

Product Data

Artificial Ears — Types 4152 and 4153

USES:

- Frequency response and sensitivity measurements on insert earphones and headphones
- Calibration of audiometers

FEATURES:

- Conform to IEC and ANSI standards
- Complete reproducibility of results
- Well-defined measuring conditions
- 2 cm³ and 6 cm³ couplers
- Adjustable clamping force

Artificial Ears Types 4152 and 4153 have been designed for measurements in the audiometric and related fields. They enable electroacoustical measurements on either insert earphones or headphones to be carried out under well defined acoustical conditions, which are of great importance for the comparability of different designs and the reproducibility of measurements.

Artificial Ears Types 4152 and 4153 consist of an acoustic coupler, a main housing containing the sockets for the connection of a Brüel & Kjær condenser microphone and a base plate with a mechanism for clamping the object being tested.

The clamping mechanism is spring loaded and provides a force which can be adjusted from 2 N (approx. 0.2 kg) to 10 N (approx. 1 kg) as recommended by the relevant ANSI Standards, the actual force value being set on a scale engraved on the clamp holder. To minimise the effect of vibration during the measurements, each Artificial Ear is isolated from shock and vibration by means of three soft rubber feet.

Artificial Ear Type 4152

In Artificial Ear Type 4152 the socket for mounting the measuring microphone permits use of a Brüel & Kjær 1" Condenser Microphone Cartridge Type 4144 with associated Preamplifier Type 2669 L (Adaptor DB 0962 re-



quired). The couplers (see Fig. 1) supplied with the Artificial Ear consist of a 2 cm³ Coupler DB 0138 in accordance with IEC 126 and ANSI S3.7-1973 for measurements on hearing aid earphones, and a 6 cm³ Coupler DB 0913 which fulfils the re-

quirements of the NBS 9A Coupler (United States National Institute of Standards and Technology, formerly the National Bureau of Standards) and the ANSIS3.6-1969 and IEC 303 Coupler for measurements on headphones. If required, a special 6 cm³



Fig. 1 Left to right: couplers DB 0138, DB 0909 and DB 0161 with their respective adaptors and stop collars

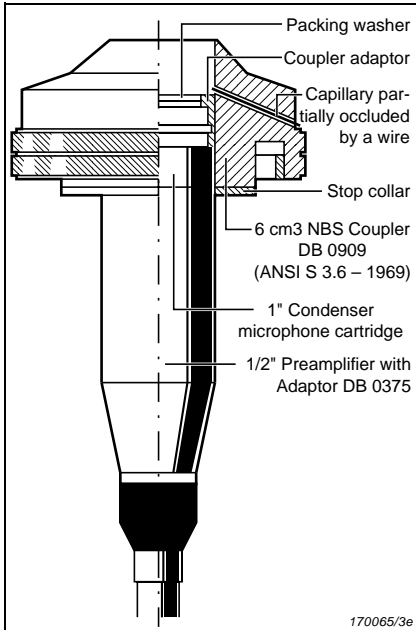


Fig. 2 Sketch showing how a 6 cm³ Coupler is mounted directly on a 1" Condenser Microphone

Coupler DB 0161 designed according to the requirements of ANSI S3.7-1973 Type 1 Coupler is available.

The 2 cm³ coupler may be used directly on the microphone with preamplifier without use of the main housing. In this manner an artificial ear is obtained which is very small and useful for measurements on, for example, spectacle type hearing aids, the arrangement still being in agreement with the IEC publication. A typical example of this type of application is the testing of hearing aids in Anechoic Test Box Type 4232. The 6 cm³ couplers may also be mounted directly on the microphone with the aid of a Stop Collar YO 2340 delivered with the 6 cm³ couplers when they are ordered separately as DB 0161 or DB 0909.

Artificial Ear Type 4153

Artificial Ear Type 4153 fulfils the requirements of IEC 318 and has an acoustical impedance basically similar to that of the human ear. The acoustic coupler (Fig. 3) contains three volumes ($V_1 = 2.5 \text{ cm}^3$, $V_2 = 1.8 \text{ cm}^3$ and $V_3 = 7.5 \text{ cm}^3$) acoustically connected in parallel by means of a narrow annular slit and four parallel holes. The slit and the four holes act as an acoustic resistance of $6.5 \times 10^6 \text{ N s/m}^5$ and $20 \times 10^6 \text{ N s/m}^5$ respectively, while their acoustic in-

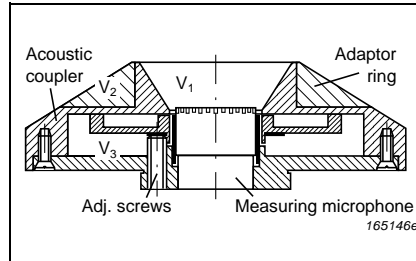


Fig. 3 Sectional view of the Acoustic Coupler used in the 4153

ductances are $5 \times 10^2 \text{ N s}^2/\text{m}^5$ for the slit and $10^4 \text{ N s}^2/\text{m}^5$ for the holes. An electrical equivalent of the acoustic circuit is shown in Fig. 4.

The coupler fits Brüel & Kjær Falcon™ Range 1/2" Microphone Type 4192, and may be used with a Falcon Range Microphone Preamplifier Type 2669 L mounted in the housing. The coupler also mounts directly on the preamplifiers by means of the Adaptor Ring DB 0742 supplied. The coupler is shaped to fit the headphone under test, and a special Adaptor DB 0843 is supplied for testing circumaural headphones.

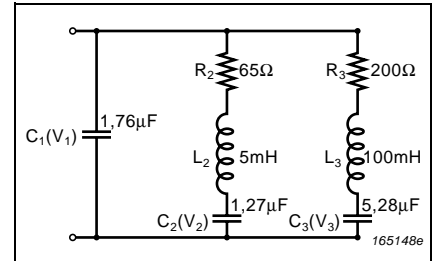


Fig. 4 The electrical equivalent circuit of the Type 4153

For calibration purposes a well defined high acoustic impedance sound source is supplied with the Ear (Fig. 5). It consists of an Earcap YJ 0305 and an Adaptor AQ 0015 for a 1/2" condenser microphone cartridge, which is used as sound transmitter.

Fig. 6 shows the pressure frequency response of Artificial Ear Type 4153 measured with Microphone Type 4192. The sound pressure is produced by the high impedance sound source, described above, which is fed from a constant AC voltage generator. The acoustical coupling be-



Fig. 5 Left to right: Adaptor DB 0843, Adaptor Ring DB 0742, Adaptor YJ 0304 and Earcap YJ 0305 with Adaptor AQ 0015 mounted

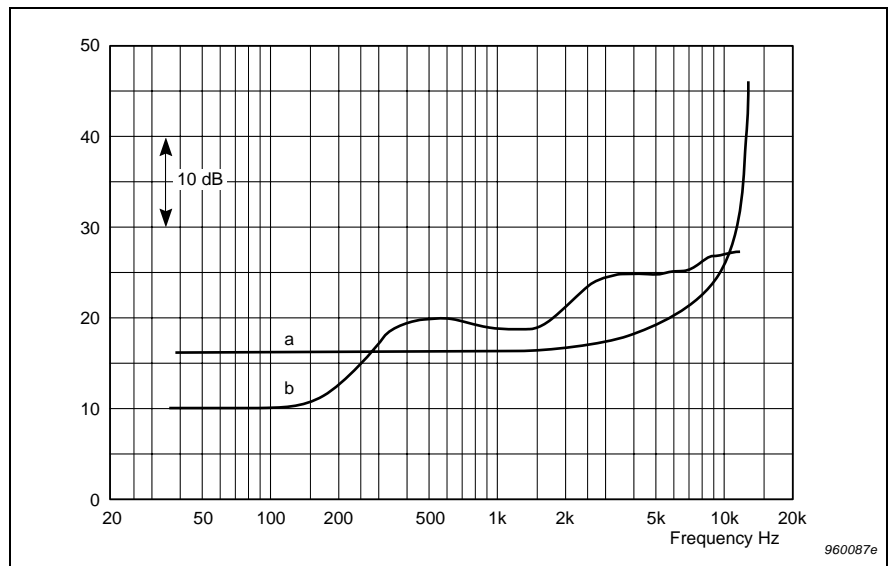


Fig. 6 Typical frequency response curves for the Artificial Ears
a) pressure response of Type 4152
b) pressure response of Type 4153

tween the transmitting microphone and the Artificial Ear is established by pressing the Earcap against the Ear.

Fig. 6 also shows the pressure frequency response of Artificial Ear Type 4152 with the 6 cm³ Coupler




DB 0913 measured with a 1" Condenser Microphone Type 4144. The sound source is the same as above.

Prepolarized Version

A modified version of Type 4153 is available for audiometer calibration

using sound level meters with no polarization voltage. This version includes Prepolarized Pressure-field 1/2-inch Microphone Type 4947.

Specifications 4152 and 4153

<p>TYPE 4152</p> <p>COUPLERS AVAILABLE: DB 0138: 2 cm³ (supplied) DB 0909: 6 cm³ (supplied) DB 0161: 6 cm³</p> <p>MAX. FORCE APPLIED TO THE TOP OF ACOUSTIC COUPLER: 10 N (1 kg)</p> <p>DIMENSIONS: Height: 104 mm (4.1 in) Max. Diameter: 123 mm (4.85 in)</p> <p>WEIGHT: 1.5 kg (3.3 lb.)</p> <p>TYPE 4153</p> <p>DIMENSIONS: Height: 104 mm (4.1 in) Max. Diameter: 123 mm (4.85 in)</p>	<p>COMPLIANCE WITH STANDARDS:</p> <table border="1"> <tr> <td></td> <td>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</td> </tr> <tr> <td>Safety</td> <td>EN 61010-1 and IEC 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use. UL 3111-1: Standard for Safety – Electrical measuring and test equipment</td> </tr> <tr> <td>EMC Emission</td> <td>EN/IEC 61000-6-3: Generic emission standard for residential, commercial and light industrial environments. 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>EMC Immunity</td> <td>EN/IEC 61000-6-1: Generic standards – Immunity for residential, commercial and light industrial environments. Note: The above is guaranteed using accessories listed in this Product Data sheet only.</td> </tr> <tr> <td>Temperature</td> <td>IEC 68-2-1 & IEC 68-2-2: Environmental Testing. Cold and Dry Heat. Operating Temperature: 5 to +40°C Storage Temperature: -25 to +70°C</td> </tr> <tr> <td>Humidity</td> <td>IEC 68-2-3: Damp Heat: (93 ± 3)% RH (non-condensing at 40°C (104°F))</td> </tr> <tr> <td>Mechanical</td> <td>Non-operating: IEC 68-2-6: Vibration: 0.3 mm, 20 m/s², 10-500 Hz IEC 68-2-27: Shock: 1000 m/s² IEC 68-2-29: Bump: 1000 bumps at 250 m/s²</td> </tr> </table>		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 61010-1 and IEC 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use. UL 3111-1: Standard for Safety – Electrical measuring and test equipment	EMC Emission	EN/IEC 61000-6-3: Generic emission standard for residential, commercial and light industrial environments. 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/IEC 61000-6-1: Generic standards – Immunity for residential, commercial and light industrial environments. Note: The above is guaranteed using accessories listed in this Product Data sheet only.	Temperature	IEC 68-2-1 & IEC 68-2-2: Environmental Testing. Cold and Dry Heat. Operating Temperature: 5 to +40°C Storage Temperature: -25 to +70°C	Humidity	IEC 68-2-3: Damp Heat: (93 ± 3)% RH (non-condensing at 40°C (104°F))	Mechanical	Non-operating: IEC 68-2-6: Vibration: 0.3 mm, 20 m/s ² , 10-500 Hz IEC 68-2-27: Shock: 1000 m/s ² IEC 68-2-29: Bump: 1000 bumps at 250 m/s ²
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COUPLER VOLUMES:		
	Volume	Acoustic Capacitance
V ₁	2.5 cm ³ = 1%	17.6 × 10 ⁻¹² m ⁵ /N
V ₂	1.8 cm ³ = 1%	12.7 × 10 ⁻¹² m ⁵ /N
V ₃	7.5 cm ³ = 1%	52.8 × 10 ⁻¹² m ⁵ /N

CONNECTIONS BETWEEN CAVITIES:		
	Acoustic Resistance	Acoustic Inductance
Annular slit:	6.5 × 10 ⁶ Ns/m ⁵	5 × 10 ² Ns ² /m ⁵
Four parallel holes	20 × 10 ⁶ Ns/m ⁵	10 ⁴ Ns ² /m ⁵

Ordering Information

<p>Type 4152 Artificial Ear</p> <p>MEASURING MICROPHONE:* Type 4144: 1" Condenser Microphone</p> <p>PREAMPLIFIER:* Type 2669 L: Falcon Range Microphone Preamplifier</p> <hr/> <p>Accessories Included</p> <p>DB 0138: 2 cm³ Coupler DB 0913: 6 cm³ Coupler (equal to DB 0909 but without base ring YO 2340) DB 0111: Coupler Adaptor Ring DB 1021: Guard Ring Adaptor DB 0962: Adaptor for Sound Level Meter</p> <hr/> <p>Optional Accessories</p> <p>DB 0161: 6 cm³ Coupler (with base ring YO 2340) DB 0909: 6 cm³ Coupler (with base ring YO 2340) DB 0375: Adaptor for Preamplifier</p> <hr/> <p>* To be ordered separately</p>	<p>Type 4153 Artificial Ear</p> <p>MEASURING MICROPHONE:* Type 4192: Falcon Range 1/2" Condenser Microphone</p> <p>PREAMPLIFIER:* Type 2669 L: Falcon Range Microphone Preamplifier</p> <hr/> <p>Accessories Included</p> <p>DB 0742: 1/2-inch Adaptor Ring DB 0843: Adaptor Plate for Headphones AQ 0015: Transmitter Adaptor YJ 0305: Earcap</p>	<p>Type 4153-W-001 Artificial Ear</p> <p>MEASURING MICROPHONE: Type 4197 Prepolarized Pressure-field 1/2-inch Microphone</p> <p>PREAMPLIFIER:* Type 2671: 1/2-inch DeltaTron[®] Microphone Preamplifier (w/ BNC connector) Type 2695: 1/2-inch DeltaTron[®] Microphone Preamplifier (short version w/ microdot connector)</p> <hr/> <p>Accessories Included</p> <p>DB 0742: 1/2-inch Adaptor Ring DB 0843: Adaptor Plate for Headphones AQ 0015: Transmitter Adaptor YJ 0305: Earcap</p>
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Brüel&Kjær reserves the right to change specifications and accessories without notice