

PRODUCT DATA

Anechoic Test Box — Type 4232

An anechoic test box ideally has two main purposes – to produce an exact acoustic replicate of an electric input signal and to exclude all external noise. Anechoic Test Box Type 4232 comes very close to these objectives, in a unit that is so small that you can easily use it on your desk.

The test box provides excellent insulation from external noise, even at low frequencies, and well-defined uniform test conditions, important requirements for obtaining accurate and repeatable measurements.

The rectangular, table-top design of the test box consists of the main bottom section that contains the sound source and the measuring plane, and the hinged lid that is easily opened to give access to the measuring plane on which the test object, coupler or microphone is placed.



USES

- Fast and reliable testing of hearing aids and microphones in a uniform sound field
- Investigation of hearing aids, microphones, earphones and telecoils

FEATURES

- High insulation against airborne noise
- Wide frequency range: 35 Hz to 10 kHz ± 3 dB (100 Hz to 8 kHz ± 2 dB)
- Uniform sound field across the measurement plane

- Total harmonic distortion typically less than 0.1% at 70 dB SPL (125 Hz to 8 kHz)
- Usable for pressure microphones down to 50 Hz and for pressure gradient microphones down to approximately 500 Hz
- Approximates the free-progressive sound field as specified by IEC 60118
- SPL at microphone opening conforms to ANSI S 3.22 – 1992
- Handy table-top design
- Built-in current loop for testing telecoil function

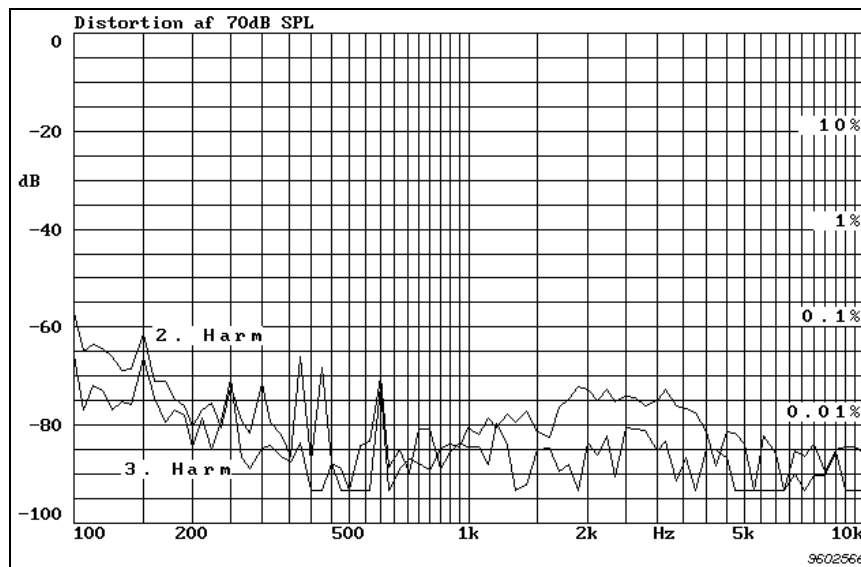
Construction of Test Box

Traditional wooden or metal box designs give significantly reduced noise rejection at lower frequencies. The design of Test Box Type 4232 involves special materials and construction principles that result in greatly improved low-frequency noise rejection, superior even to big sand-filled designs. Compared to traditional designs, a general improvement of noise rejection is obtained over the entire frequency range.

The heavy lid is constructed similar to the bottom section to obtain the same acoustic performance. It is hinged to the back panel of the bottom section and special care has been taken to ensure a good acoustic seal. In daily use the test box is very easy to handle. A gas-filled, 18 mm spring-damper on each side balance the lid and hold it in an open or closed position. The lid is operated by a single movement of the large handle that can be operated equally simply with both left and right hand.

The Sound Source

Fig. 1
Distortion of the test box at 70 dB SPL



The sound source is a high-quality loudspeaker that has been specially selected to obtain very low acoustic distortion (minimal cone break-up and overshoot and a flat frequency response). Contrary to traditional designs, the loudspeaker is mounted firmly, directly on the wall of the test box. This design has been selected to eliminate any uncontrolled resonances. The harmonic distortion of the sound source at 70 dB SPL is typically less than 0.1% and far exceeds the requirements of IEC 60118 and ANSI S3.22. The sound source can handle complex test signals at levels exceeding 110 dB SPL. A distortion measurement is shown in Fig. 1.

Measuring Plane and Connections

The measuring area is made of foam, which makes it easy to position the reference microphone or coupler with the supplied clips. The centre of the plane is clearly indicated by a round piece of blue foam. The approximate free-field conditions above 500 Hz, and the positioning of the speaker in the same horizontal plane as the measuring object, allow the performance of directional microphones to be tested. A built-in current loop makes it possible to test hearing aids with telecoil facility. Thin cables, for minimum interference with measurements, are fitted inside the box for connecting a reference microphone and coupler. Typically, a constant current is used to drive the telecoil. To obtain that, a resistor is normally placed in a series with the coil. With a 100 Ω series resistance, a field strength of 100 mA/m is obtained with a driving

voltage and current of 2.6 V and 25 mA. A small panel allows hearing aid battery eliminators and auxiliary equipment to be connected.

The Back Panel

Fig. 2
Back panel of Anechoic Test Box Type 4232. All connections to the inside of the test box are made via the connectors on the back panel

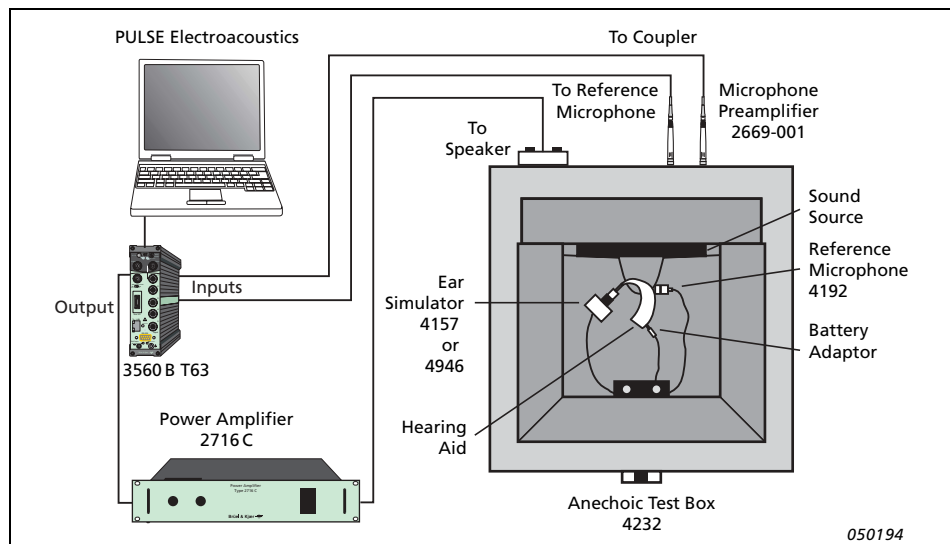


The back panel (see Fig. 2) contains all the connections to the inside of the test box. For minimum acoustic interference, the preamplifiers for both the reference microphone and the coupler are placed outside the test box. The preamplifiers are screwed directly into the connectors on the back panel. Type 2669-001 must be used for prepolarized microphones. The connection for hearing aid battery eliminators allows, for example, the current consumption for hearing aids to be measured, or to measure the hearing aid response when simulating various voltage conditions of the battery. The auxiliary input can be used for connecting electrical signals to the hearing aid, for example, for interfacing to the hearing aid according to the Hi-Pro standard. An acoustically sealed passage is provided for use if other external cables are required.

The connection for hearing aid battery eliminators allows, for example, the current consumption for hearing aids to be measured, or to measure the hearing aid response when simulating various voltage conditions of the battery. The auxiliary input can be used for connecting electrical signals to the hearing aid, for example, for interfacing to the hearing aid according to the Hi-Pro standard. An acoustically sealed passage is provided for use if other external cables are required.

Use of Anechoic Test Box Type 4232

Fig. 3
Test setup with the test box for measurements on hearing aids. The test box is illustrated as a plan view and is not drawn to scale



A typical hearing aid measuring system, see Fig. 3, consists of two main sections. The first sets up and regulates the sound field while the second analyses the signal from the hearing aid and records the result. Typical hearing aid frequency response and distortion curves obtained with this setup are shown in Fig. 4.

Test Box Type 4232 provides repeatable, constant sound pressure level conditions, with very low acoustic distortion, over the measuring plane inside the chamber. It is possible to perform measurements in most environments, even at low acoustical levels (35 to 50 dB SPL).

A typical uncorrected frequency characteristic for the test box at 96 dB excitation level is shown in Fig. 5. The response is within ± 2 dB from 100 Hz to 8 kHz. The smooth shape of the curve makes it very simple to equalize. As well as providing a suitable test environment internally, the chamber must also attenuate external noise. Any outside noise which is not sufficiently suppressed at the measuring plane will affect measurements.

Fig. 4
 Frequency Response
 (upper graph) and
 Total Harmonic
 Distortion (lower
 graph) measured on a
 hearing aid

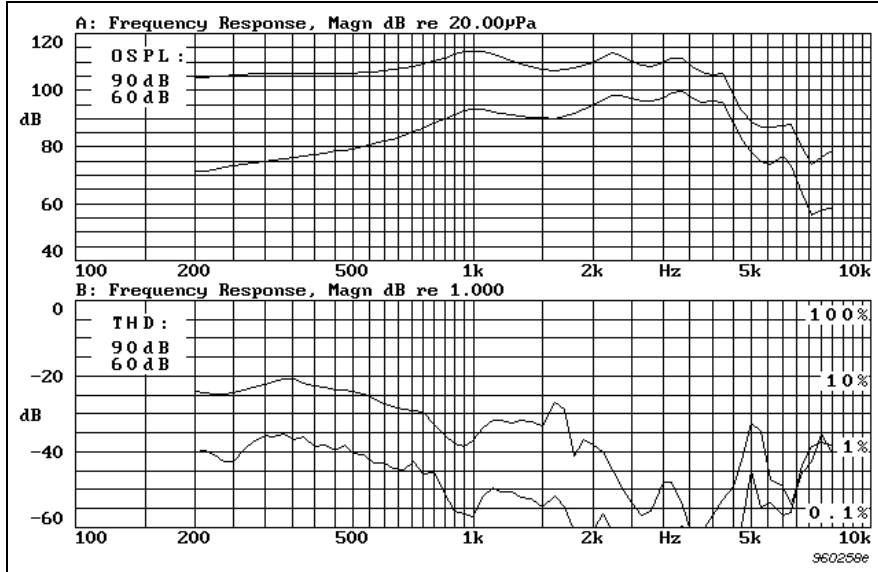


Fig. 5
 Frequency Response
 for the test box
 measured at 96 dB
 excitation level

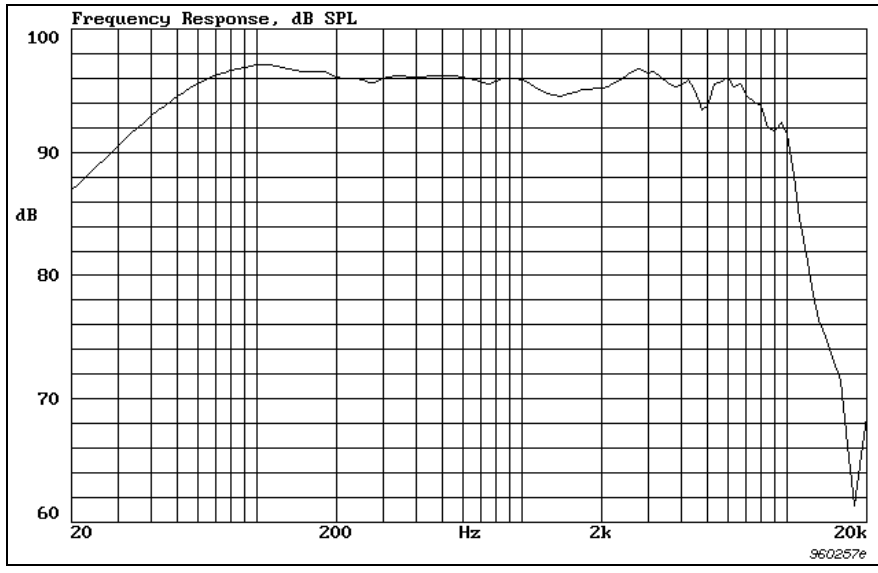
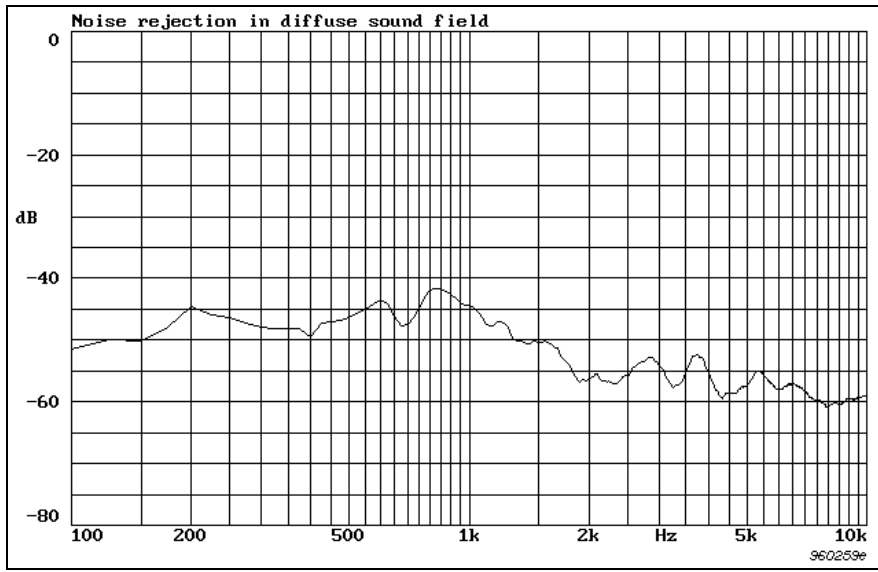


Fig. 6
 Typical noise
 suppression of the test
 box when subjected to
 a diffuse sound field





The typical noise suppression of the test box when subjected to a diffuse sound field is shown in Fig. 6. Any normal office or quality control department will provide a suitable acoustic environment in which tests can be made with Type 4232.

Associated Products

Ear Simulator Type 4157 (IEC 60711 coupler) is delivered fully assembled and calibrated and has its own 1/2" microphone built in. A wide range of adaptors are supplied which permit easy coupling of all types of insert earphones and hearing aids.

Instead of the Ear Simulator, the 2cc Click-on Coupler Type 4946 can be used. The coupler is made to IEC and ANSI requirements, and fits 1" and 1/2" microphones.

Compliance with Standards

 	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive. C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand
Safety	EN/IEC 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use. UL 61010B-1: Standard for Safety – Electrical measuring and test equipment
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. Note: The above is guaranteed using accessories listed in this Product Data sheet only.

Specifications – Anechoic Test Box Type 4232

Acoustical

DYNAMIC RANGE

From below 35 dB to above 110 dB SPL (re 20 μ Pa)

UNIFORMITY OF THE SOUND FIELD

The measuring area is equivalent to the area occupied by the blue foam

The free-field sound level within the measuring area is equal to the regulated SPL within: ± 1 dB from 20 Hz to 10 kHz

INSULATION AGAINST AIRBORNE NOISE

>40 dB, 20 Hz to 1500 Hz

45 to 55 dB, >1500 Hz

SENSITIVITY (FOR 1 W INPUT)

110 dB SPL at the test point. The test point is defined as the centre of the measuring area

DISTORTION (125 HZ TO 8 KHZ)

100 dB SPL:

<0.5% 2nd harmonic

<0.3% 3rd harmonic

70 dB SPL:

<0.1% 2nd harmonic

<0.06% 3rd harmonic

FREQUENCY RANGE (WITHOUT ELECTRICAL EQUALIZATION)

100 Hz to 8 kHz (± 2 dB)

35 Hz to 10 kHz (± 3 dB)

6 dB/octave attenuation slope below 35 Hz

24 dB/octave attenuation slope above 10 kHz

EXCITATION LEVELS

Upper Limit: Maximum 110 dB SPL

Lower Limit: Determined by ambient noise level and noise rejection

FREE-FIELD PROPERTIES OF SOUND FIELD

Approximates free-field conditions above 500 Hz. Sound radiation is in the horizontal plane

Electrical

LOUDSPEAKER

Maximum Continuous Input Power: 4.5 W

Maximum Peak Input Power: 40 W

Nominal Impedance: 8 Ω (maximum 25 Ω)

TELECOIL

Resistance: 1 Ω

Inductance: 9 μ H

Connectors

REFERENCE MICROPHONE

11.7 mm–UNF thread for fitting an external 1/2" microphone preamplifier

MEASURING MICROPHONE

11.7 mm–UNF thread for fitting an external 1/2" microphone preamplifier

BATTERY ADAPTOR

Three-pole Mini Jack socket

TELECOIL LOOP

Standard Jack socket

SPEAKER

Spring-loaded terminals for stripped cable ends

AUXILIARY

5-pole mini DIN socket (Hi-Pro standard)

Dimensions and Weight

Height: 260 mm (10.2")

Width: 365 mm (14.4")

Depth: 400 mm (15.7")

Weight: 22 kg (48.5 lb.)

Dimensions of Measurement Chamber: 60 × 165 × 200 mm
(2.4 × 6.4 × 7.8")

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

Ordering Information

Type 4232 Anechoic Test Box
Includes the following accessories:
2 × UA 1375 Clip for holding IEC 711 or 2 cm³ Coupler
UA 1376 Clip for holding reference microphone
UA 1370 Protection bracket for external microphone preamplifier

Accessories Available

DB 0962 Adaptor, to mount 1" Microphone on ½" Preamplifier

Additional Instrumentation

MICROPHONES

Type 4144 Pressure-field 1" Microphone
Type 4192 Falcon Range[®] Pressure-field ½" Microphone
Type 4947 Prepolarized Pressure-field ½" Microphone

COUPLERS

Type 4157 Ear Simulator (including IEC 60711 Coupler and Type 2669-001 Preamplifier)
Type 4946 2cc Click-on Coupler (excluding microphone)

PREAMPLIFIERS

Type 2669-001 Falcon Range[®] ½" Microphone Preamplifier for use with Type 4232

Type 2671 DeltaTron[®] Microphone Preamplifier
Type 2695 ½" DeltaTron[®] Microphone Preamplifier (short – fits inside Type 4232)

CONDITIONING

Type 2829 4-channel Microphone Power Supply
Type 2690 A-OS2 2-channel Microphone Conditioning Amplifier (NEXUS[™])
Type 2693 A-OS44 4-channel DeltaTron[®] Conditioning Amplifier with filters (NEXUS[™])
Type 5935 L Dual Microphone Supply with LEMO sockets

ANALYSIS

Type 3560 B-T63 PULSE[™] Audio Analyzer
BZ 5548-N SSR Analysis – Harmonic Distortion
BZ 5549-N SSR Analysis – Intermodulation Distortion

CABLES

AO 0087 D-030 3 m BNC to BNC cable for DeltaTron[®] Microphone Preamplifier Type 2672
AO 0419 D-030 3 m Cable with LEMO Connector for Falcon Range[®] ½" Microphone Preamplifier Type 2669-001
AO 0531 D-030 3 m 10–32 UNF to BNC Connector for ½" DeltaTron[®] Microphone Preamplifier Type 2695

CALIBRATION

Type 4231 Sound Calibrator

Brüel & Kjær reserves the right to change specifications and accessories without notice

HEADQUARTERS: DK-2850 Nærum · Denmark · Telephone: +45 4580 0500 · Fax: +45 4580 1405
www.bksv.com · info@bksv.com

Australia (+61) 2 9889-8888 · Austria (+43) 1 865 74 00 · Brazil (+55) 11 5188-8161 · Canada (+1) 514 695-8225
China (+86) 10 680 29906 · Czech Republic (+420) 2 6702 1100 · Finland (+358) 9-521 300 · France (+33) 1 69 90 71 00
Germany (+49) 421 17 87 0 · Hong Kong (+852) 2548 7486 · Hungary (+36) 1 215 83 05 · Ireland (+353) 1 807 4083
Italy (+39) 0257 68061 · Japan (+81) 3 5715 1612 · Netherlands (+31) 318 55 9290 · Norway (+47) 66 77 11 55
Poland (+48) 22 816 75 56 · Portugal (+351) 21 47 11 4 53 · Republic of Korea (+82) 2 3473 0605
Singapore (+65) 6377 4512 · Slovak Republic (+421) 25 443 0701 · Spain (+34) 91 659 0820 · Sweden (+46) 8 449 8600
Switzerland (+41) 44 880 7035 · Taiwan (+886) 2 2502 7255 · United Kingdom (+44) 14 38 739 000
USA (+1) 800 332 2040 · Local representatives and service organisations worldwide

Brüel & Kjær 

