

# GRAS 45BB

KEMAR Head & Torso, Non-configured



Connection: 0 V/CCP or 200 V/LEMO  
Channel(s): 2  
ANSI: S3.36, S3.25  
IEC: 60318-7

The 45BB KEMAR head and torso is a configurable acoustic research tool that simulates the changes that occur to sound waves as they pass a human head and torso. Its equivalent with mouth simulator is [GRAS 45BC KEMAR Head & Torso, non-configured](#)

## Introduction

The KEMAR head and torso simulator was introduced by Knowles in 1972 and quickly became the industry standard for hearing-aid manufacturers and research audiologists (visit [KEMAR.us](https://www.kemar.us) to read the full story). The GRAS KEMAR has the same dimensions and acoustical properties as the original KEMAR from 1972 and is 100% backward compatible.

When fitted with pinna simulator, ear canal extension, and IEC 60318-4 Ear Simulator, KEMAR closely mimics the acoustic properties of the human ear.

KEMAR meets the international standards as specified by IEC: 60318-7 and ANSI: S3.36, S3.25.

The 45BB KEMAR is a non-configured KEMAR - without a mouth simulator. The 45BC KEMAR is identical, except that it has a built-in Mouth Simulator. Read more about 45BC KEMAR [here](#).

## Design

### Anthropometric Head and Torso

The major difference between KEMAR and the standard commercially available head and torso simulators (HATS) is that KEMAR is built on large statistical research of the average human body - meaning that the KEMAR has the same acoustical properties as an average human, including distinct facial features. Therefore it provides acoustic diffraction similar to that encountered around the median human head and torso, both in the proximity and in the far-field. Because of its anthropometric shape, it does so more realistically than any other manikin. KEMAR is the only manikin with a changeable ear-to-shoulder ratio simulating both male and female median values.

### True to the Legacy - but Improved

The current KEMAR has the same dimensions and acoustical properties as the original KEMAR, but has been developed further by GRAS to meet the industry's demand for realistic measurements. Today, more than 40 years after its inception KEMAR can test any device that contains both loudspeakers and microphones as well as perform binaural recordings of product sound and music.

At GRAS, we safeguard KEMAR's legacy, but are also continuously expanding the range of features and functionalities leading to new applications and uses - without compromising KEMAR's original form.

In 2013, KEMAR underwent a substantial rejuvenation that introduced major improvements to build quality, user-friendliness and configurability. KEMAR's previous fiberglass construction was updated to a plastic composite that provides a more user-friendly and ruggedized construction. At the same time, many other improvements were introduced, making KEMAR much easier to configure, calibrate and service.

### Ease of Use

The interior of KEMAR's head can be accessed easily by pushing a button and lifting the scalp.

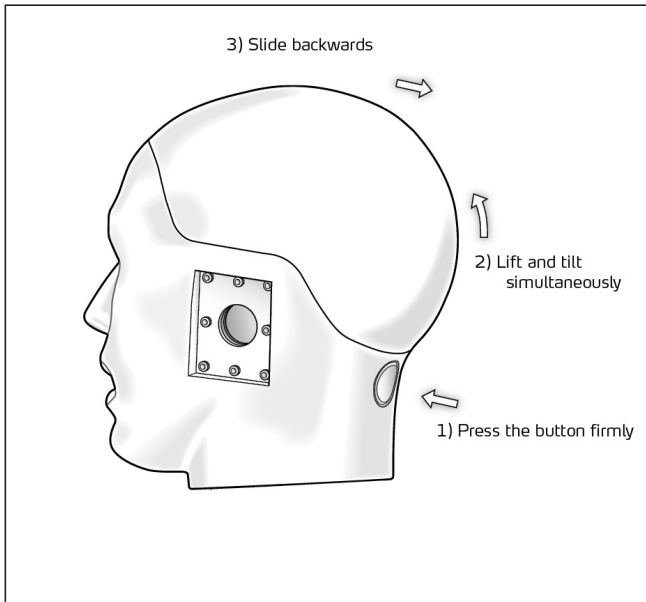
The transducers are mounted and removed by a simple snap-fit mechanism.

Standard pinnae are push mounted from the outside. The anthropometric pinnae, however, are secured from the inside by two screws in addition to the push mounting.

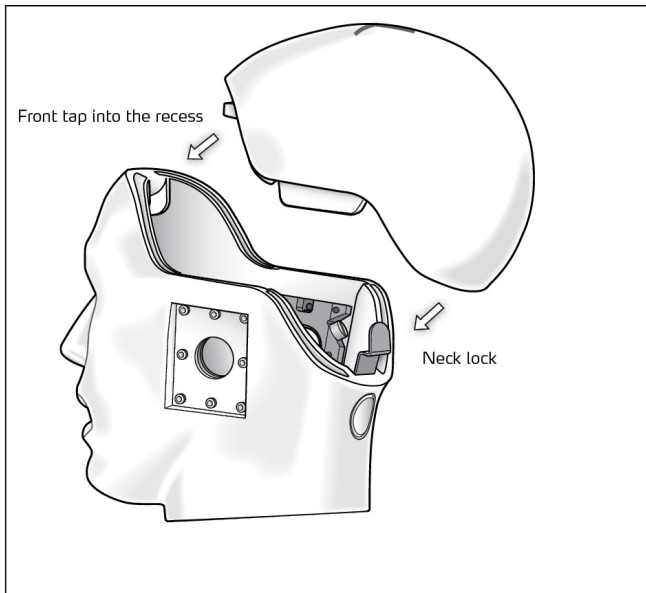
A scale around KEMAR's neck indicates the head angle and allows for repeatable measurements.

In most cases, calibration can be done from the outside without dismantling the ear simulator(s).

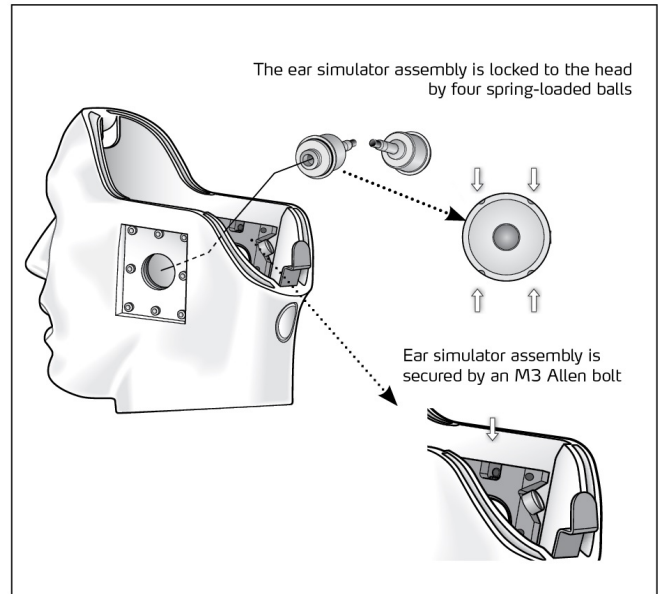
However, for some configurations - with microphones and anthropometric pinnae - dismantling of the transducers before calibration is necessary.



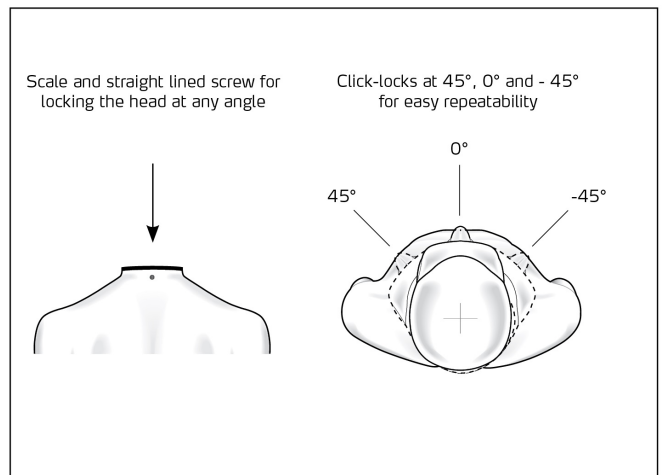
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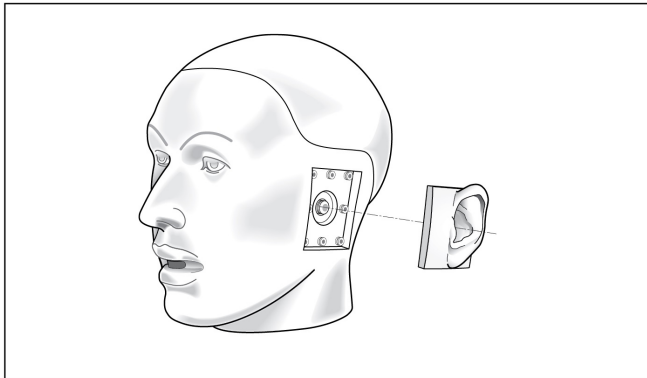
Mounting the neck is a simple push fit.



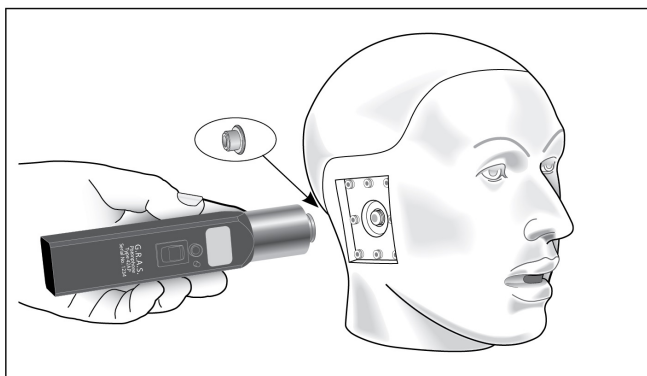
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A scale around KEMAR's neck indicates the head angle and allows for repeatable measurements.



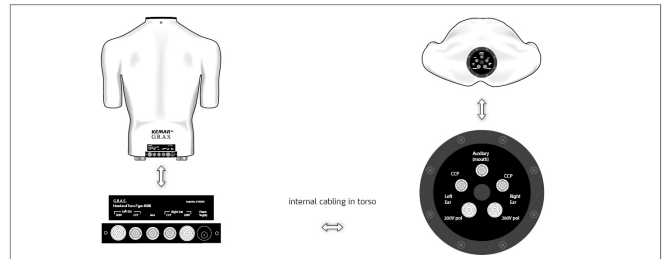
Standard pinnae are push mounted from the outside. The anthropometric pinnae, however, are secured from the inside by two screws in addition to the push mounting.



In most cases, calibration can be done from the outside without dismantling the ear simulator(s).

## Cabling and Connections

All internal cabling is factory mounted. The sockets for connection to ear simulators or microphones are easily accessible at the top of the neck, the sockets for connection to instrumentation are located at the lower back.



## Mounting Options

KEMAR is delivered with two tripod adapters, one for tripods with 3/8" thread and one for ø35 mm loudspeaker stands.

## Typical Applications and Use

### A Multi-configurable Test Tool

The 45BB KEMAR Head and Torso, non-configured is a KEMAR without any application-specific accessories. As such, this KEMAR is intended for customers who want to reuse accessories already in their possession. But the non-configured KEMAR is also the core of all configured 45BB KEMARs.

The main application-specific accessories are:

- 60318-4 ear simulators, both externally polarized and prepolarized
- A low-noise ear simulation system, externally polarized
- ½ inch or ¼ inch. microphones, externally polarized and prepolarized
- Preamplifiers selected to match the actual configuration
- Straight and conical ear canal extensions, made from steel
- Straight and conical ear canal extensions, made from POM
- 12 different standard pinnae, small and large, soft and hard, normal or VA-style
- 2 anthropometric pinnae, with anthropometric concha and ear canal.

With these, KEMAR can be configured for a wide range of both standard and special applications, making it the most versatile manikin for in-situ anthropometric testing today.

KEMAR is used in various industries around the world and is the recognized industry-standard for in-situ anthropomorphic testing in the fields of:

- Hearing aid testing
- Ear and headphone testing
- Sound recording and sound-quality evaluation

A KEMAR with Mouth Simulator can be configured for headset testing and telephone test. Read more [here](#).

KEMAR is available in a number of configurations that are delivered fully assembled, tested and calibrated as complete out-of-the-box systems. Each configuration is optimized for a specific application, with transducer(s), preamplifiers, pinna simulators, and cables and accessories.

The pre-configured KEMARs are listed below:

## **KEMAR for Hearing Aid test**

### *Single-channel Test of Hearing Aids*

For single-channel testing of hearing aids, a LEMO version and a CCP version are available. They are configured with a 60318-4 ear simulator and large pinnae 55 Shore 00. Read more here:

[GRAS 45BB-1 KEMAR for Hearing Aid test, 1-Ch LEMO](#)

[GRAS 45BB-2 KEMAR for Hearing Aid test, 1-Ch CCP](#)

### *Test of Binaural Hearing Aids*

For testing of binaural hearing aids that use RF communication, similarly configured KEMARs are available, but these use non-metal (POM) ear canal

extensions and ear holder plates that do not interfere with RF communication. Read more here:

[GRAS 45BB-7 KEMAR for Test of Binaural Hearing Aid, 2-Ch LEMO](#)

[GRAS 45BB-8 KEMAR for Test of Binaural Hearing Aid, 2-Ch CCP](#)

## **KEMAR for Ear and Headphone Test**

### *Testing of Ear and Headphones*

For ear and headphone testing, a KEMAR configured with 60318-4 ear simulators and standard large straight pinnae 55 Shore 00 is available, both in a LEMO and a CCP version. Read more here:

[GRAS 45BB-5 KEMAR for Ear and Headphone Test, 2-Ch LEMO](#)

[GRAS 45BB-6 KEMAR for Ear and Headphone Test, 2-Ch CCP](#)

### *Testing of Ear and Headphones with Anthropometric Pinnae*

For testing of modern in-ear type ear and headphones, a KEMAR configured with 60318-4 ear simulators and anthropometric pinnae 35 Shore 00 is available. Both a LEMO and a CCP version are available. The anthropometric pinna introduces better fit and repeatability when testing anthropometrically shaped insert types of ear and headphones. Read more here:

[GRAS 45BB-9 KEMAR with Anthropometric Pinnae for Ear and Headphone Test, 2-Ch LEMO](#)

[GRAS 45BB-10 KEMAR with Anthropometric Pinnae for Ear and Headphone Test, 2-Ch CCP](#)

### *Low-noise Testing of Ear and Headphones*

For low-noise testing of ear and headphones, a

single channel and a dual-channel version are available. The combination of a special low-noise version of the ear simulator and the anthropometric pinnae introduces major improvements to fit, accuracy, repeatability, and low- and high-frequency performance when testing ear and headphones. This KEMAR can also test at or below the threshold of human hearing. It is available for single and dual-channel testing. The low-noise artificial ear is available in a LEMO version only. Read more here:

[GRAS 45BB-11 KEMAR with Anthropometric Pinnae for Low-noise Ear and Headphone Test, 1-Ch LEMO](#)

[GRAS 45BB-12 KEMAR with Anthropometric Pinnae for Low-noise Ear and Headphone Test, 2-Ch LEMO](#)

### *High-frequency Testing of Ear and Headphones with Anthropometric Pinnae*

For testing of modern in-ear type ear and headphones, a KEMAR configured with high-frequency ear simulators and anthropometric pinnae 35 Shore 00 is available. The high-frequency ear simulators extend the useful frequency range to 20 kHz. Both a LEMO and a CCP version are available. The anthropometric pinnae introduce better fit and repeatability when testing anthropometrically shaped insert types of ear and headphones. Read more here:

[GRAS 45BB-13 KEMAR for High-Frequency Test of Ear and Headphones, 2-Ch LEMO](#)

[GRAS 45BB-14 KEMAR for High-Frequency Test of Ear and Headphones, 2-Ch CCP](#)

### *Hi-Res Testing of Ear and Headphones with Anthropometric Pinnae*

For testing of modern in-ear type ear and headphones, a KEMAR configured with hi-res ear

simulators and anthropometric pinnae 35 Shore 00 is available. The hi-res ear simulators extend the useful frequency range to 50 kHz. Both a LEMO and a CCP version are available. The anthropometric pinnae introduce better fit and repeatability when testing anthropometrically shaped insert types of ear and headphones. Read more here:

[GRAS 45BB-15 KEMAR for High-Frequency Test of Ear and Headphones, 2-Ch LEMO](#)

[GRAS 45BB-16 KEMAR for High-Frequency Test of Ear and Headphones, 2-Ch CCP](#)

### **KEMAR for Sound Quality Recording**

A KEMAR configured with 1/2" pressure microphones for sound quality evaluation and recording is available, both in a LEMO and a CCP version. Read more here:

[GRAS 45BB-3 KEMAR for Sound Quality Recording, 2-Ch LEMO](#)

[GRAS 45BB-4 KEMAR for Sound Quality Recording, 2-Ch CCP](#)

### **KEMAR with Mouth Simulator**

In addition to the 45BB KEMARs, a number of pre-configured KEMARs with mouth simulator are available. These are:

[GRAS 45BC-1 KEMAR for Headset Test, 2-Ch LEMO](#)

[GRAS 45BC-2 KEMAR for Headset Test, 2-Ch CCP](#)

[GRAS 45BC-3 KEMAR for Telephone Test, 1-Ch LEMO](#)

[GRAS 45BC-4 KEMAR for Telephone Test, 1-Ch CCP](#)

[GRAS 45BC-9 KEMAR with Mouth Simulator and Anthropometric Pinnae for Headset Test, 2-Ch LEMO](#)

[GRAS 45BC-10 KEMAR with Mouth Simulator and Anthropometric Pinnae for Headset Test, 2-Ch CCP](#)

[GRAS 45BC-11 KEMAR with Mouth Simulator and Anthropometric Pinnae for Low-noise Headset Test, 1-Ch LEMO](#)

[GRAS 45BC-12 KEMAR with Mouth Simulator and Anthropometric Pinnae for Low-noise Headset Test, 2-Ch LEMO](#)

[GRAS 45BC-13 KEMAR for High-Frequency Headset Test, 2-Ch LEMO](#)

[GRAS 45BC-14 KEMAR for High-Frequency Headset Test, 2-Ch CCP](#)

[GRAS 45BC-15 KEMAR for Hi-Res Headset Test, 2-Ch LEMO](#)

[GRAS 45BC-16 KEMAR for Hi-Res Headset Test, 2-Ch CCP](#)

## Performance and Warranty

KEMAR is made of components from our standard portfolio and is 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 as for these our normal 5-year warranty apply. The warranty period for cables is 6 months.

Temperature range, operation	°C / °F	-30 to 60 / -22 to 140
Temperature range, storage	°C / °F	-40 to 65 / -40 to 149
Humidity range non condensing	% RH	0 to 95%
ANSI standard		S3.36, S3.25
IEC standard		60318-7
Weight	g / oz	11.45 k / 404

GRAS Sound & Vibration reserves the right to change specifications and accessories without notice.



## Included items

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

## Optional items

### Power Modules for Externally Polarized Ear Simulators and Microphones

<a href="#">GRAS 12AK</a>	1-Channel Power Module with gain, filters and SysCheck generator
<a href="#">GRAS 12AD</a>	1-Channel Power Module
<a href="#">GRAS 12AA</a>	2-Channel Power Module with gain, filters and SysCheck generator
<a href="#">GRAS 12AR</a>	2-Channel Power Module
<a href="#">GRAS 12AQ</a>	2-Channel Universal Power Module with signal conditioning and PC interface

### Power Modules for Pre-polarized Ear Simulators and Microphones

<a href="#">GRAS 12AL</a>	1-Channel CCP Power Module with A-weighting filter
<a href="#">GRAS 12AQ</a>	2-Channel Universal Power Module with signal conditioning and PC interface

### For Ear Simulator Calibration

<a href="#">GRAS 42AP</a>	Intelligent Pistonphone (250 Hz or 251.2 Hz, 114 dB +/- 0.05 dB)
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<a href="#">GRAS 42AA</a>	Pistonphone (250 Hz, 114 dB +/- 0.08 dB)
<a href="#">GRAS RA0157</a>	1/2" Calibration Adapter for KEMAR Pinna

## Pinna Simulators

<a href="#">GRAS KB0060</a>	KEMAR Small Right Ear 55 Shore 00
<a href="#">GRAS KB0061</a>	KEMAR Small Left Ear 55 Shore 00
<a href="#">GRAS KB0065</a>	KEMAR Large Right Ear 55 Shore 00
<a href="#">GRAS KB0066</a>	KEMAR Large Left Ear 55 Shore 00
<a href="#">GRAS KB1060</a>	KEMAR Small Right Ear, 35 Shore 00
<a href="#">GRAS KB1061</a>	KEMAR Small Left Ear 35 Shore 00
<a href="#">GRAS KB1065</a>	KEMAR Large Right Ear 35 Shore 00
<a href="#">GRAS KB1066</a>	KEMAR Large Left Ear 35 Shore 00
<a href="#">GRAS KB0090</a>	KEMAR Large Right Ear (VA-Style/SQ) 55 Shore 00
<a href="#">GRAS KB0091</a>	KEMAR Large Left Ear (VA-Style/SQ) 55 Shore 00
<a href="#">GRAS KB1090</a>	KEMAR Large Right Ear (VA-Style) 35 Shore 00
<a href="#">GRAS KB1091</a>	KEMAR Large Left Ear (VA-Style) 35 Shore 00
GRAS KB5000	KEMAR Large Right Anthropometric Pinna 35 Shore 00
<a href="#">GRAS KB5001</a>	KEMAR Large Left Anthropometric Pinna 35 Shore 00

## Ear Mould Simulators

<a href="#">GRAS KB0110</a>	Ear Mould Simulator for 2 mm Inner diameter tubing
<a href="#">GRAS KB0111</a>	Ear Mould Simulator for 3 mm Inner diameter tubing

## Ear Canal Extension and Microphone Holder Kits (kits with 2 pcs and O-rings)

GRAS RA0237	Straight Ear Canal Extension Kit for KEMAR
<a href="#">GRAS RA0238</a>	VA-tapered Ear Canal Extension Kit for KEMAR
GRAS RA0239	Ear canal Extension Kit w. silicone lining for KEMAR

GRAS RA0240	Holder for long 1/2" microphone Kit for KEMAR
GRAS RA0241	Holder for short 1/2" microphone Kit for KEMAR
GRAS RA0243	Holder for 1/2" microphone Kit for KEMAR
GRAS RA0244	O-ring kit for KEMAR, 2 pcs.
GRAS RA0249	Straight Ear Canal Extension Kit for KEMAR, made of POM, for binaural hearing aid test
GRAS RA0250	Tapered Ear Canal Extension Kit for KEMAR, made of POM, for binaural hearing aid test

## KEMAR Retrofit Kit for Binaural Hearing Aid Test

<a href="#">GRAS RA0251</a>	KEMAR Retrofit Kit for Binaural Hearing Aid Test: The Kit includes Ear Holder Plates, mounting bolts and the RA0249 and RA0250 Ear Canal Extension Kits. Included items are made of POM, Nylon and Teflon.
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## KEMAR Retrofit Kit for Anthropometric Pinna

<a href="#">GRAS RA0311</a>	KEMAR Retrofit Kit for Anthropometric Pinna. The Kit includes Ear Simulator Holder, 2 finger screws and a 3 mm Allen Key.
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## Extension Cables

<a href="#">GRAS AA0008</a>	LEMO 7-pin - LEMO 7-pin Cable, 3 m
<a href="#">GRAS AA0009</a>	LEMO 7-pin - LEMO 7-pin Cable, 10 m
<a href="#">GRAS AA0020-CL</a>	LEMO 7-pin - LEMO 7-pin Cable, Customized Length xxxx cm
GRAS AA0034	BNC-BNC Cable, 2 m
<a href="#">GRAS AA0035</a>	BNC-BNC Cable, 3 m
GRAS AA0036	BNC-BNC Cable, 5 m
<a href="#">GRAS AA0037</a>	BNC-BNC Cable, 10 m
<a href="#">GRAS AA0039-CL</a>	BNC-BNC Cable, Customized Length, xxxx cm

## Flight Case

GRAS KM0094	PELI Case for KEMAR
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## Simulation Model of KEMAR

GRAS KB3000	Simulation Model of KEMAR with large pinnae
GRAS KB3001	Simulation Model of KEMAR with small pinnae

## Stand for KEMAR

GRAS AL0026	Loudspeaker stand for KEMAR, Ø 35 mm
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## Miscellaneous

GRAS KB0000	KEMAR Handbook
GRAS KB0010	T-Shirt for KEMAR

GRAS Sound & Vibration reserves the right to change accessories without notice.

# GRAS Worldwide

Subsidiaries and distributors in more  
than 40 countries

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## ABOUT GRAS SOUND & VIBRATION

GRAS is a worldwide leader in the sound and vibration industry. We develop and manufacture state-of-the-art measurement microphones to industries where acoustic measuring accuracy and repeatability is of utmost importance in R&D, QA and production. This includes applications and solutions for customers within the fields of aerospace, automotive, audiology, and consumer electronics. GRAS microphones are designed to live up to the high quality, durability and accuracy that our customers have come to expect and trust.

**GRAS** Sound & Vibration