

GRAS 45BD

AutoKEMAR Automotive Head and Torso Simulator



The GRAS 45BD AutoKEMAR is a specialized version of the renowned GRAS KEMAR, designed specifically for automotive acoustic testing. With its seat-mount system compatible with ISOFIX, the AutoKEMAR can be securely positioned in a car seat, ensuring precise and repeatable in-car measurements. The fixture's flexible design allows for comprehensive adjustability, including neck rotation, height, seat distance, forward and backward tilt, and viewing angle, providing true-to-life positioning and measurement versatility.

The AutoKEMAR is ideal for realistic in-car acoustic measurements, supporting a wide range of research and testing scenarios. It is user-reconfigurable, allowing for upgrades and replacements of ear simulators, microphones, and pinnae to suit different applications. An optional mouth simulator is available for speech-related testing, making AutoKEMAR a complete and adaptable solution for automotive acoustic evaluation. The system is offered in multiple pre-configured versions, ready to meet diverse testing needs right out of the box.

Introduction

Today's drivers expect more than performance, they demand a quiet, refined ride and an immersive audio experience. Whether powered by a traditional combustion engine or an electric drivetrain, in-cabin acoustic quality has become a defining factor in modern automotive design.

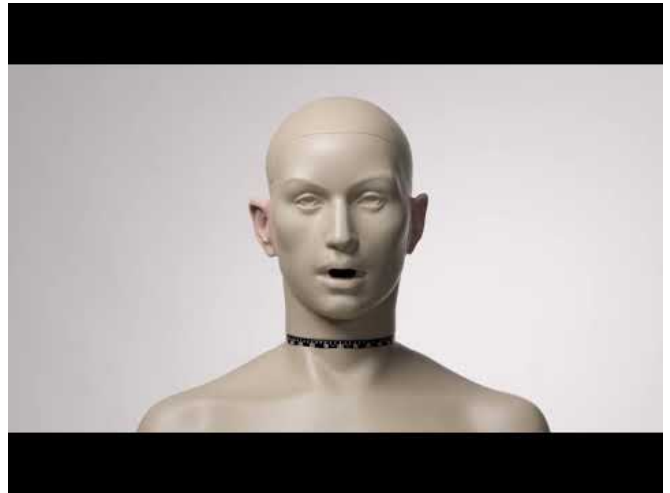
From benchmarking and tuning premium sound systems to sound quality testing, or minimizing unwanted noise and optimizing NVH (Noise, Vibration, and Harshness) performance, achieving excellence requires precise, repeatable, and realistic acoustic measurements.

AutoKEMAR's human-like acoustic properties allow engineers to perform accurate in-cabin measurements that closely replicate how sound behaves around a real occupant. The result is data you can trust, enabling better sound system design, more effective noise control, and a superior driving experience.

Key Features

- Widest and most flexible positioning capabilities and motion range in the market.
- Available in multiple configurations.
- User reconfigurable: One unit -> Multiple applications.
- Multiple types of microphones, ear simulators and pinnae available.
- Accurate positioning, & Precision: Ensures consistent and repeatable measurements.
- Human-Like Acoustics: Mimics human head and torso for accurate sound simulation.
- Mouth simulator option available (can be retrofitted).
- Low-noise version available (11.5 dBA).
- Easy-access cable connector panel.
- ISOFIX-compatible for secure mounting.
- Lashing Strap secure mounting system for non-ISOFIX compatible car seats.

- Rattle free operation (Static, Dyno, On-road Tests).
- TEDS compatible.
- Equalization curves available: Free-field, Diffuse-field and Direction Independent.



Typical Applications and Use

Automotive in-cabin acoustics:

- Audio system performance & tuning
- Sound Quality & Sound Design
- Infotainment and DSP testing
- Speech intelligibility and voice quality
- Hands-free communication
- In-cabin NVH
- Wind tunnel measurements

Other:

- Vehicles Exterior Sound / Noise
- eVTOL, Trains, Airplane cabins, etc.
- Any applications that will benefit from HATS (Consumer electronics: headphones, headsets, smart speakers. Hearing aids testing)

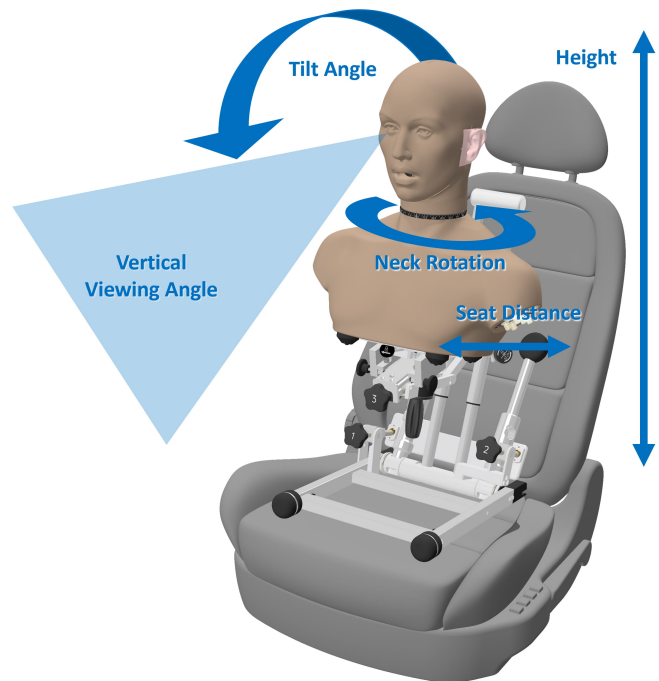


Wide range of movement

Thanks to its ingenious seat-mount design, the GRAS 45BD AutoKEMAR offers the widest and most flexible range of motion available on the market.

This advanced fixture allows precise head and torso movement across all typical seating and driving positions, and even more extreme or unconventional setups, such as those representing very short or tall occupants, or relaxed resting positions.

By accommodating this broad range of realistic body postures, AutoKEMAR enables comprehensive and highly representative in-cabin acoustic testing, ensuring that every relevant listening position can be evaluated to take vehicle acoustics to the next level.



AutoKEMAR allows for multiple degrees of manual movement:

- Neck Rotation
- Height
- Seat Distance
- Tilt Angle Frontwards and Backwards
- Vertical Viewing Angle

User-Reconfigurable: One AutoKEMAR - Multiple applications

Built on the same proven platform as the original GRAS KEMAR, the AutoKEMAR is designed for easy reconfiguration and maximum versatility.

Thanks to its snap-fit system, users can quickly remove and replace ear simulators, microphones, and pinnae, making it simple to adapt the fixture to different test setups or measurement needs. Multiple pinna types are available to match a variety of acoustic conditions.

This flexibility allows different teams to use the same AutoKEMAR for a wide range of applications, from sound-quality benchmarking and voice-quality evaluation to telecommunications testing inside the vehicle.

Each AutoKEMAR can be upgraded or reconfigured in just minutes using readily available spare parts, ensuring that your investment stays future-proof and adaptable to evolving automotive acoustics needs.



ISOFIX Compatibility

The GRAS 45BD AutoKEMAR features a seat-mount system fully compatible with ISOFIX, allowing it to be securely fastened to a car seat for stable and repeatable in-cabin measurements. When mounted using ISOFIX, AutoKEMAR achieves maximum stability and precision, ensuring the widest possible range of movement while maintaining a firm, vibration-free position against the seat.

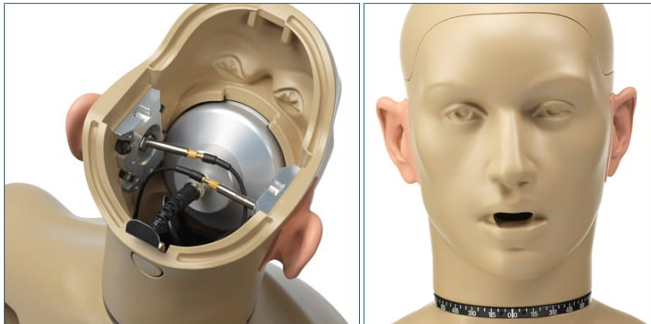
No ISOFIX? No Problem

For vehicles or test setups without integrated ISOFIX anchor points, standard or custom ISOFIX adapters can be used to ensure a secure installation. In addition, every AutoKEMAR includes telescopic arms and a ratchet lashing strap system, allowing the Seat Mount to be firmly secured even when ISOFIX is not available.



Mouth Simulator Option

The GRAS 45BD AutoKEMAR can be equipped with an optional mouth simulator, enabling realistic speech and voice testing inside the vehicle cabin. The mouth simulator acts as an acoustic sound source located inside the head, emitting audio signals through AutoKEMAR's mouth opening.



When equipped with a mouth simulator, the AutoKEMAR is a comprehensive solution for in-car microphone testing, speech intelligibility measurements, and evaluation of voice-control and hands-free communication systems.

It can be ordered with a mouth simulator or upgraded later through a retrofit option.

Rattle free design

Every component of the GRAS 45BD AutoKEMAR, from the head and torso to the seat-mount assembly, is engineered for rattle-free performance.

This robust design ensures stable and noise-free operation, even in demanding test environments. As a result, AutoKEMAR is suitable not only for static in-cabin measurements, but also for tests conducted on dynamometers and even light on-road evaluations when secured with the ISOFIX mount or the Ratchet Lashing Strap system.

With its vibration-resistant construction, AutoKEMAR delivers consistent, high-fidelity acoustic data under real-world testing conditions.

Compatibility

The GRAS 45BD AutoKEMAR is available in multiple configurations, featuring various combinations of microphones, pinnae, ear simulators, and mouth simulators to meet specific testing needs.

The acoustic signals captured by AutoKEMAR's two

“ears” are output as analog voltage signals proportional to the measured sound pressure. The microphones and ear simulators require a CCP (Constant Current Power) supply, also known as IEPE, ICP, or CCLD, and AutoKEMAR is fully compatible with all these standards.

If your data acquisition (DAQ) system does not provide a CCP supply, an external CCP power module can be used. Alternatively, AutoKEMAR's internal microphones can operate from a +48V Phantom Power supply when paired with an adapter such as the GRAS AG0003.

For setups including a mouth simulator, AutoKEMAR requires an analog signal from an external signal generator. The mouth simulator can be used in either passive mode (driven externally) or active mode (with a built-in amplifier).

Quality & Warranty

The GRAS 45BD AutoKEMAR is built from premium components sourced from the GRAS standard portfolio, all manufactured with high-quality materials and precision-engineered parts to ensure long-term stability, durability, and performance.

Every unit undergoes rigorous quality control to meet GRAS's exacting standards for reliability and repeatability. This commitment to excellence allows us to offer a two-year warranty covering defects in materials and workmanship.

Exceptions:

- Microphones supplied with AutoKEMAR are covered by a five-year warranty.
- Cables carry a six-month warranty.

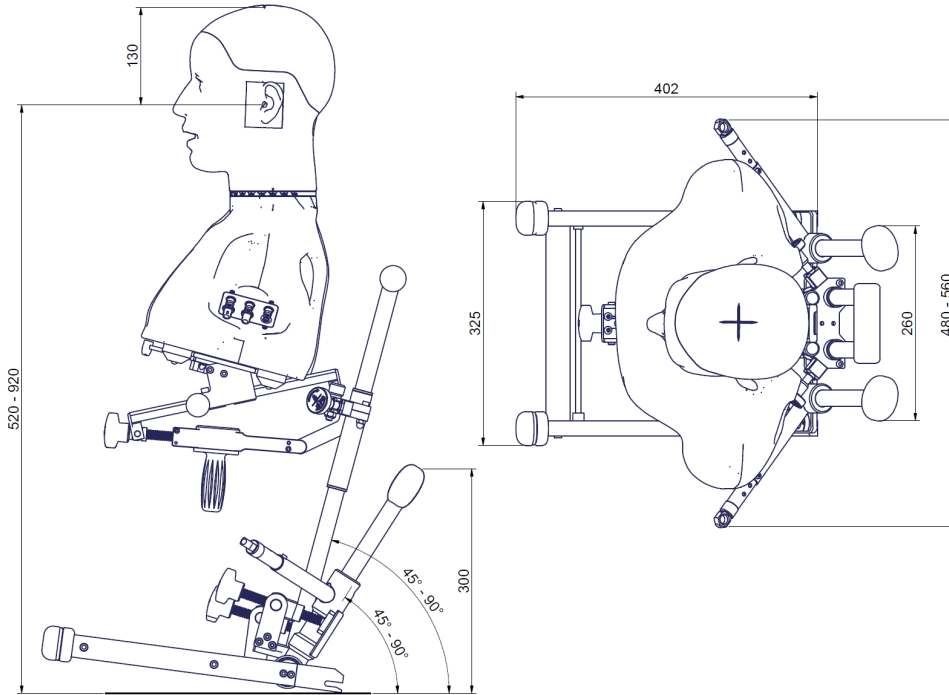
Part no		45BD-01	45BD-02	45BD-07	45BD-09	45BD-10	45BD-15
Configuration	-	Sound Quality	Low-Noise Sound Quality	High-Freq Ear Sim	Sound Quality, w Mouth	Low-Noise Sound Quality, w Mouth	High-Freq Ear Sim, w Mouth
Mouth Simulator	-		No			Yes	
Output Channels (Ears)	-				2		
Ear Simulators	-		No	RA0402 (69C-C-8 kit)		No	RA0402 (69C-C-8 kit)
Microphone Type	-	40AO (46AO-S2 kit)	40CH (46CH kit)	40AO (inside RA0402)	40AO (46AO-S2 kit)	40CH (46CH kit)	40AO (inside RA0402)
Pinnae Type	-	KB0090/1 Sound Quality	KB0090/1 Sound Quality	KB5000/1 Anthropometric	KB0090/1 Sound Quality	KB0090/1 Sound Quality	KB5000/1 Anthropometric
Ear Canal	-		No	Yes		No	Yes
Connector Type	-				BNC		
Set Sensitivity @ 250 Hz (±2 dB)	mV/Pa	12.5	70	12.5	12.5	70	12.5
Set Sensitivity @ 250 Hz (±2 dB)	dB (ref 1V/Pa)	-38	-23	-38	-38	-23	-38
Dynamic Range Lower Limit	dB(A)	25	11,5	25	25	11,5	25
Dynamic Range Upper Limit - Max SPL	dB	150	113	150	150	113	150
Temperature Range, operation	°C/°F			-30 to 60 / -22 to 140			
Temperature Range, storage	°C/°F			-40 to 65 / -40 to 149			
Humidity Range, noncondensing	%RH			0 to 95			
Seat Mount Weight	kg			9 / 9.75 (with arms and ratchet lashing strap)			

Part no		45BD-01	45BD-02	45BD-07	45BD-09	45BD-10	45BD-15
Configuration	-	Sound Quality	Low-Noise Sound Quality	High-Freq Ear Sim	Sound Quality, w Mouth	Low-Noise Sound Quality, w Mouth	High-Freq Ear Sim, w Mouth
Head and Torso Weight	kg	6 (without mouth) / 6.35 (with mouth)					
Total Weight	kg	15 - 16.1					
Seat Fixation	-	ISOFIX or Ratchet Lashing Strap					
Head Rotation Range	°	-120 to +120					
Max Safe Acceleration Exposure	g (g-force)	1					
Mouth Input Impedance	Ω	8 (without PSU)					
Mouth Maximum Power, continuous	W	10					
Mouth Maximum Power, pulsed 2 sec.	W	50					
Mouth Input Impedance	k Ω	20 (with PSU)					
Mouth Gain	dB	10					
Mouth Input Signal, max.	V _{pp}	2 (with PSU)					
Mouth Power Supply (PSU), external	V DC	24					

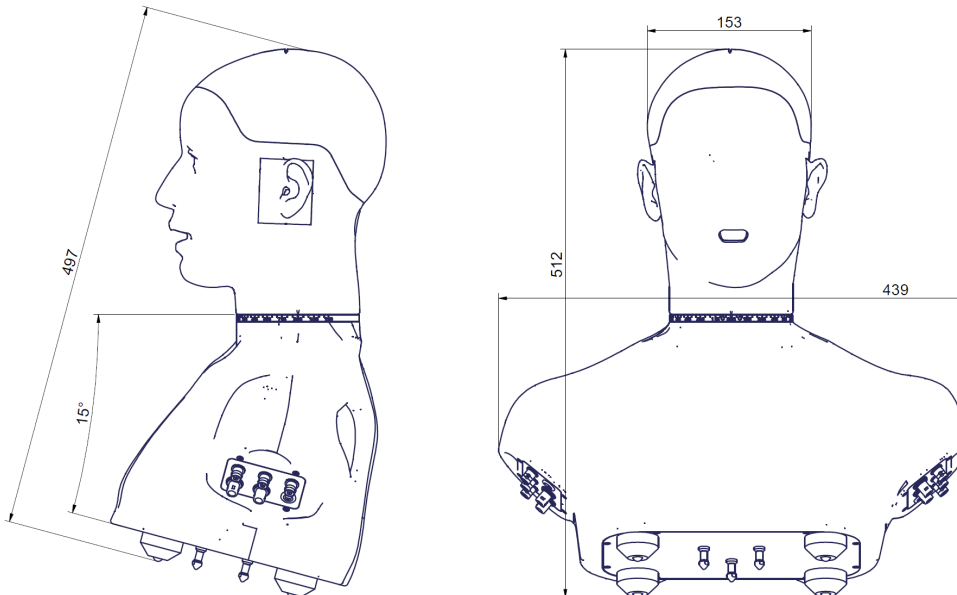
No Mouth Simulator

All dimensions in mm.

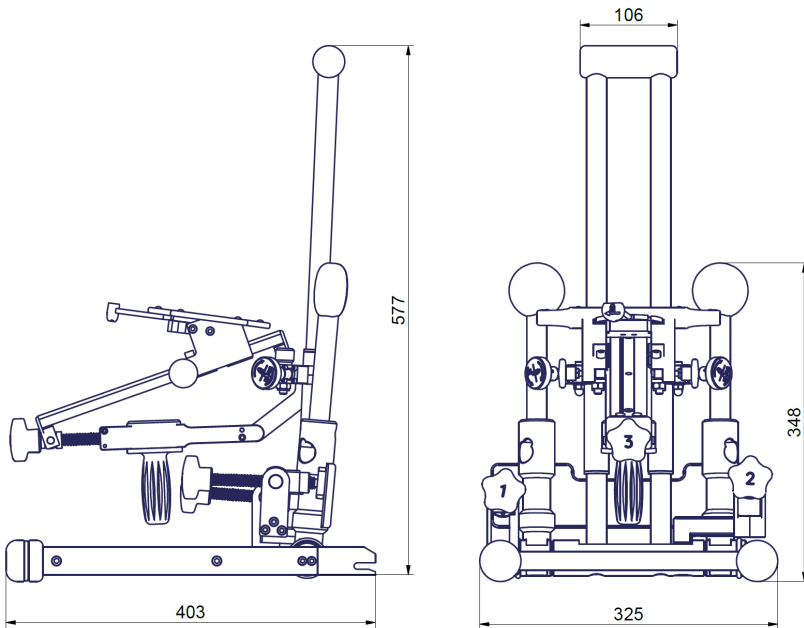
AutoKEMAR



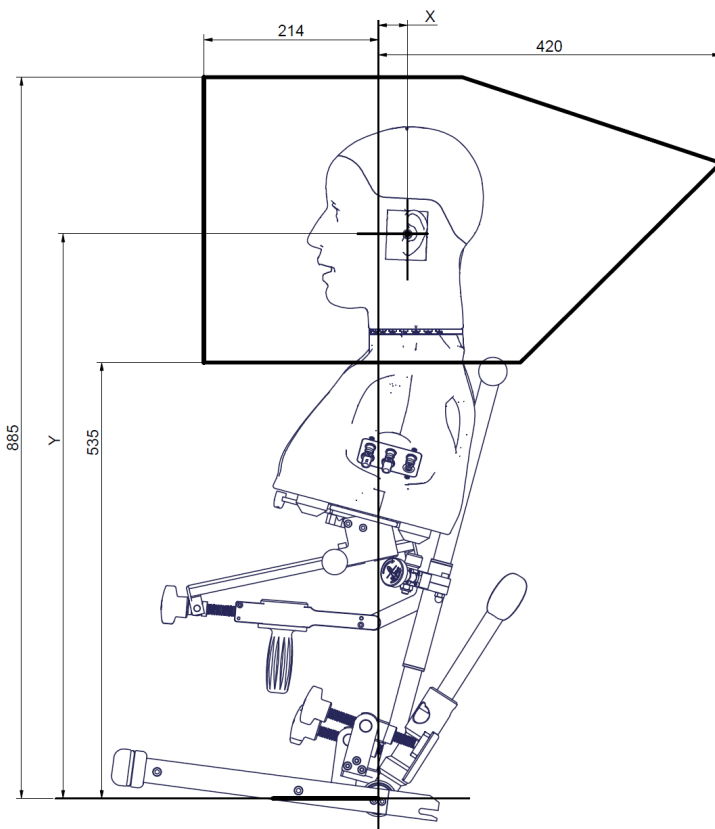
HATS



Seat Mount



Range of Movement



Included items

GRAS 45BD-01 AutoKEMAR Sound Quality, 2-Ch CCP

GRAS AL0040	Seat Mount for AutoKEMAR
GRAS 46A0-S2 x2	1/2" CCP Pressure Microphone Set. Includes 40A0 microphone and 26CK preamplifier
GRAS RA0241	Holder for short 1/2" microphone kit (includes 2 units)
GRAS KB0090	KEMAR Large Right Ear, 00 Shore55 (VA/SQ)
GRAS KB0091	KEMAR Large Left Ear, 00 Shore 55 (VA/SQ)
GRAS RA0579	Calibration Adapter for Sound Quality AutoKEMAR
AA0018-S x2	35 cm Cable Microdot – BNC (in use for L-R ears)
GRAS YY0018	2 mm Allen Key
GRAS YY0028	3 mm Allen Key
GRAS YY0013	4 mm Allen Key
AA0035 x2	3 m BNC - BNC Cable (spare for connection to DAQ)
AL0038	Inclinometer
RA0578	Ratchet Lashing Strap for AutoKEMAR
-	Product Manual
-	Calibration Certificate
-	USB Stick with AutoKEMAR data

GRAS 45BD-02 AutoKEMAR Low-Noise Sound Quality, 2-Ch CCP

GRAS AL0040	Seat Mount for AutoKEMAR
GRAS 46CH x2	Low noise sound quality microphone set. Includes 40CH microphone, RA0240 holder, RA0412 adapter and 26CB preamplifier
GRAS KB0090	KEMAR Large Right Ear, 00 Shore55 (VA/SQ)
GRAS RA0579	Calibration Adapter for Sound Quality AutoKEMAR

GRAS KB0091	KEMAR Large Left Ear, 00 Shore 55 (VA/SQ)
AA0018-S x2	35 cm Cable Microdot – BNC (in use for L-R ears)
GRAS YY0018	2 mm Allen Key
GRAS YY0028	3 mm Allen Key
GRAS YY0013	4 mm Allen Key
AA0035 x2	3 m BNC - BNC Cable (spare for connection to DAQ)
AL0038	Inclinometer
RA0578	Ratchet Lashing Strap for AutoKEMAR
-	Product Manual
-	Calibration Certificate
-	USB Stick with AutoKEMAR data

GRAS 45BD-07 AutoKEMAR High-Freq Ear Sim, Anthr. Pinna, 2-Ch CCP

GRAS AL0040	Seat Mount for AutoKEMAR
GRAS 69CC-8 x2	Prepol Hi-freq 711 Ear Sim incl. angle adaptor and preamp. Includes RA0402 ear simulator, 26CB preamplifier and RA0002 adapter
GRAS KB5000	Large Right Anthropometric Pinna Shore 00-35
GRAS KB5001	Large Left Anthropometric Pinna Shore 00-35
AA0018-S x2	35 cm Cable Microdot – BNC (in use for L-R ears)
GRAS YY0018	2 mm Allen Key
GRAS YY0028	3 mm Allen Key
GRAS YY0013	4 mm Allen Key
AA0035 x2	3 m BNC - BNC Cable (spare for connection to DAQ)
AL0038	Inclinometer
RA0578	Ratchet Lashing Strap for AutoKEMAR
-	Product Manual
-	Calibration Certificate

- USB Stick with AutoKEMAR data

GRAS 45BD-09 AutoKEMAR Sound Quality, w Mouth, 2-Ch CCP

GRAS AL0040	Seat Mount for AutoKEMAR
GRAS 46A0-S2 x2	1/2" CCP Pressure Microphone Set. Includes 40A0 microphone and 26CK preamplifier
GRAS RA0241	Holder for short 1/2" microphone kit (includes 2 units)
GRAS KB0090	KEMAR Large Right Ear, 00 Shore55 (VA/SQ)
GRAS KB0091	KEMAR Large Left Ear, 00 Shore 55 (VA/SQ)
GRAS RA0579	Calibration Adapter for Sound Quality AutoKEMAR
AA0018-S x2	35 cm Cable Microdot - BNC (in use for L-R ears)
GRAS YY0018	2 mm Allen Key
GRAS YY0028	3 mm Allen Key
GRAS YY0013	4 mm Allen Key
AA0035 x2	3 m BNC - BNC Cable (spare for connection to DAQ)
AL0038	Inclinometer
RA0578	Ratchet Lashing Strap for AutoKEMAR
-	Product Manual
-	Calibration Certificate
-	USB Stick with AutoKEMAR data
-	Mouth Simulator
-	Mouth Simulator Power Supply
GRAS 40PM-1	EQset Microphone
GRAS RA0577	MRP Positioning fixture for AutoKEMAR
AA0027	3 m SMB - BNC Cable

GRAS 45BD-10 AutoKEMAR Low-Noise Sound Quality, w Mouth, 2-Ch CCP

GRAS AL0040	Seat Mount for AutoKEMAR
GRAS 46CH x2	Low noise sound quality microphone set. Includes 40CH microphone, RA0240 holder, RA0412 adapter and 26CB preamplifier
GRAS KB0090	KEMAR Large Right Ear, 00 Shore55 (VA/SQ)
GRAS KB0091	KEMAR Large Left Ear, 00 Shore 55 (VA/SQ)
GRAS RA0579	Calibration Adapter for Sound Quality AutoKEMAR
AA0018-S x2	35 cm Cable Microdot – BNC (in use for L-R ears)
GRAS YY0018	2 mm Allen Key
GRAS YY0028	3 mm Allen Key
GRAS YY0013	4 mm Allen Key
AA0035 x3	3 m BNC - BNC Cable (spare for connection to DAQ)
AL0038	Inclinometer
RA0578	Ratchet Lashing Strap for AutoKEMAR
-	Product Manual
-	Calibration Certificate
-	USB Stick with AutoKEMAR data
UP0001	AutoKEMAR Mouth Upgrade
-	Mouth Simulator Power Supply
GRAS 40PM-1	EQset Microphone
GRAS RA0577	MRP Positioning fixture for AutoKEMAR
AA0027	3 m SMB - BNC Cable

GRAS 45BD-15 AutoKEMAR High-Freq Ear Sim, Anthr. Pinna, w Mouth, 2-Ch CCP

GRAS AL0040	Seat Mount for AutoKEMAR
GRAS 69CC-8 x2	Prepol Hi-freq 711 Ear Sim incl. angle adaptor and preamp. Includes RA0402 ear simulator, 26CB preamplifier and RA0002 adapter
GRAS KB5000	Large Right Anthropometric Pinna Shore 00-35
GRAS KB5001	Large Left Anthropometric Pinna Shore 00-35

AA0018-S x2	35 cm Cable Microdot – BNC (in use for L-R ears)
GRAS YY0018	2 mm Allen Key
GRAS YY0028	3 mm Allen Key
GRAS YY0013	4 mm Allen Key
AA0035 x2	3 m BNC - BNC Cable (spare for connection to DAQ)
AL0038	Inclinometer
RA0578	Ratchet Lashing Strap for AutoKEMAR
-	Product Manual
-	Calibration Certificate
-	USB Stick with AutoKEMAR data
-	Mouth Simulator
-	Mouth Simulator Power Supply
GRAS 40PM-1	EQset Microphone
GRAS RA0577	MRP Positioning fixture for AutoKEMAR
AA0027	3 m SMB - BNC Cable

Optional items

If you are looking to reconfigure an existing AutoKEMAR, use the “AUTOKEMAR RECONFIGURATION GUIDE” available in the product manual.

Ear Simulators and Microphones

GRAS RA0045-S1	Prepolarized Ear Simulator According to IEC 60318-4 (60711)
GRAS RA0402	Prepolarized High-Frequency Ear Simulator
GRAS RA0404	Prepolarized Hi-Res Ear Simulator
GRAS 40AO	Prepolarized Pressure Microphone

Preamplifiers

GRAS 26CB	1/4" CCP Standard Preamplifier for Microphone with Microdot Connector
GRAS 26CK	1/2" CCP Standard Preamplifier with Microdot Connector, Very Short

Mouth Simulators

GRAS UP0001	45BD AutoKEMAR Mouth Simulator Upgrade
GRAS RA0577	MRP Positioning fixture for AutoKEMAR

Microphones for Mouth Simulator Calibration using RA0577 positioning fixture

GRAS 40PM-1	EQset Miniature Pressure Microphone
GRAS 40PM	EQset Miniature Pressure Microphone

Standard Pinnae, SOFT

GRAS KB1060	Small Right Pinna, 35 Shore 00
GRAS KB1061	Small Left Pinna, 35 Shore 00
GRAS KB1065	Large Right Pinna, 35 Shore 00
GRAS KB1066	Large Left Pinna, 35 Shore 00

Standard Pinnae, HARD

GRAS KB0060	Small Right Pinna, 55 Shore 00
GRAS KB0061	Small Left Pinna, 55 Shore 00

GRAS KB0065	Large Right Pinna, 55 Shore 00
GRAS KB0066	Large Left Pinna, 55 Shore 00

Anthropometric Pinnae

GRAS KB5000	Large Right Anthro. Pinna, 35 Shore 00
GRAS KB5001	Large Left Anthro. Pinna, 35 Shore 00
GRAS KB5002	Large Right (mirrored left) Anthro. Pinna, 35 Shore 00

Sound Quality Pinnae, SOFT

GRAS KB1068	Small Right Pinna, 35 Shore 00
GRAS KB1069	Small Left Pinna, 35 Shore 00
GRAS KB1090	Large Right Pinna, 35 Shore 00
GRAS KB1091	Large Left Pinna, 35 Shore 00

Sound Quality Pinnae, HARD

GRAS KB0068	Small Right Pinna, 55 Shore 00
GRAS KB0069	Small Left Pinna, 55 Shore 00
GRAS KB0090	Large Right Pinna, 55 Shore 00
GRAS KB0091	Large Left Pinna, 55 Shore 00

Ear Simulator / Microphone Holders

GRAS RA0240	Holder for long 1/2" microphone kit
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GRAS RA0241	Holder for short 1/2" microphone kit
GRAS RA0517	Kit with GR1874 Ear simulator holder ring for anthropometric pinna
GRAS RA0237	Straight ear canal extension kit

Microphone to Preamplifier Adapter

GRAS RA0001	Right-angled (90°) Adapter for 1/2" microphone and 1/4" preamplifier
GRAS RA0002	Right-angled adjustable adapter for 1/2" mic/ 1/4" preamp
GRAS RA0003	Adapter for 1/2" microphone and 1/4" preamplifier
GRAS RA0412	Kit of 8 degr. angular adapters 1/2" to 1/4"

Power Modules for Pre-polarized Ear Simulators and Microphones

GRAS 12BE	2-channel CCP Power Module with TEDS Support
GRAS 12AQ	GRAS 12AQ 2-Channel Universal Power Module with signal conditioning and PC interface
GRAS 12AL	1-Channel CCP Power Module with A-weighting filter

Flight Case

GRAS KM0113K	Optional Flight Case for AutoKEMAR
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For Calibration

GRAS 42AG	Multifunction Sound Calibrator, Class 1
GRAS 42AP	Intelligent Pistonphone, Class 0
GRAS RA0579	Calibration Adapter for Sound Quality AutoKEMAR

Stand for KEMAR

GRAS AL0041	Tripod Adapter for AutoKEMAR
GRAS AL0026	Tripod Stand (Requires AL0041 Tripod Adapter)

Cables

GRAS AA0032	0.5 m BNC-BNC cable
GRAS AA0033	1 m BNC-BNC cable
GRAS AA0034	2 m BNC-BNC cable
GRAS AA0035	3 m BNC-BNC cable
GRAS AA0036	5 m BNC-BNC cable
GRAS AA0037	10 m BNC-BNC cable
GRAS AA0038	30 m BNC-BNC cable
GRAS AA0018-S	35 cm Microdot-BNC cable
GRAS AA0070	3 m Microdot-BNC cable
GRAS AA0071	5 m Microdot-BNC cable
GRAS AA0072	10 m Microdot-BNC cable

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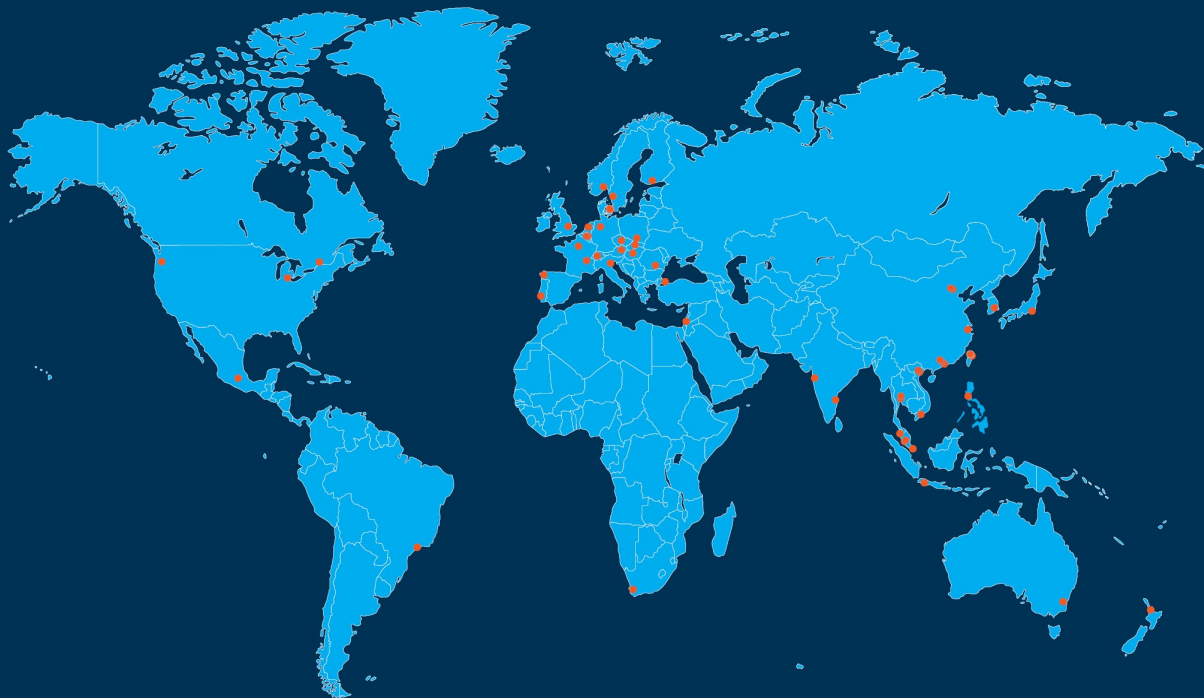
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About GRAS Sound & Vibration

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 is represented through subsidiaries and distributors in more than 40 countries and is part of Axiometrix Solutions, a leading test solutions provider comprised of globally recognized measurement brands. Read more at www.GRASacoustics.com

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