PRODUCT DATA

Multifunction Acoustic Calibrator Type 4226

Multifunction Acoustic Calibrator Type 4226 enables you to check for the proper function of microphones, sound level meters and other related instruments. Type 4226 generates accurate and stable sound pressure with a frequency varying from 31.5 Hz to 16 kHz in octave steps, plus a signal at 12.5 kHz.

Using the coupler provided, the test signal can be applied to either ½″ or ¼″ microphones, or picked up from an electrical output. For ease of use, Type 4226 can also apply a very accurate inverse A-weighting correction.

An external generator can be connected to Type 4226 if a frequency sweep or semi-automatic test is desired.

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Uses and Features

Uses

- Simulated free- and diffuse-field calibration of microphones
- Verification of ½″ and ¼″ microphone setups and acoustic instruments conforming to IEC 60651 and ANSI S 1.4-1983
- Verification of instruments according to parts of IEC 61672

Features

- Conforms to EN/IEC 60942 2003 class I and ANSI S 1.40-1984
- Wide frequency range: 31.5 Hz to 16 kHz in octave steps, plus 12.5 kHz signal
- Calibration levels of 94 dB, 104 dB and 114 dB
- Free-field simulation for most ½″ Brüel & Kjær microphones
- Inverse A-weighting
- Recurrent pulses for time-weighting and burst signal checks

Brüel & Kjær

About the Calibrator

The high reliability of electronic measuring instruments such as sound level meters enables you to make accurate measurements after a simple check with a single-tone calibrator. In many cases this check is also carried out after each measurement to validate the results. You can both check and calibrate microphones, sound level meters and other acoustic instruments with Multifunction Acoustic Calibrator Type 4226. The calibrator is easy to use so you can make periodical comprehensive checks whenever extra confidence is required in a measurement.

The calibrator's signal generation method ensures that over a wide frequency range, it gives a very accurate and stable SPL. The SPL produced is practically independent of atmospheric pressure changes.

The response obtained from a microphone of any type, free-field or pressure, will always be its pressure response. However, the main interest for sound level meters is the free-field response. Because the difference between the pressure response and the free-field response is known with Brüel & Kjær microphones, you can correct the SPL in the coupler as a function of frequency to obtain a flat response from an ideal free-field microphone. This SPL correction is automatically applied by the calibrator when you specify which Brüel & Kjær microphone is to be calibrated.

The construction of the calibrator also enables you to connect an external generator (for example, for frequency sweeps) or to pick up an electrical calibration signal (for example, for filter checks).

Using the Calibrator

Type 4226 is a laboratory precision instrument. Its size, and the included power supply make the instrument easy to use in-situ (for example, with a sound level meter or a large measurement setup in an anechoic chamber). The simplicity of use also makes it highly portable; no specific documentation or correction tables are required for checks on standard Brüel & Kjær sound level meters, noise dose meters, microphones, etc.

Calibrating the Sensitivity

An SPL of 94 dB ±0.2 dB re 20 µPa at 1 kHz can be used for calibration purposes. You can use other calibration levels and frequencies with slightly reduced accuracy (see the specifications).

Checking the Frequency Response

Type 4226 delivers a very stable tone with a frequency varying from 31.5 Hz to 16 kHz in octave steps, with an extra tone at 12.5 kHz. The 12.5 kHz tone is used for checking the highest frequency specified for type 1 sound level meters. The actual frequency of the tone corresponds to those frequencies recommended in ISO 266.

Checking A-weighting Networks

A 94 dB inverse A-weighted SPL can be applied in Type 4226's acoustic coupler. This means that an SPL of 94 dB, plus the corrections due to the microphone type and the sound field type, plus the inverse A-weighting correction is produced in the coupler. All the corrections are, of course, frequency-dependent, so to check an A-weighted measuring instrument means making sure that it reads 94 dB within the tolerances.

Checking Input Attenuators

Using the three calibrated levels of 94, 104 and 114 dB at all frequencies, the proper function of an instrument's input attenuators can be tested.

Checking Time Weighting Networks

This is a check in accordance with IEC 60651 that is made by comparing the instrument readings for short pulses obtained for a continuous signal of the same level. The difference depends on the time weighting. The preset test frequency is 2 kHz and each pulse is an integer number of cycles, whatever the frequency. The pulses are automatically repeated: one pulse of approximately 200 ms every 2 s for the F (Fast) time weighting; and one pulse of approximately 500 ms every 8 s for the S (Slow) time weighting. The delay between pulses ensures that the detector of the instrument under test has time to decay before the next pulse.

Checking Crest Factor Capabilities

To check the crest factor capability of sound level meters (standards require a crest factor capability of 10 for type 0 and 1 instruments), the signal from the AC output socket (crest factor: 10) can be applied directly to the sound level meter input stage. It is valid to check a sound level meter in this way as the crest factor capability is normally limited by the detector of the sound level meter and not by the microphone.

Calibrating a Noise Dose Meter

Noise dose meters are calibrated using one of the three calibrated levels and Type 4226's built-in timer. The timer automatically switches off the stabilised SPL after 30 s. This gives a well-defined noise dose to calibrate the meter. The frequency response of the noise dose meter is checked by applying the inverse A-weighted level and by changing the signal frequency.

Using AC Output

Type 4226's AC Out socket outputs a signal similar to the signal normally sent to the acoustic transducer. Consequently, all the electrical tests that can be carried out with this signal are similar to the acoustic tests described above (except for the signal for crest factor capability checks). The electrical test signals are convenient for calibrating or checking recorders, filters and other acoustic instruments.

Using an External Generator

A generator with an output voltage between 0.5 and 1.5 V can be connected to Type 4226. The calibrator regulates the level in the coupler to ensure a constant SPL relative to the inverse reference microphone response. With an external generator, the inverse A-weighting and the corrections for free-field and reference microphone response should not be applied since they refer to the frequencies delivered by the internal generator.

Specifications – Multifunction Acoustic Calibrator Type 4226

All values are typical at 25 °C (77 °F), unless measurement uncertainty is specified. All uncertainty values are specified at 2 σ (that is, expanded uncertainty using a coverage factor of 2)

Compliance with Standards

	China RoHS mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China WEEE mark indicates compliance with the EU WEEE Directive
Safety	EN/IEC 61010–1: Safety requirements for electrical equipment for measurement, control and laboratory use
EMC Emission	EN 50081-1: Generic emission standard. Part 1: Residential, commercial and light industry EN 50081-2: Generic emission standard. Part 2: Industrial environment CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits FCC Rules, Part 15: Complies with the limits for a Class B digital device
EMC Immunity	EN 50082-1: Generic immunity standard. Part 1: Residential, commercial and light industry EN 50082-2: Generic immunity standard. Part 2: Industrial environment **NOTE:** The specified calibration levels will not deviate more than 0.5 dB when exposed to RF specified in EN 50082-2 (10 V/m field)
Temperature	IEC 60068-2-1 & IEC 60068-2-2: Environmental Testing. Cold and Dry Heat. Operating Temperature: –10 to +55 °C (+14 to 131 °F) Storage Temperature: –25 to +70 °C (–13 to +158 °F
Humidity	IEC 60068-2-3: Damp Heat: 90% RH (non-condensing at 30 °C (86 °F))
Mechanical	Non-operating: IEC 60068–2–6: Vibration: 0.3 mm, 20 m/s^2, 10 – 500 Hz IEC 60068–2–27: Shock: 1000 m/s^2 IEC 60068–2–29: Bump: 3000 bumps at 250 m/s^2
Enclosure	IEC 60529: Protection provided by enclosures: IP 20

Calibration Function

NOMINAL SOUND PRESSURE LEVELS
94 dB, 104 dB and 114 dB

REFERENCE SOUND PRESSURE LEVEL
(at reference ambient conditions)
94 dB ±0.2 dB re 20 μPa, at 1 kHz
10 dB and 20 dB Level Step Accuracy: ±0.1 dB for f ≤8 kHz; ±0.2 dB for f >8 kHz

NOMINAL FREQUENCIES
From 31.5 Hz to 16 kHz in octave steps, plus 12.5 kHz

FREQUENCY ACCURACY
±1% re the ISO 266 stated exact frequencies

FREQUENCY STABILITY
Better than ±30 ppm

FREQUENCY RESPONSE
Pressure Field: Linear (94 dB, 104 dB and 114 dB SPL) and inverse A-weighting (94 dB SPL at 1 kHz)
Equivalent 0° Free-field: Linear (94 dB, 104 dB and 114 dB SPL) and inverse A-weighting (94 dB SPL at 1 kHz)

REFERENCE AMBIENT CONDITIONS
Ambient Temperature: 20 °C (68 °F)
Ambient Pressure: 1013 hPa

INFLUENCE OF AMBIENT CONDITIONS
(at reference sound pressure level)
Ambient Temperature: +0.002 dB/°C in the range –10 to +50 °C (max. temp. uncertainty ±5 °C)
Ambient Pressure: +0.00055 dB/hPa in the range 650 to 1080 hPa. For 114 dB SPL setting: 850 to 1080 hPa
(max. pressure uncertainty ±30 hPa (to satisfy IEC 60942 class 1 requirements))
Magnetic Field Sensitivity: No observable effect (<0.01 dB) at 100 A/m

LEVEL ACCURACY AT FIXED FREQUENCIES
(linear and inverse A-weighting)
Pressure Field (re 1 kHz):

31.5 to 125 Hz	250 to 500 Hz	2 to 4 kHz	8 kHz	12.5 to 16 kHz
±0.15 dB	±0.10 dB	±0.15 dB	±0.25 dB	±0.5 dB

Equivalent 0° Free-field (re 1 kHz):

31.5 to 125 Hz	250 to 500 Hz	2 kHz	4 kHz	8 kHz	12.5 kHz	16 kHz
±0.2 dB	±0.10 dB	±0.2 dB	±0.3 dB	±0.5 dB	±1.5 dB	±1.5 dB

TOTAL HARMONIC DISTORTION
≤3%

Additional Functions

TIME WEIGHTING TESTS
Frequency: 2 kHz preselected
Test Level: Typically 94 dB. Adjustable approx. ±12 dB
Signal: Continuous reference and toneburst
Level Between Bursts: Ref. level –20 dB
Burst Duration: 500 ms (S) and 200 ms (F)

CREST FACTOR TEST
Frequency: 2 kHz preselected
Test Level: Typically 94 dB. Adjustable approx. ±12 dB
Signal: Continuous reference and toneburst of 40 Hz repetition frequency. Crest factor 3 at preselected and higher frequencies
NOTE: All burst signals consist of an integral number of sine waves with amplitude shifting at zero crossing

DOSE METER CALIBRATION
Calibration Period: 30 s
Obtained Doses at 1 kHz:

SPL dB	IEC	ANSI
94	0.26% ±0.01%	0.18% ±0.01%
104	2.62% ±0.20%	0.73% ±0.03%
114	26.20% ±1.90%	2.90% ±0.12%

AC OUTPUT
Output Voltage: 12.5 mV ±0.5 mV at settings 94 dB, 1 kHz and pressure mode. Voltage changes according to the selected level, type of microphone, sound field and function. Signal for testing time weighting and crest factor capabilities as above, except crest factor = 10
NOTE: The acoustic output is switched off when a plug is inserted in the AC OUT socket
Output Impedance: 600 Ω, short-circuit proof
Frequency Response: ±0.2 dB from 31.5 to 16 kHz in Pressure mode

EXTERNAL GENERATOR INPUT
Input Voltage: 0.5 V – 1.5 V
Input Impedance: 47 kΩ
Frequency Response in the Coupler:

31.5 Hz to <8 kHz	8 kHz to <12.5 kHz	12.5 kHz to 16 kHz
±0.15 dB	±0.25 dB	±0.50 dB

NOTE: These tolerances are relative to the inverse pressure response of the reference microphone (see the user manual). Only pressure and linear response are possible with external generator

Standards

Type 4226 complies with:
- IEC 60942-1988 Sound Calibrators, Class 1 (at reference sound pressure level)
- ANSI S1.40-1984, Specifications for Acoustical Calibrators

Specifications Valid for Brüel & Kjær Microphone Types

Pressure Field: Type 4180
Equivalent 0° Free Field:

Microphone Settings	Traditional Types	Falcon Types
a	4129, 4130, 4176	4187, 4188
b	4155, 4165	4189, 4190
c	4133, 4134, 4147, 4149	4191, 4192, 4193

NOTE: For other types of microphones, see user manual

General Specifications

STABILISATION TIME
The LED corresponding to the selected frequency lights continuously when the SPL is stabilised (typically 2 to 10 s)

BATTERIES
Type: 4 × 1.5 V alkaline cells IEC LR6
Life Time: 10 hours approx. at 20 °C with alkaline batteries
Battery Check: The Batt. Low LED is lit when reaching the last 10% of the battery life

EFFECTIVE COUPLER VOLUME
Approximately 400 cm^3 at 31.5 Hz, decreasing to approximately 30 cm^3 at 1 kHz. Obtained by feedback

DIMENSIONS AND WEIGHT
- Length: 275 mm (10.8 in)
- Width: 230 mm (9.0 in)
- Height: 90 mm (3.5 in)
- Weight: 1.5 kg (3.3 lb)

Ordering Information

Type 4226 **Multifunction Acoustic Calibrator**

includes the following accessories:
- UA-1231: ½″ Microphone Adapter
- DP-0781: ¼″ Microphone Adapter
- AO-0481: Mini-Jack to BNC cable (1.5 m)
- 4 × QB-0013: Alkaline Batteries (IEC LR6)

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