According to a.o. the following standard:
- EN 1793: Road traffic noise reducing devices - Test method for determining the acoustic performance

5 Specifications

5.1 Functional

All specifications at T_A = 25ºC and RH = 40-60 %, unless otherwise noted.

Parameter	Condition	Min	Typ	Max	Unit
Levels					
Sensitivity	1 kHz	28 -31	40 -28	57 -25	mV/Pa dB re 1V/Pa
Equivalent Noise Floor	A-weighted		14		dB SPL
Maximum input level	Typical @ 1 kHz		119		dB SPL
Dynamic Range	1 kHz, A-weighted		105		dB
SNR	@ 94 dB SPL, 1 kHz, A-weighted		80		dB
Electrical					
Output Impedance				10	Ω
Output Max Voltage Swing			2		V_{pp}
Output DC Bias Voltage	I_{DC} = 4.5mA		3.5		V
Max Load	-1 dB @ 10 kHz, capacity		1		µF
Output Socket			BNC		
Spectral Responses					
FFR0[7] (see figure)	Uncalibrated, 20 Hz - 20 kHz, third octave bands, re 1 kHz	-1		5	dB
Environment					
Operating Temperature Range		-20		+60	°C
Storage Temperature Range		-40		+85	°C
Mechanics					
Weight			25		g
Length			98		mm



[7] FFR0: Free Field Response on axis and in front of the microphone

Third octave band response uncertainties after calibration, AEM-01 re reference mic (PFR, FFR0, FFR90, RIR) or AEM-01 with re without windscreen (FFR0W, FFR90W, RIRW)

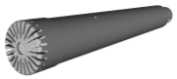
Parameter		Uncertainty per Frequency Range [dB]		
Name	**Description**	**20 Hz - 5 kHz**	**20 Hz - 10 kHz**	**20 Hz - 20 kHz**
PFR	Pressure Field Response	0.0	0.0	0.2
FFR0	Free Field Response 0°	0.1	0.1	0.9
FFR0W	Free Field Response 0° with WS01 windscreen	1.0	1.9	4.2
FFR90	Free Field Response 90°	0.1	0.4	0.5
FFR90W	Free Field Response 90° with WS01 windscreen	1.2	2.6	3.8
RIR	Random Incidence Response	0.1	0.2	4.1
RIRW	Random Incidence Response with WS01 Windscreen	1.2	1.7	6.5

5.2 Environmental tests

The following conditions will change the sensitivity at 1 kHz by less than 3 dB and negligibly affect its performance after 6 hours of recovery at room temperature.

- +85 °C for 200 hours
- -40 °C for 200 hours
- Previous temperatures cycled 5 times at a 4 h cycle time
- +60 °C and 90 % RH for 200 hours

6 Accessories[8] and ordering information

	Description	Ordering Code
	½" omnidirectional free-field electret condenser IEPE microphone (including calibration data)	**AEM-01**
	BNC cable 2 m 10 m 50 m 100 m	**CA08-2m** **CA08-10m** **CA08-50m** **CA08-100m**
	Microphone/Stand coupler ½"-15mm (black, red or blue)	**MS01-black** **MS01-red** **MS01-blue**
	Windscreen	**WS01**
	P48/IEPE Input Adapter Converts a P48 phantom power microphone input to an IEPE microphone input.	**AEXB01**

[8] For additional or alternative options, please contact info@acoustics-engineering.com

Acoustics Engineering develops systems for the prediction and measurement of acoustical parameters, resulting in user-friendly tools that enable you to perform fast and accurate acoustical measurements and calculations.

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