

# Product Data

## Anechoic Test Box — Type 4232

### 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  $\pm 3$  dB (100 Hz to 8 kHz  $\pm 2$  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 approx. 500 Hz
- Approximates the free-progressive sound field as specified by IEC 118
- SPL at microphone opening conforms to ANSI S3.22–1992
- Handy table-top design
- Built-in current loop for testing telecoil function

Anechoic Test Box Type 4232 is a very compact anechoic chamber with a built-in sound source. It is for use with external instrumentation such as the Audio Analyzer Type 2012, or Measuring Amplifier and Sine Generator, for measurements on small test items such as hearing aids and microphones.

### Description

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 are placed.



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### Construction of Test Box

Traditional wooden or metal box designs give significantly reduced noise rejection at lower frequencies. The innovative 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 simple with both left and right hand.

### The Sound Source

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 118 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. 3.

### 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



Fig. 1 Back panel of the Anechoic Test Box Type 4232. All connections to the inside of the test box are made via the connectors on the back panel

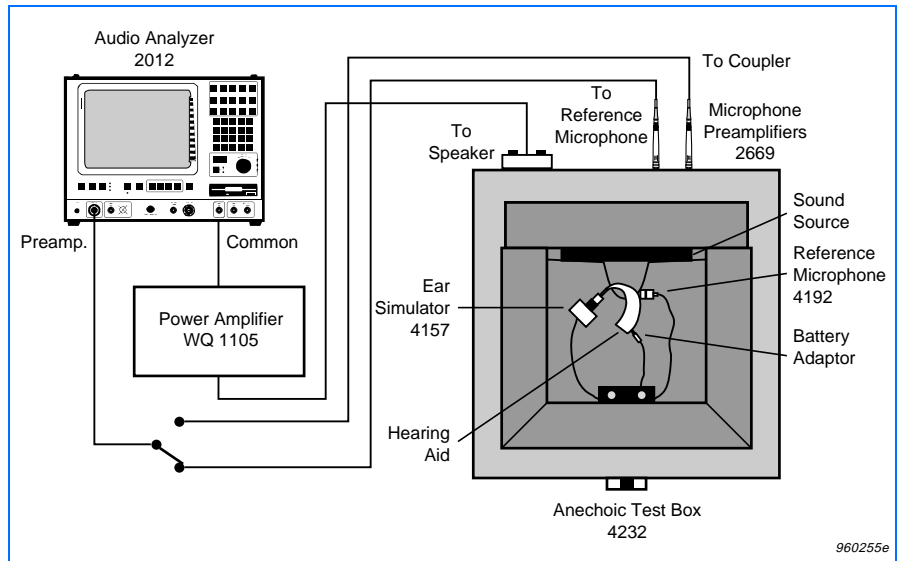


Fig. 2 Test set-up with the test box for measurements on hearing aids. The test box is illustrated as a plan view and is not drawn to scale

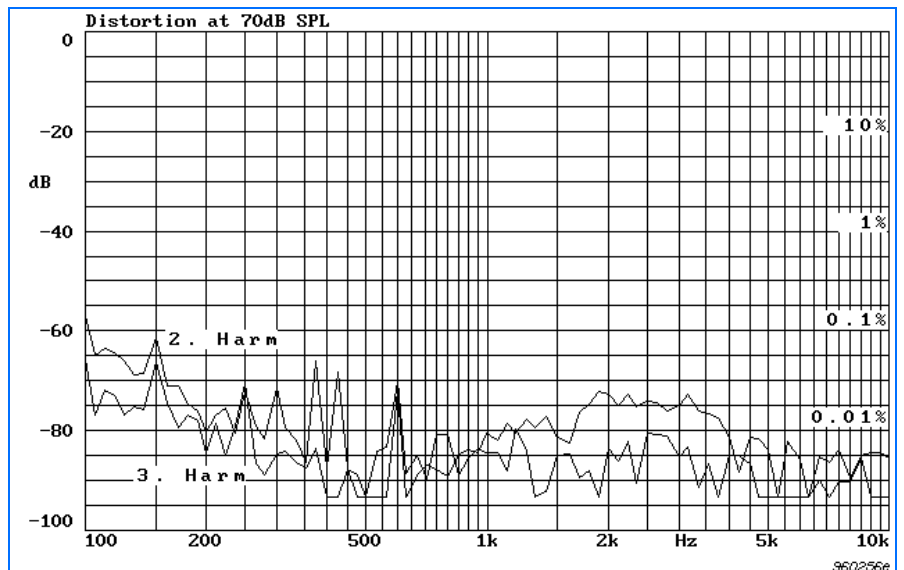


Fig. 3 Distortion of the test box at 70 dB SPL

and coupler. A small panel allows 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. A bracket (UA 1370) is available as an accessory for protecting the preamplifiers. The connection for hearing aid battery eliminators allows, for example, the

### The Back Panel

The back panel (see Fig. 1) 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. A bracket (UA 1370) is available as an accessory for protecting the preamplifiers. 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

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 hearing aid measuring system, see Fig 2, 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 set-up, using Audio Analyzer Type 2012, are shown in Fig. 4.

A typical uncorrected frequency characteristic for the test box at 96 dB excitation level is shown in Fig. 5. The response is within  $\pm 2$  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. 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

The Ear Simulator Type 4157 (IEC 711 coupler) is delivered fully assembled and calibrated and has its own  $\frac{1}{2}$ " 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  $2\text{ cm}^3$  Coupler DB0138 can be used. The coupler is made to IEC and ANSI requirements, and fits directly on 1" microphones and on  $\frac{1}{2}$ " types using

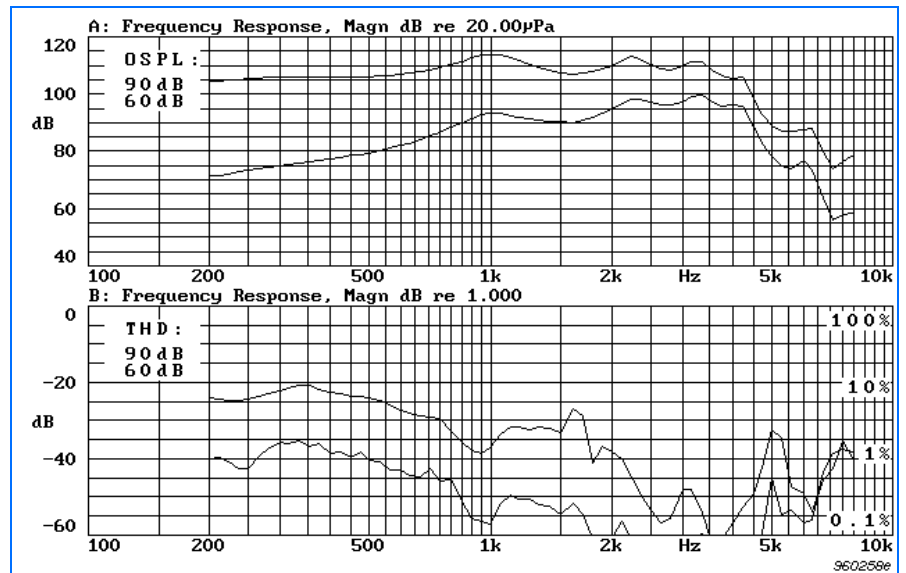


Fig.4 Frequency Response (upper graph) and Total Harmonic Distortion (lower graph) measured on a hearing aid using Audio Analyzer Type 2012

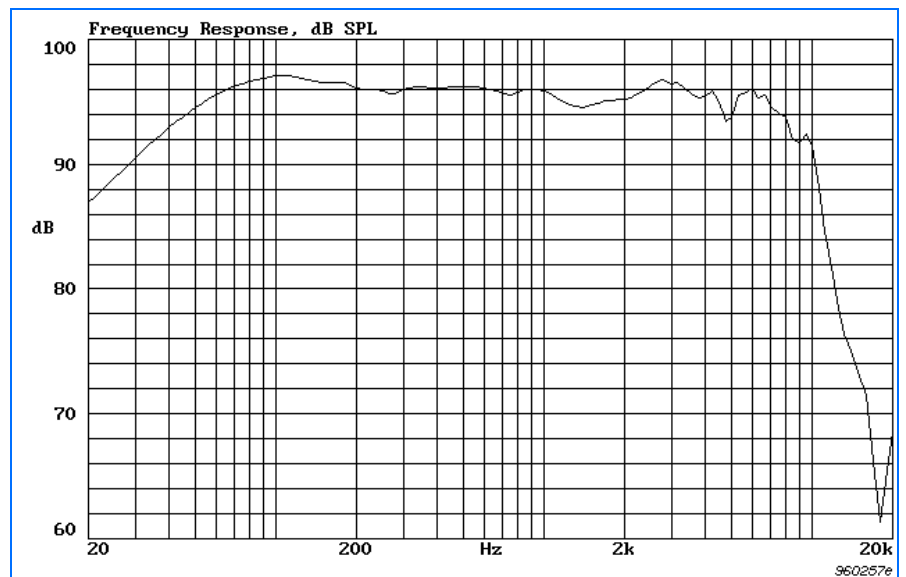


Fig.5 Frequency response for the test box measured at 96 dB excitation level

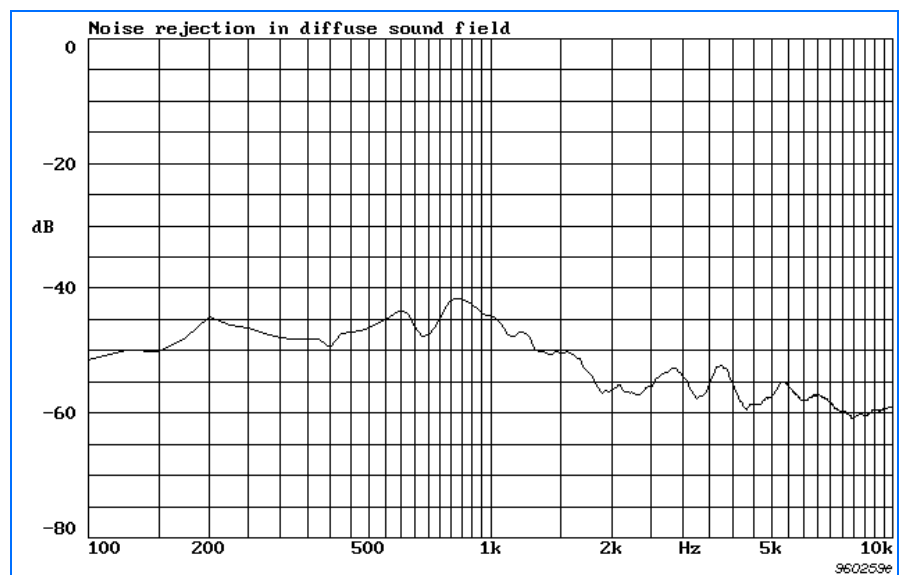


Fig.6 Typical noise suppression of the test box when subjected to a diffuse sound field

adaptor UA 0873. The 1/2" Type 4192 or 1" Type 4144 pressure response

microphones, together with Microphone Preamplifier Type 2669, are

recommended.

## Specifications 4232

<p><b>Acoustical</b></p> <p><b>DYNAMIC RANGE:</b> From below 35 dB to above 110 dB SPL (re 20 µPa)</p> <p><b>UNIFORMITY OF THE SOUND FIELD:</b> 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</p> <p><b>INSULATION AGAINST AIRBORNE NOISE:</b> &gt;40 dB, 20 Hz to 1500 Hz 45 to 55 dB, &gt;1500 Hz</p> <p><b>SENSITIVITY (for 1 W input):</b> 110 dB SPL at the test point. The test point is defined as the centre of the measuring area</p> <p><b>DISTORTION (125 Hz to 8 kHz):</b> <b>100 dB SPL:</b> &lt;0.5% 2nd harmonic &lt;0.3% 3rd harmonic <b>70 dB SPL (see Fig. 3):</b> &lt;0.1% 2nd harmonic &lt;0.06% 3rd harmonic</p> <p><b>FREQUENCY RANGE (without electrical equalization):</b> 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</p> <p><b>EXCITATION LEVELS:</b> <b>Upper Limit:</b> Max. 110 dB SPL <b>Lower Limit:</b> Determined by ambient noise level and noise rejection</p> <p><b>FREE-FIELD PROPERTIES OF SOUND FIELD:</b> Approximates free-field conditions above 500 Hz. Sound radiation is in the horizontal plane</p>	<p><b>Electrical</b></p> <p><b>LOUDSPEAKER:</b> <b>Max. Continuous Input Power:</b> 4.5 W <b>Max. Peak Input Power:</b> 40 W <b>Nominal Impedance:</b> 8 Ω (max. 25 Ω)</p> <p><b>Connectors</b></p> <p><b>REFERENCE MICROPHONE:</b> 11.7 mm–UNF thread for fitting an external 1/2" microphone preamplifier</p> <p><b>MEASURING MICROPHONE:</b> 11.7 mm–UNF thread for fitting an external 1/2" microphone preamplifier</p> <p><b>BATTERY ADAPTOR:</b> Three-pole Mini Jack socket</p> <p><b>COMPLIANCE WITH STANDARDS:</b></p> <table border="1"> <tr> <td style="text-align: center;"><b>CE</b></td> <td>CE-mark indicates compliance with: EMC Directive.</td> </tr> <tr> <td><b>EMC Emission</b></td> <td>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.</td> </tr> <tr> <td><b>EMC Immunity</b></td> <td>EN 50082–1: Generic immunity standard. Part 1: Residential, commercial and light industry. <b>Note:</b> The above is guaranteed using accessories listed in this Product Data sheet only.</td> </tr> </table>	<b>CE</b>	CE-mark indicates compliance with: EMC Directive.	<b>EMC Emission</b>	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.	<b>EMC Immunity</b>	EN 50082–1: Generic immunity standard. Part 1: Residential, commercial and light industry. <b>Note:</b> The above is guaranteed using accessories listed in this Product Data sheet only.	<p><b>TELECOIL LOOP:</b> Standard Jack socket</p> <p><b>SPEAKER:</b> Spring-loaded terminals for stripped cable ends</p> <p><b>AUXILIARY:</b> 5-pole mini DIN socket (Hi-Pro standard)</p> <p><b>Dimensions and Weight</b></p> <p><b>Height:</b> 260 mm (10.2") <b>Width:</b> 365 mm (14.4") <b>Depth:</b> 400 mm (15.7") <b>Weight:</b> 22 kg (48.5 lb.)</p> <p><b>Note:</b> All values are typical at 25°C (77°F), unless measurement uncertainty or tolerance field is specified. All uncertainty values are specified at 2σ (i.e. expanded uncertainty using a coverage factor of 2)</p>
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## Ordering Information

<p>Type 4232 Anechoic Test Box <b>Includes the following accessories:</b> 2 × UA 1375: Clip for holding IEC 711 or 2 cm<sup>3</sup> Coupler UA 1376: Clip for holding reference microphone</p> <p><b>Optional Accessories</b></p> <p><b>UA 1370:</b> Protection bracket for external microphone preamplifiers</p>	<p><b>UA 1371:</b> Battery adaptor for battery size 675 <b>UA 1372:</b> Battery adaptor for battery size 13 <b>UA 1373:</b> Battery adaptor for battery size 312 <b>UA 1374:</b> Battery adaptor for battery size 10/230 <b>DB 0138:</b> 2 cm<sup>3</sup> Coupler. Complies with IEC 126 1971 and ANSI S3.7-1973 <b>UA 0873:</b> 1" to 1/2" coupler adaptor <b>DB 0962:</b> Adaptor for 1" Microphone</p>	<p><b>Type 4157:</b> Occluded Ear Simulator. Complies with IEC 711 1982 and ANSI S3.25–1979 <b>Type 4144:</b> 1" Pressure Microphone <b>Type 4192:</b> 1/2" Pressure Microphone <b>Type 2669:</b> Microphone Preamplifier</p>
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Brüel&Kjær reserves the right to change specifications and accessories without notice



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