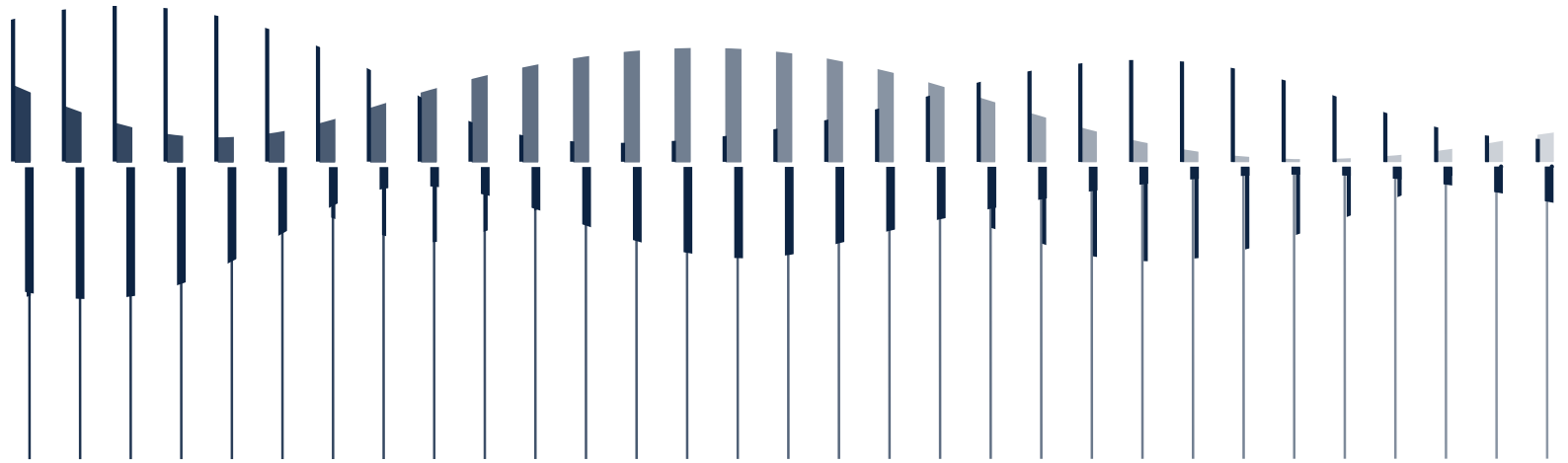
Instruction Manual

GRAS 45BB KEMAR Head and Torso

GRAS 45BC KEMAR Head and Torso with Mouth Simulator



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GRAS Sound & vibration

Revision History

Revision	Date	Description
1	21 March 2013	First edition
2	10 September 2013	Configurations and retrofit kits for test of binaural hearing aids added. Software for 3D simulation (**Virtual KEMAR)** added.
3	9 September 2014	Description of test setup for Sound Quality Recording added. Description of the mounting method for ear simulators and microphone holders revised. Ear Canal Extension for 45BB-7 & 45BB-8 changed to RA0249 (straight). Ordering information deleted, see gras.dk.
4	12 December 2014	New frequency response curves for mouth simulator, reflecting design changes to mouth simulator.
5	4 May 2015	Parts list on page 25 corrected
6	13 August 2015	Paragraph about snap lock mounting of microphone and ear simulator added.
7	15 January 2016	Anthropometric ear and low-noise ear simulator added. New configurations 45BB-9 to 12 added.
8	8 April 2016	New configurations 45BC-9 to 12 added.
9	20 July 2016	Frequency response for 43BB low-noise system corrected.
10	02 November 2016	Cables for KEMAR's configured for low-noise test corrected
11	10 March 2017	Caution about use of force with the angled adapter, p. 49.
12	22 January 2018	4 high resolution configs (45BB-13&14, 45BC-13&14) added.
13	23 February 2018	Correction factor for calib. with anthro. pinnae added to p. 63
14	22 June 2018	Section about calibration of low-noise configuration expanded
15	27 August 2019	Configurations with hi-res ear simulator added. Section about calibration updated.
16	15 January 2020	KB 3002 virtual KEMAR with anthropometric pinnae added on page 14.
17	26 August 2020	LEMO removed from naming of Low-noise configurations.
18	2 September 2020	Information about calibration at 1 kHz added.
19	2 December 2020	GR0408 and GR0409 added to 45BB and 45BC configurations.

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Introduction

The Concept

KEMAR® is a model of the human head and torso for in-situ anthropometric testing of hearing aids, ear-phones and communication devices. It is an acoustic research tool that simulates the changes that occur to sound waves as they pass a human head and torso, such as the diffractions and reflections caused by the ear.*

The head and torso (HATS) is based on worldwide average male and female head and torso dimensions. It meets the requirements of ANSI S3.36/ASA58-1985, IEC 60318-7:2017 and is based on ITU-T P 58.

KEMAR® was introduced by Knowles Electronics in 1972. It was the first head and torso simulator designed especially for acoustic research and enabled for the first time the hearing aid laboratories to perform repeatable simulated in-situ measurements of hearing aids.

As the capabilities and strengths of KEMAR® became known to the industry, KEMAR was standardized along with several new measurement methods for BTE/ITC instruments.

Initiated by the ongoing development of electronics, KEMAR® soon became the industry standard for testing all types of hearing aids, headphones, and earphones.

Today, KEMAR® is a versatile, multi-configurable research tool that can be used to accurately investigate the sound emission and pick-up characteristics of all types of electroacoustic communication devices that contains both loudspeakers and microphones, such as telephone sets, headsets and hands-free telecommunication devices.

It can also be used for binaural recordings of product sound and music.

Standards

Depending on configuration:

- ANSI S3.36/ASA58-2012, *Specification for a Manikin for Simulated in situ Airborne Acoustic Measurements*
- ANSI S3.25/ASA80-1989 *American National Standard for an Occluded Ear Simulator*
- IEC 60318-7:2017 *Head and Torso Simulator for the Measurement of Hearing Aids*
- IEC 60318-4 (711) *Ear Simulator, Occluded-ear simulator for the measurement of earphones coupled to the ear by means of ear inserts*
- ITU-T Rec. P.57 Type 3.3 *Artificial Ears*

  and based on

- ITU-T Rec. P.58 *Head and Torso Simulator for Telemetry*

* *See also the KEMAR Book (KB0000). Can also be downloaded from www.gras.dk.*

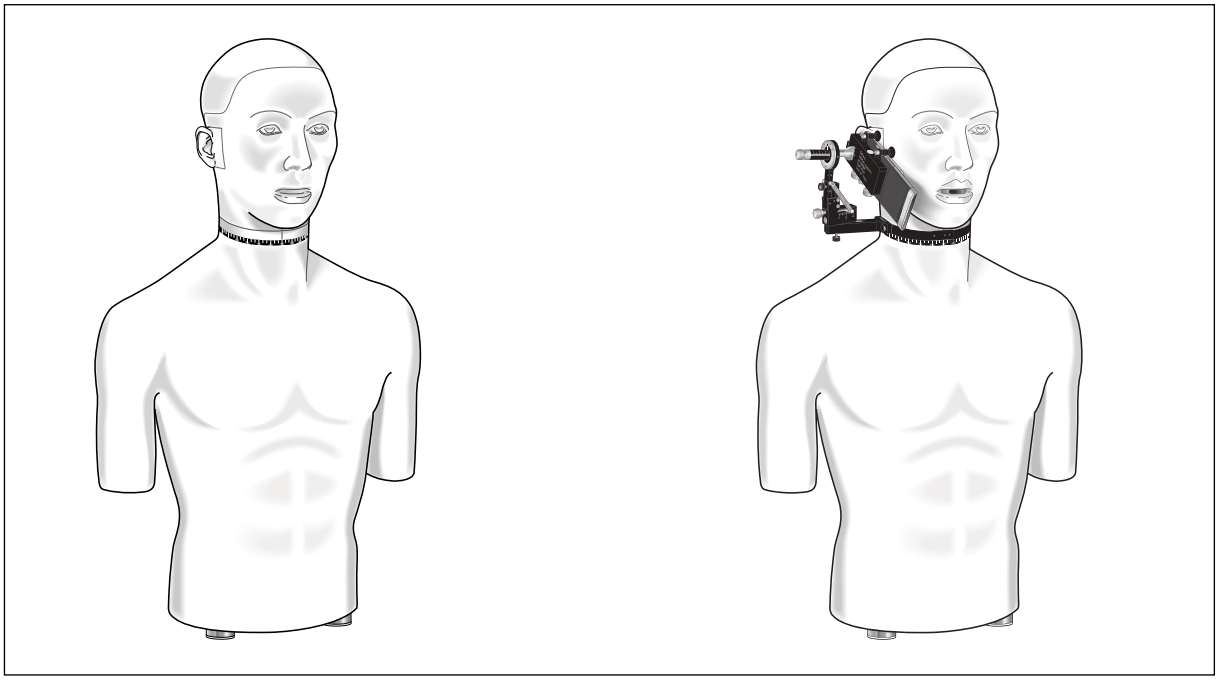


Fig. 1. *45BB KEMAR shown with one neck ring.*

Fig. 2. *The 45BC KEMAR with Mouth Simulator – here shown with 45EA Handset Positioning System*

General Description

45BB KEMAR and 45BC KEMAR – Common Description

This section describes what the 45BB KEMAR and the 45BC KEMAR with Mouth Simulator have in common. The additional features of the 45BC are described in “45BC KEMAR Head and Torso with Mouth Simulator – 45BC only” on page 15.

The GRAS 45BB KEMAR Head and Torso and the GRAS 45BC KEMAR Head and Torso with Mouth Simulator simulate the way an average human being influences a sound field. They are modernized versions of the original KEMAR and made according to the same dimensions and specifications as the original KEMAR. They ensure compliance with the original and all subsequent standards for in-situ anthropometric testing.

They are delivered pre-configured with a comprehensive range of accessories for a number of standard measurement configurations. For more information, see page 16 and page 25 and the following pages.

This section describes KEMAR’s transducers:

- The artificial ears（45BB and 45BC）
- The KEMAR mouth（45BC only）

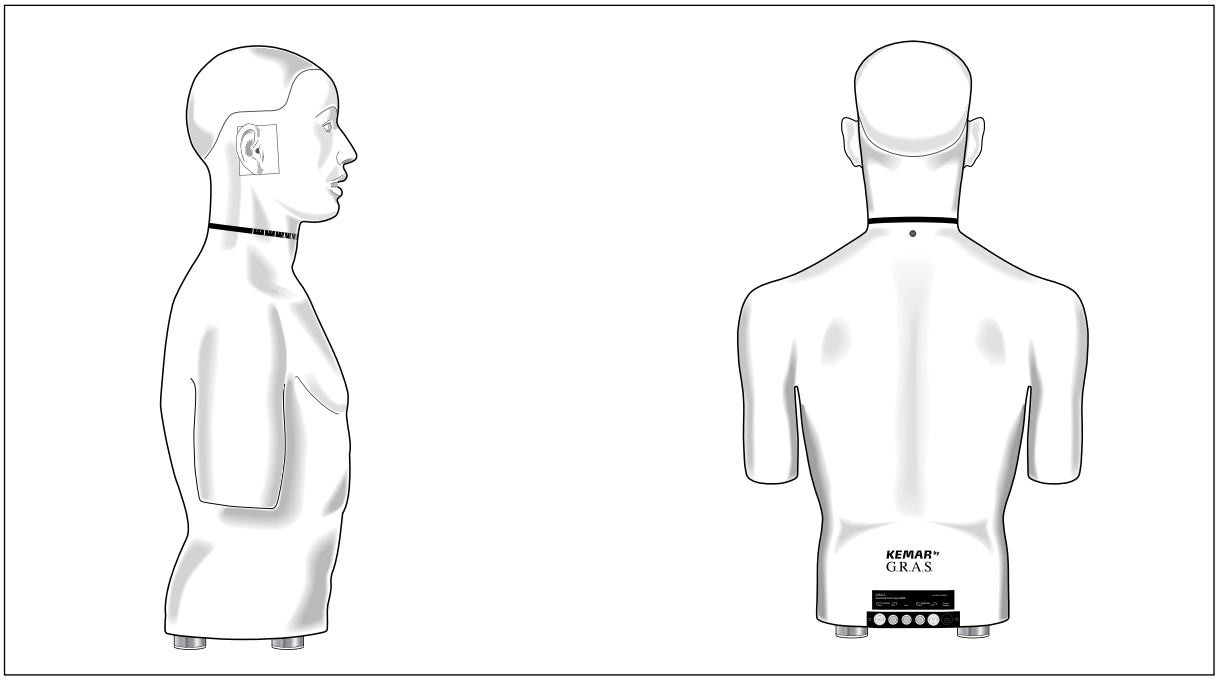


Fig. 3. *Side view of KEMAR shown with pinnae.*

Fig. 4. *KEMAR provides full instrumentation connectivity at the bottom of the back.*

Artificial Ears

To simulate the human ear KEMAR can be fitted with a number of combinations of ear simulators and pinnae. Two types of ear simulators are available:

- The well known standardized IEC 60318-4 ear simulator, available in a LEMO version and a CCP version.
- A low-noise ear simulator, basically as the above, but fitted with a highly sensitive low-noise microphone system.

Three types of pinnae are available:

- Standard pinnae for use with straight ear canal extension
- VA-type pinna for use with tapered ear canal extension
- Anthropometric pinnae that seal directly against the ear simulator.

KEMAR Pinna

Standard Pinna

Six different pairs of pinnae are available from GRAS for the KEMAR Head and Torso. They are designed for an easy push-fit in the ear recesses on the sides of the KEMAR Head.

A pair of KEMAR pinnae is included in all pre-configured KEMARs, selected according to the configuration in question.

The KEMAR standard pinnae are available in a normal and a soft version:

- Normal, 55 Shore 00 as specified by IEC 60318-7
- Soft, 35 Shore 00, identical to the working standard recommended by ITU-T Type 3.3

To obtain the desired sealing conditions for telephone testing, pinnae 35 Shore 00 are most often used. Pinnae 55 Shore 00 are normally used for all other applications.

GRAS provides these pinnae in three sizes:

- Large pinnae corresponding to the large ears typical of American and European males (Fig. 5). These pinnae are identical to the original pinnae on which all subsequent standards are based. (See IEC 60318-7:2017 Head and Torso Simulator)
- Small pinnae corresponding to the small ears that are typical of American and European females as well as Far-eastern males and females (Fig. 6).
- VA-style pinnae (Veterans Administration) for use with a tapered ear canal extension. These are used for hearing aid testing, but are also for sound-quality recordings as the large ear entrance of the VA-style pinnae accommodates ½" microphones.

Note: Always mount both right and left pinna, even if only one side is being measured.

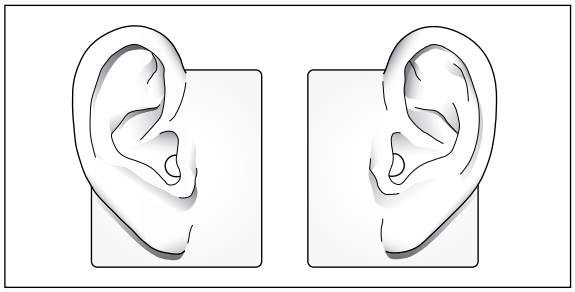


Fig. 5. *Large pinnae. The anthropometric pinnae have the same outer shape.*

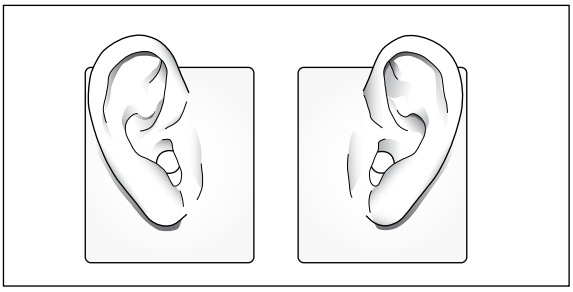


Fig. 6. *Small pinnae.*

Anthropometric Pinna

The anthropometric pinna is a pinna whose outer form is identical to the standardized large pinna, but the ear canal has been extended so that it couples directly to the entrance of the artificial ear. The ear canal now has the first and second bend and the interface to the concha is oval so that the pinna now resembles the average human pinna, resulting in improved fit with insert type devices. When a supra-aural headphone set is mounted, the anthropometric pinna collapses against the head very much in the same way a human pinna does. The hardness is 35 Shore 00.

Ear Canal Extensions

All standard GRAS ear canal extension are made of steel and will not deform when testing devices in the concha or devices that are pressed against the pinnae, for example telephone handsets and earphones. This ensures an ultimate interface to the IEC 60318-4 Ear Simulator, resulting in a high degree of repeatability. For binaural hearing aid testing, ear canal extensions made of plastic are available. These are shown on page 10. The ear canal extensions are for use with the standard pinnae.

Steel Ear Canal Extension Kits for KEMAR Standard Pinna	
	RA0237 Ear Canal Extension Kit with standard pinna-extension tube, ⌀ 7.5 mm, 8.3 mm long. Standardized according to IEC60318-7. 2 pcs, O-rings included.
	RA0238 Ear Canal Extension Kit with tapered pinna-extension tube. ⌀ 9.85 tapering down to ⌀ 7.5 mm, 7.4 mm long. 2 pcs, O-rings included.
	RA0239 Ear Canal Extension Kit with silicon rubber lining, ⌀ 7.5 mm, 14 mm long. Standardized according to ANSI S12.42. 2 pcs, O-rings included.

Fig. 7 shows an ear canal extension mounted in KEMAR. The ear canal extension is screwed onto the ear simulator and then push-mounted from the inside. Refer to Fig. 36 on page 56 for further information.

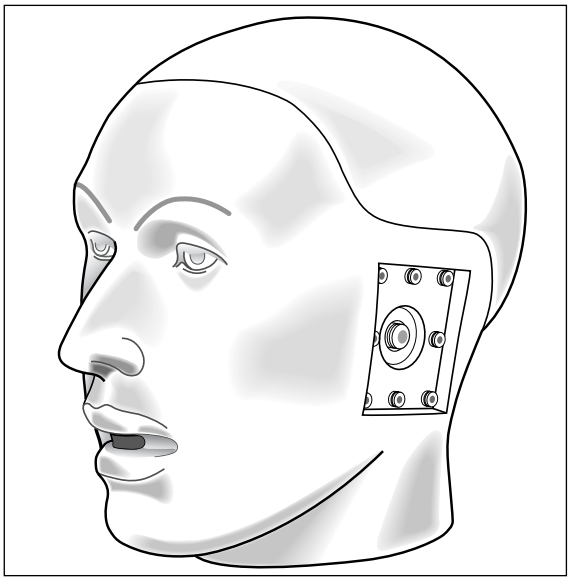


Fig. 7. *KEMAR fitted with an ear canal extension. It is push-mounted from the inside.*

Plastic Ear Canal Extensions for Test of Binaural Hearing Aids

For testing of binaural hearing aids using RF communication, plastic versions of the straight and the tapered ear canal extensions are available. To obtain the desired effect of noninterference with RF communication inside the head, KEMAR must also be fitted with plastic ear holder plates. How to do this is described on page 60.

Ear Canal Extension Kits for KEMAR for Test of Binaural Hearing Aids	
	**RA0249** Straight Earl Canal Extension Kit for KEMAR, Ø 7.5 mm, 8.3 mm long. Made of POM. Standardized according to IEC60318-7. 2 pcs. O-rings are included.
	**RA0250** Tapered Ear Canal Extension Kit for KEMAR. Made of POM. Ø 9.85 tapering down to Ø 7.5 mm, 7.4 mm long. 2 pcs. O-rings are included.

KEMAR can also be ordered pre-configured for test of Binaural Hearing Aids. See page 23 for more information about the 45BB-7 and 45BB-8 KEMAR.

The IEC 60318-4 (formerly 60711) Ear Simulator

The GRAS 60318-4 Ear Simulator is an ear simulator with an input impedance that closely resembles that of the human ear when it is combined with ear canal extension and pinna.

It meets the requirements of:

- IEC 60318-4:2010 "Occluded-ear simulator for the measurement of earphones coupled to the ear by ear inserts."
- ITU-T P. 57 (08/96) "Series P: Telephone transmission quality, Objective measuring apparatus: Artificial ears."

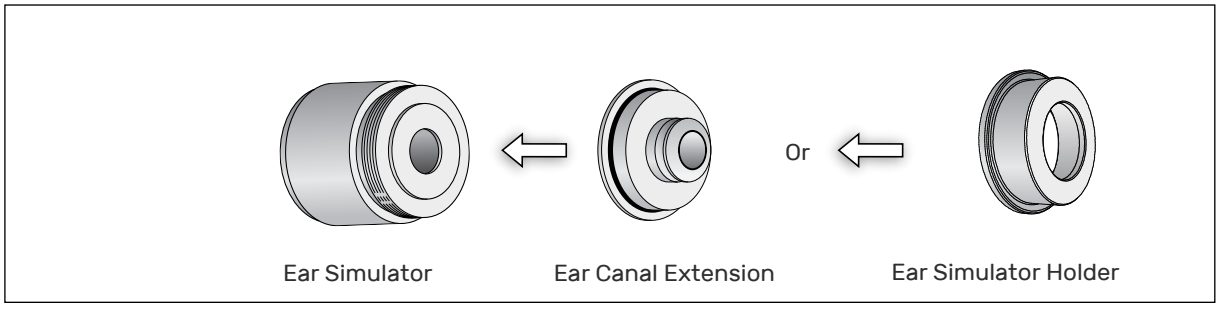


Fig. 8. *The ear canal extension/ear simulator holder is screwed onto the ear simulator.*

It embodies a number of carefully designed volumes connected via well-defined and precisely tuned resistive grooves. Its input impedance resembles that of the human ear and therefore it loads the device under test in a way very similar to the human ear.

Fig. 9 shows a typical frequency response of the IEC 60318-4 Ear Simulator.

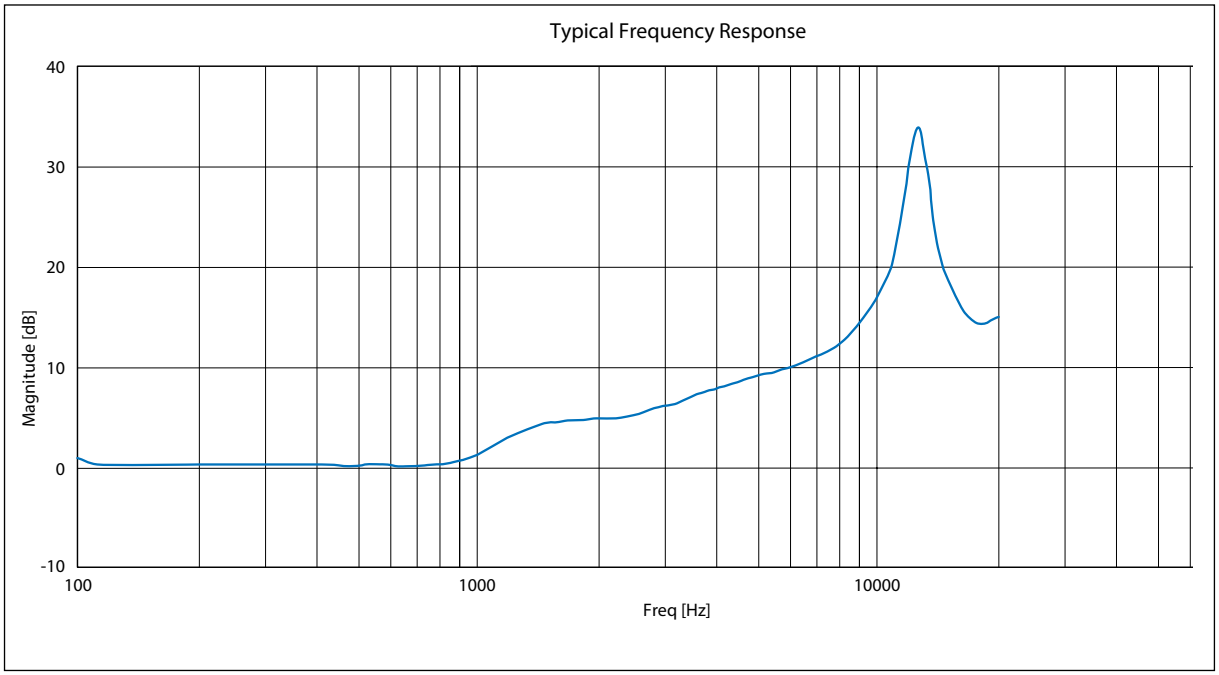


Fig. 9. *Typical coupler frequency response re. 500 Hz.*

The response is measured according to IEC standard 60318-4, part 5.2 Calibration Method. The frequency response is shown for the closed coupler for a constant volume displacement source, normalized to the response at 500 Hz.

The ear simulator comes in two versions, an externally polarized version, RA0045, requiring a 200 V polarization voltage and a prepolarized version, RA0045-S1.

Note: The RA0045 / RA0045-S1 can be mounted for both left and right ear.

The Externally Polarized Ear Simulator RA0045

It is based on the GRAS 40AG ½" Ext. Polarized Pressure Microphone and is supplied with an individual calibration chart for the coupler-microphone combination.

It requires a traditional 200 V polarization voltage. Connection is via 7-pin LEMO.

The Prepolarized Ear simulator RA0045-S1

It is based on the GRAS 40AO ½" Prepolarized Pressure Microphone and is supplied with an individual calibration chart for the coupler-microphone combination.

It requires a CCP supply and connection is via a BNC cable.

The 43BB Low-noise Ear Simulator/43BB Low-noise Ear Simulator System

The GRAS 43BB is a low-noise, high-sensitive version of the well known IEC 60318-4 ear simulator. It consists of the standardized IEC 60318-4 ear simulator and the GRAS 40HT low-noise microphone system. It has a very low noise floor – below 10.5 dB(A) – and can measure sound levels below or close to the threshold of human hearing.

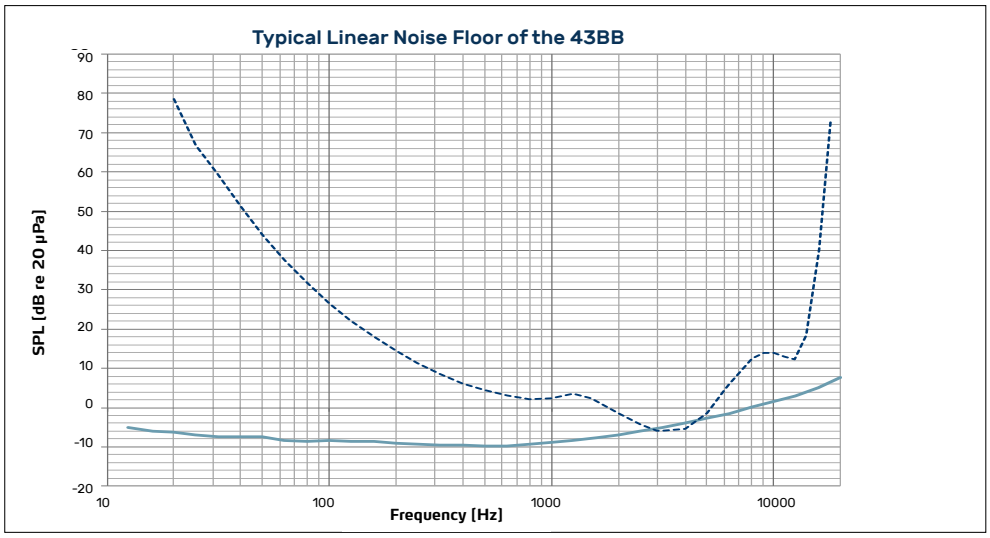


Fig. 10. *The noise floor (solid curve) is typically below the threshold of human hearing (dashed curve)*

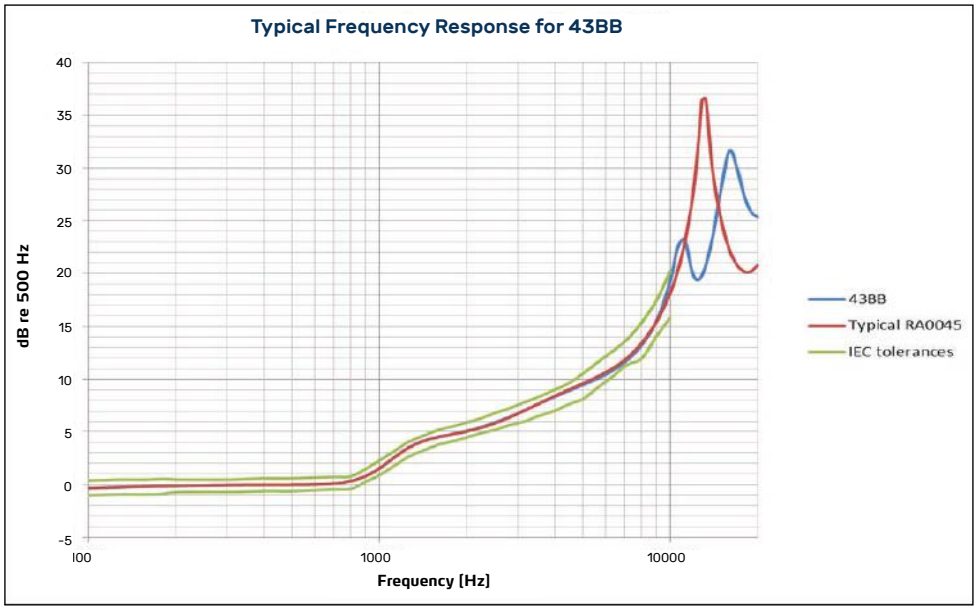


Fig. 11. *Typical frequency response (solid blue) versus the IEC tolerances (dashed black) and the ideal IEC 60318-4 frequency response (red curve)*

The RA0401/RA0402 High-Frequency Ear Simulator

The RA0401 and RA0402 are high-frequency versions of the standard IEC 60318-4 Ear Simulator. Thanks to internal damping the resonance at 13.5 kHz is dampened and measurements up to 20 kHz are now possible.

For further information about RA0401/RA0402, visit gras.dk. A whitepaper discussing the High-Frequency Ear Simulator in detail can be downloaded from the RA0401 product page at gras.dk.

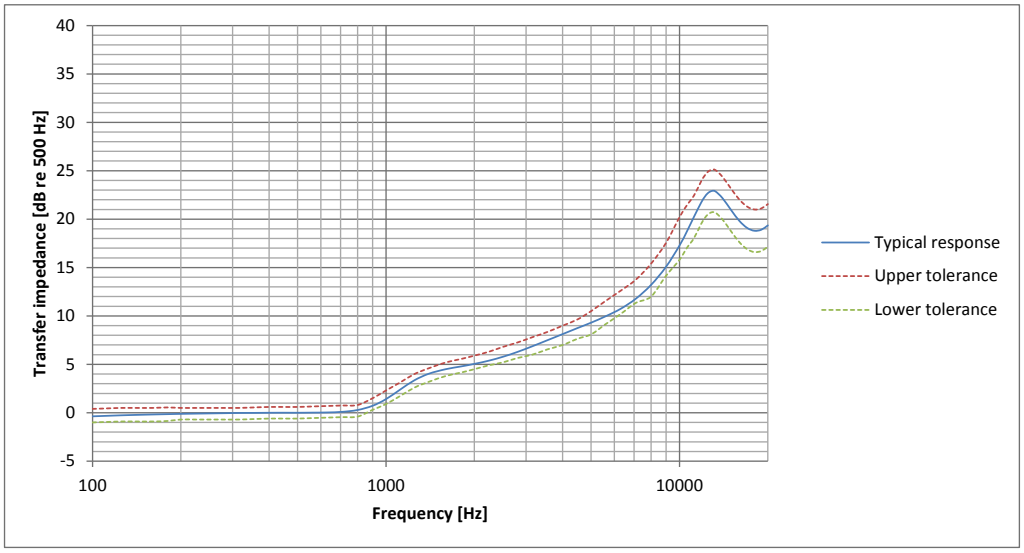


Fig. 12. *Typical coupler frequency response re. 500 Hz.*

The RA0403/RA0404 Hi-Res Ear Simulator

The RA0403 and RA0404 are hi-res versions of the standard IEC 60318-4 Ear Simulator. Thanks to internal damping the resonance at 13.5 kHz is dampened. Where the RA0401 and RA0402 use 1/2" microphones, the RA0403 and RA0404 use 1/4" microphones, extending the useful frequency range to 50 kHz.

For further information about RA0403/RA0404, visit gras.dk.

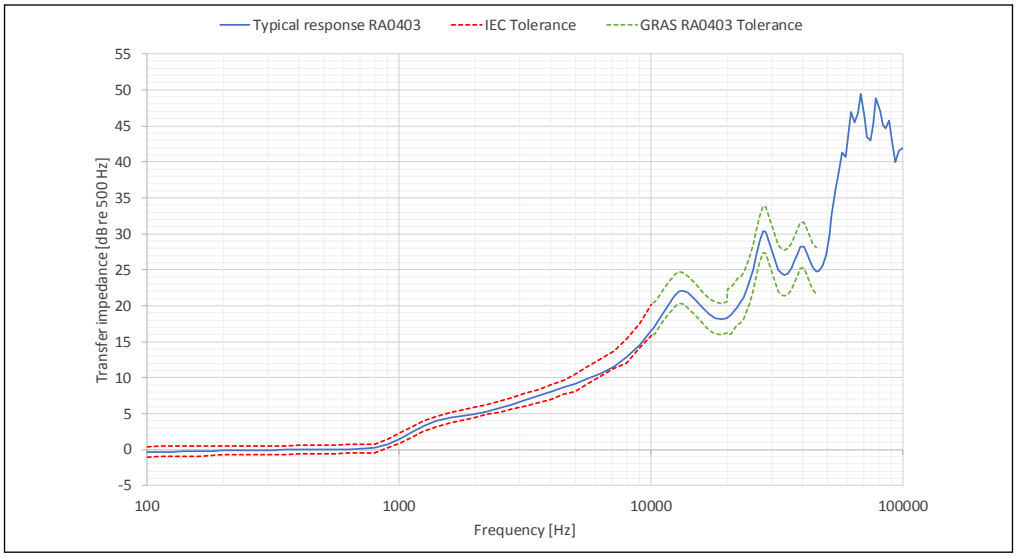


Fig. 13. *Typical coupler frequency response re. 500 Hz.*

3D Simulation Model

For simulation of KEMAR's influence on the sound field, a simulation model of KEMAR can be ordered separately.

This product contains a USB flash drive with a CAD file. The CAD file is in STEP file format and is made as a solid part file and is compatible with almost any 3D CAD software. A 3D CAD viewer application is necessary to view and measure the STEP files. The format of a STEP File is defined in ISO 10303-21.

Three versions are available, one for KEMAR with small pinnae, one for KEMAR with large pinnae, and one for KEMAR with anthropometric pinnae.

Simulation Model of KEMAR	Order number
Virtual KEMAR with large pinnae	KB3000
Virtual KEMAR with small pinnae	KB3001
Virtual KEMAR with anthropometric pinnae	KB3002

45BC KEMAR Head and Torso with Mouth Simulator – 45BC only

The 45BC KEMAR Head and Torso is similar to the 45BB except that it also has a built-in mouth simulator and a power amplifier for the mouth simulator. The power amplifier is located in the KEMAR's base.

It is for

- Testing of headsets and earphones with integrated microphones.
- Testing of telephones, cell phones, Voip-phones etc. and similar communication devices.

Handsets (for example mobile phones) are typically tested by aid of the 45EA Handset Positioning System as shown in Fig. 14

The 45BC KEMAR can be ordered pre-configured for these applications, refer to page 30 and the following pages for further information.

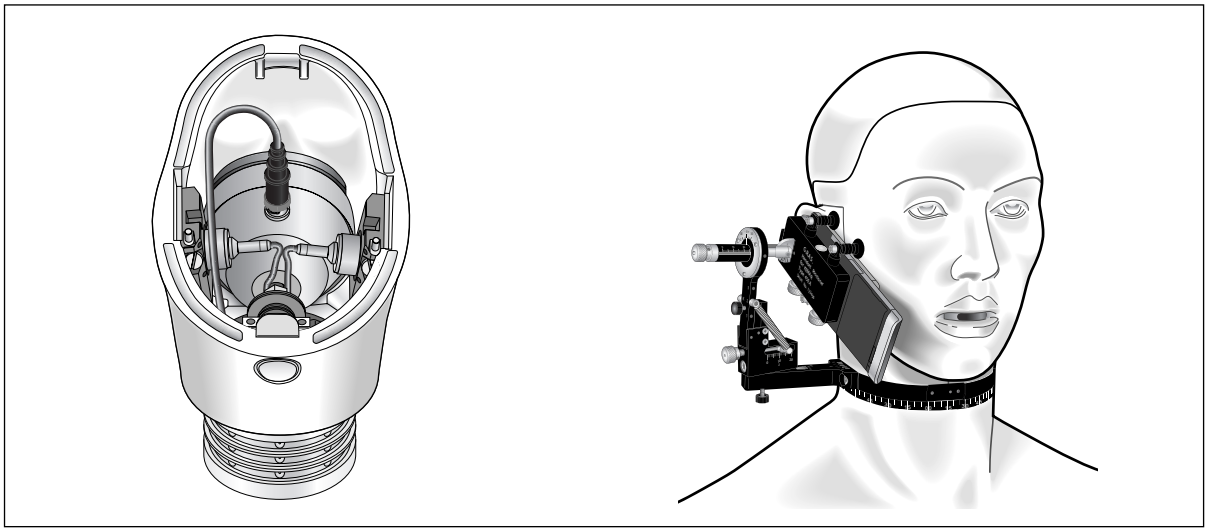


Fig. 14. *45BC KEMAR with Mouth Simulator and Ear simulator and with 45EA Handset Positioning System.*

The mouth simulator [45BC ONLY] is a sound source that simulates the sound field at close quarters. At the mouth reference point (MRP), which is 25 mm from the lip plane, it can produce a continuous SPL of up to 100 dB, from 100 Hz to 10 kHz.

It is based on the ITU-T Rec. P58 standard.

- It has a built-in power amplifier located in the torso and can therefore be used with a computer-based test setup.
- Using the 45EA Handset Positioning System, the 45BC KEMAR can be used for measurement of handheld communication devices, as shown in Fig. 14.

For feeding an external signal to the mouth simulator, two options exist:

- Feed a line signal via the built-in power amplifier.
- Feed the signal directly from an external power amplifier. In this case, do not connect the included power supply to the KEMAR (the internal power amplifier is automatically bypassed).

Fig. 15 shows the typical frequency response curves for a swept-sine signal 100 Hz – 10 kHz.

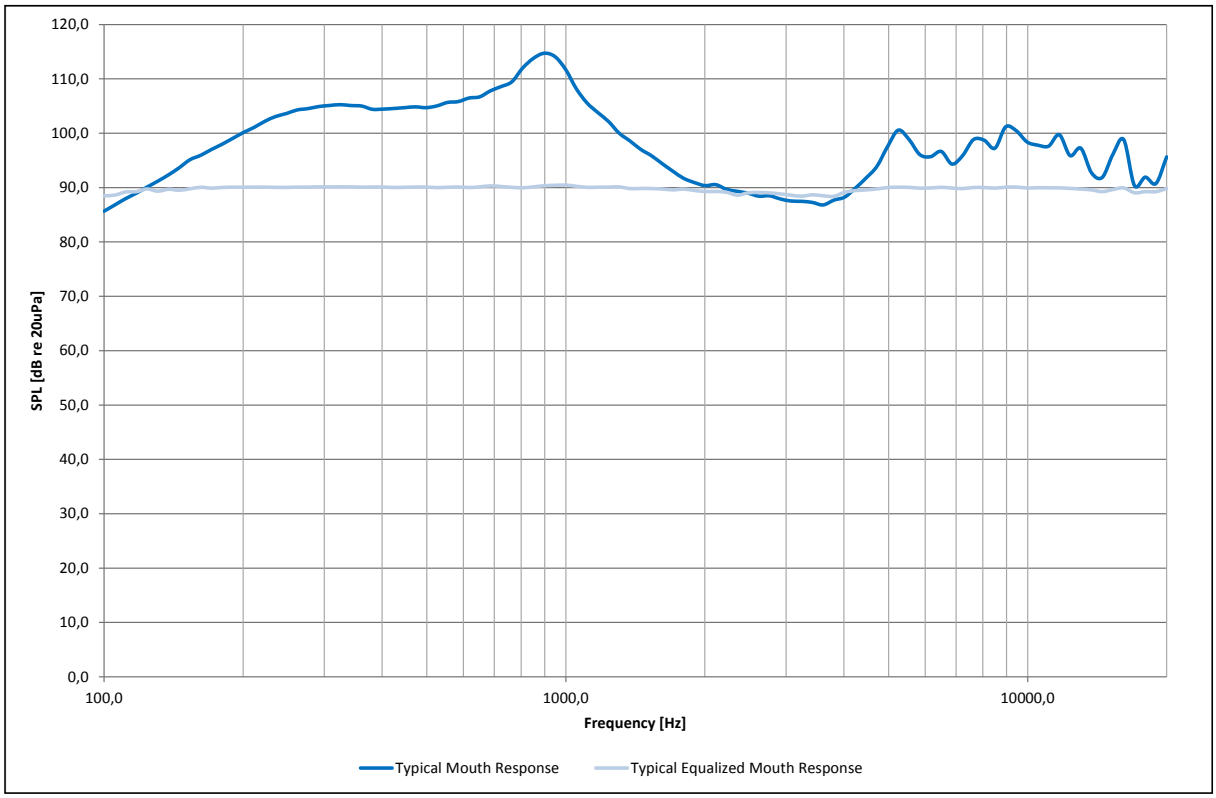


Fig. 15. *Typical frequency response measurements using the ITU-T Rec. P.58 setup shown in Fig. 52 on page 65. The upper curve is the frequency response for an input signal of 1 V RMS with the internal amplifier switched on. The lower curve shows the same response equalized at 90 dB.*

45BB KEMAR – Delivered Items

45BB KEMAR Head & Torso, non-configured

The GRAS 45BB KEMAR Head & Torso, non-configured is a basic head and torso assembly without configuration specific accessories. The parts shown in Fig. 16 are included.

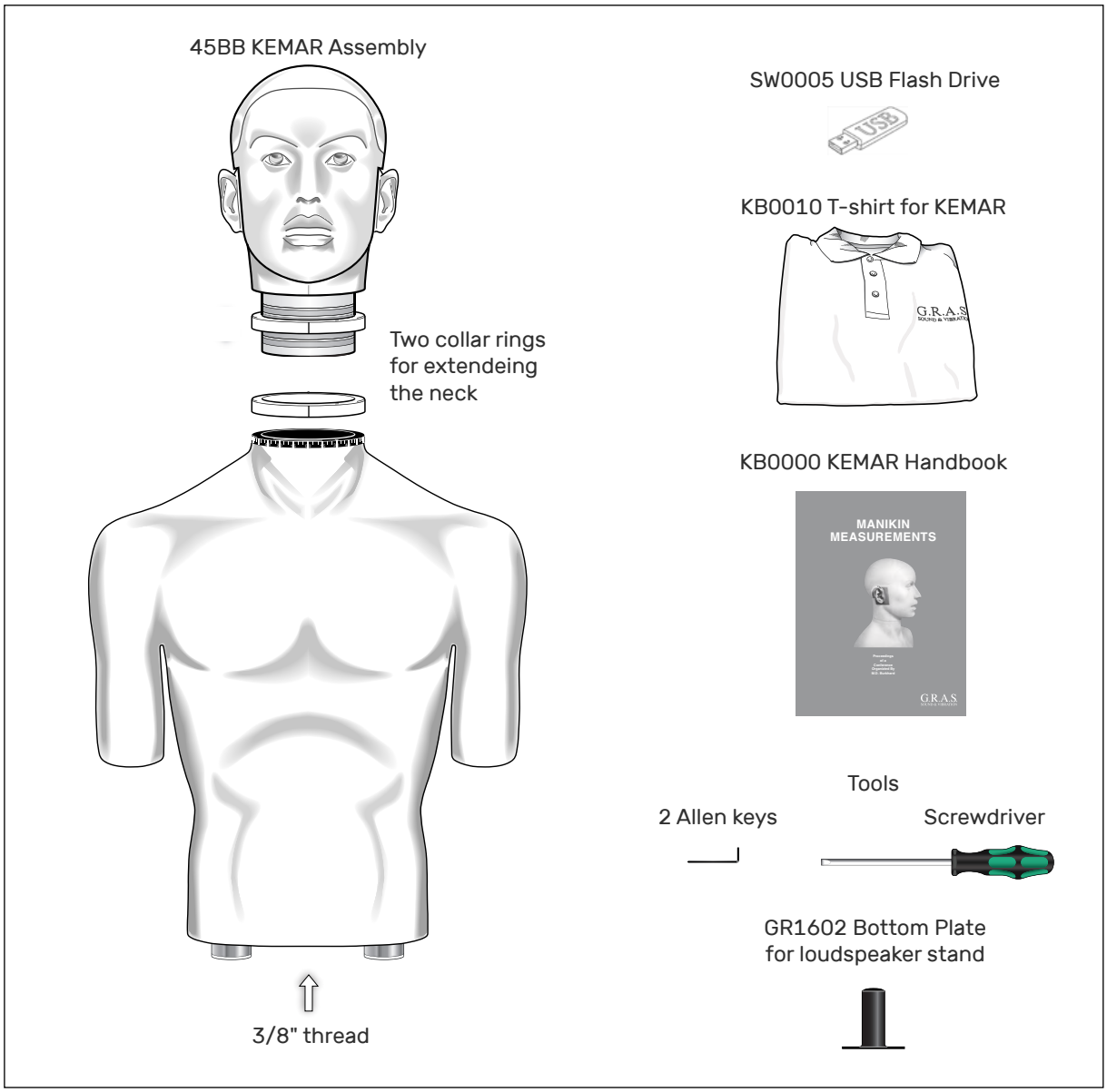


Fig. 16. *45BB KEMAR Head & Torso, non-configured. Pinnae are not included.*

The components listed below are delivered if you order a non-configured version of the 45BB KEMAR without the additional application specific components. If you order a pre-configured 45BB KEMAR, the components that comprise the 45BB KEMAR Head & Torso, non-configured are delivered as part of the pre-configured assemblies.

45BB KEMAR Head and Torso, non-configured		**Order number**
KEMAR Head and Torso, non-configured		45BB
Delivered items		Part number
KEMAR Head Assembly	1	45BH
KEMAR Torso	1	45BT
Neck Extension Ring, 11 mm	2	GR1589
USB Flash Drive with HRTF and Free-field correction data	1	SW0005
T-shirt	1	KB0010
KEMAR Book	1	KB0000
Allen key, 2 mm	1	YY0018
Allen key, 4 mm	1	YY0013
Screwdriver, 5.5 mm	1	YY0039
Bottom plate with 3/8" thread for tripod（factory mounted）	1	GR1573
Bottom plate with 35 mm hole for loudspeaker stand AL0026	1	GR1602

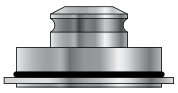
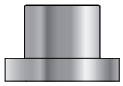
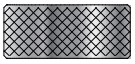
Preassembled 45BBs are available for the following applications:

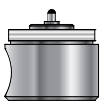
- Hearing aids test, see page 20.
- Sound quality recording, see page 21.
- Earphones and headphones test, see page 22.
- Test of binaural hearing aids, see page 23.
- Test of earphones and headphones with anthropometric pinnae, page 24.
- Low-noise testing with anthropometric pinnae, see page 25.
- High-frequency test of ear and headphones, see page 26.
- Test of ear and headphones w. hi-res ear simulator, page 27.

45BB-1 KEMAR for Hearing Aid Test, 1-Ch LEMO

45BB-2 KEMAR for Hearing Aid Test, 1-Ch CCP

Basic Delivery	
KEMAR Head and Torso, non-configured	45BB

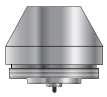
Common Accessories			
	Ear Mould Simulator KB0110 (2 mm) KB0111 (3 mm) (for BTE hearing aids)	Ear Canal Extension Kit (2 pcs) RA0237	
	Large Left Straight Pinna (55 Shore 00) KB0066	Large Right Straight Pinna (55 Shore 00) KB0065	
	External Ear Canal 1 x GR0408	Union Nut 2 x GR0409	

45BB-1 LEMO		45BB-2 CCP	
	Ear Simulator RA0045	Ear Simulator RA0045-S1	
	¼" Preamp., short 26AS-S3 incl. 40 cm cable	¼" Preamp., short 26CS	
	Adapter for ½" Microphone and ¼" Preamplifier GR0010	Right-angled Adapter for ½" Microphone and ¼" Preamplifier RA0001	
	Microphone Extension Cable, 3 m AA0008	Microphone Cable, Microdot, 35 cm AA0018-S	
		Microphone Extension Cable, 3 m AA0035	

45BB-3 KEMAR for Sound Quality Recording, 2-Ch LEMO

45BB-4 KEMAR for Sound Quality Recording, 2-Ch CCP

Basic Delivery	
KEMAR Head and Torso, non-configured	45BB

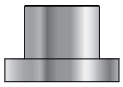
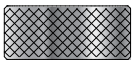
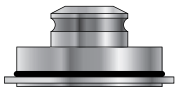
Common Accessories			
	Adapter for ½" Microphone and ¼" Preamplifier 2 x RA0003	Holder for ½" Microphone Kit (2 pcs) RA0241	
	Large Left Tapered Pinna (VA-style 55 Shore 00) KB0091	Large Right Tapered Pinna (VA-style 55 Shore 00) KB0090	

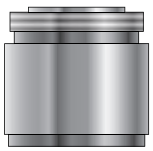
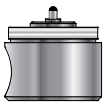
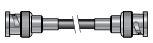
45BB-3 LEMO		45BB-4 CCP	
	½" Pressure Microphone 2 x 40AG	½" Pressure Microphone 2 x 40AO	
	¼" Preamp., short 2 x 26AS-S3 incl. 40 cm cable	¼" Preamp., short 2 x 26CS	
	Microphone Extension Cable, 3 m 2 x AA0008	Microphone Cable, Microdot, 35 cm 2 x AA0018-S	
		Microphone Extension Cable, 3 m 2 x AA0035	

45BB-5 KEMAR for Ear and Headphone Test, 2-Ch LEMO

45BB-6 KEMAR for Ear and Headphone Test, 2-Ch CCP

Basic Delivery	
KEMAR Head and Torso, non-configured	45BB

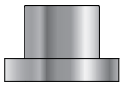
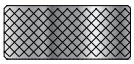
Common Accessories			
	Large Left Straight Pinna (55 Shore 00) KB0066	Large Right Straight Pinna (55 Shore 00) KB0065	
	External Ear Canal 2 x GR0408	Union Nut 2 x GR0409	
	External Ear Canal 2 x RA0237		

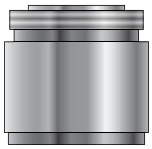
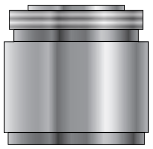
45BB-5 LEMO		45BB-6 CCP	
	Ear Simulator 2 x RA0045	Ear Simulator 2 x RA0045-S1	
	¼" Preamp., short 2 x 26AS-S3 incl. 40 cm cable	¼" Preamp., short 2 x 26CS	
	Adapter for ½" Microphone and ¼" Preamplifier 2 x GR0010	Right-angled Adapter for ½" Microphone and ¼" Preamplifier 2 x RA0001	
	Microphone Extension Cable, 3 m 2 x AA0008	Microphone Cable, Microdot, 35 cm 2 x AA0018-S	
		Microphone Extension Cable, 3 m 2 x AA0035	

45BB-7 KEMAR for Test of Binaural Hearing Aid, 2-Ch LEMO

45BB-8 KEMAR for Test of Binaural Hearing Aid 2-Ch CCP

Basic Delivery	
KEMAR Head and Torso, non-configured Delivery as a standard 45BB except that the assemblies for holding the Pinnae and Ear Canal Extensions are made from POM to enable RF communication.	45BB

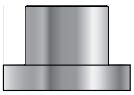
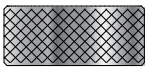
Common Accessories			
	Large Left Straight Pinna (55 Shore 00) KB0066	Large Right Straight Pinna (55 Shore 00) KB0065	
	Straight Ear Canal Extension Kit (POM, 2 pcs) RA0249	Rigt-angled Adapter for ½" Microphone and ¼" Preamplifier 2 x RA0001	
	External Ear Canal 2 x GR0408	Union Nut 2 x GR0409	

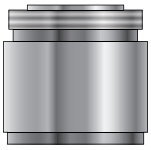
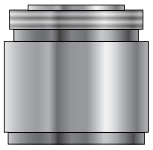
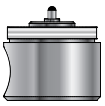
45BB-7 LEMO		45BB-8 CCP	
	Ear Simulator 2 x RA0045	Ear Simulator 2 x RA0045-S1	
	¼" Preamp., short 2 x 26AS-S3 incl. 40 cm cable	¼" Preamp., short 2 x 26CS	
	Microphone Extension Cable, 3 m 2 x AA0008	Microphone Cable, Microdot, 35 cm 2 x AA0018-S	
		Microphone Extension Cable, 3 m 2 x AA0035	

45BB-9 KEMAR w. Anthropometric Pinna for Ear and Headphone Test, 2-Ch LEMO

45BB-10 KEMAR w. Anthropometric Pinna for Ear and Headphone Test, 2-Ch CCP

Basic Delivery	
KEMAR Head and Torso, non-configured	45BB

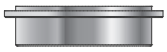
Common Accessories			
	Large Left Anthropometric Pinna (35 Shore 00) KB5001	Large Right Anthropometric Pinna (35 Shore 00) KB5000	
	External Ear Canal 2 x GR0408	Union Nut 2 x GR0409	
	Ear Simulator Holder 2 x GR1874		

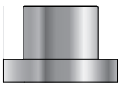
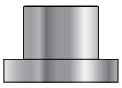
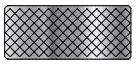
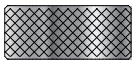
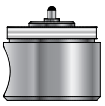
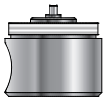
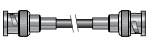
45BB-9 LEMO		45BB-10 CCP	
	Ear Simulator 2 x RA0045	Ear Simulator 2 x RA0045-S1	
	¼" Preamp., short 2 x 26AS-S3 incl. 40 cm cable	¼" Preamp., short 2 x 26CS	
	Adapter for ½" Microphone and ¼" Preamplifier 2 x GR0010	Right-angled Adapter for ½" Microphone and ¼" Preamplifier 2 x RA0001	
	Microphone Extension Cable, 3 m 2 x AA0008	Microphone Cable, Microdot, 35 cm 2 x AA0018-S	
		Microphone Extension Cable, 3 m 2 x AA0035	

45BB-11 KEMAR for Low-noise Ear and Headphone Test, 1-Ch

45BB-12 KEMAR for Low-noise Ear and Headphone Test, 2-Ch

Basic Delivery	
KEMAR Head and Torso, non-configured	45BB

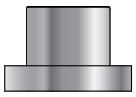
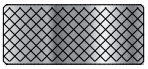
Common Accessories			
	Large Left Anthropometric Pinna (35 Shore 00) KB5001	Large Right Anthropometric Pinna (35 Shore 00) KB5000	
	Ear Simulator Holder 2 x GR1874		

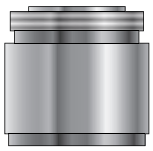
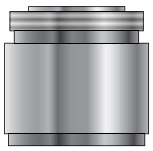
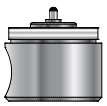
45BB-11 1-channel		45BB-12 2-Channel	
	Low-noise Ear Simulator 1 x 43BB-1	Low-noise Ear Simulator 2 x 43BB-1	
	External Ear Canal 1 x GR0408	External Ear Canal 2 x GR0408	
	Union Nut 1 x GR0409	Union Nut 2 x GR0409	
	Right-angled Adapter for ½" Mic.and ¼" Preamp. 1 x RA0001	Right-angled Adapter for ½" Mic.and ¼" Preamp. 2 x RA0001	
	¼" Preamplifier 1 x 26HG incl. 3 m cable	¼" Preamplifier 2 x 26HG incl. 3 m cable	
	Filter and Gain Unit 1 x 26HT	Filter and Gain Unit 2 x 26HT	
	LEMO Cable, 1 m 1 x AA0059	LEMO Cable, 1 m 2 x AA0059	
	CCP Cable,3 m 1 x AA0035	CCP Cable, 3 m 2 x AA0035	
	Power Module 1 x 12HF	Power Module 2 x12HF	

45BB-13 High-Frequency Test of Ear and Headphones, 2-Ch LEMO

45BB-14 High-Frequency Test of Ear and Headphones, 2-Ch CCP

Basic Delivery	
KEMAR Head and Torso, non-configured	45BB

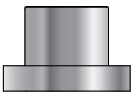
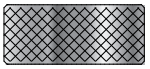
Common Accessories			
	Large Left Anthropometric Pinna (35 Shore 00) KB5001	Large Right Anthropometric Pinna (35 Shore 00) KB5000	
	External Ear Canal 2 x GR0408	Union Nut 2 x GR0409	
	Ear Simulator Holder 2 x GR1874		

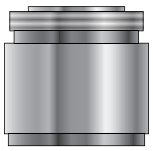
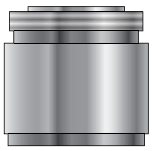
45BB-13 LEMO		45BB-14 CCP	
	Ear Simulator 2 x RA0401	Ear Simulator 2 x RA0402	
	¼" Preamp., short 2 x 26AS-S3 incl. 40 cm cable	¼" Preamp., short 2 x 26CS	
	Adapter for ½" Microphone and ¼" Preamplifier 2 x GR0010	Right-angled Adapter for ½" Microphone and ¼" Preamplifier 2 x RA0001	
	Microphone Extension Cable, 3 m 2 x AA0008	Microphone Cable, Microdot, 35 cm 2 x AA0018-S	
		Microphone Extension Cable, 3 m 2 x AA0035	

45BB-15 KEMAR, Test of Ear & Headphones w. Hi-Res Ear Simulator, 2-Ch LEMO

45BB-16 KEMAR, Test of Ear & Headphones w. Hi-Res Ear Simulator, 2-Ch CCP

Basic Delivery	
KEMAR Head and Torso, non-configured	45BB

Common Accessories			
	Large Left Anthropometric Pinna (35 Shore 00) KB5001	Large Right Anthropometric Pinna (35 Shore 00) KB5000	
	External Ear Canal 2 x GR0408	Union Nut 2 x GR0409	
	Ear Simulator Holder 2 x GR1874		

45BB-15 LEMO		45BB-16 CCP	
	Ear Simulator 2 x RA0403 (w 1/4" micriophone)	Ear Simulator 2 x RA0404 (w 1/4" micriophone)	
	¼" Preamp., short 2 x 26AS-S3 incl. 40 cm cable	¼" Preamp., short 2 x 26CS	
	Microphone Extension Cable, 3 m 2 x AA0008	Microphone Cable, Microdot, 35 cm 2 x AA0018-S	
		Microphone Extension Cable, 3 m 2 x AA0035	

45BC KEMAR – Delivered Items

45BC KEMAR Head & Torso with Mouth Simulator, non-configured

The GRAS 45BC KEMAR Head & Torso with Mouth Simulator, non-configured is a basic head and torso assembly with mouth simulator, but without application-specific accessories. The parts shown in Fig. 17 are included.

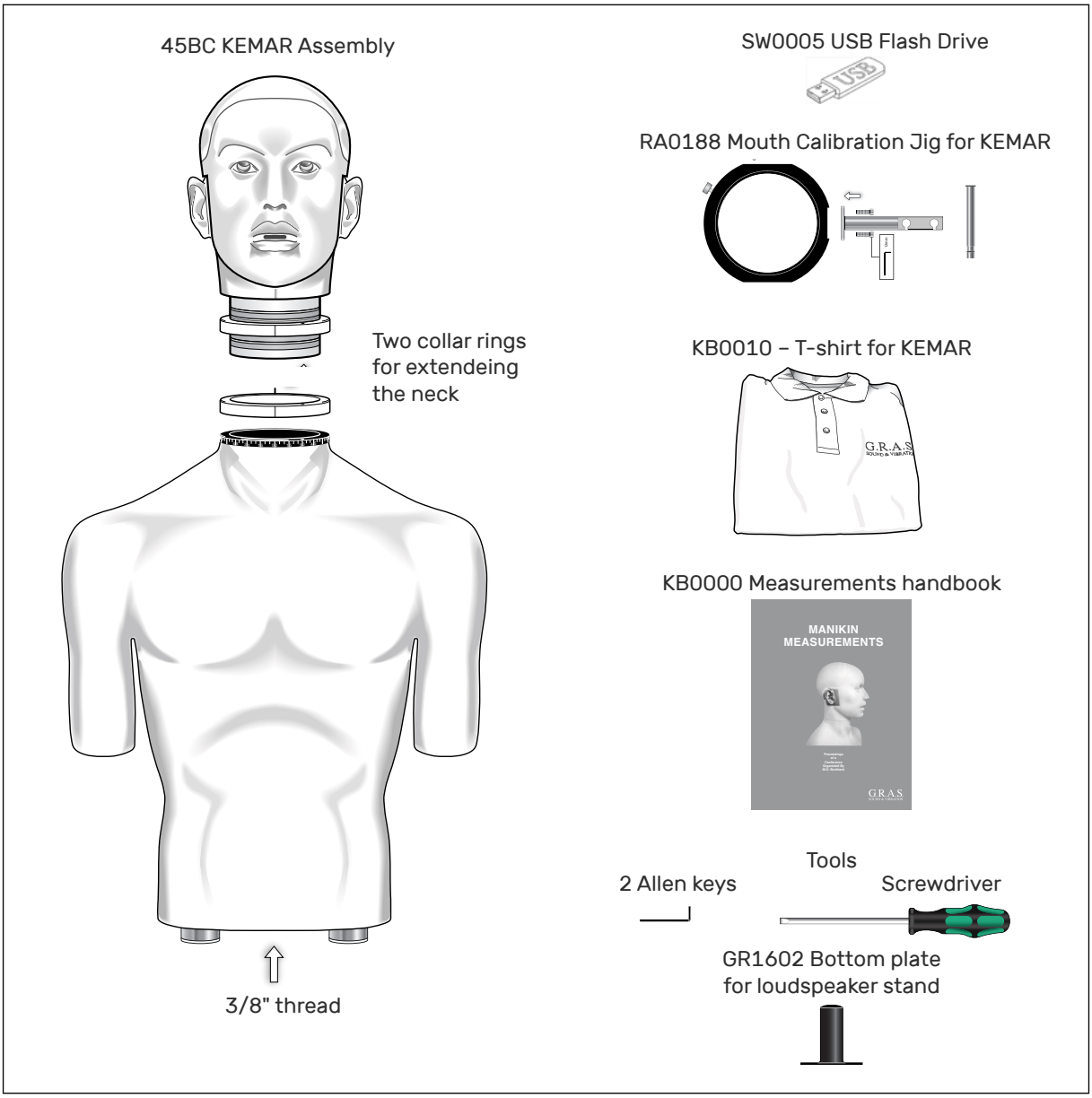


Fig. 17. *45BC KEMAR non configured shown with included accessories. Pinna are not included.*

45BC KEMAR Head & Torso with Mouth Simulator, non-configured – Delivered Items

The components listed are delivered if you order the GRAS 45BC KEMAR Head & Torso with Mouth Simulator, non-configured. If you order a 45BC KEMAR for a specific application, the components that comprise the non-configured 45BC KEMAR are delivered in addition to the application-specific accessories.

45BC KEMAR Head and Torso with Mouth Simulator, non-configured		Order number
KEMAR Head and Torso with Mouth Simulator, non-configured		45BC
Delivered items		Part number
KEMAR Head Assembly with mouth simulator	1	45BH-S1
KEMAR Torso	1	45BT-S1
Neck Extension Ring, 11 mm	2	GR1589
USB Flash Drive with HRTF and Free-field corrections data	1	SW0005
T-Shirt	1	KB0010
Mouth Calibration Jig for KEMAR	1	RA0188
BNC-BNC Cable, 50 cm	1	AA0032
Mouth Simulator Extension Cable, BNC-BNC, 3 m	1	AA0035
Power Supply for mouth simulator's amplifier	1	AB0012
KEMAR Book	1	KB0000
Allen key, 2 mm	1	YY0018
Allen key, 4 mm	1	YY0013
Screwdriver, 5.5 mm	1	YY0039
Bottom plate with 3/8" thread for tripod (factory mounted)	1	GR1573
Bottom plate with 35 mm hole for loudspeaker stand AL0026	1	GR1602

Preconfigured 45BCs are available for the following applications:

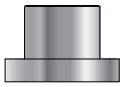
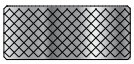
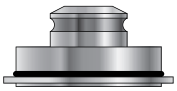
- Headset test, see page 30.
- Telephone test with Handset Positioning System 45EA, see page 31.
- Headset Test w. Anthropometric Pinnae, see page 32.
- Low-noise Headset Test, see page 33.
- High-frequency test of headsets, see page 34.
- Test of headsets w. hi-res ear simulator, see page 35.

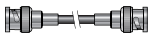
The designations 45BC-5 to 45BC-8 are not used/reserved for future configurations.

45BC-1 KEMAR for Headset Test, 2-Ch LEMO

45BC-2 KEMAR for Headset Test, 2-Ch CCP

Basic Delivery	
KEMAR Head and Torso with Mouth Simulator, non-configured	45BC

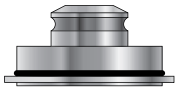
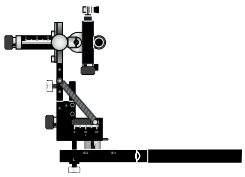
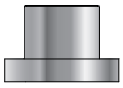
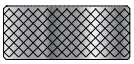
Common Accessories			
	Large Left Straight Pinna (55 Shore 00) KB0066	Large Right Straight Pinna (55 Shore 00) KB0065	
	External Ear Canal 2 x GR0408	Union Nut 2 x GR0409	
	Ear Canal Extension Kit (2 pcs) RA0237		

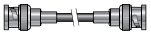
45BC-1 LEMO		45BC-2 CCP	
	Ear Simulator 2 x RA0045	Ear Simulator 2 x RA0045-S1	
	¼" Preamp., short 2 x 26AS-S3 incl. 40 cm cable	¼" Preamp., short 2 x 26CS	
	Adapter for ½" Microphone and ¼" Preamplifier 2 x GR0010	Right-angled Adapter for ½" Microphone and ¼" Preamplifier 2 x RA0001	
	Microphone Extension Cable, 3 m 2 x AA0008	Microphone Cable, Microdot 2 x AA0018-S (35 cm) 1 x AA0070 (3 m)	
	¼" Pressure Microphone Set for calibration of mouth 46BP-1	¼" Pressure Microphone Set for calibration of mouth 46BD	
		Microphone Extension Cable, 3 m 2 x AA0035	

45BC-3 KEMAR for Telephone Test, 1-Ch LEMO

45BC-4 KEMAR for Telephone Test, 1-Ch CCP

Basic Delivery	
KEMAR Head and Torso with Mouth Simulator, non-configured	45BC

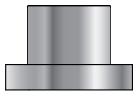
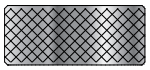
Common Accessories			
	Ear Canal Extension Kit (2 pcs) RA0237	Handset Positioning System 45EA	
	Large Left Straight Pinna (35 Shore 00) KB1066	Large Right Straight Pinna (35 Shore 00) KB1065	
	External Ear Canal GR0408	Union Nut GR0409	

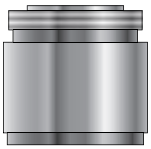
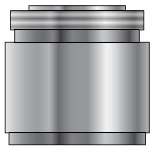
45BC-3 LEMO		45BC-4 CCP	
	Ear Simulator RA0045	Ear Simulator RA0045-S1	
	¼" Preamp., short 26AS-S3 incl. 40 cm cable	¼" Preamp., short 26CS	
	Adapter for ½" Microphone and ¼" Preamplifier GR0010	Right-angled Adapter for ½" Microphone and ¼" Preamplifier RA0001	
	Microphone Extension Cable, 3 m AA0008	Microdot Mic. Cable, AA0018-S (35 cm) AA0070 (3 m)	
	¼" Pressure Microphone Set for calibration of mouth 46BP-1	¼" Pressure Microphone Set for calibration of mouth 46BD	
		Microphone Extension Cable, 3 m AA0035	

45BC-9 KEMAR w. Anthropometric Pinna for Headset Test, 2-Ch LEMO

45BC-10 KEMAR w. Anthropometric Pinna for Headset Test, 2-Ch CCP

Basic Delivery	
KEMAR Head and Torso with Mouth Simulator, non-configured	45BC

Common Accessories			
	Large Left Anthropometric Pinna (35 Shore 00) KB5001	Large Right Anthropometric Pinna (35 Shore 00) KB5000	
	External Ear Canal 2 x GR0408	Union Nut 2 x GR0409	
	Ear Simulator Holder 2 x GR1874		

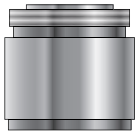
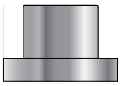
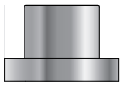
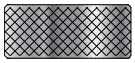
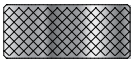
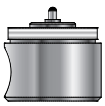
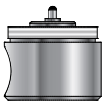
45BC-9 LEMO		45BC-10 CCP	
	Ear Simulator 2 x RA0045	Ear Simulator 2 x RA0045-S1	
	¼" Preamp., short 2 x 26AS-S3 incl. 40 cm cable	¼" Preamp., short 2 x 26CS	
	Adapter for ½" Microphone and ¼" Preamplifier 2 x GR0010	Right-angled Adapter for ½" Microphone and ¼" Preamplifier 2 x RA0001	
	Microphone Extension Cable, 3 m 2 x AA0008	Microphone Cable, Microdot 2 x AA0018-S (35 cm) 1 x AA0070 (3 m)	
	¼" Pressure Microphone Set for calibration of mouth 46BP-1	¼" Pressure Microphone Set for calibration of mouth 46BD	
		Microphone Extension Cable, 3 m 2 x AA0035	

45BC-11 KEMAR for Low-noise Headset Test, 1-Ch

45BC-12 KEMAR for Low-noise Headset Test, 2-Ch

Basic Delivery	
KEMAR Head and Torso with Mouth Simulator, non-configured	45BC

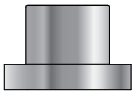
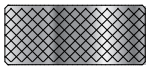
Common Accessories			
	Large Left Anthropometric Pinna (35 Shore 00) KB5001	Large Right Anthropometric Pinna (35 Shore 00) KB5000	
	¼" Pressure Microphone Set for calibration of mouth 46BD	Microphone Cable, Microdot, 3 m AA0070	

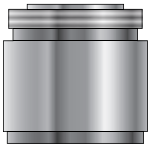
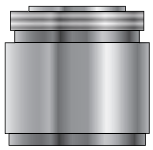
45BC-11 1-Channel		45BC-12 2-Channel	
	Low-noise Ear Simulator 1 x 43BB-1	Low-noise Ear Simulator 1 x 43BB-1	
	Ear Simulator Holder 1 x GR1874	Ear Simulator Holder 2 x GR1874	
	External Ear Canal 1 x GR0408	External Ear Canal 2 x GR0408	
	Union Nut 1 x GR0409	Union Nut 2 x GR0409	
	Right-angled Adapter for ½" Microphone and ¼" Preamplifier 1 x RA0001	Right-angled Adapter for ½" Microphone and ¼" Preamplifier 2 x RA0001	
	¼" Preamplifier 1 x 26HG incl. 3 m cable	¼" Preamplifier 2 x 26HG incl. 3 m cable	
	Filter and Gain Unit 1 x 26HT	Filter and Gain Unit 2 x 26HT	
	BNC - BNC Cable, 1 m 2 x AA0035	BNC-BNC Cable, 3 m 3 x AA0035	
	LEMO Cable, 1 m 1 x AA0059	LEMO Cable, 1 m 2 x AA0059	
	Power Module 1 x 12HF	Power Module 2 x12HF	

45BC-13 KEMAR for High-Frequency Headset Test, 2-Ch LEMO

45BC-14 KEMAR for High-Frequency Headset Test, 2-Ch CCP

Basic Delivery	
KEMAR Head and Torso with Mouth Simulator, non-configured	45BC

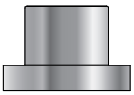
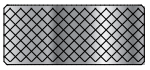
Common Accessories			
	Large Left Anthropometric Pinna (35 Shore 00) KB5001	Large Right Anthropometric Pinna (35 Shore 00) KB5000	
	External Ear Canal 2 x GR0408	Union Nut 2 x GR0409	
	Ear Simulator Holder 2 x GR1874		

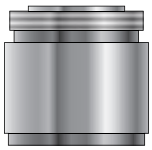
45BC-13 LEMO		45BC-14 CCP	
	Ear Simulator 2 x RA0401	Ear Simulator 2 x RA0402	
	¼" Preamp., short 2 x 26AS-S3 incl. 40 cm cable	¼" Preamp., short 2 x 26CS	
	Adapter for ½" Microphone and ¼" Preamplifier 2 x GR0010	Right-angled Adapter for ½" Microphone and ¼" Preamplifier 2 x RA0001	
	Microphone Extension Cable, 3 m 2 x AA0008	Microphone Cable, Microdot 2 x AA0018-S (35 cm) 1 x AA0070 (3 m)	
	¼" Pressure Microphone Set for calibration of mouth 46BP-1	¼" Pressure Microphone Set for calibration of mouth 46BD	
		Microphone Extension Cable, 3 m 2 x AA0035	

45BC-15 KEMAR, Test of Headsets w. Hi-Res Ear Simulator, 2-Ch LEMO

45BC-16 KEMAR, Test of Headsets w. Hi-Res Ear Simulator, 2-Ch CCP

Basic Delivery	
KEMAR Head and Torso with Mouth Simulator, non-configured	45BC

Common Accessories			
	Large Left Anthropometric Pinna (35 Shore 00) KB5001	Large Right Anthropometric Pinna (35 Shore 00) KB5000	
	External Ear Canal 2 x GR0408	Union Nut 2 x GR0409	
	Ear Simulator Holder 2 x GR1874		

45BC-15 LEMO		45BC-16 CCP	
	Ear Simulator 2 x RA0403 (w 1/4" micriophone)	Ear Simulator 2 x RA0404 (w 1/4" micriophone)	
	¼" Preamp., short 2 x 26AS-S3 incl. 40 cm cable	¼" Preamp., short 2 x 26CS	
	Microphone Extension Cable, 3 m 2 x AA0008 1 x AA0091	Microphone Cable, Microdot 2 x AA0018-S (35 cm) 1 x AA0070 (3 m)	
	¼" Pressure Microphone Set for calibration of mouth 46BP-1	¼" Pressure Microphone Set for calibration of mouth 46BD	
		Microphone Extension Cable, 3 m 2 x AA0035	

Test Setups

The 45BB KEMAR Head and Torso and the 45BC KEMAR Head and Torso with Mouth Simulator are delivered fully pre-configured and tested for a number of standard test setups.

Where applicable, two versions are available:

- A LEMO version with externally polarized ear simulators/microphones
- A CCP version with prepolarized ear simulators/microphones.

The low-noise system is available as a LEMO version only.

45BB Head and Torso

Configuration	LEMO	CCP
Hearing aid test (1-channel)	45BB-1	45BB-2
Sound quality recording (2-channel)	45BB-3	45BB-4
Ear- and headphone test (2-channel)	45BB-5	45BB-6
Test of binaural hearing aids (2-channel)	45BB-7	45BB-8
Ear- and headphone test, anthropometric pinna (2-channel)	45BB-9	45BB-10
Low-noise ear- and headphone test	45BB-11 (1-channel) 45BB-12 (2-channel)	
High-frequency test of headphones (2-channel)	45BB-13	45BB-14
Test of ear and headphones w. Hi-Res Ear Simulator (2-channel)	45BB-15	45BB-16

45BC Head and Torso with Mouth Simulator

Configuration	LEMO	CCP
Headset test (2-channel)	45BC-1	45BC-2
Telephone test (1-channel)	45BC-3	45BC-4
Headset test w anthropometric pinna (2-channel)	45BC-9	45BC-10
Low-noise headset test	45BC-11 (1-channel) 45BC-12 (2-channel)	
High-frequency test of headsets (2-channel)	45BC-13	45BC-14
Test of headsets w. Hi-Res Ear Simulator (2-channel)	45BC-15	45BC-16

On the following pages, examples of typical test setups for the 45BB KEMAR Head and Torso and the 45BC KEMAR Head and Torso with Mouth Simulator are shown.

45BB KEMAR Test Setups

The 45BB-1 KEMAR Head & Torso for hearing aid test, 1-Ch LEMO and the 45BB-2 KEMAR Head & Torso for hearing aid test, 1-Ch CCP can be used for testing any kind of hearing-aids.

Hearing Aid Test

The hearing aids can be:

- BTE (Behind The Ear)
- Full-concha ITE (In The Ear)
- ITC (In The Canal)
- CIC (Completely In the Canal).

Ear Mould Adapters:

- Use KB0110 for Ø 2 mm tube, use KB0111 for Ø 3 mm tube.

Fig. 18 shows an example of a test setup with the GRAS 45BB-1 KEMAR.

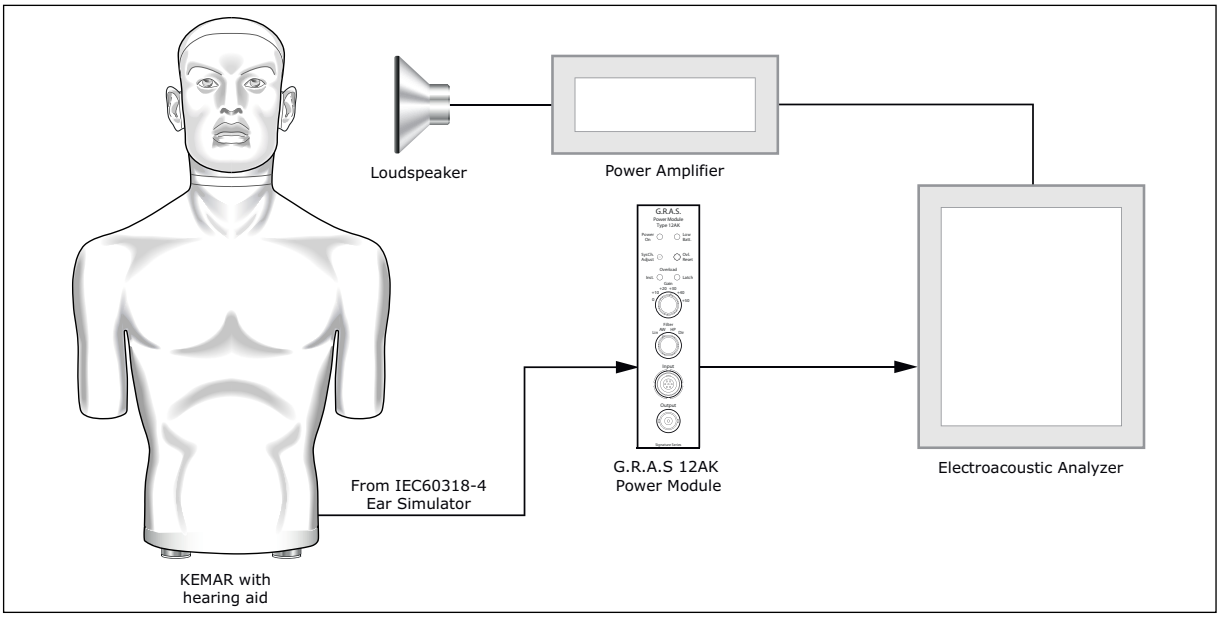


Fig. 18. *Monaural setup with 45BB-1 for testing hearing aids.*

The test signal from the generator is sent to a loudspeaker via a power amplifier. The signal from the loudspeaker is picked up by the hearing aid attached to KEMAR's ear.

The externally-polarized microphone of the RA0045 Ear Simulator fitted to KEMAR picks up the hearing aid's audio signal and sends it to the analyzer via for example the GRAS 12AK Power Module.

Alternatively, a 45BB-2 KEMAR Head & Torso for hearing aid test, 1-Ch CCP can be used. The 45BB-2 uses a prepolarized ear simulator and a CCP preamplifier requiring a Constant-Current Power supply, often provided directly by the analyzer.

Full details of the items delivered with 45BB-1 and 45BB-2 KEMAR are given on page 20.

Sound Quality Recording

The GRAS 45BB-3 KEMAR Head & Torso for sound quality recording, 2-Ch LEMO and the 45BB-4 KEMAR Head & Torso for sound quality recording, 2-Ch CCP are used for evaluation of the quality of sound.

Fig. 19 shows a binaural setup for recording sound using a 45BB-3 KEMAR configured with two 40AG ½" externally-polarized pressure microphones.

The microphones fitted to KEMAR pick up the sound of the test object and sends it to an analyzer via the 12AA Dual Channel Power Module.

Notes for this setup:

- Ear Simulators and Ear Canal Extensions are not part of this setup, ½" pressure microphones are used.
- VA-style Pinnae are used because the large ear entrance of the VA-style pinnae accommodates ½" microphones.

Alternatively, a 45BB-4 KEMAR Head & Torso for sound quality recording, 2-Ch CCP can be used. The 45BB-4 uses prepolarized microphones and CCP preamplifiers requiring Constant-Current Power supplies, often provided directly by the analyzer.

Full details of the pre-configured 45BB-3 KEMAR and 45BB-4 KEMAR for sound quality recording are listed on page 21.

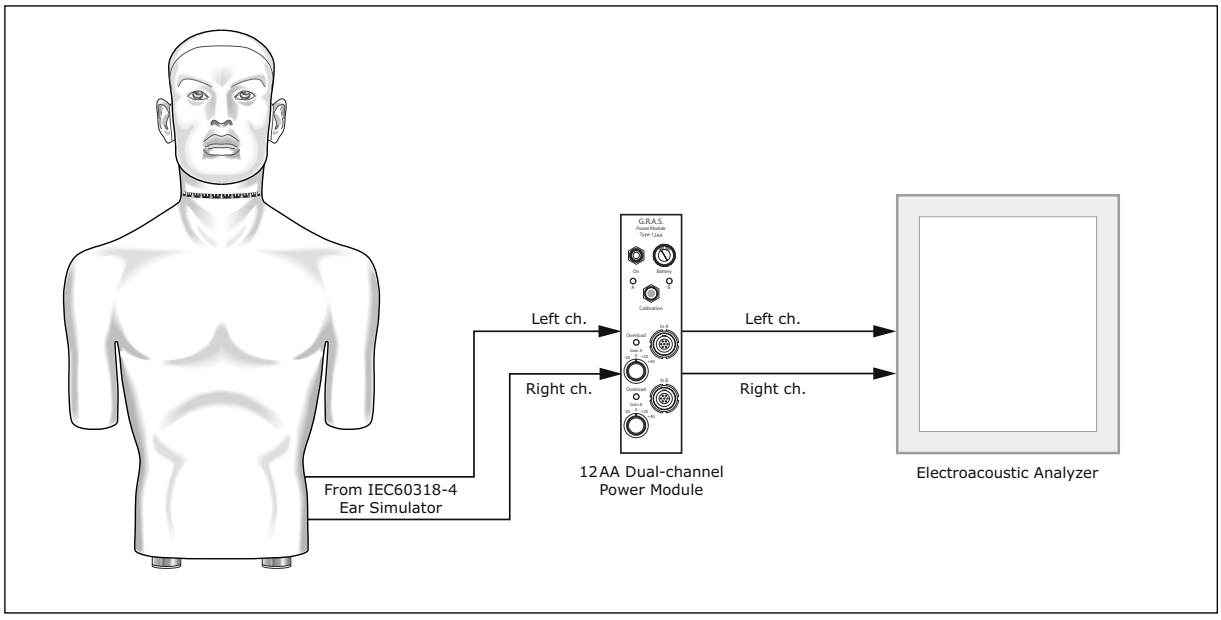


Fig. 19. *Binaural setup for evaluation of sound quality.*

Ear and Headphone Test

The GRAS 45BB-5 Head & Torso for ear- and headphone test, 2-Ch LEMO and the GRAS 45BB-6 Head & Torso for ear- and headphone test, 2-Ch CCP are used for testing earphones and headphones.

Fig. 20 shows a binaural setup for testing earphones. The test signal is passed via an adjustable power amplifier to the earphones attached to KEMAR's ears.

The IEC 60318-4 Ear Simulators fitted to KEMAR picks up the earphones' audio signals and send them to the analyzer via the 12AA Power Module.

Alternatively, a 45BB-6 KEMAR Head & Torso for ear- and headphone test, 2-Ch CCP can be used. The 45BB-6 uses prepolarized ear simulators and CCP preamplifiers requiring Constant-Current Power supplies, often provided directly by the analyzer.

Full details of the pre-configured 45BB-5 KEMAR and 45BB-6 KEMAR for ear and headphone tests are given on page 22.

The 45BB KEMAR configurations for high-frequency and hi-res headphone testing – the 45BB-13 to 45BB-16, see page 26 to page 27 – are also connected as shown below.

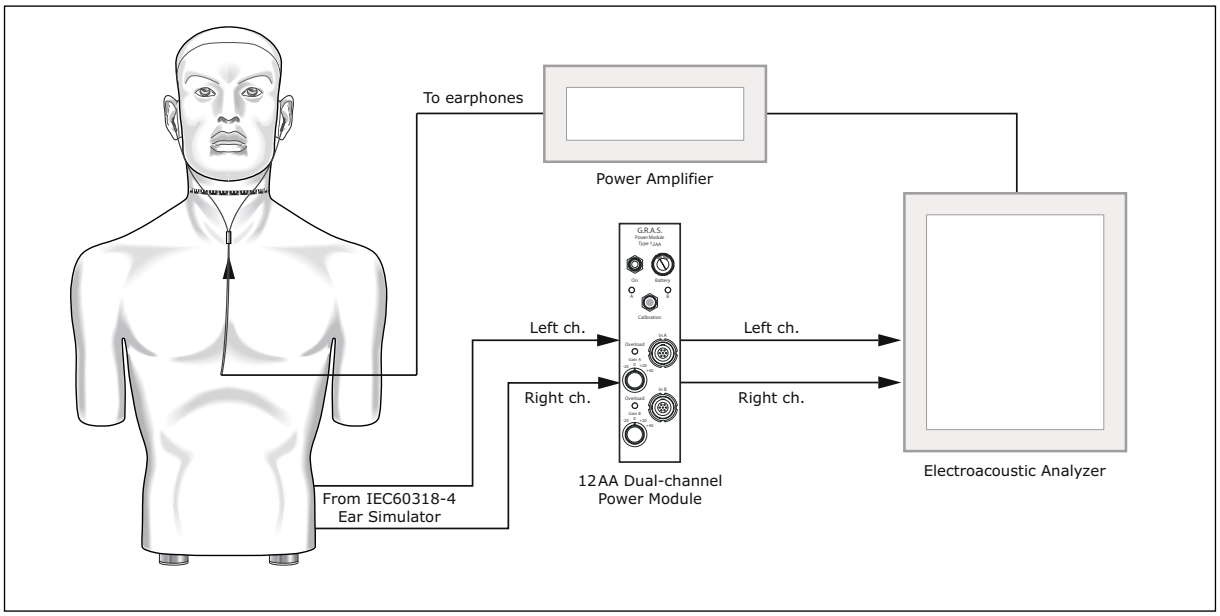


Fig. 20. *Binaural setup for testing of earphones and headphones.*

Test of Binaural Hearing Aids

The 45BB-7 KEMAR for Test of Binaural Hearing Aid, 2-Ch LEMO and the 45BB-8 KEMAR for Test of Binaural Hearing Aid 2-Ch CCP can be used for testing of binaural hearing-aids using RF communication.

Normally, a 45BB or 45BC KEMAR is fitted with ear-holder plates made of aluminium. The 45BB-7 and 45BB-8 KEMAR come with ear-holder plates and ear-canal extensions made of POM. The ear-holder plates are mounted with bolts made from nylon and Teflon. In this way it is ensured that RF-signals inside the head are not disturbed.

A KEMAR with ear-holder plates of aluminium can be retrofitted with these parts for test of binaural hearing aids. For further information, refer to page 10.

The measurement setup is identical to the one described in Fig. 18 except that it is a dual-channel setup. A two channel power module is needed, e.g. a 12AA 2-Channel Power Module with gain, filters and SysCheck generator for 45BB-7 (LEMO) and 12AR 2-Channel Power Module for 45BB-8 (CCP).

Details of the items delivered with 45BB-7 and 45BB-8 KEMAR are given on page 23.

Low-noise Test of Ear- and Headphones

The GRAS 45BB-11 KEMAR and 45BB-12 KEMAR are used for low-noise testing of earphones and headphones.

Fig. 21 shows a monaural setup for testing earphones. The test signal is passed via an adjustable power amplifier to the earphones attached to KEMAR's ears.

The Low-noise Ear Simulators fitted to KEMAR picks up the earphone's audio signal and sends it to the analyzer via the 26HT Gain and Filter Unit and the 12HF Power Module.

The items needed for single-channel and dual-channel low-noise test of ear and headphones are given on page 25.

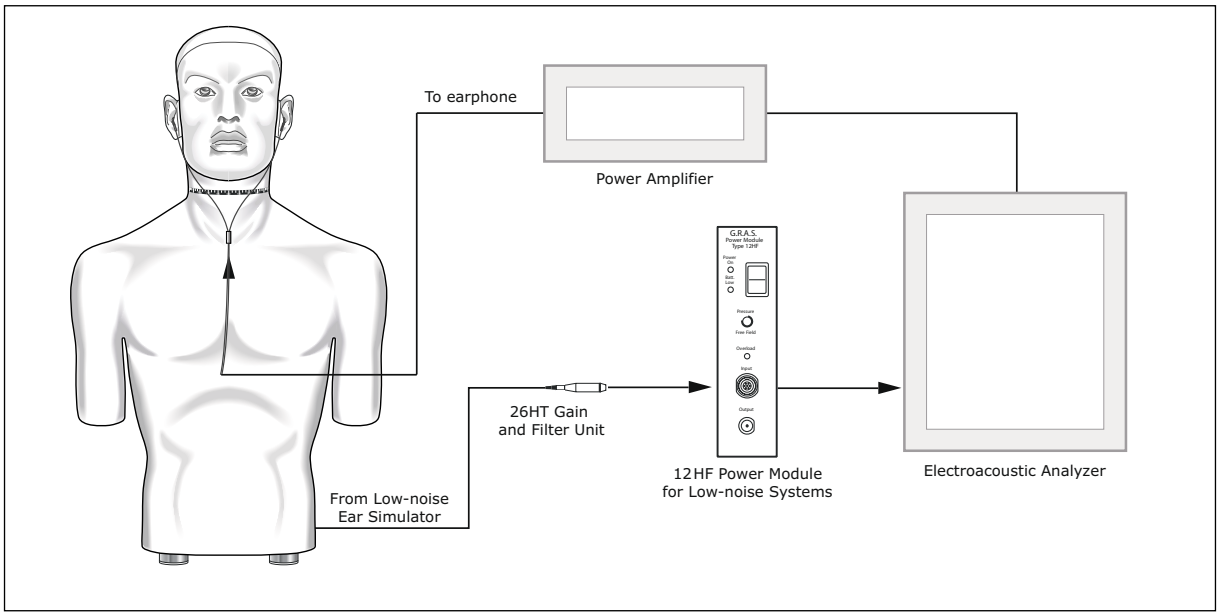


Fig. 21. *Setup for single-channel low-noise testing of earphones.*

Important. If you have a dual channel setup, note that the low noise ear simulators are carefully matched with the 26HT gain/filter units. It is therefore imperative that the ear simulators are used with the gain/filter units with which they were calibrated and delivered. You can use the labels on the cables or the serial numbers stated in the Calibration Charts to ensure this.

45BC KEMAR Test Setups

Headset Test

The GRAS 45BC-1 KEMAR Head & Torso with Mouth Simulator for headset test, 2-Ch LEMO and the 45BC-2 KEMAR Head & Torso with Mouth Simulator for headset test, 2-Ch CCP are used for testing of all types of headsets:

- Insert types
- Intra-concha
- Supra-concha
- Supra-aural.

Testing the Headphones of Headsets

Fig. 22 shows a binaural setup for testing the headphones of a headset. Note that the binaural setup requires:

- Two sets of artificial ear assemblies
- The 12AA dual-channel Power Module.

The stereo test signal is passed to the headset's headphones via an adjustable external power amplifier. The IEC 607318-4 Ear Simulator fitted to KEMAR picks up the headset's audio signal and sends it to the analyzer via the 12AA Power Module.

Alternatively, a 45BC-2 KEMAR Head & Torso with Mouth Simulator for headset test, 2-Ch CCP can be used. The 45BC-2 uses prepolarized ear simulators and CCP preamplifiers requiring Constant-Current Power supplies, often provided directly by the analyzer.

Full details of the pre-configured 45BC-1 and 45BC-2 KEMARs for headset tests are given on page 30.

The 45BC KEMAR configurations for high-frequency and hi-res headset testing – the 45BC-13 to 45BC-16, see page 34 to page 35 – are also connected as shown below.

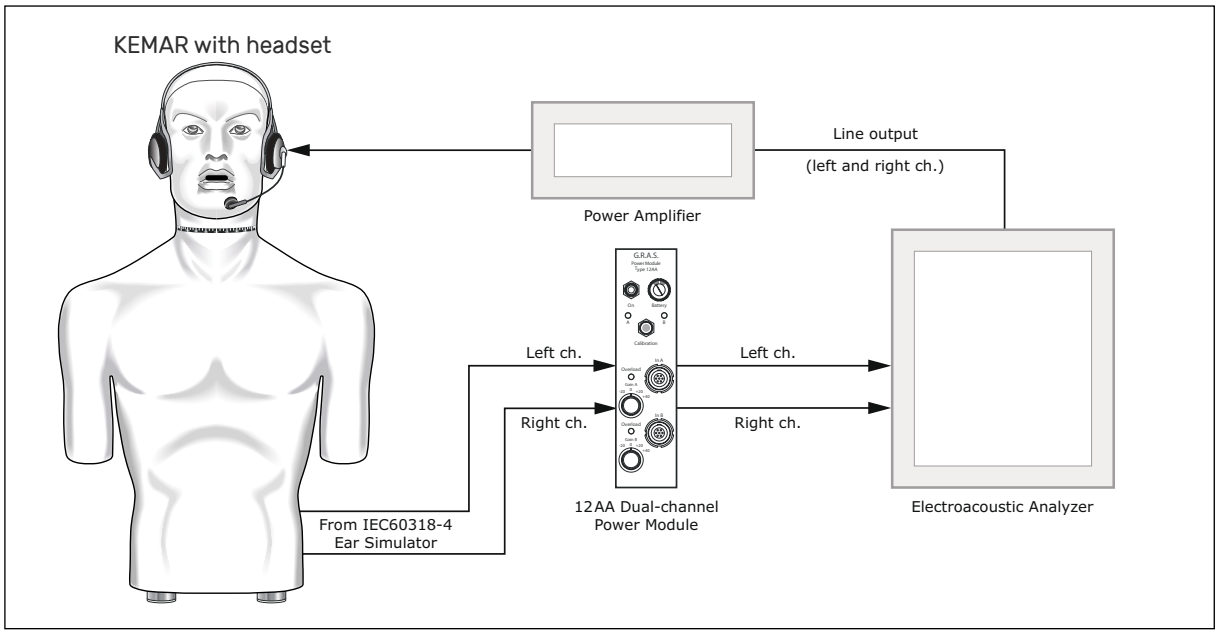


Fig. 22. *Binaural setup for test of headset headphones.*

Boom Microphone of Headsets

Fig. 23 shows a monaural setup for testing a headset's boom microphone.

The test signal is passed to the mouth simulator via the built-in power amplifier. The headset's microphone receives the signal and sends it to the analyzer via some appropriate signal conditioning.

Alternatively, a 45BC-2 KEMAR Head & Torso with Mouth Simulator for headset test, 2-Ch CCP can be used. The 45BC-2 uses prepolarized ear simulators and CCP preamplifiers requiring Constant-Current Power supplies, often provided directly by the analyzer.

Full details of the pre-configured KEMARs for headset tests are given on page 30.

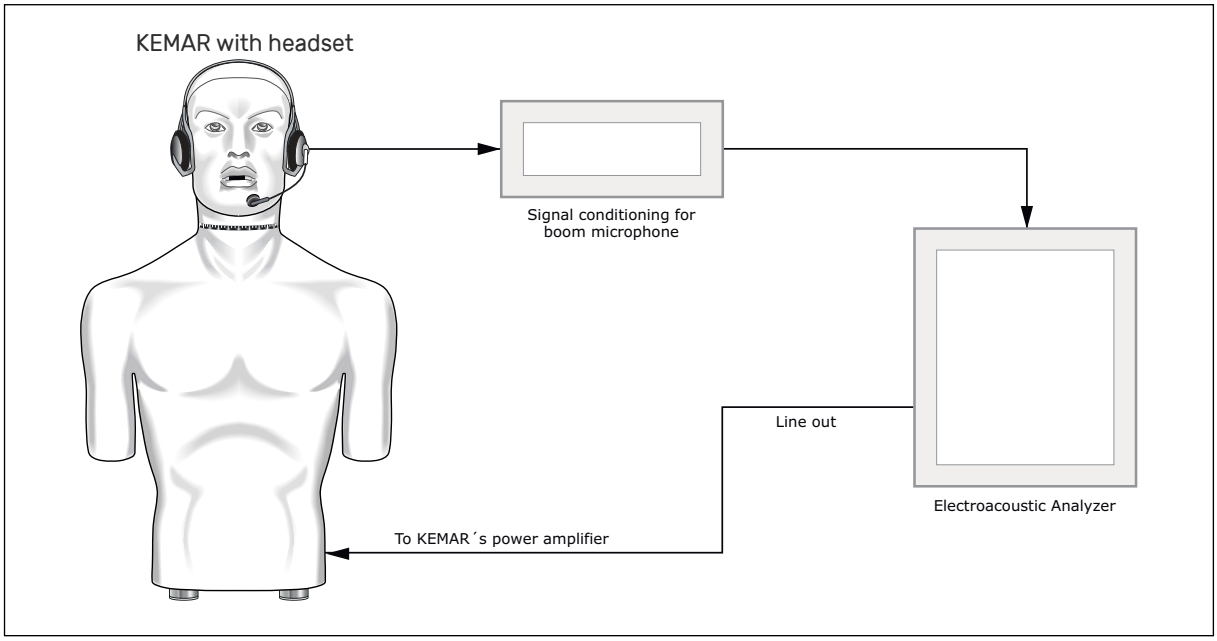


Fig. 23. *Monaural setup for testing a headset microphone.*

Bluetooth Headsets

KEMAR Type 45BC fitted with the Artificial Ear assembly described in the previous section can also be used for Testing the Receiver of Bluetooth Headsets

Fig. 24 shows a monaural setup for testing the earphones of a headset.

Receiving: The KEMAR artificial ear receives the RF-to-audio converted signal from the Bluetooth headset's receiver. Via KEMAR's internal connections, the signal is then forwarded to the power module and further on to the analyzer.

Transmitting: The handset's microphone receives the audio signal generated by the mouth simulator, and the Bluetooth headset converts the signal to an RF signal to transmit to the air interface.

The microphone of the IEC 60318-4 Ear Simulator fitted to KEMAR picks up the headset's audio signal and transmits it to the analyzer via the 12AK Power Module.

Alternatively, a 45BC-2 KEMAR Head & Torso with Mouth Simulator for headset test, 2-Ch CCP can be used. The 45BC-2 uses prepolarized ear simulators and CCP preamplifiers requiring Constant-Current Power supplies, often provided directly by the analyzer.

Full details of the pre-configured KEMARs for headset tests are given on page 30.

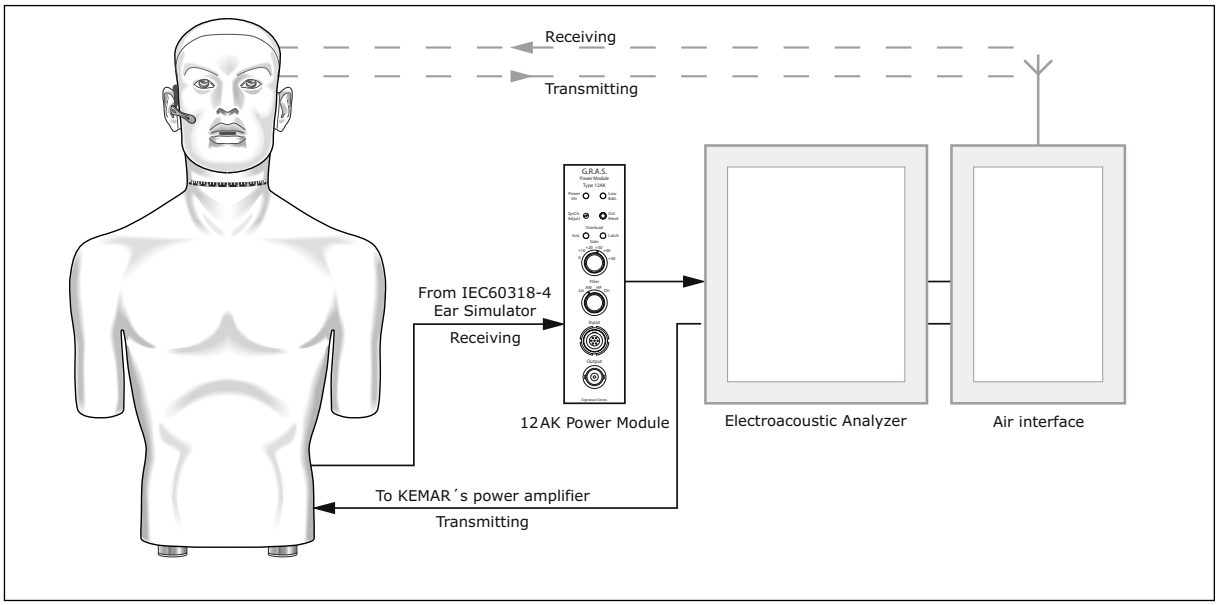


Fig. 24. *Monaural setup for testing a Bluetooth headset in both transmitting and receiving direction.*

Telephone Test

The GRAS 45BC-3 KEMAR Head & Torso with Mouth Simulator for telephone test, 1-Ch LEMO and the GRAS 45BC-4 KEMAR Head & Torso with Mouth Simulator for telephone test, 1-Ch CCP is typically used together with the 45EA Handset Positioning System for telephone tests – as shown in Fig. 25. The Handset Positioning System simulates the arm-wrist-hand and fingers of the operator. The exact position of the handset is defined by graduated scales, thus enabling an accurate and repeatable positioning with a high level of freedom.

Receiving: The KEMAR artificial ear receives the acoustic signal from the handset's speaker. Via KEMAR's internal connections, the signal is then forwarded to the power module and further on to the analyzer.

Transmitting: The handset's microphone receives the audio signal generated by the mouth simulator, and the handset converts the signal into an RF signal to be transmitted to the air interface and analyzed according to the specifications/standards.

For this setup, the standardized soft pinnae KB1065/KB1066 are included.

The setup shown here is with the 45BC-3 KEMAR with externally polarized ear simulators. Alternatively, a 45BC-4 KEMAR for telephone test, 2-Ch CCP can be used. The 45BC-4 uses a prepolarized ear simulator and a CCP preamplifier requiring a Constant-Current Power supply, often provided directly by the analyzer.

Full details of the pre-configured KEMARs for telephone tests are given on page 31.

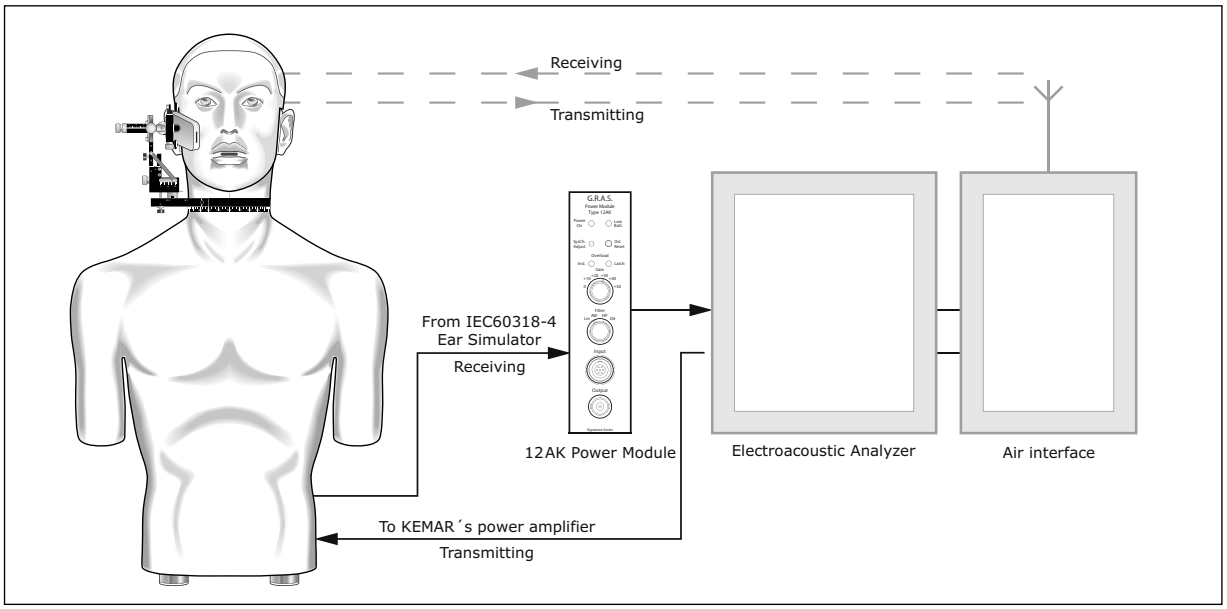


Fig. 25. *Monaural setup for testing a mobile phone handset in both transmitting and receiving direction.*

Handset Positioning System

Refer to the user manual for the 45EA Handset Positioning System for further information.

Low-noise Testing of Headsets

Fig. 26 shows a binaural setup for low-noise testing of the headphones of a headset.

A binaural setup requires the use of two 43BB low-noise ear simulator systems.

It is important that the 26HT Gain and Filter units are connected to the correct ear simulator as each pair of ear simulator and gain and filter unit are calibrated together. You can use the labels on the cables or the serial numbers stated in the Calibration Charts to ensure this. The power modules are interchangeable.

The stereo test signal is passed to the headset's headphones via an adjustable external power amplifier. The Low-noise Ear Simulator fitted to KEMAR picks up the headset's audio signal and sends it to the analyzer via the 26HT Gain Unit and the 12HF Power Module.

Full details of the pre-configured KEMARs for low-noise headset tests are given on page 33.

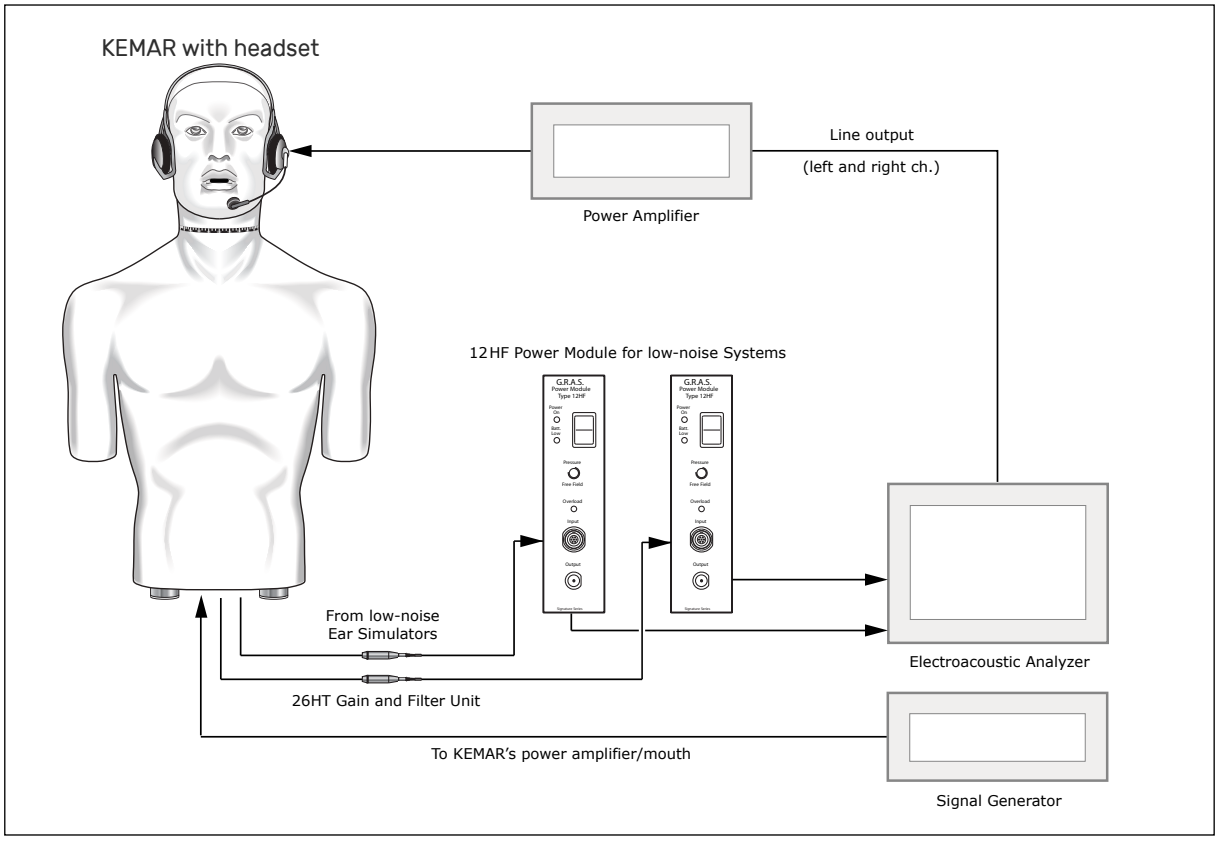


Fig. 26. *A binaural setup for low-noise testing of a headset.*

Cabling and Connections

External and Internal Sockets

Fig. 27 shows the location of KEMAR's sockets. Remove the head to access the sockets in the bottom of the neck.

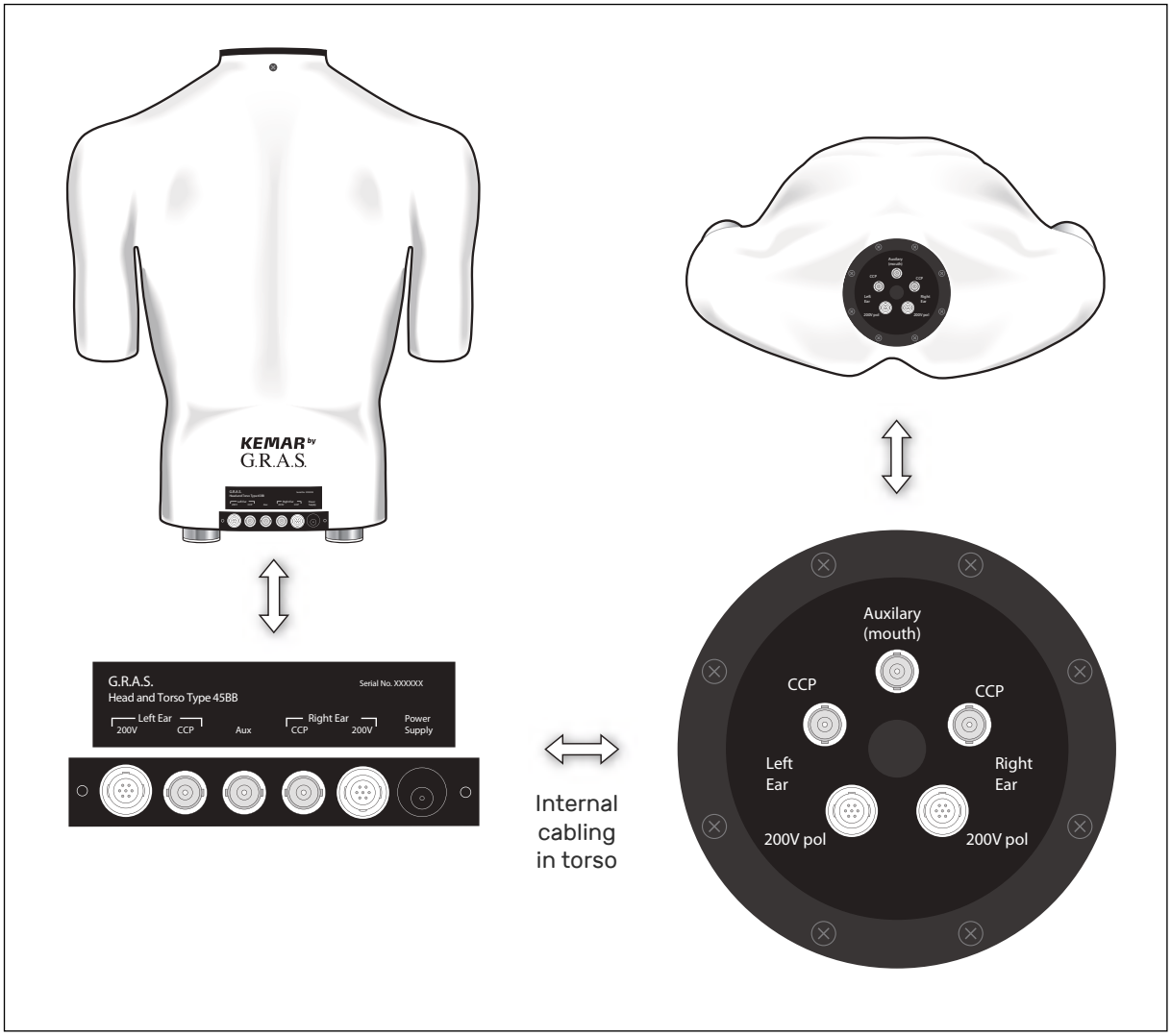


Fig. 27. *External connectors are located at the base of the torso. Connectors for transducers in the head are located at the bottom of the neck.*

Setup with Power Modules and Externally Polarized Microphones

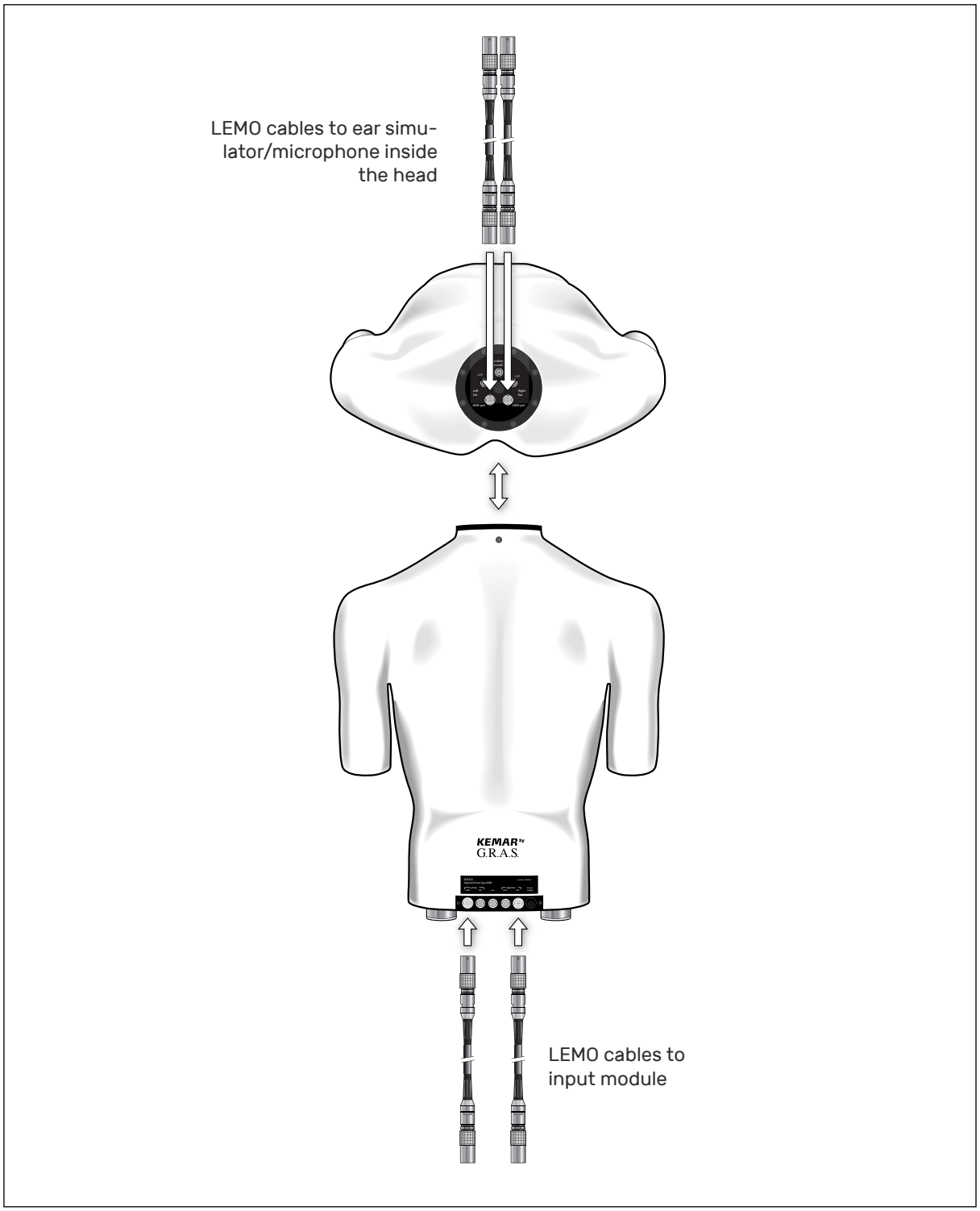


Fig. 28. *Connections for setups based on traditional power modules and externally-polarized microphones.*

Setup with CCP Preamplifiers and Prepolarized Microphones

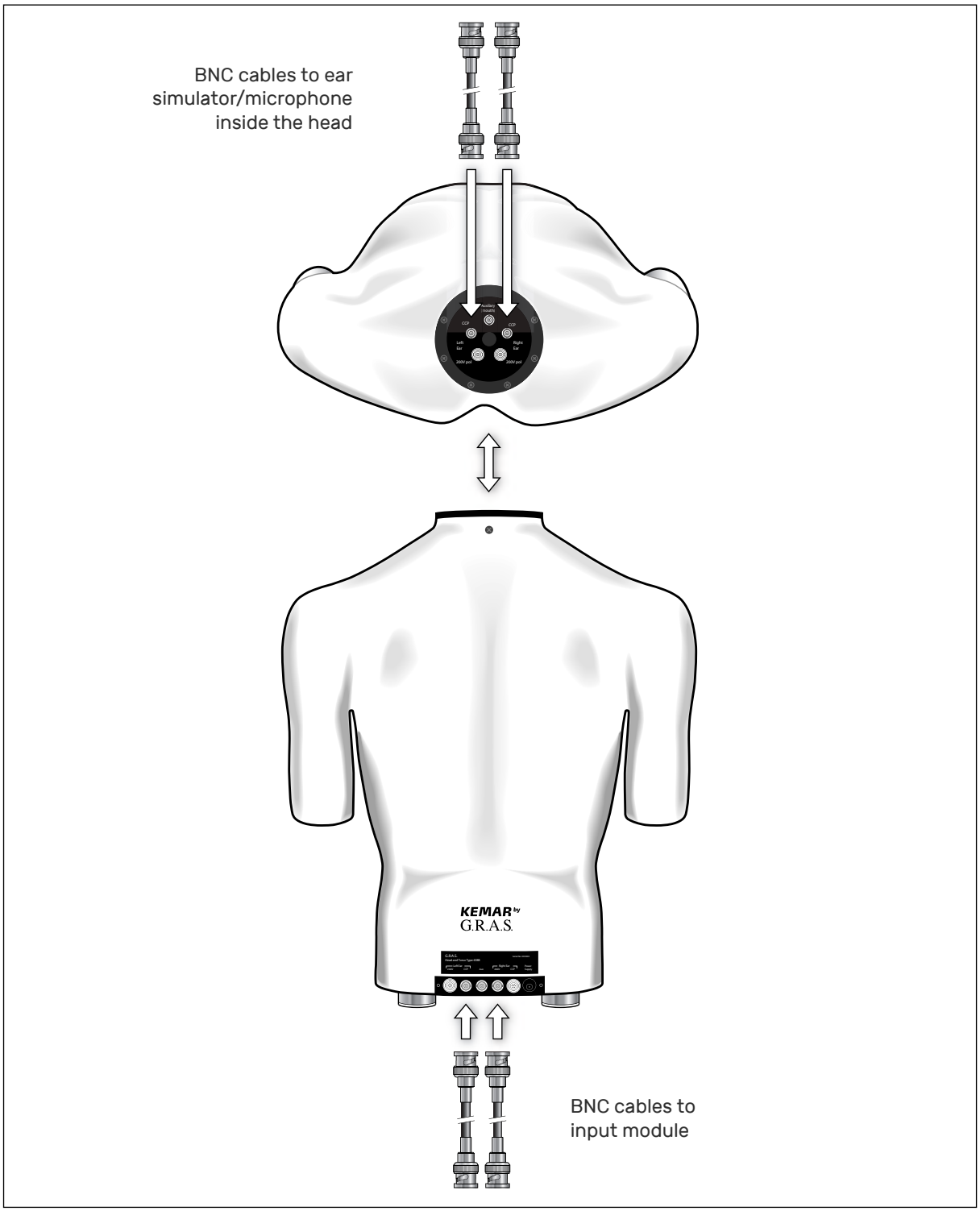


Fig. 29. *Internal and external cable connections for setups based on CCP preamplifiers and prepolarized microphones.*

Setup with Low-noise Ear-Simulator

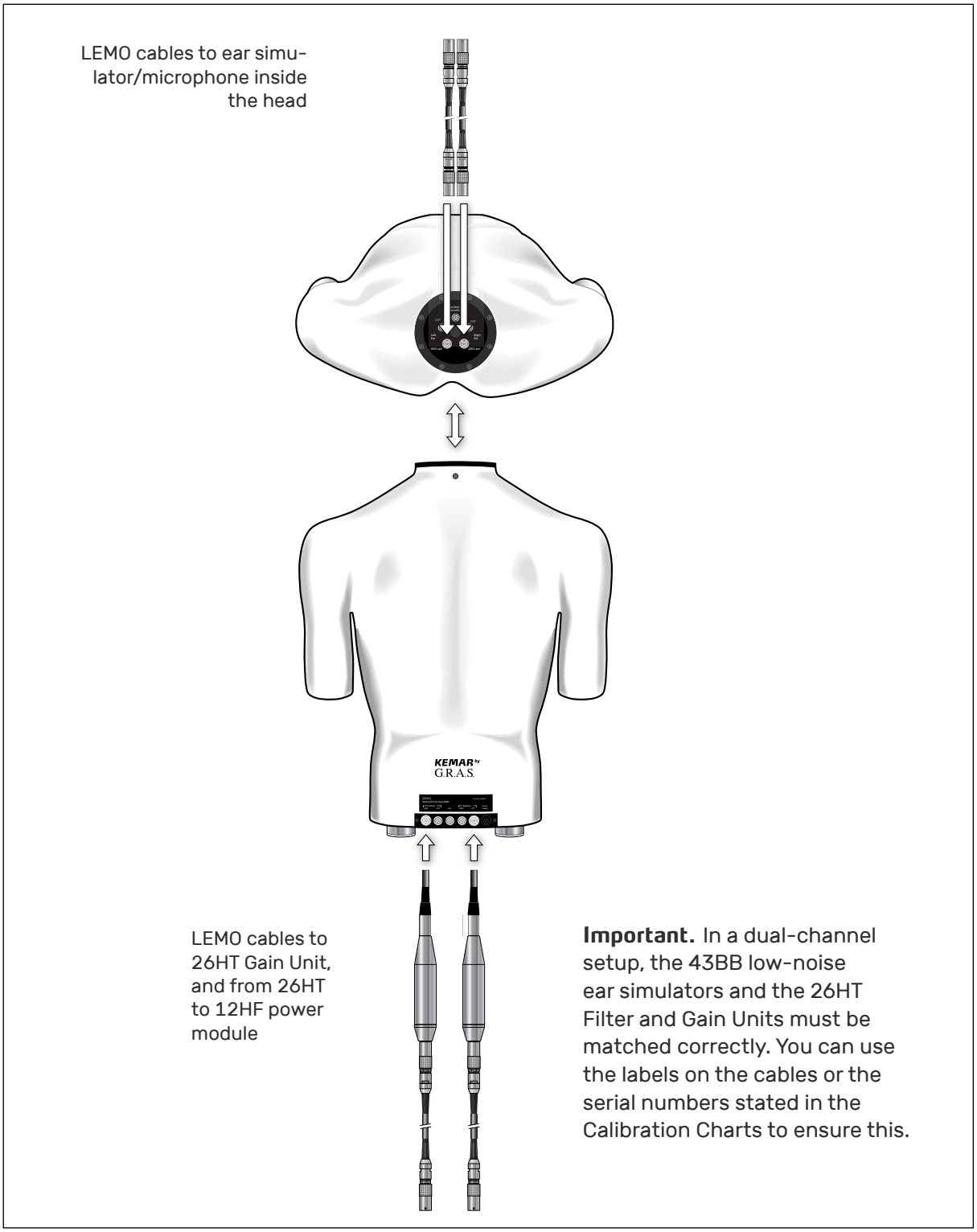


Fig. 30. *Connections for setup with low-noise ear simulator.*

Connections for the Mouth Simulator [45BC ONLY]

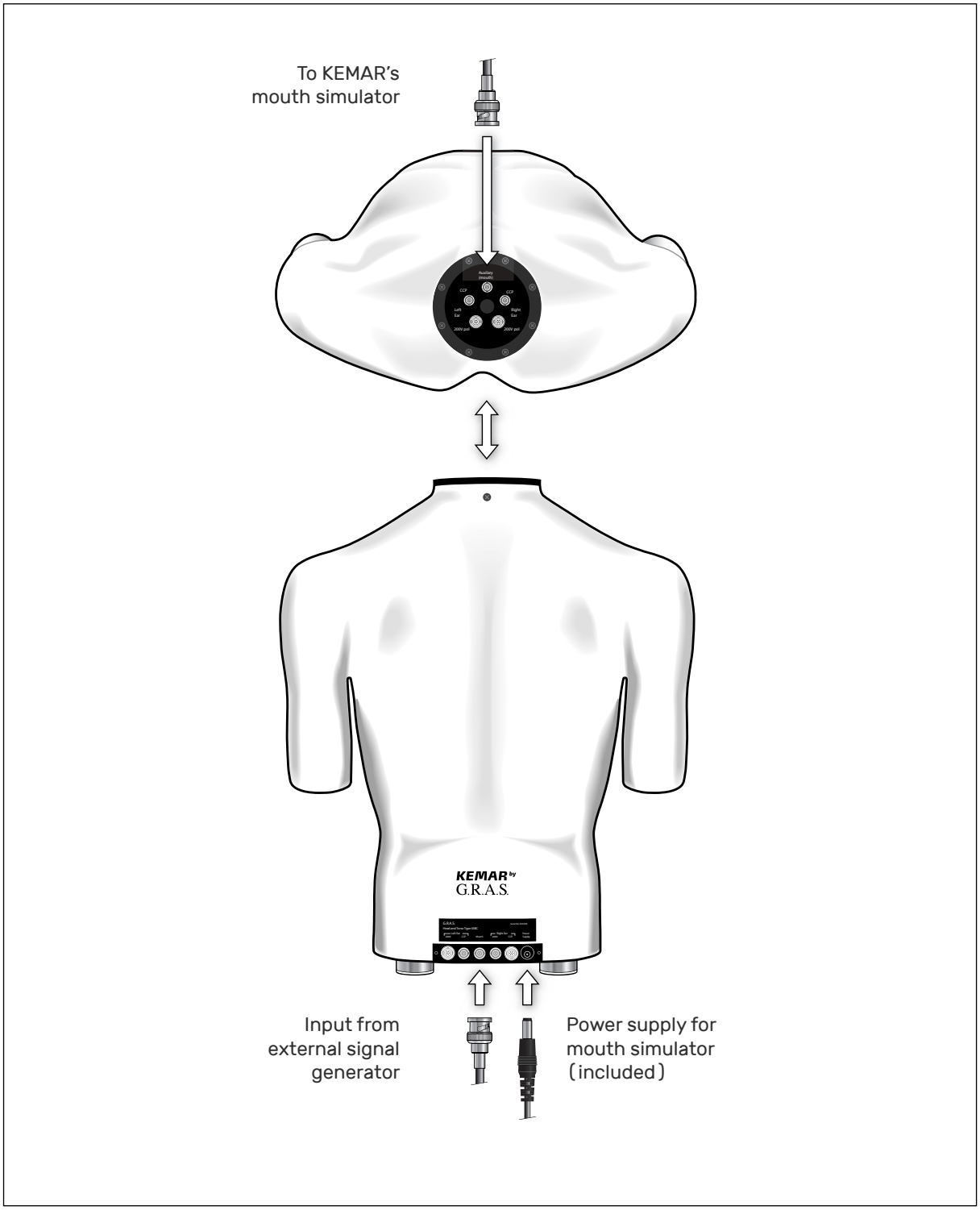


Fig. 31. *Connections for use of KEMAR's Mouth Simulator [45BC ONLY].*

Disassembly and Maintenance

Removing and Installing the Top of the KEMAR Head

The transducers – the ear simulator(s) and/or the mouth simulator – are built into the KEMAR at delivery. To get access to the interior of the head, you must remove the top of the head as shown in Fig. 32.

Removing the Top

1. Push hard on the round button at the back of the head. This will release the lock at the bottom of the neck.
2. Lift off the back end of the top in a forward movement.
3. Once the bottom of the back has been lifted, pull backwards to release the front pin.

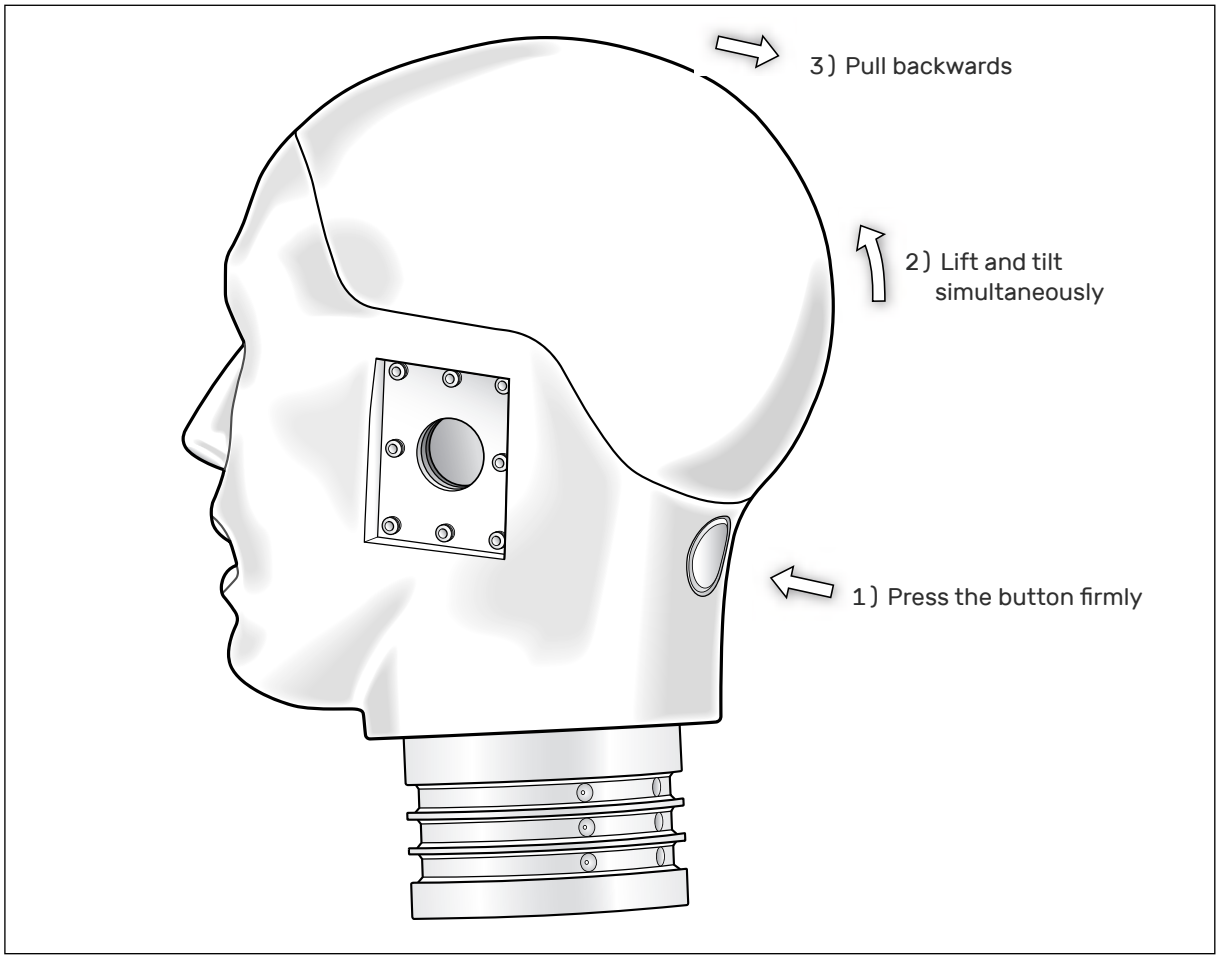


Fig. 32. *Removing the top of the head.*

Mounting the Top of the Head

The top of the head is attached to the head by a tap at the front, two springs and a metal plate at the back.

To install the top of the head:

1. Slide the pin at the front of the top into the slit at the top front of the (fore)head.
2. Push down the back of the top until you hear a click, signalling that it is now locked.

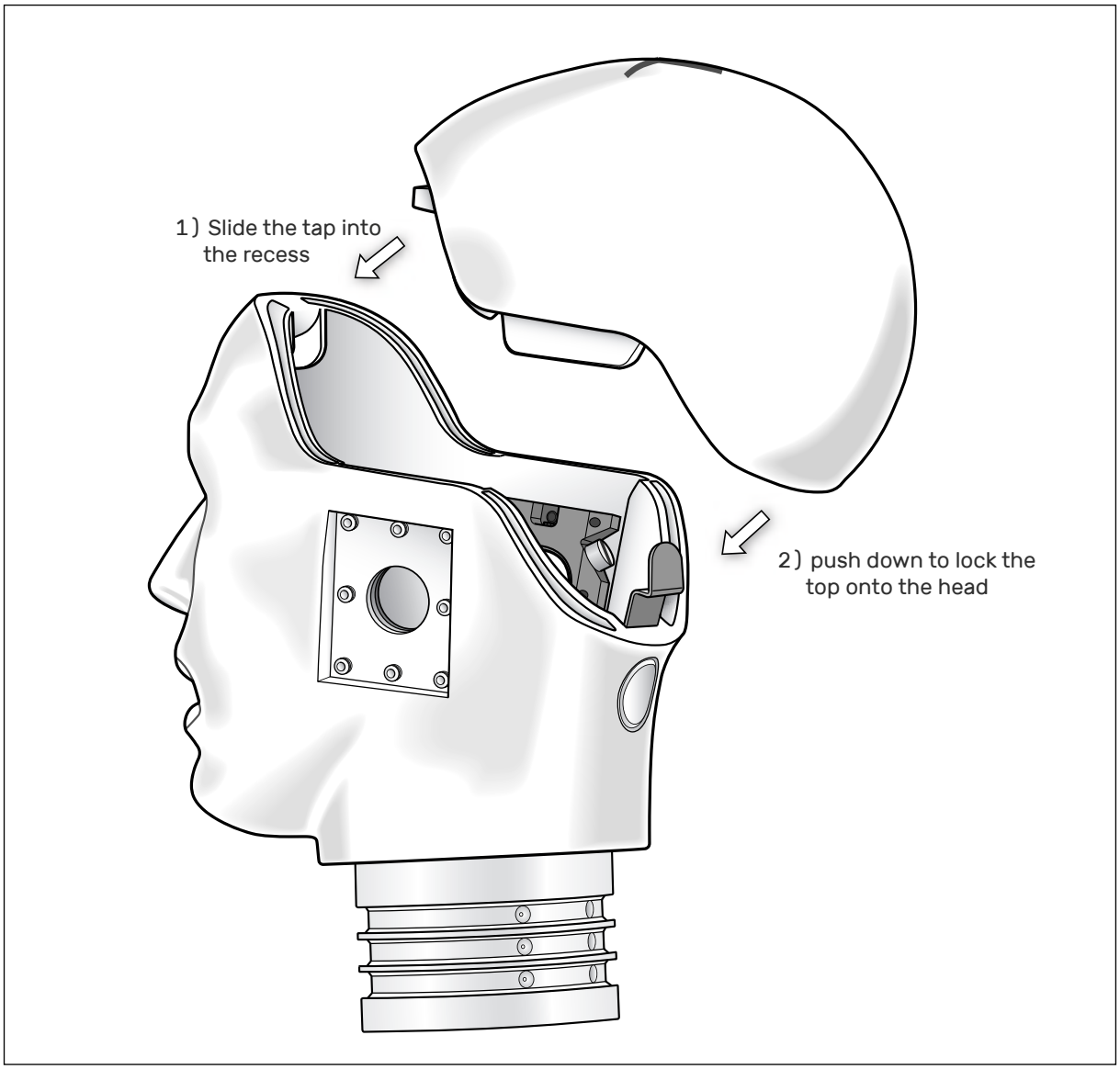


Fig. 33. *Mounting the top of the head.*

Removing and Mounting Transducers

The Snap Lock Mechanism

Ear simulators and microphones are mounted in KEMAR's head with a snap lock mechanism. Four spring-loaded balls in KEMAR's ear holder plates locks the flange of the ear canal extension or microphone holder and keeps them locked in position. An O-ring on the front of the flange of the ear canal extension/microphone holder ensures a tight fit. The mechanism is illustrated in Fig. 34 below. Because of the snap lock mechanism, it is possible to remove ear simulator or microphone set without further disassembly. The ear simulator holder is without O-ring.

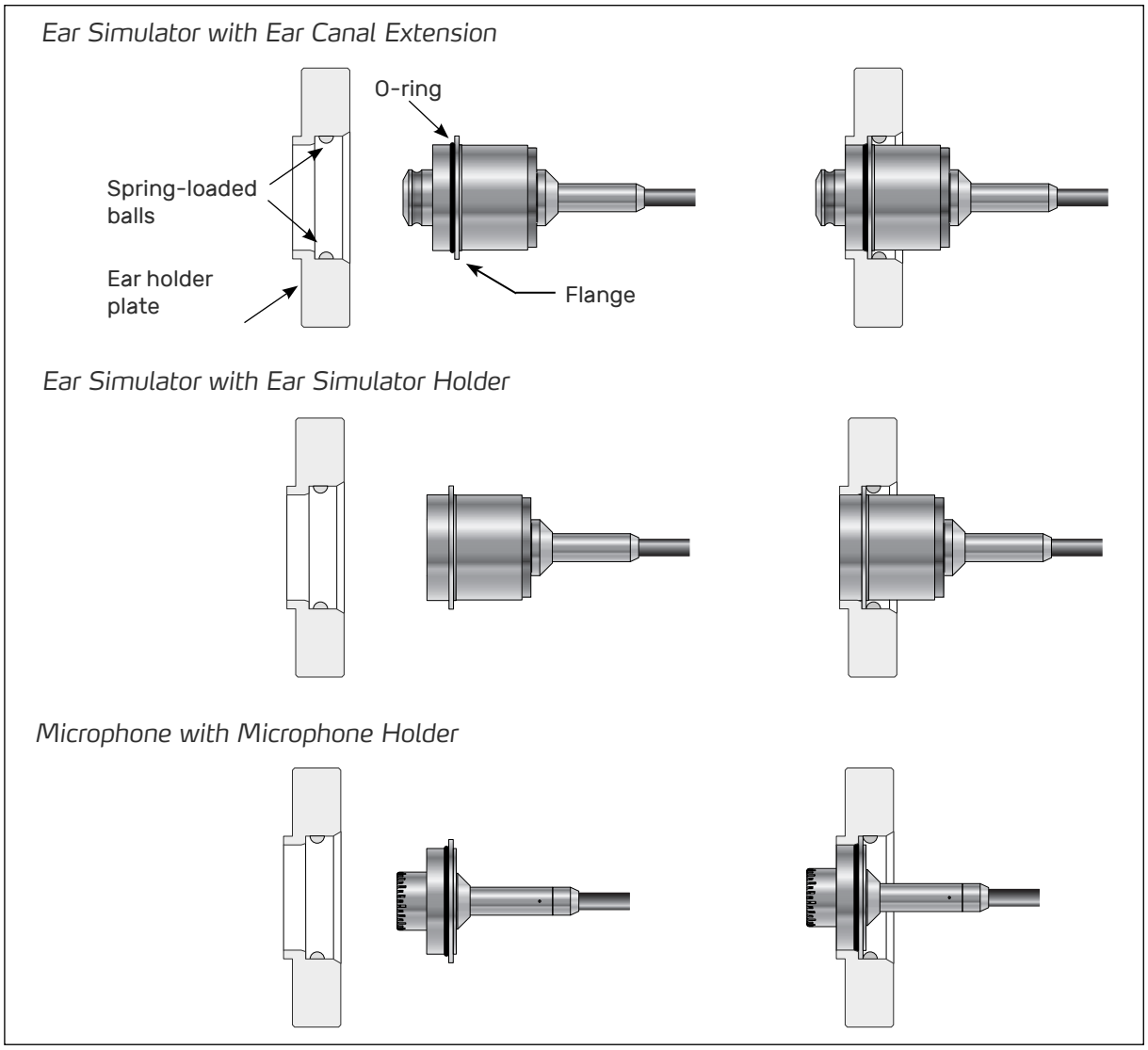


Fig. 34. *KEMAR's snap lock mechanism for mounting of ear canal extension, microphone and ear simulator holder for the anthropometric pinna.*

Assembling with Ear Canal Extension,Microphone Holder or Ear Simulator Holder

Before mounting in KEMAR, ear simulator/microphone must be assembled with preamplifier and ear canal extension, microphone holder or ear simulator holder, as shown in . When assembling, take care to not overtighten the threads.

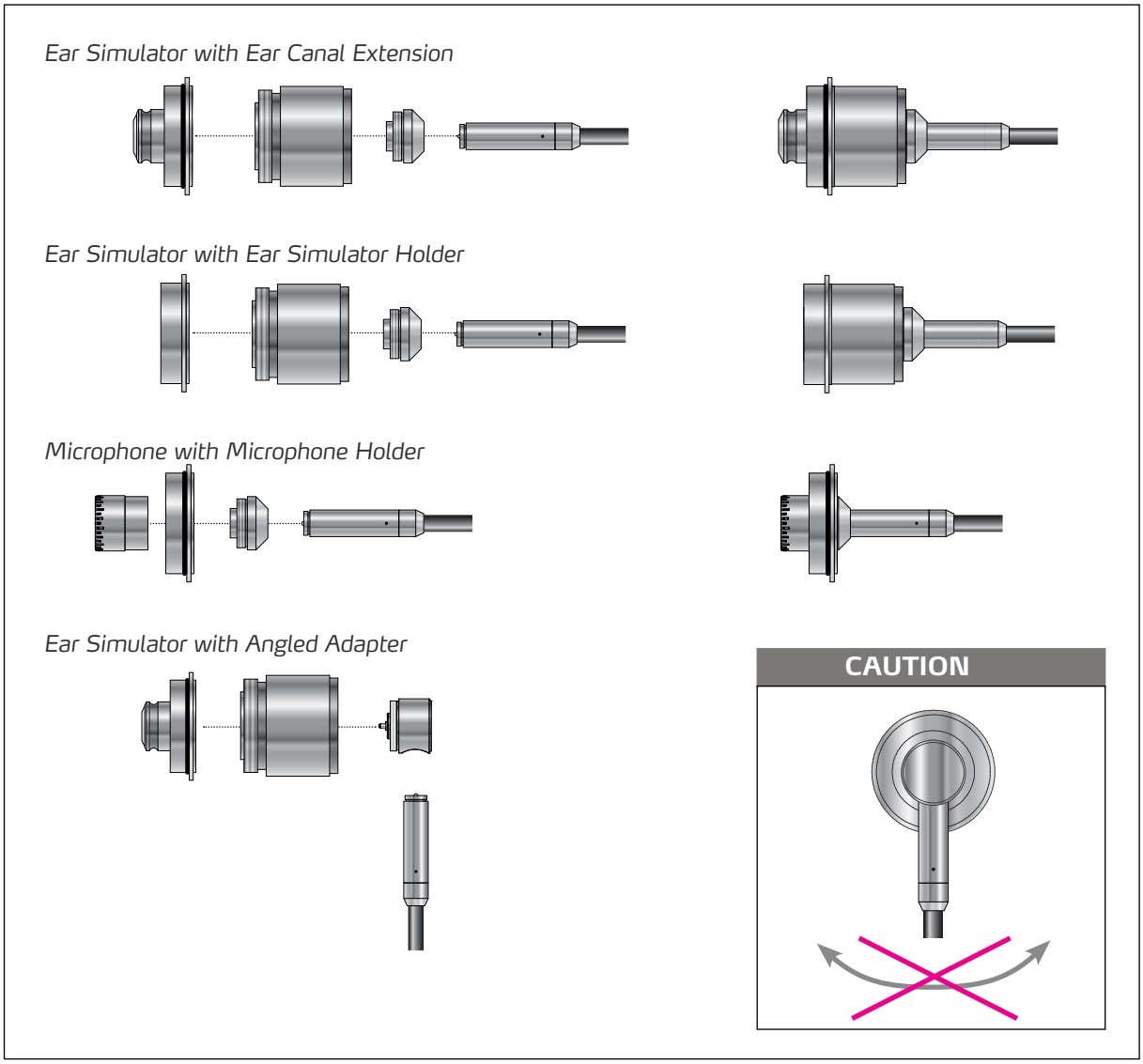


Fig. 35. *Assembly before mounting: Angled adapters must be used with the ear simulator for binaural configurations.*

Caution! Only use gentle finger force when attaching the angled adapter to the ear simulator. Do NOT use the preamplifier as a lever to tighten the angled adapter onto the ear simulator. If you do, there is a real risk that the angled adapter will be attached to the microphone in the ear simulator so tightly that it cannot be removed again without also accidentally removing the microphone.

Removal

Loosen the Allen locking screw and push on the ear simulator/microphone holder from the outside.

Mounting

Guide the front of the ear canal extension/the holder through the ear holder plate and push on the back until it clicks into position. Secure the assembly with the M3 Allen screw.

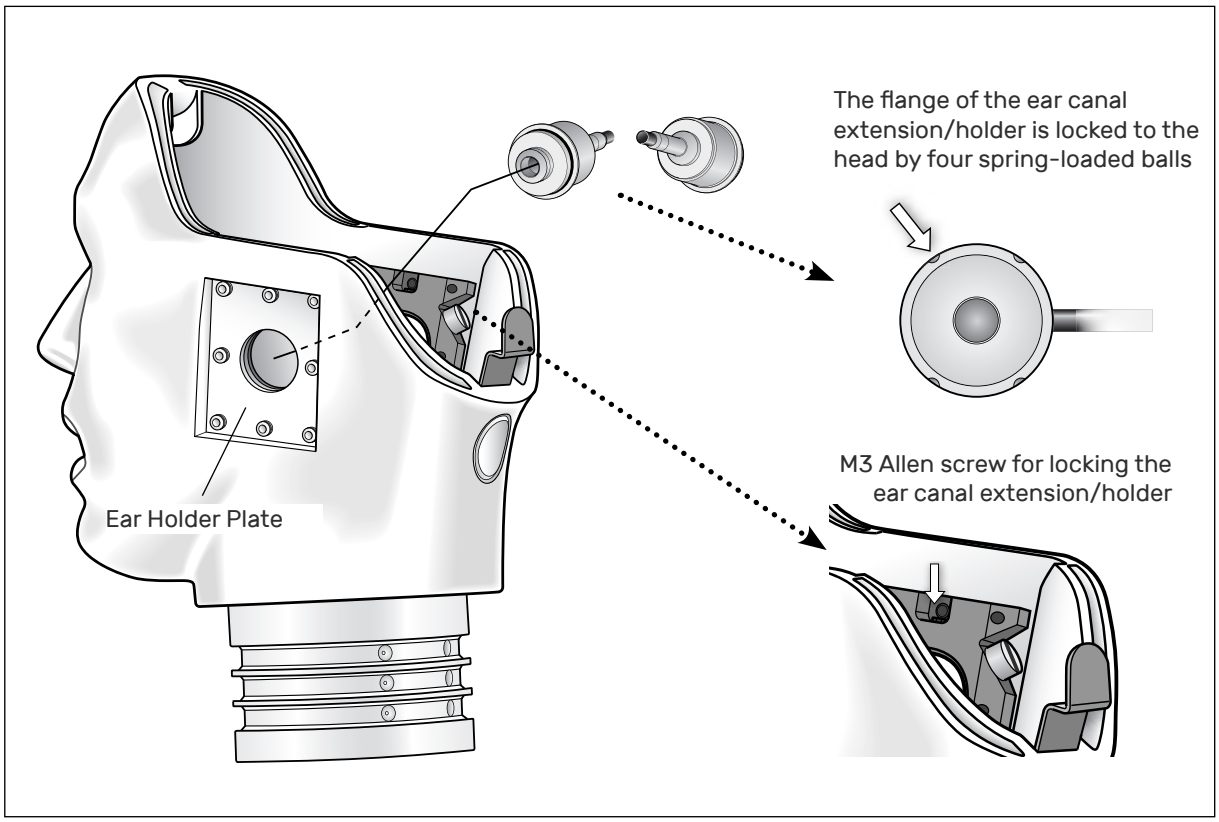


Fig. 36. *Mounting ear simulator or microphone/ear simulator holder in KEMAR.*

Removing and Mounting the Standard Pinna

The standard pinna are mounted as shown in Fig. 37. The standard KEMAR pinnae all have eight holes corresponding to the KEMAR's eight studs. A pinna is removed by gently prying and pulling it outwards. Do NOT pull at the ear lobe.

To mount the pinna:

1. Push the pinna in place.
2. Ensure that the eight holes seat properly on the eight studs.

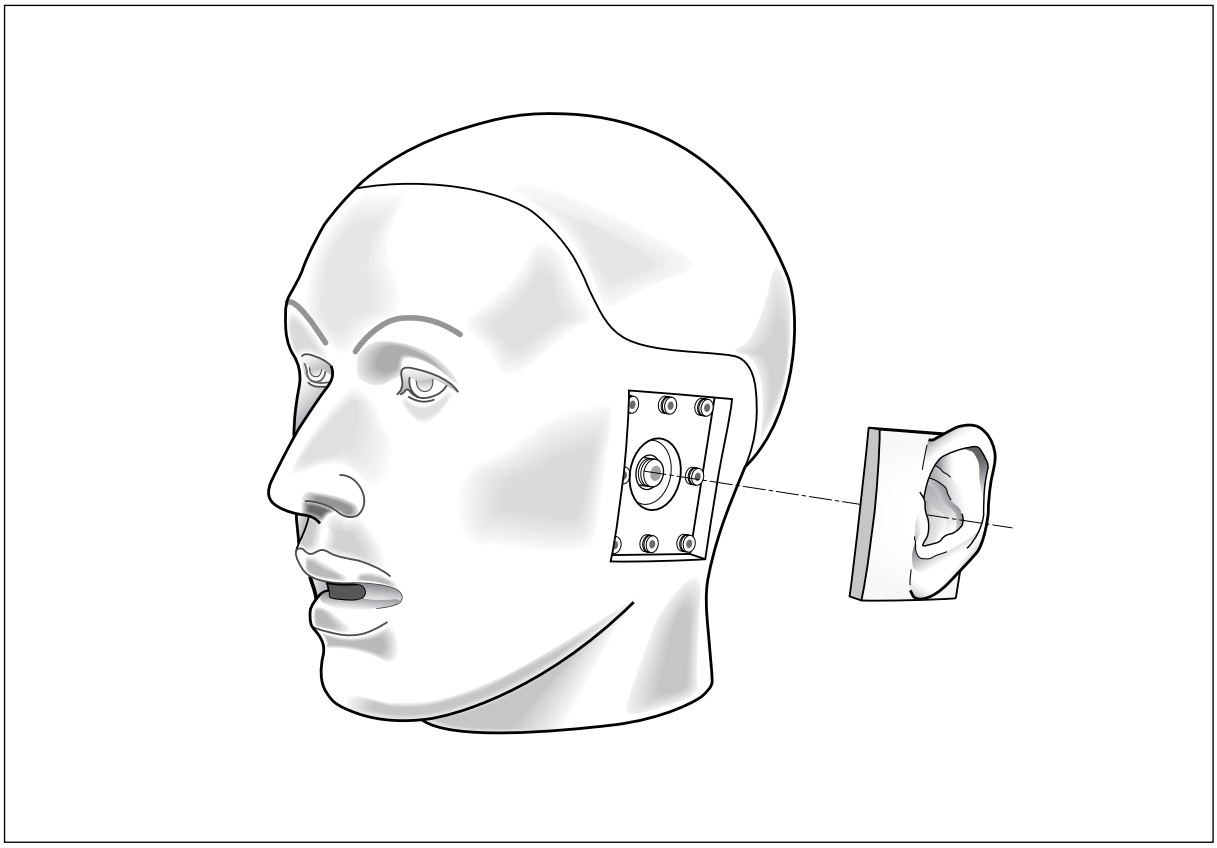


Fig. 37. *Mounting the standard pinna.*

Removing and Mounting the Anthropometric Pinna

As shown in Fig. 38, the anthropometric pinna is secured to the KEMAR head with two M3 finger screws from the inside of the head. These screws ensure that the pinna seals correctly against the KEMAR head and the artificial ear. They also ensure that the sealing is not affected by mounting and removal of the device under test. Before removing the pinna, these screws must be removed.

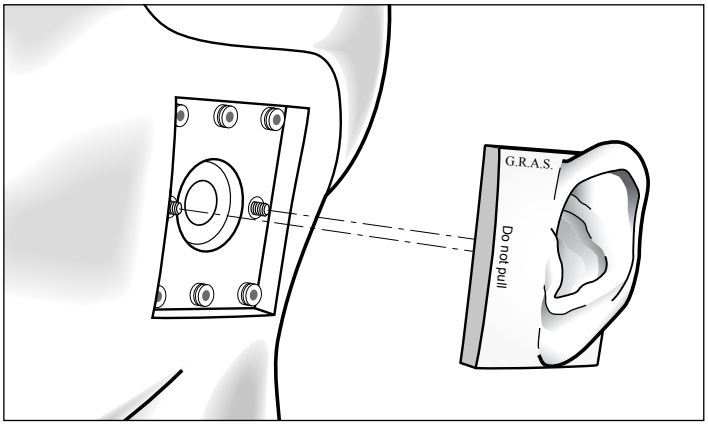


Fig. 38. *The mounting method for the anthropometric pinna.*

Removing the Pinna

1. Loosen the two finger screws shown in Fig. 38.
2. Gently pry the pinna loose at its outer edges. Do NOT pull at the ear lobe.

Mounting the Pinna

Mounting the pinna is done in the reverse order.

1. Mount the ear onto the studs, see Fig. 38.
2. While pressing the pinna against KEMAR's head, secure the two finger screws, see Fig. 40.

Do not use tools to tighten the screw, finger force is sufficient.

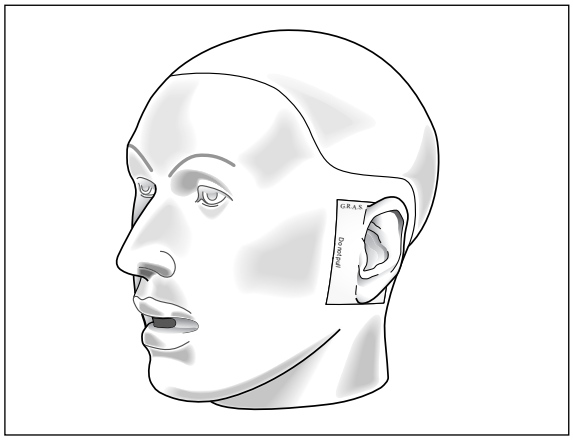


Fig. 39. *KEMAR with the new pinna.*

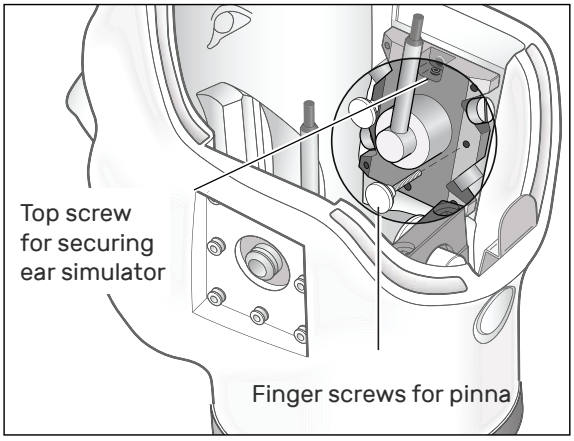


Fig. 40. *The finger screws securing the pinna.*

Locking the Head at an Angle

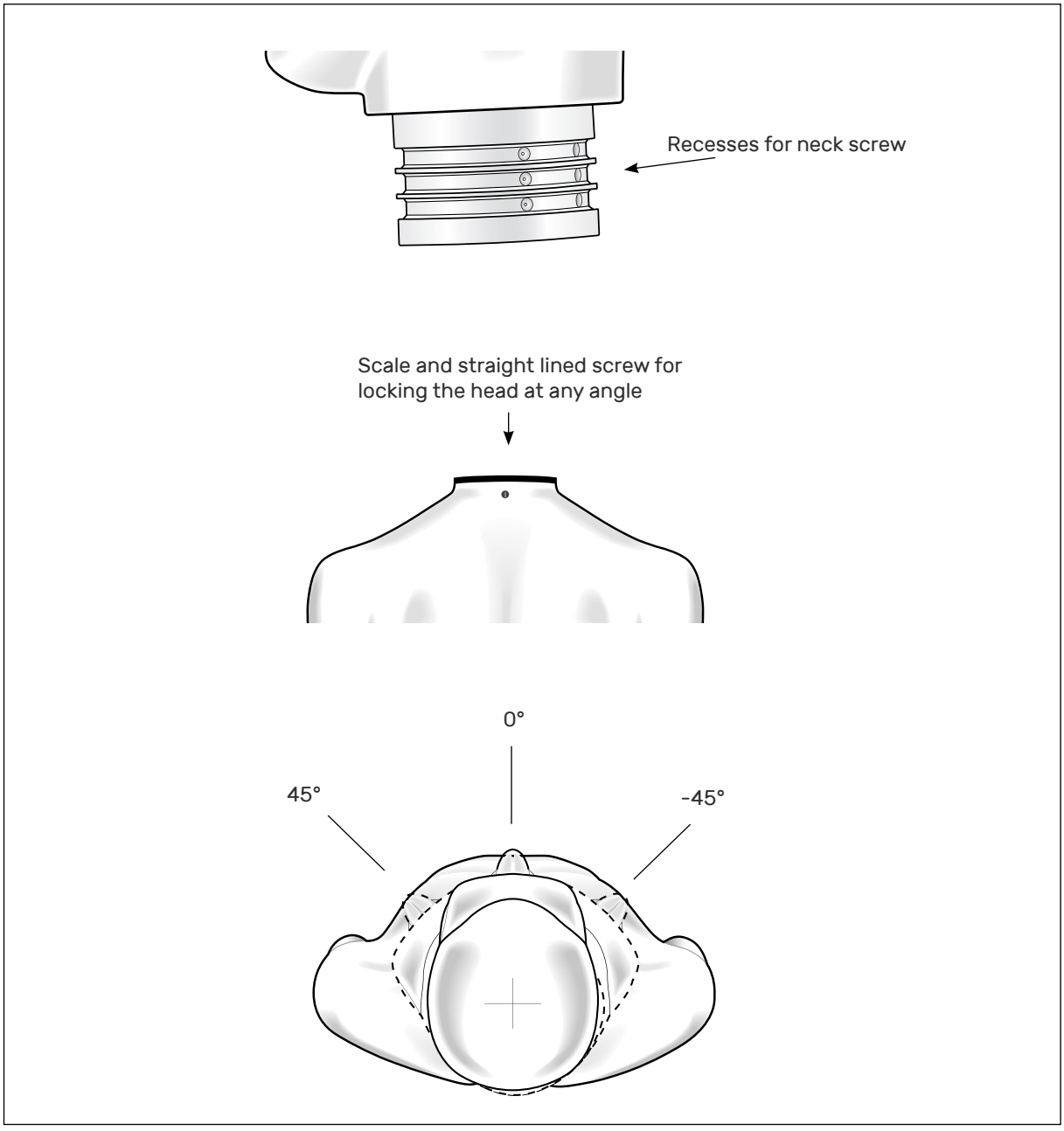


Fig. 41. *The head can be locked at any angle, with click locks at -45°,0° and 45°.*

Retrofitting KEMAR for Test of Binaural Hearing Aid

KEMAR Retrofit Kit for Test of Binaural Hearing Aid		Order number
KEMAR Retrofit Kit for Test of Binaural Hearing Aid		*RA0251*
Delivered items	Pcs	Part number
Plastic Ear Holder Plates	2	GR1676
Teflon Screw for Ear Holder Plate, M3 x 14	14	GR1677
Teflon Screw for Ear Holder Plate, M3 x 7	2	GR1678
Nylon Screw for securing the Ear Canal Extension, M3 x 6	2	SK2550
Straight plastic Earl Canal Extension Kit for KEMAR	2	RA0249
Tapered plastic Earl Canal Extension Kit for KEMAR	2	RA0250

Normally KEMAR is fitted with ear holder plates made of aluminium. For test of binaural hearing aids, KEMAR can be ordered with ear holder plates made of POM. See page 40 for more information. Retrofitting a KEMAR with plastic parts are described in Fig. 42 and Fig. 43. When fitted with these parts, KEMAR does not interfere with RF signals.

Removing the Aluminum Ear Holder Plates

To remove the aluminium Ear Holder Plates, use a 3 mm Allen key to remove the 8 steel screws holding each plate and pull them out.

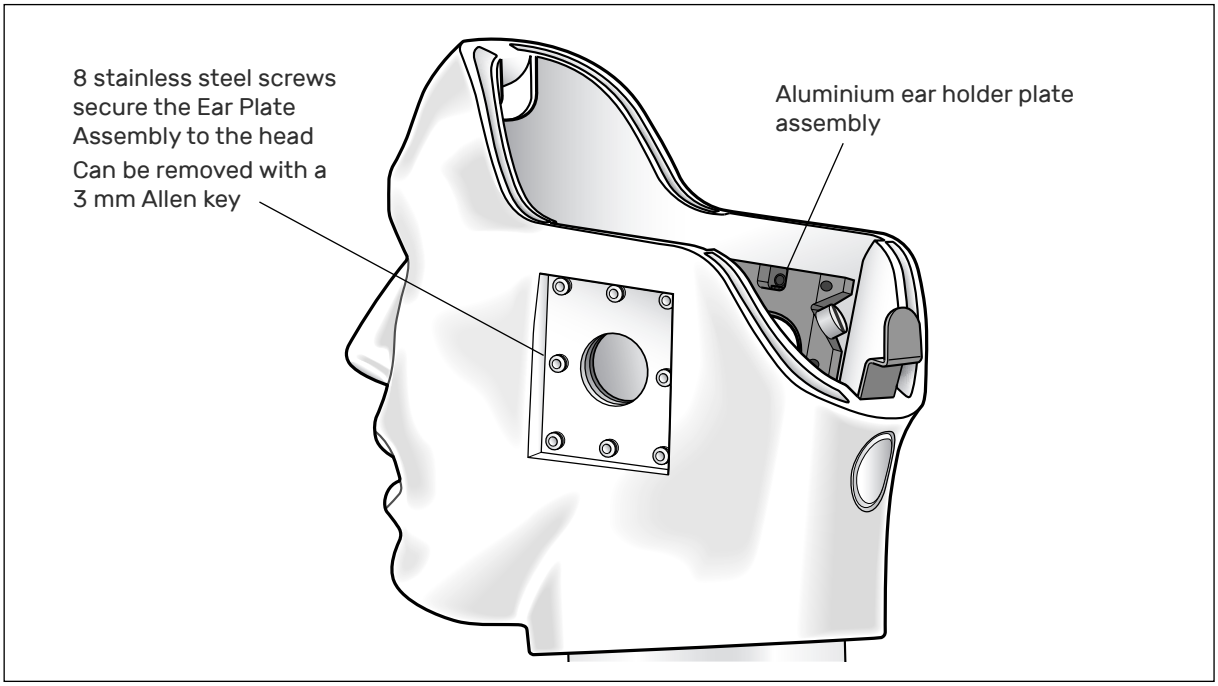


Fig. 42. *45BB KEMAR fitted with the standard aluminum ear holder plate assemblies.*

Mounting the Plastic Ear Holder Plates

The ear holder plates are secured by 8 screws.

Use a suitable screwdriver to fasten the 8 Teflon screws.

Note that one screw is shorter than the others. This one must be used in the upper middle position as shown in Fig. 43.

Important. Do not tighten the 8 Teflon screws too much.

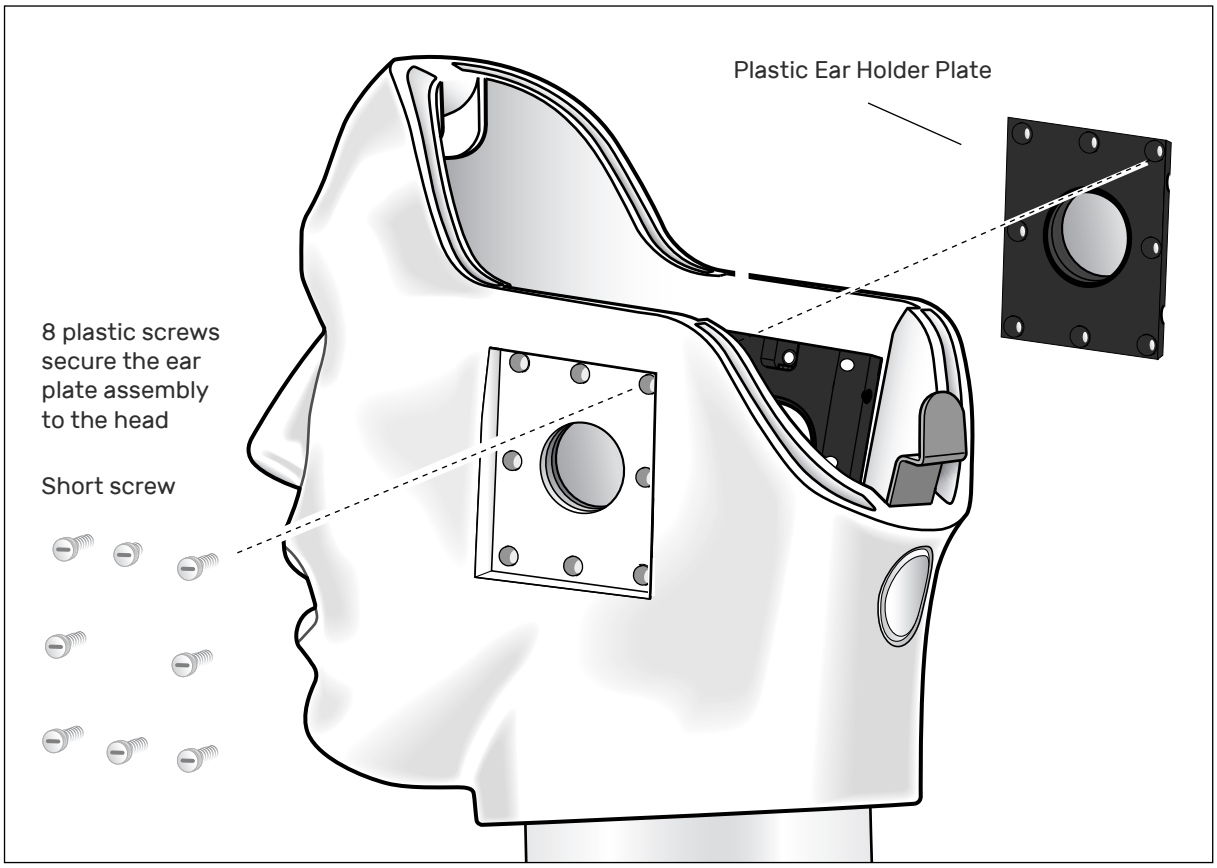


Fig. 43. *Fitting the KEMAR head with plastic ear plate assemblies.*

Retrofitting KEMAR with Anthropometric Pinna

KEMAR Retrofit Kit for Anthropometric Pinna		Order number
KEMAR Retrofit Kit for Anthropometric Pinna		*RA0311*
Delivered items	Pcs	Part number
Ear Simulator Holder for Anthropometric Pinna	1	GR1874
Finger Screws	2	SK6012
Allen key, 3 mm	1	YY0028
External Ear Canal*	1	GR0408
Union Nut*	1	GR0409

* External Ear Canal and Union Nut are needed for calibration of the ear simulator, see “Calibrating a KEMAR configured with Anthropometric Pinnae” on page 72.

The Anthropometric Pinna (right: KB5000 and left: KB5001) must be ordered separately.

A KEMAR head has 8 studs for mounting a standard pinna. However, the anthropometric pinna uses only six of these studs.

The two studs in the middle horizontal row must be removed to make room for two finger screws that hold the pinna from the inside.

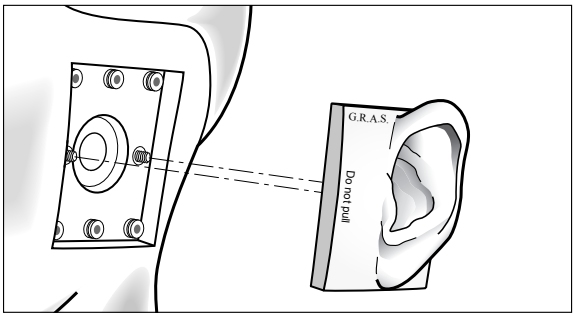


Fig. 44. *Studs and screws for the anthropometric pinna.*

Mounting the Anthropometric Pinna

1. Using the 3 mm Allen key, remove the two Allen stud screws.
2. Pull out the ear simulator.

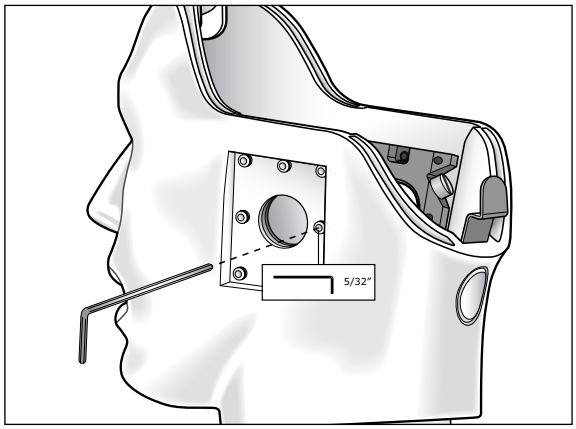


Fig. 45. *Removal of the two middle studs.*

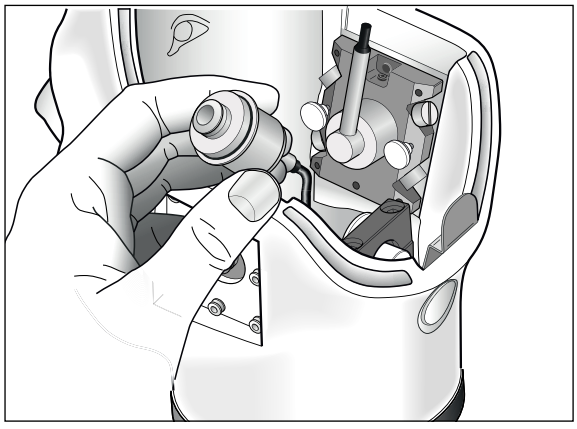


Fig. 46. *Ear Simulator with Ear Canal Extension.*

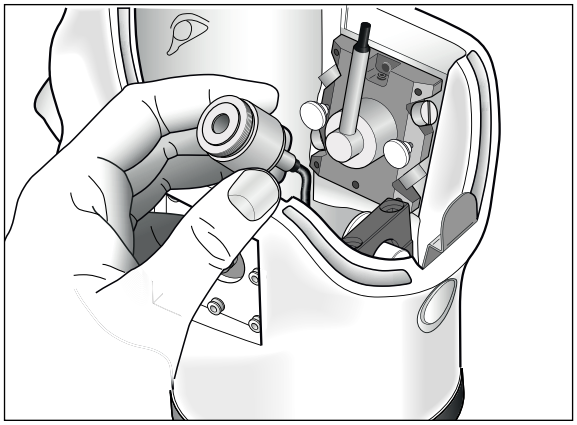


Fig. 47. *Ear Simulator without Ear Canal Extension.*

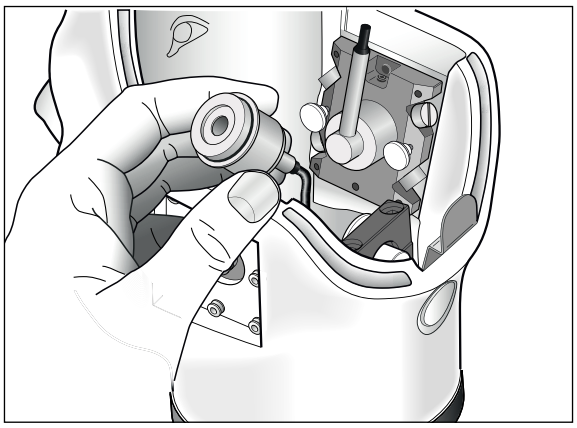


Fig. 48. *Ear Simulator with the new Ear Simulator Holder.*

3. Remove the Ear Canal Extension by unscrewing it counterclockwise. (Fig. 47)
4. Mount the Ear Simulator Holder onto the Ear Simulator by turning it clockwise. (Fig. 48)
5. Mount the Ear Simulator in the Ear Holder Plate by pushing it until secured by the snap-locking mechanism. (The snap-locking mechanism is explained in Fig. 34 on page 54). Tighten the top screw to prevent the ear simulator from popping out during the next steps. (Fig. 49)
6. Mount the anthropometric pinna by pushing it over the 6 studs. (Fig. 44).
7. Mount the two finger screws and tighten them, using only finger force. While tightening the finger screws, press the ear against KEMAR's head. (Fig. 49 and Fig. 50)

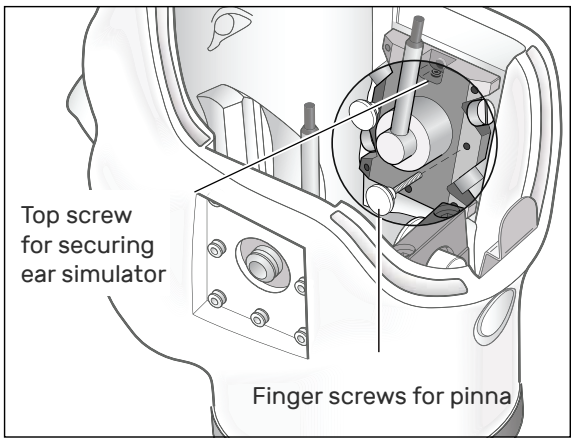


Fig. 49. *Screw for securing the ear simulator and the anthropometric ear.*

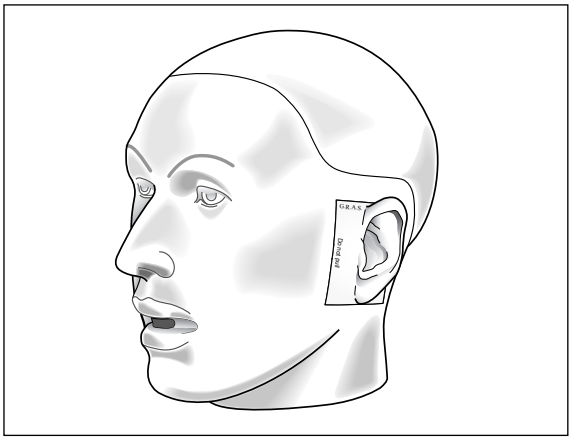


Fig. 50. *KEMAR with anthropometric pinna.*

Assembly for the Mouth Simulator [45BC ONLY]

One end of the BNC-BNC Cable AA0033 is connected to the mouth simulator's BNC socket as shown in Fig. 51, the other end is led through the neck opening and connected to the Aux socket located at the top of the torso. The connection to the top of the torso is shown in detail in Fig. 31.

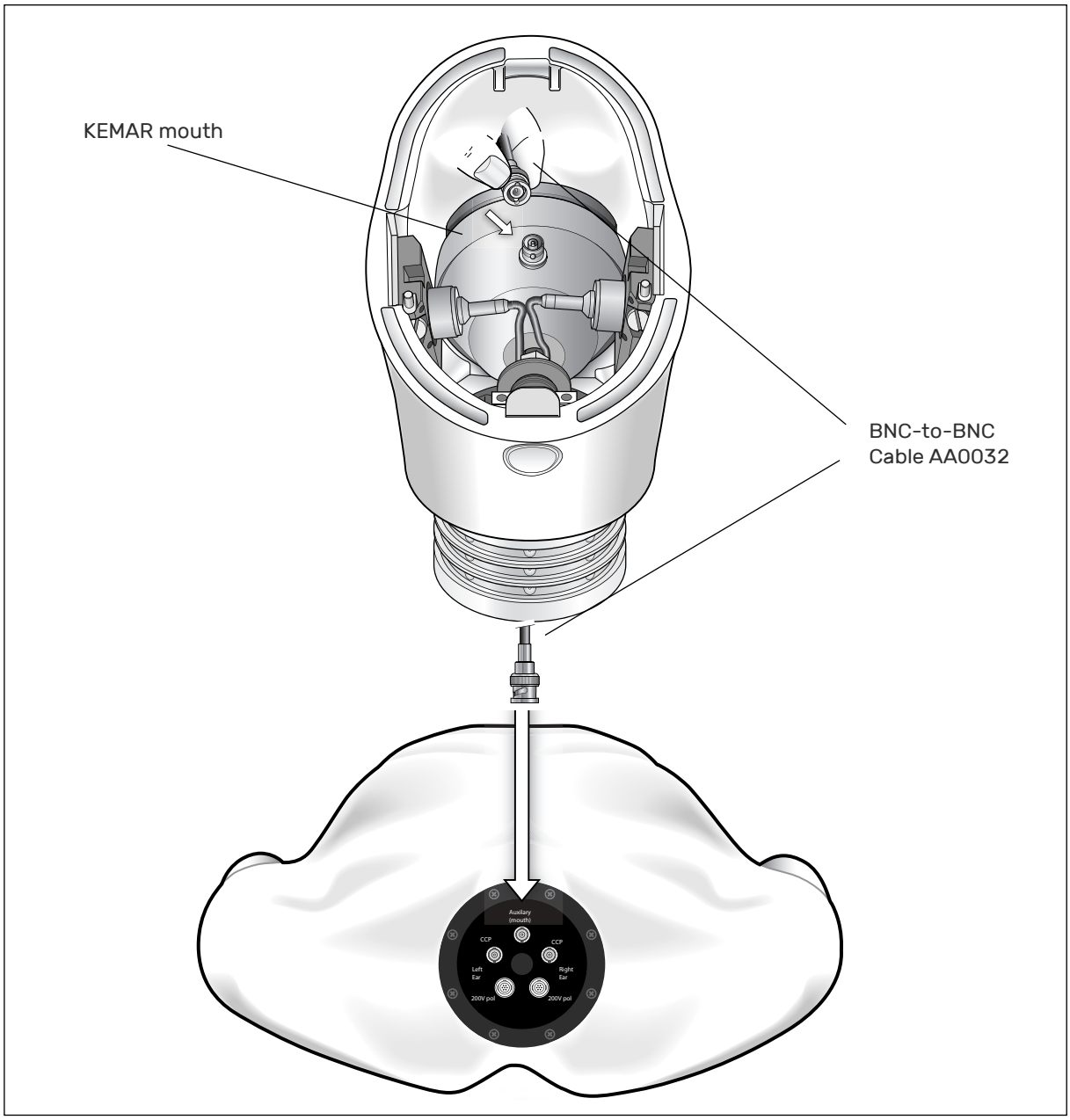


Fig. 51. *The 45BC KEMAR Manikin with mouth simulator (already mounted with preamplifier and Ear Simulator.*

Equalizing the Mouth Simulator [45BC ONLY]

To equalize the mouth simulator, you will need:

- The ¼" pressure microphone set delivered for this purpose with the pre-configured KEMAR. (LEMO: 46BP, CCP: 46BD).
- An analyzer that is capable of equalizing the mouth simulator signal.

The tube holds the microphone and preamplifier at 90° incidence to the mouth simulator.

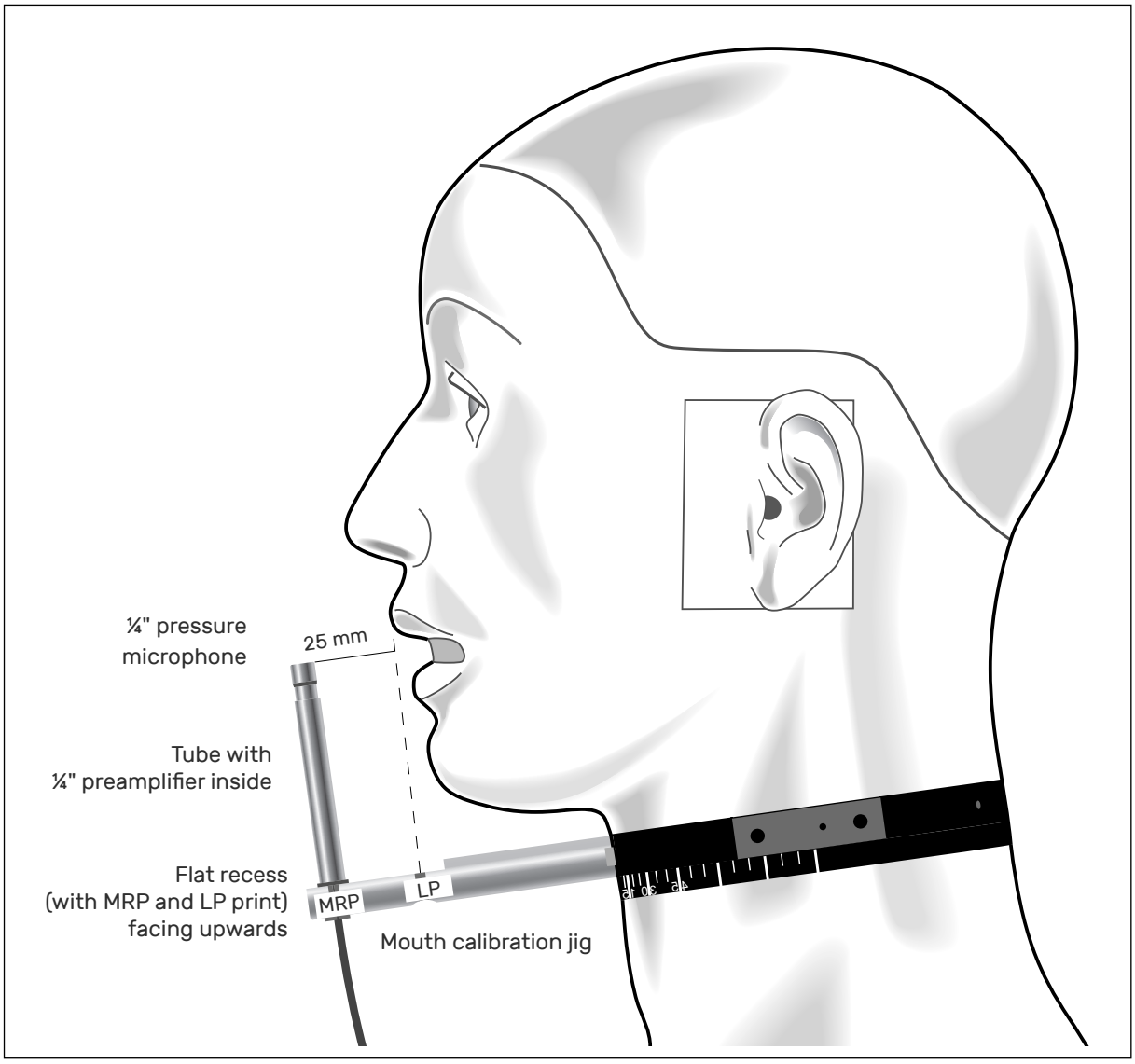


Fig. 52. *Setup for calibrating the mouth simulator according to ITU-T Rec. P.58.*

1. Using the 2 mm Allen key and the 2 x M3 screws (all supplied), mount the microphone holder onto the black collar ring (Fig. 53). The collar rings for extending the neck are not used.
2. Mount the assembly onto KEMAR.

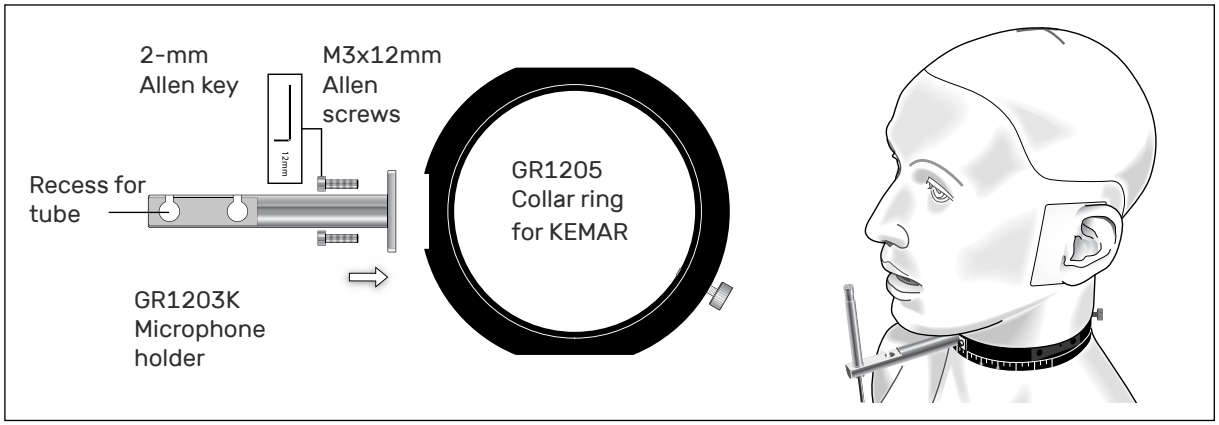


Fig. 53. *Calibration Jig with Collar Ring and Microphone Holder.*

Mounting the 46BP LEMO Microphone Set

The microphone set must be inserted from the bottom of the tube, and therefore the grid must be removed. See Fig. 54 (left part). Proceed as follows:

1. Remove the grid,
2. Insert the microphone set into the tube.
3. Push it through the tube until the preamplifier's thread for the grid is accessible from above.
4. Screw the grid onto the microphone now inside the tube. You can use the recess in the tube to fixate the preamplifier while mounting the microphone grid.
5. The grid's diameter is slightly larger than that of the tube and ensures that the microphone set is correctly positioned in the tube.
6. Place the tube into the microphone holder's recess. (See Fig. 54).

Mounting the 46BD CCP Microphone Set

A CCP microphone set can be inserted into the tube from the top of the tube and therefore there is no need to remove the grid. See Fig. 54 (right part). Proceed as follows:

1. Disconnect the cable from the preamplifier.
2. Slide the cable up through the tube.
3. Connect the cable to the preamplifier.

4. Slide down the microphone set into the tube until the grid rests on the tube. The grid's diameter is slightly larger than that of the tube and ensures that the microphone set is correctly positioned in the tube.
5. Place the tube into the microphone holder's recess. (See Fig. 54).

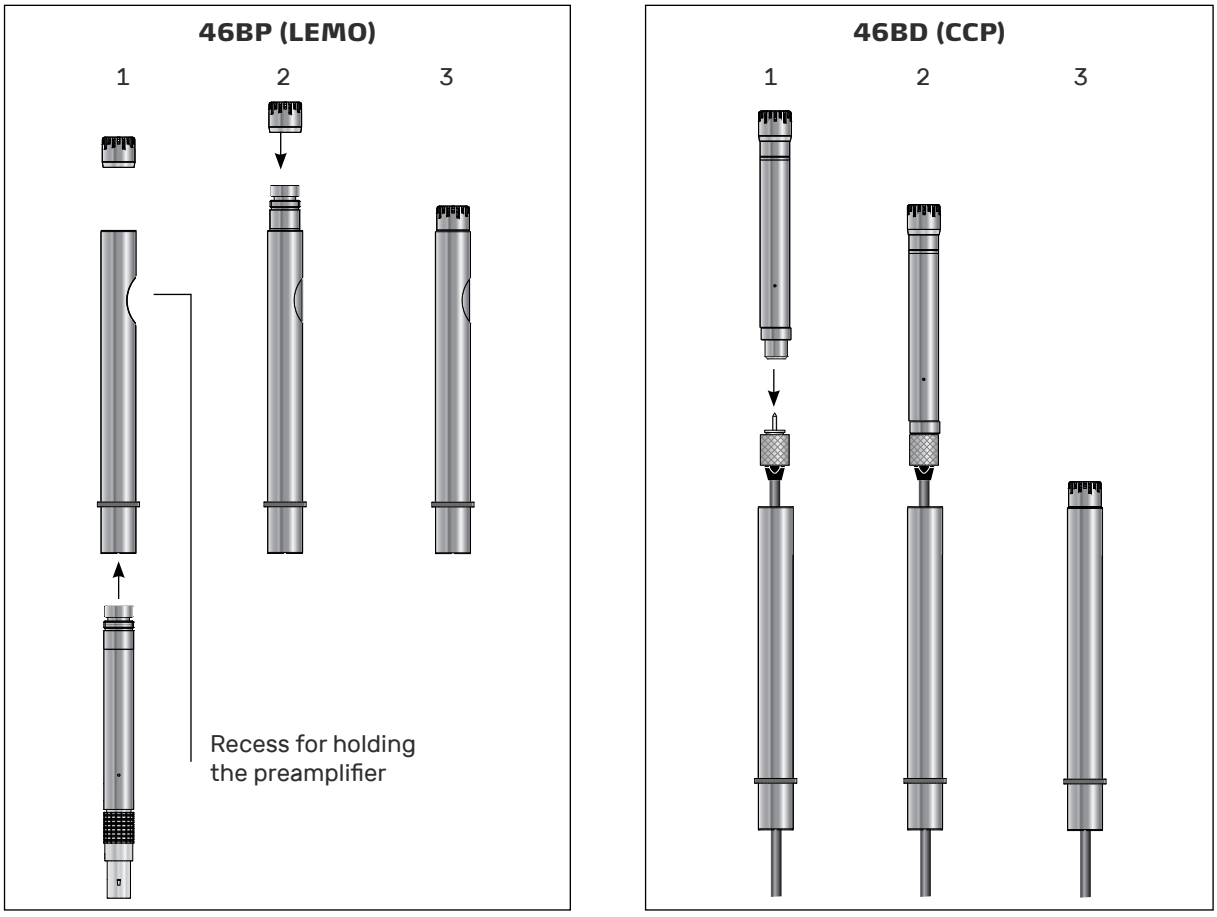


Fig. 54. *Mounting the 46BP (LEMO) and the 46BD (CCP) microphone set for mouth equalization.*

When equalized, the mouth will typically perform as shown in Fig. 15 on page 16.

Cleaning

Clean the head, torso, and collar rings using a soft cloth, a drop of washing-up liquid, and lukewarm water.

Calibration

Correction Factors

The correction factors for the various calibration options are listed below. The correction factors are needed because the different calibration options introduce varying effective volumes.

The correction factors have nothing to do with the different pinna used.

KEMAR with Standard Ear Simulator (RA0045-series and RA040X-series)		
In-situ calibration, without dismantling		
	Accessories	Correction factor
42AP and 42AA	GR0917, GR0924, RA0237, RA0238	-0.62 dB
Calibration done outside the head after clicking out the ear simulator		
42AP and 42AA	GR0408	-1.03 dB
42AG @250 Hz, 114 dB	GR0408	-0.09 dB
42AG @250 Hz, 94 dB	GR0408	-0.09 dB
42AG @1KHz, 114 dB	GR0408	-0.2 dB*
42AG @1KHz, 94 dB	GR0408	-0.2 dB*
KEMAR with Low-Noise Ear Simulator 43BB-1		
42AP and 42AA	RA0090, GR0408	-0.7 dB
42AG @250 Hz, 94 dB	GR0408	-0.09 dB
42AG @1KHz, 94 dB*	GR0408	-0.2 dB*

* Se the following section **Calibration at 1 kHz**.

Calibration at 1 kHz

At 1 kHz, the frequency response changes from unit to unit. The actual value for the specific ear simulator is stated on the calibration chart and must be added to the correction.

For example:
If the response of the specific ear simulator at 1 kHz is + 1.45 dB (re 500 Hz), the final correction value will be -0.2 + 1.45 = 1.25 dB.

GRAS recommends calibrating at 250 Hz whenever possible.

In-Situ Calibration, without Dismantling

Calibration of a KEMAR Configured with the 60318-4 Artificial Ear

To calibrate the ear simulator, you will need the following (available from GRAS):

- A pistonphone with a ½" coupler, e.g. GRAS 42AP Intelligent Pistonphone (recommended) or GRAS 42AA Pistonphone.
- An adapter (RA0157) for use with the pistonphone (required for setups based on the RA0045 Ear Simulator according to IEC 60318-4 – see Fig. 55.

It is assumed that the components in each setup are connected to suitable external equipment (e.g. an audio analyzer).

For information about operating the pistonphones, refer to their instruction manuals. Due to size constraints, a sound calibrator cannot be used for in-situ calibration. Use the ear simulator with the RA0237 or the RA0238 Ear Canal Extension. Note: Ear-mould simulator must be absent.

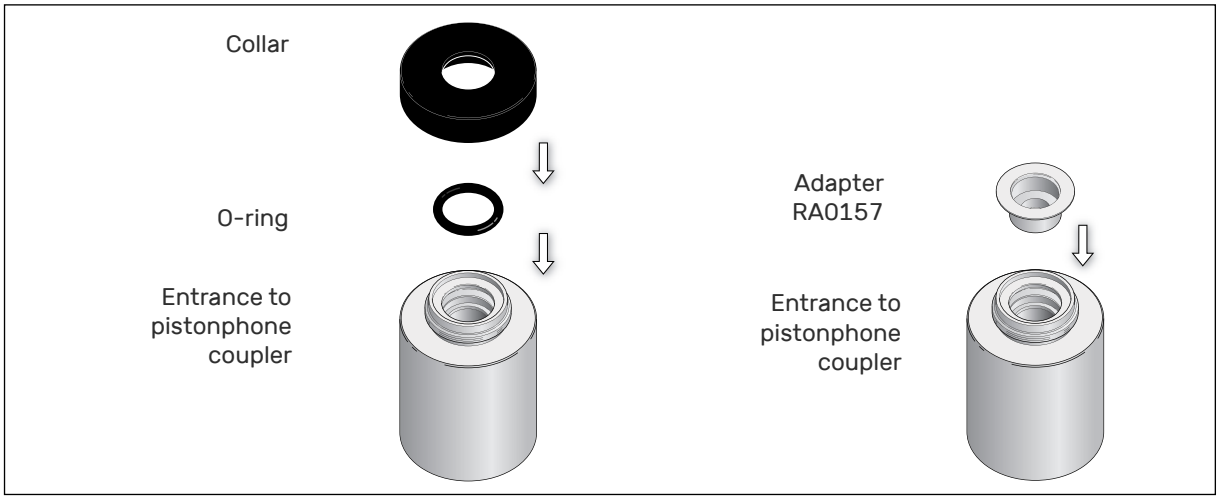


Fig. 55. *Fitting the Adapter RA0157 to the pistonphone.*

You will be calibrating the ear simulator and its holder as a whole with a pistonphone fitted with a ½" coupler and the RA0157 Adapter. This, in effect, increases the coupler volume such that the signal from the pistonphone will be reduced by **0.62 dB**.

1. Remove the pistonphone collar, and remove the O-ring (Fig. 55, left).
2. Push the Adapter RA0157 all the way into the coupler entrance (Fig. 55, right).
3. Remove the KEMAR Pinna to expose the entrance to the ear canal extension.
4. Place the pistonphone over the entrance to the ear-canal extension (Fig. 56), push it gently down to the stop, hold it there, and switch it on.

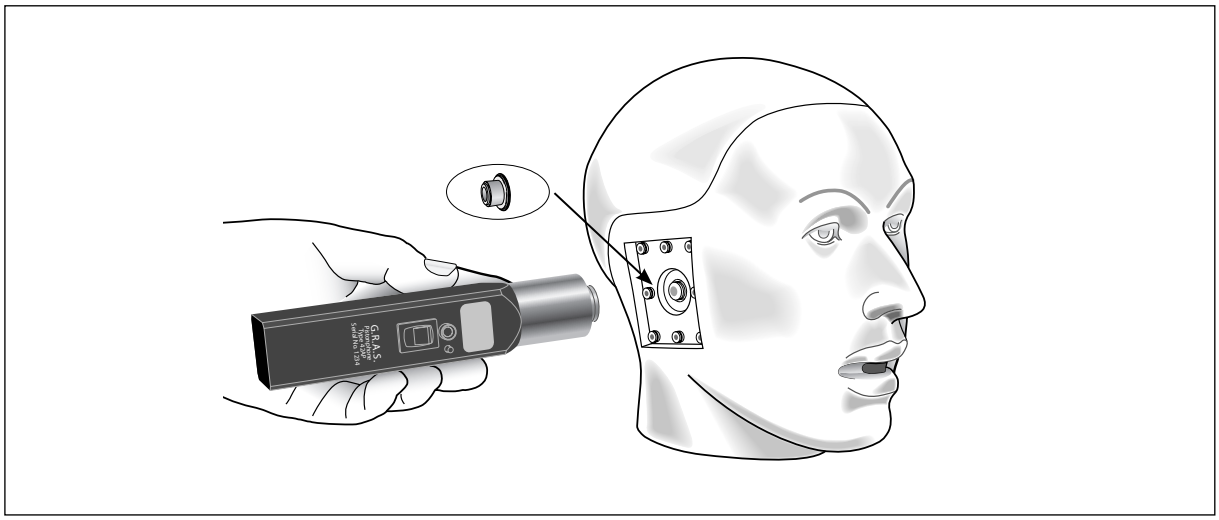


Fig. 56. *In-situ calibration of ear simulator. The low-noise ear simulator cannot be calibrated in-situ.*

5. Set the analyzer to either wide band or to the 1/3-octave band (center frequency: 250 Hz).
6. When conditions are stable, adjust the analyzer so that it correctly gauges the pistonphone signal (nominally 114.00 – 0.62 = 113.38 dB).

Important. Refer to the pistonphone manual for making barometric corrections.

Calibration Done Outside the Head, after Clicking out the Ear Simulators

Calibrating a KEMAR Configured with a Low-noise Ear Simulator

For calibrating the low-noise ear simulator, the 42AG Multifunction Calibrator must be used because it calibrates at 94 dB, a level that will not overload the ear simulator.

Because of size constraints, the ear simulator must be removed from the KEMAR head for calibration.

1. Connect the 26HT via its LEMO plug to the LEMO input socket of the 12HF.
2. Connect the BNC output of the 12HF to the analyzer and switch both power module and analyzer on.
3. Push fit the 1/2" coupler onto the 1" coupler of the 42AG. The 1/2" is a spare part delivered with the 42AG.
4. Set the 42AG to 250Hz, 94 dB.
5. Mount the RA0234 Low-noise Ear Simulator, including GR0408 External Ear Canal as shown in Fig. 57 below, and switch on the pistonphone.

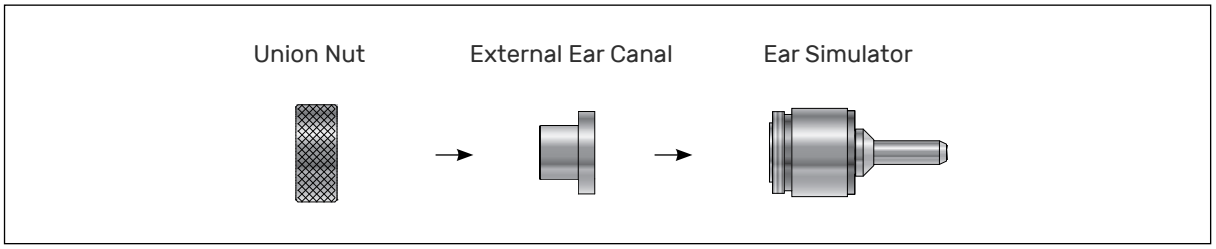


Fig. 57. *Mounting the GR0408 External Ear Canal on the ear simulator.*

6. Adjust the analyzer to indicate 94 dB re. 20 µPa. Adjust this value by a further **–0.09 dB** to account for the additional ear simulator volume.

Refer to your calibrator's manual for further information.

Calibrating a KEMAR Configured for Sound Quality Recording

Calibration of the 1/2" microphones of a KEMAR configured for Sound Quality Recording (45BB-3 and 45BB-4) cannot be done in-situ. Therefore, you must remove the microphone assemblies (holder + microphone sets) from the ear holder plates. There is no need for further disassembly, you need not remove the microphone from the microphone holder.

1. Remove KEMAR's top as shown in Fig. 32 on page 52.
2. Push on the microphone holder (RA0241) from the outside until it is released from the snap fit, see "Removing and Mounting Transducers" on page 54.

Now that the microphone set - still mounted on the microphone holder - is no longer fixed to KEMAR's ear holder plate, it is possible to calibrate the 1/2" microphone using a pistonphone fitted with coupler, O-ring and collar (shown in the left part of Fig. 55 on page 69) for 1/2" microphone calibration. Refer to the manual for your pistonphone for further instructions.

Calibrating a KEMAR configured with Anthropometric Pinnae

When KEMAR is configured with the anthropometric pinnae, in situ calibration is not possible, therefore the ear simulator must to be removed from the KEMAR head, see Fig. 34 and Fig. 48.

Also, the holder must be dismounted, and replaced by GR0408 External Ear Canal secured with the GR0409 Union Nut as shown in Fig. 58.

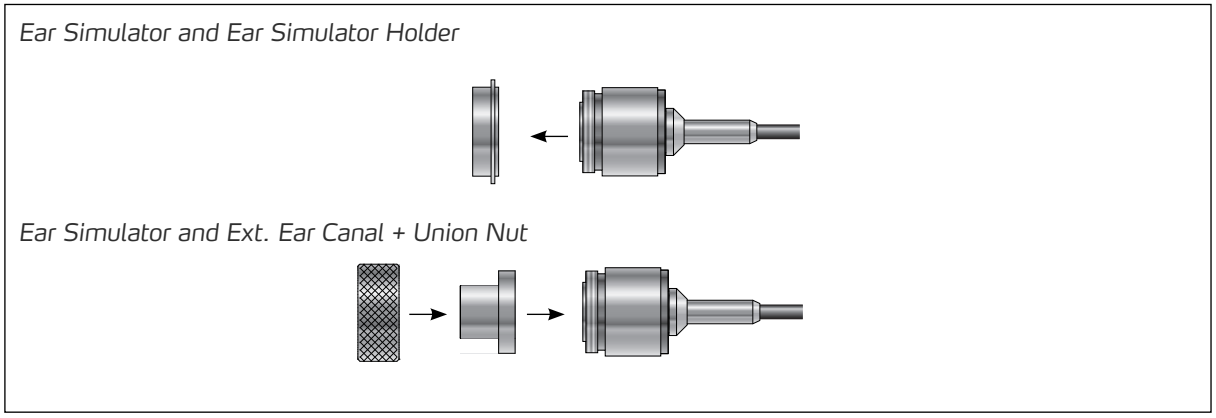


Fig. 58. *For calibration, the ear simulator holder must be substituted for the external ear canal.*

The pistonphone should be used without its collar.

The correction factor is 1.03 dB.

Refer to the manual for your pistonphone for further instructions.

Technical Specifications

Head-related Transfer Function Measurements

The following pages feature Head-related Transfer Function (HRTF) measurements in 0° azimuth, performed with a sound source at a distance of 1.4 m from the KEMAR.

Effects of Pinna (Concha) Size and Shore Hardness

Fig. 59 show the results for four different pinnae measured against the IEC 60959 limits.

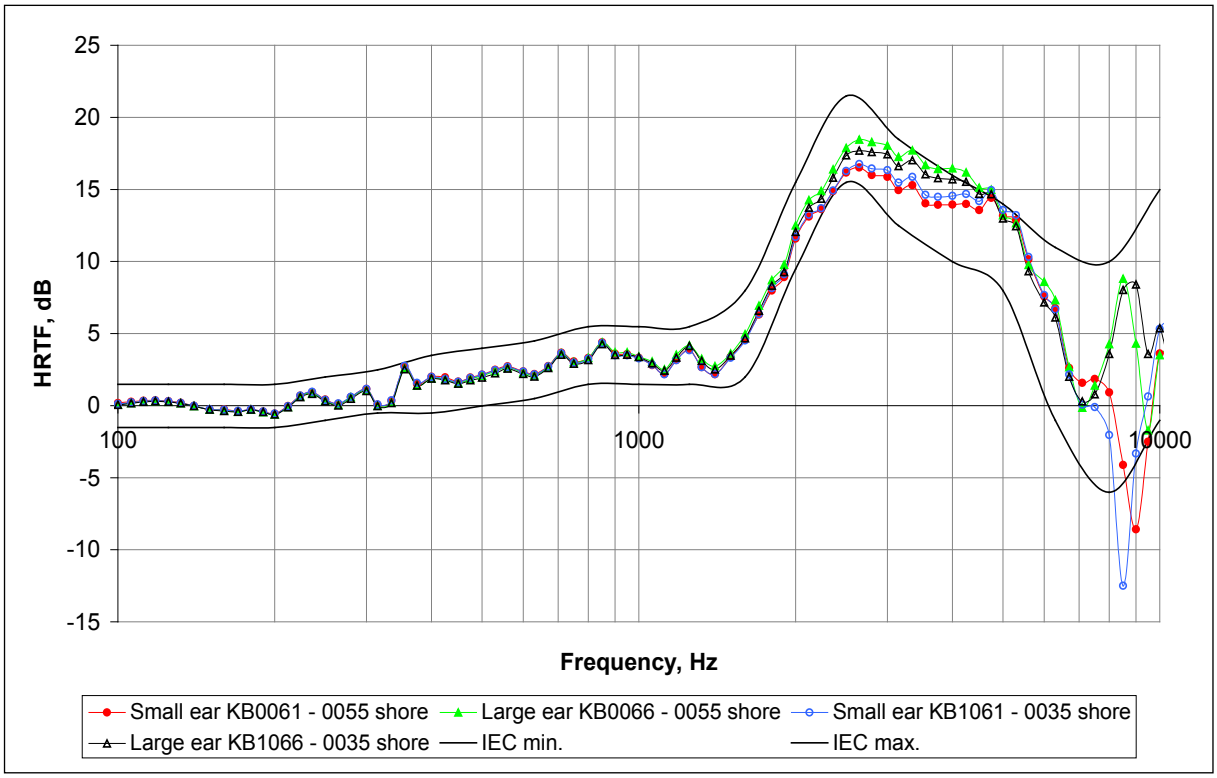


Fig. 59. *Sound pressure level measured in the frequency range 100 Hz - 10 kHz for four different types of pinnae (soft/hard - large/small). The characteristics are displayed against the interpolated limits defined by IEC 60959.*

360° HRTF Measurements on Large Left Pinna 55 Shore 00 KB0066

Fig. 60 shows 360° measurements on a large 55 Shore 00 pinna at seven frequencies from 250 Hz to 20 kHz.

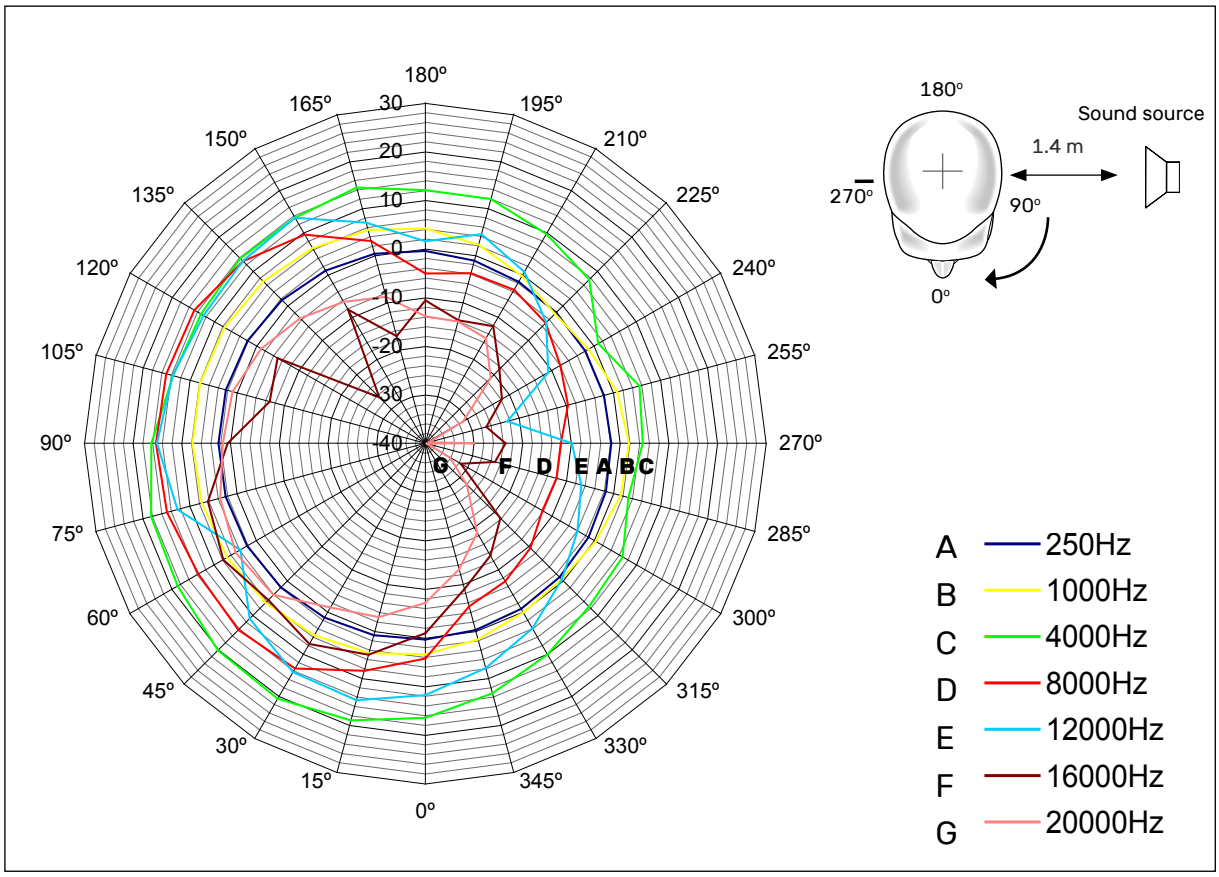


Fig. 60. *360° measurement of sound pressure level at seven frequencies. The curves are normalized to the level at 90° (left pinna pointing directly towards the sound source).*

Effects of Clothing and Hair

A small pinna KB0060 55 Shore 00 hardness against a range of manikin attire.

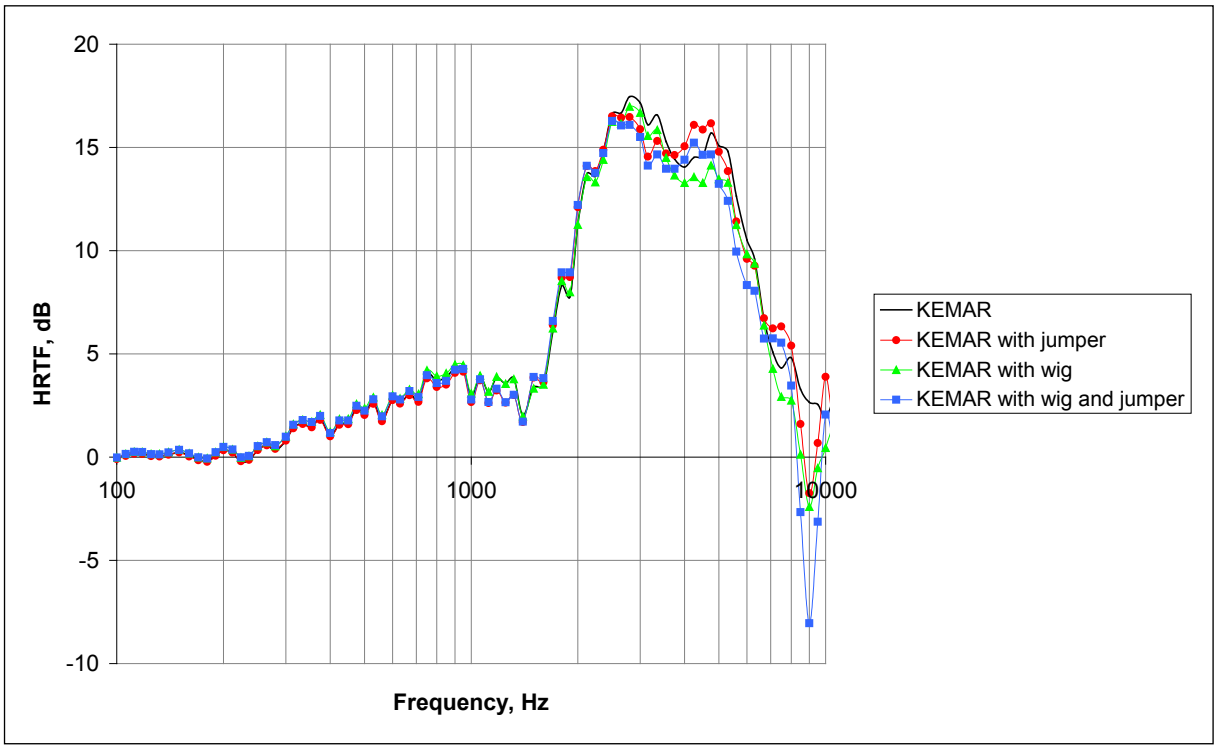


Fig. 61. *Sound pressure level measured in the frequency range 100 Hz - 10 kHz for four different combinations of manikin attire.*

Effects of Neck Length

A small pinna KB0060 55 Shore 00 hardness against a varying neck length (0, 1, and 2 collar rings).

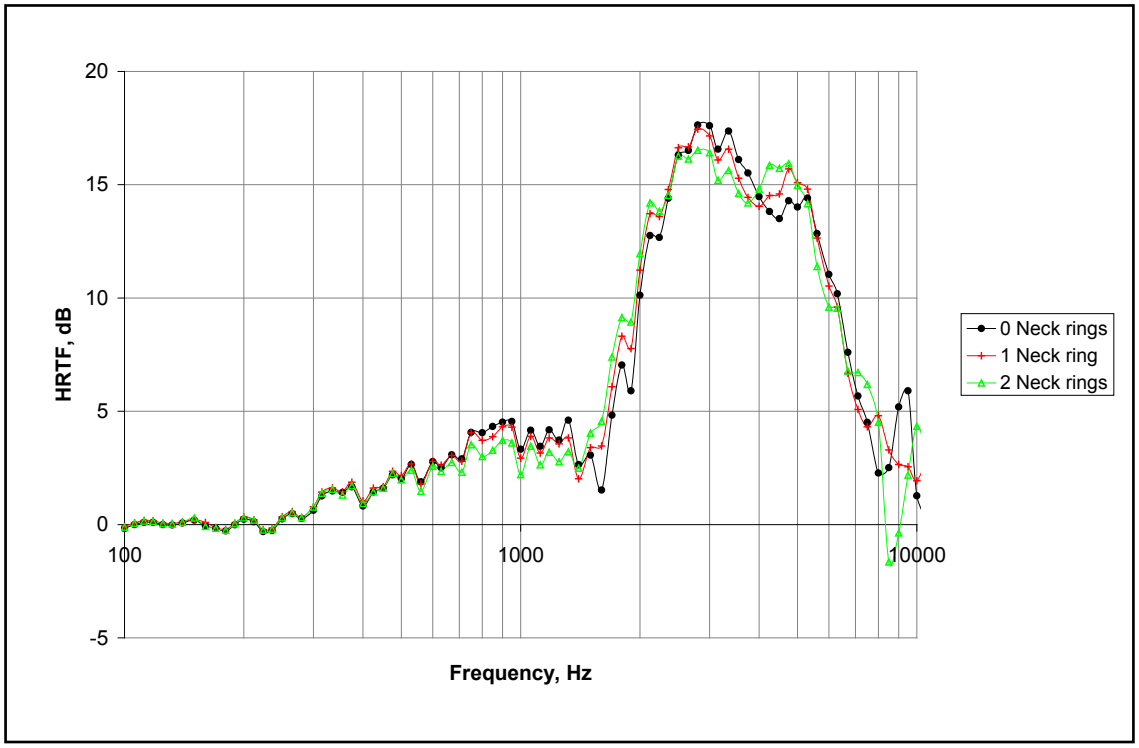


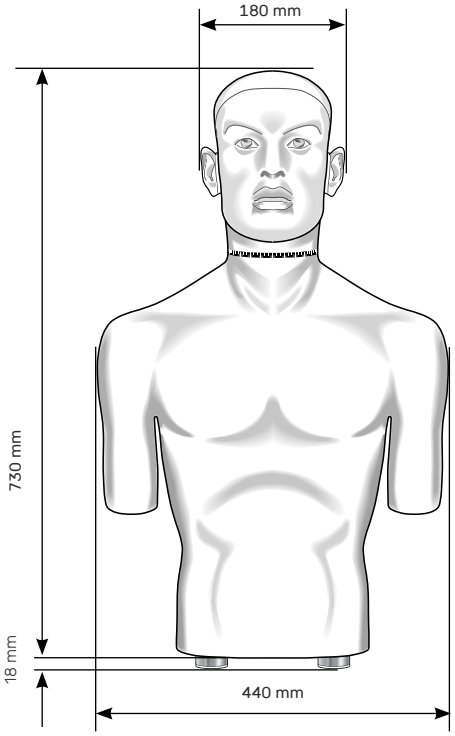
Fig. 62. *Sound pressure level measured in the frequency range 100 Hz - 10 kHz for three different neck lengths.*

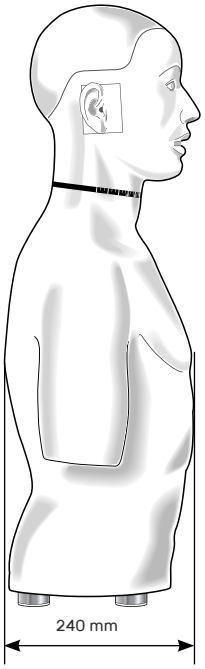
Standards, Dimensions and other Specifications

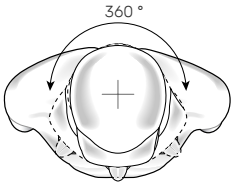
Standards	
ANSI S3.36/ASA58-2012	Specification for a Manikin for Simulated in situ Airborne Acoustic Measurements
ANSI S3.25/ASA-2009	American National Standard for an Occluded Ear Simulator
IEC 60318-7:2011	Head and Torso Simulator for the Measurement of Hearing Aids
IEC 60318-4	Ear Simulator, Occluded-ear simulator for the measurement of earphones coupled to the ear by means of ear inserts
ITU-T Rec. P.57	Type 3.3 Artificial Ears

Weight and Dimensions	
Weight	11.45 kg

KEMAR Dimensions







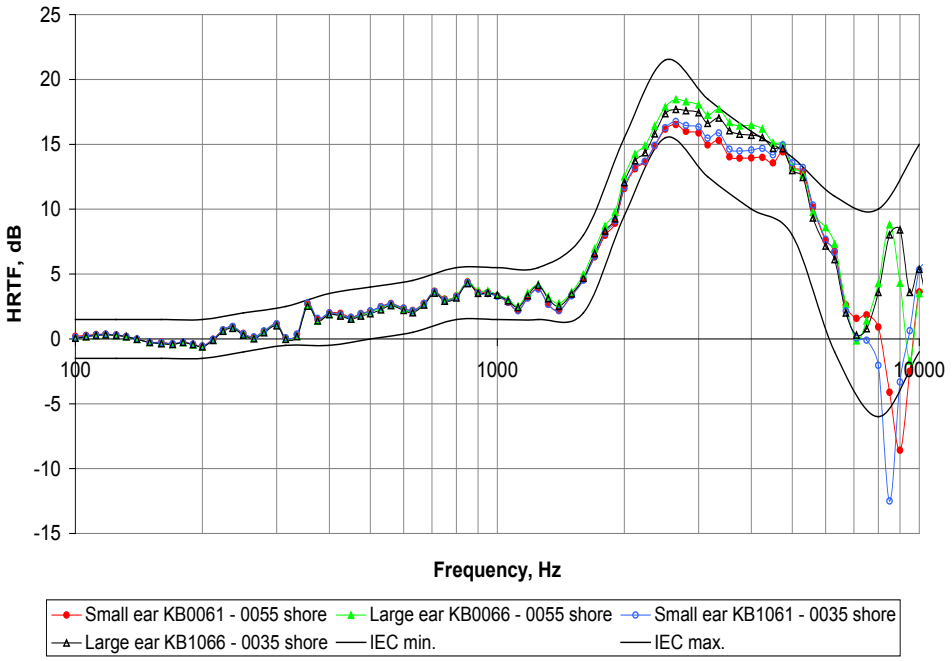
AL0026 Loudspeaker Stand
(optional)

Adjustable height 92-137cm
Weight 3.2 kg

KEMAR Base	
Bottom plate for tripod	Factory mounted bottom plate with 3/8" UNC-16 standard thread.
Bottom plate for loudspeaker stand	GR1602 Bottom plate with 35 mm hole for Loudspeaker Stand AL0026
Feet	4 feet, removable

KEMAR External Connectors	
2 × 7-pin LEMO	For externally polarized microphones
3 × BNC	2 for prepolarized microphones (CCP), 1 for signal to mouth simulator
DC-socket	For mouth simulator amplifier, 24 V DC, max 1A

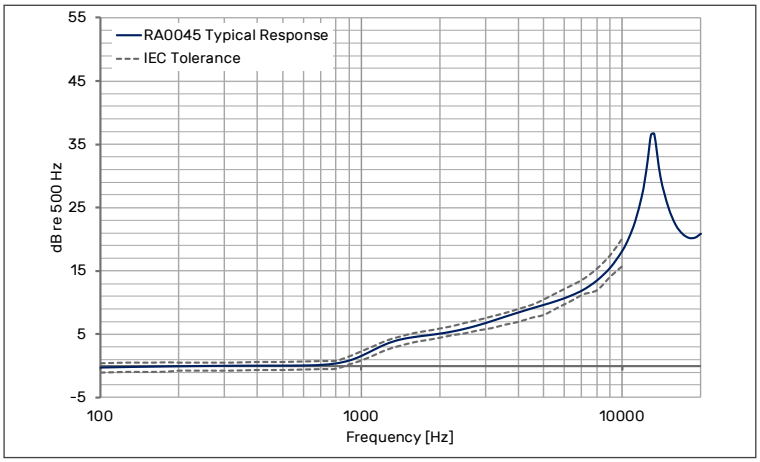
Head Related Transfer Function	
Standard IEC 60318-7:2011	*Head and Torso Simulator for the Measurement of Hearing Aids*

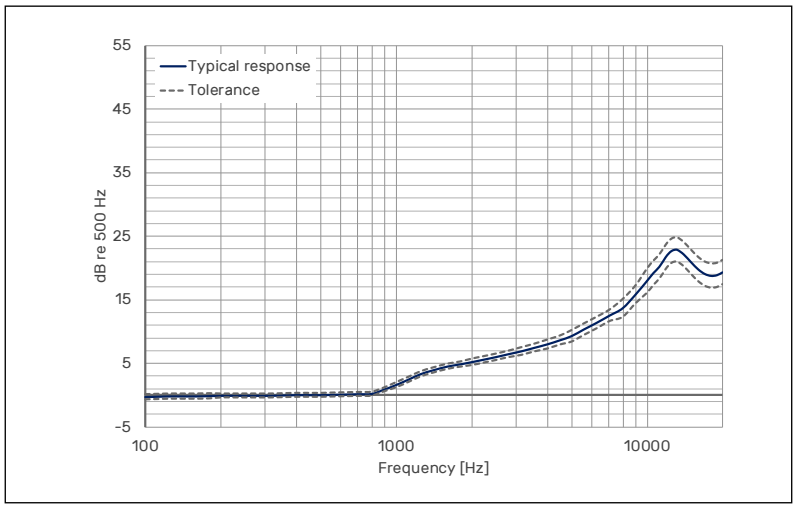


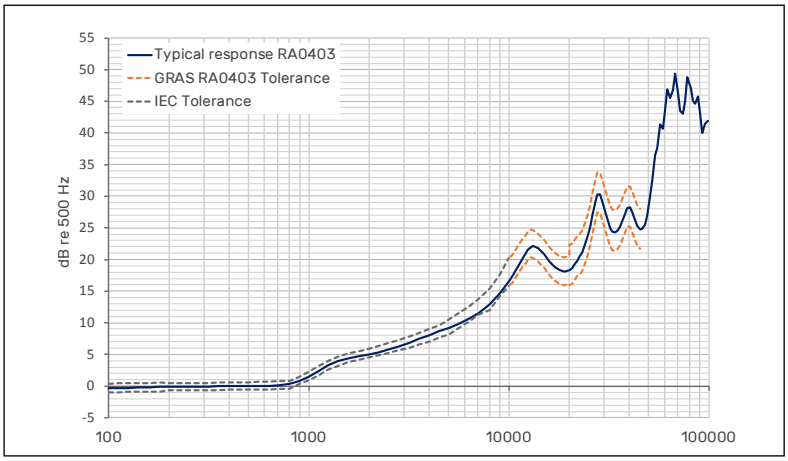
Head-related Transfer Function (HRTF) measurements for four different types of pinnae (soft/hard - large/small). in 0º azimuth, performed with a sound source at a distance of 1.4 m from the KEMAR.

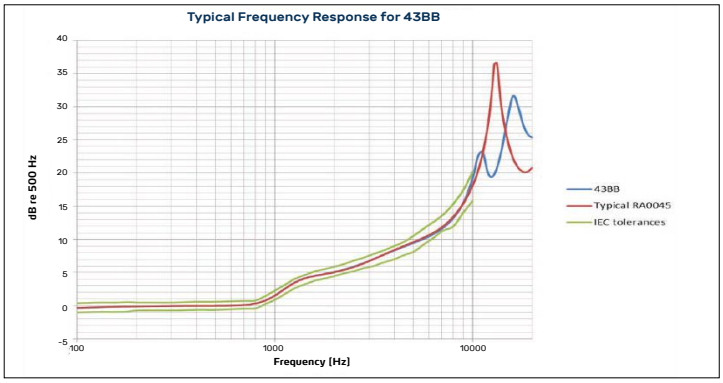
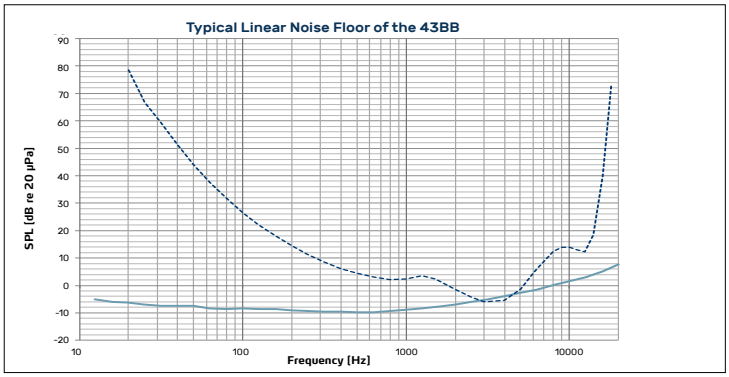
KEMAR Standardized Pinnae	
Standard	
IEC 60318-7: 2011	Head and Torso Simulator for the Measurement of Hearing Aids

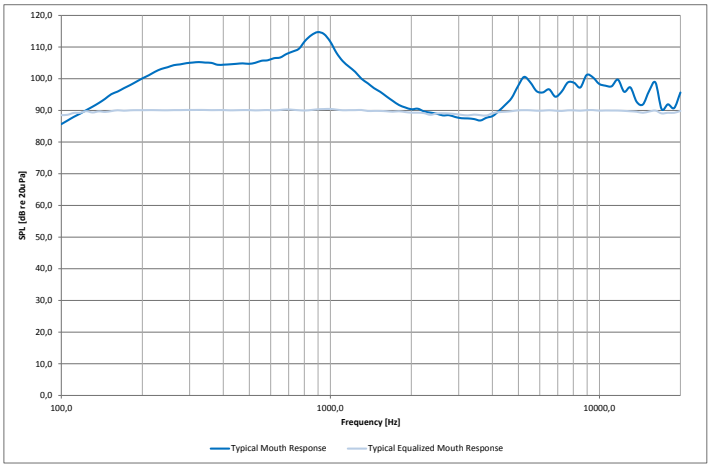
Ear Canal Extensions	
RA0237, RA0249	Straight Ear Canal Extension, Ø 7.5 mm, 7.9 mm long
RA0238, RA0250	Tapered Ear Canal Extension, Ø 9.85 mm, tapering down to Ø 7.5 mm, 7.4 mm long
RA0239	Straight, rubber lined Ear Canal Extension, Ø 7.5 mm, 14 mm long

RA0045 Ear Simulator	
Standards	
IEC 60318-4	Occluded-ear simulators for the measurement of earphones coupled to the ear by ear inserts
ITU-T Recommendation P.57	Series P: Telephone transmission quality, Objective measuring apparatus: Artificial ears
ANSI S3.25/ASA-2009	American National Standard For an Occluded Ear Simulator
Frequency Response	
Typical transfer impedance re 500 Hz	
Resonance frequency	13.5 kHz ± 1 kHz
Sensitivity	
Sensitivity	12.5 mV/Pa
Dynamic Range	
RA0045（LEMO）	25 dBA to 163 dB
RA0045-S1（CCP）	25 dBA to 150 dB
Effective Volume	
at 500 Hz	1260 mm^3
Dimensions	
Height	23.0 mm
Diameter	23.75 mm
Environmental Calibration Conditions	
Temperature	23 °C ±3 °C
Relative humidity	60 % ±20 %
Barometric pressure	101.3 kPa ±3 kPa

RA0401/RA0402 High-Frequency Ear Simulator	
Standards, based on:	
IEC 60318-4	Occluded-ear simulators for the measurement of earphones coupled to the ear by ear inserts
ITU-T Recommendation P.57	Series P: Telephone transmission quality, Objective measuring apparatus: Artificial ears
ANSI S3.25/ASA-2009	American National Standard For an Occluded Ear Simulator
Frequency Response	
Typical transfer impedance re 500 Hz	
Resonance frequency	13.5 kHz ± 1 kHz
Sensitivity	
Sensitivity	12.5 mV/Pa
Dynamic Range	
RA0401（LEMO）	25 dBA to 163 dB
RA0402（CCP）	25 dBA to 150 dB
Effective Volume	
at 500 Hz	1260 mm^3
Dimensions	
Height	23.0 mm
Diameter	23.75 mm
Environmental Calibration Conditions	
Temperature	23 °C ±3 °C
Relative humidity	60 % ±20 %
Barometric pressure	101.3 kPa ±3 kPa

RA0403/RA0404 Hi-res Ear Simulator	
Standards, based on:	
IEC 60318-4	Occluded-ear simulators for the measurement of earphones coupled to the ear by ear inserts.
ITU-T Recommendation P.57	Series P: Telephone transmission quality, Objective measuring apparatus: Artificial ears
ANSI S3.25/ASA-2009	American National Standard For an Occluded Ear Simulator
Frequency Response	
Typical transfer impedance re 500 Hz	
Resonance frequency	13.5 kHz ± 1 kHz
Sensitivity	
Sensitivity	1.6 mV/Pa
Dynamic Range	
RA0403 (LEMO)	44 dBA to 169 dB
RA0404 (CCP)	46 dBA to 166 dB
Effective Volume	
at 500 Hz	1260 mm^3
Dimensions	
Height	23.0 mm
Diameter	23.75 mm
Environmental Calibration Conditions	
Temperature	23 °C ±3 °C
Relative humidity	60 % ±20 %
Barometric pressure	101.3 kPa ±3 kPa

43BB Low-noise Ear Simulator	
Frequency Response	
Typical frequency response re 500 Hz Typical frequency response (solid blue) versus the IEC tolerances (dashed black) and the ideal IEC 60318-4 frequency response (red curve)	
Noise floor Typical linear noise floor (solid blue) versus the human hearing threshold (dashed blue) in dB SPL	
Sensitivity	
Sensitivity	800 mV/pa
Dynamic Range	
RA0234	10.5 dBA to 113 dB
Effective Volume	
at 500 Hz	1260 mm^3
Dimensions	
Height	23.0 mm
Diameter	23.75 mm
Environmental Calibration Conditions	
Temperature	23° C ±3° C
Relative humidity	60 % ±20 %
Barometric pressure	101.3 kPa ±3 kPa

Mouth Simulator	
Frequency Response	
Frequency response before and after equalization	
Maximum Continuous Output Level at MRP	
200 Hz – 6 kHz	110 dB re. 20 µPa
100 Hz – 10 kHz	100 dB re. 20 µPa
Total Harmonic Distortion（equalized, 90 dB re 20 µPa at MRP）	
200 Hz - 5 kHz	Typically 1 %, max. 1.5 %
Mouth to Ear Crosstalk Attenuation（closed ear, 1/3 octave band）	
100 Hz - 1 kHz	50 dB
1 kHz - 8 kHz	40 dB
Loudspeaker	
Impedance	8 Ω
Continuous	10 W
Pulsed	50 W（for 2 sec.）
Power Amplifier	
Gain	10 dB
Input impedance	20 kΩ
Power supply	24 V
Max. input voltage	2 V RMS

Temperature	
Operation	–30° C to + 60° C
Storage	–40° C to + 65° C

Relative Humidity	
Operation	0 + 90%, non condensing
Storage	0 + 90%, non condensing

CE Conformity	
Safety	EN/IEC 61010
EMC Emission	EN/IEC 61010-1
EMC immunity	EN/IEC 61010-6

Warranty	
2 years	KEMAR is made of components from our standard portfolio and are all manufactured of high-quality material and branded parts that were chosen and processed to ensure life-long stability and robustness. This enables us to offer 2 years warranty against defective materials and workmanship. Exceptions: Microphones included in KEMAR: Our normal 5 year warranty applies. The warranty for cables is 6 months.

Service and Repair

All repairs are made at GRAS International Support Center located in Denmark. Our Support Center is equipped with the newest test equipment and staffed with dedicated and highly skilled engineers. Upon request, we make cost estimates based on fixed repair categories.
If a product covered by warranty is sent for service, it is repaired free of charge, unless the damage is the result of negligent use or other violations of the warranty. All repairs are delivered with a service report, as well as an updated calibration chart.

Manufactured to conform with:

CE marking directive: 93/68/EEC

WEEE directive: 2002/96/EC

RoHS directive: 2002/95/EC

GRAS Sound & Vibration continually strives to improve the quality of our products for our customers; therefore, the specifications and accessories are subject to change.