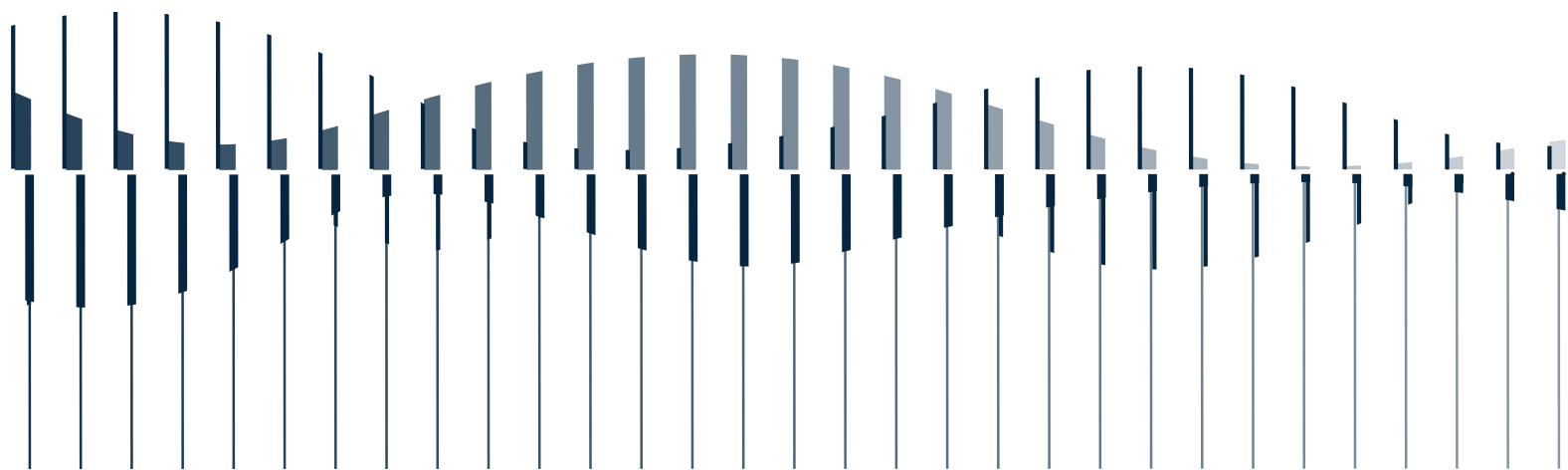




Instruction Manual

GRAS 45CC Headphone Test Fixture

45CC-1 to 45CC-12



Revision History

Any feedback or questions about this document are welcome at gras@gras.dk.

Revision	Date	Description
1	23 June 2016	Preliminary release
2	16 September 2016	First publication
3	2 March 2018	45CC-9 to 45CC-12 configurations added, specs for 69CC-3 and 69CC-4 added. Microphone assembly part numbers updated (p. 7-14)

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Quick Assembly Guide

The 45CC comes fully assembled and tested, however the user must mount the Ear Plate Assemblies. For those who do not need a detailed instruction, the illustration below should be enough to get started.

1. Slide the ear plate assembly's **Rods** into the **Slots** on the 45CC.
2. When they are located at the desired position, secure them with the screws on the back.

For further information, see “45CC-9 Externally Polarized 1/4” Microphones” on page 16 and “Assembling the 45CC” on page 25.

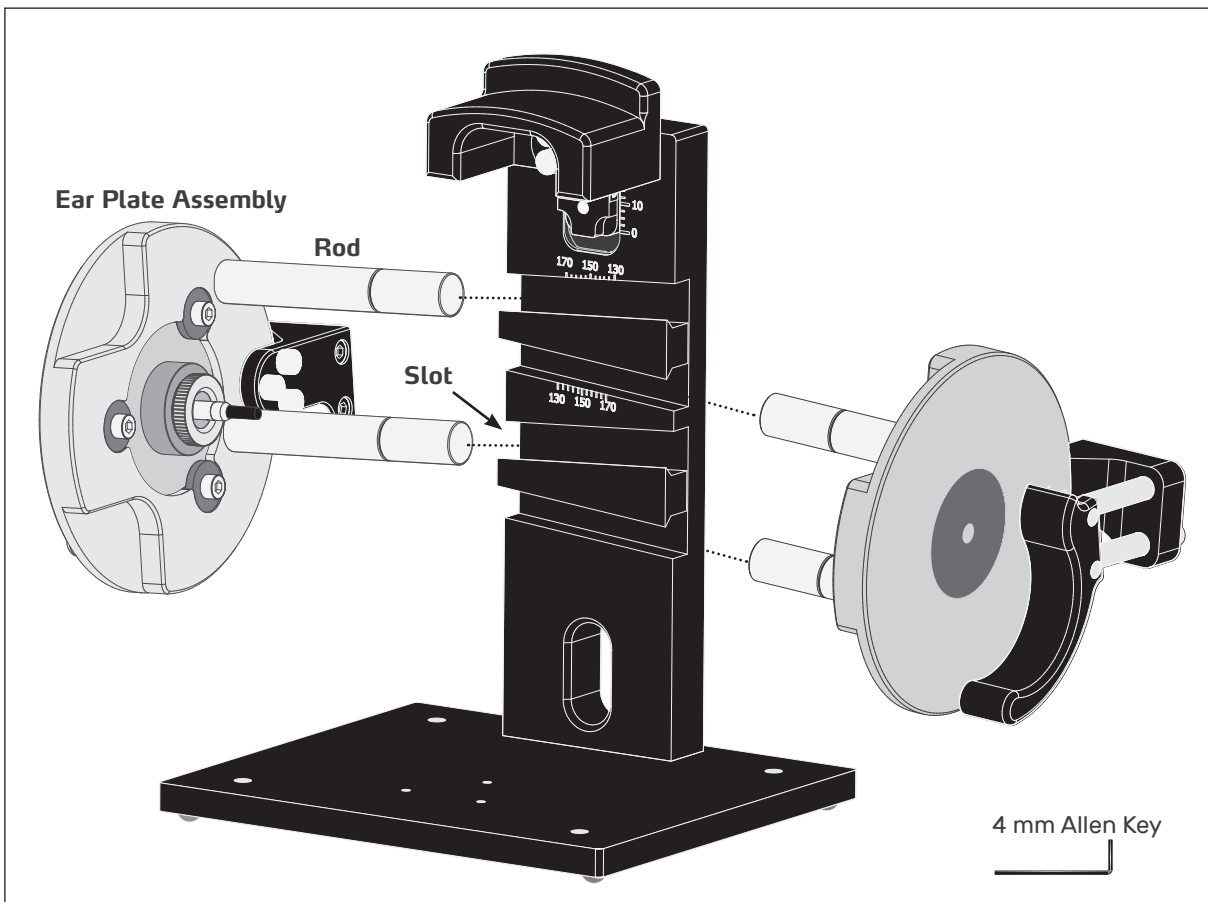


Fig. 1. Mounting the ear plate assemblies in the 45CC

Introduction

Overview

The 45CC Headphone Test Fixture is for testing of headphones and headsets. With a focus on accurate and reproducible test results, the test fixture can easily be adapted to many different headphone/headset designs and sizes.

- Adjustable head dimensions:
 - Distance between ears adjustable from 130 to 170 mm
 - Headband Holder height adjustable from 75 to 135 mm
- Reproducible positioning of Device Under Test with 45CC's unique Positioning Guides. All adjustments can be done in seconds.
- The microphones can easily be dismantled for calibration.

All adjustments to headband position and height as well as distance between ear plates can be done quickly and very accurately. Precise scales make it easy to document all settings: headband position, width between ears, position of positioning guide. This also makes it easy to set up other 45CCs to mirror the original setup.

Once the test fixture has been adjusted to fit a certain headphone, the design of headband holder, ear plates and the unique positioning system ensures that when testing identical headphones you will get the same positioning and fit from one test to the next.

About This Manual

This manual consists of the following main sections:

- The **45CC Configurations** details the 8 pre-configurations that GRAS has made available. The contents of these configurations are listed in detail in the following section, **Delivered Items**.
- **Delivered Items** lists the items that are delivered with each configuration. This section can be used as a reference to check your delivery and help you identify items mentioned in this manual.
- **General Description** explains how the 45CC is designed and what adjustments are available.
- The section **Assembly and Adjustments** explains the assembly and adjustment procedures necessary to prepare the 45CC for use.
- The section about **Calibration** shows how to dismantle a microphone for calibration. For specific information about how to calibrate, refer to the documentation for your calibration equipment.
- For people eager to get started, the one-page **Quick Assembly Guide** on page 4 should be a help.

The 45CC Configurations

For your convenience, we have made 45CC available in 12 different pre-configurations.

Except for the mounting of the ear plate assemblies and the mouth, they come fully assembled and tested from the factory.

45CC Configured with 1/2" Microphones

45CC-1 with Externally Polarized 1/2" Microphones

45CC-2 with Prepolarized 1/2" Microphones

45CC configured with 1/2" externally polarized or prepolarized microphones is primarily intended as a tool for QC and PL testing of headphones.

45CC Configured with Ear Simulators

45CC-3 with IEC 60318-1 Ear Simulators and Ext. Polarized 1/2" Microphones

45CC-4 with IEC 60318-1 Ear Simulators and Prepolarized 1/2" Microphones

45CC configured with IEC 60318-1 ear simulators and 1/2" externally polarized or prepolarized microphones is primarily intended as a tool for QC and PL testing of headphones. Where the acoustical load from an ear simulator is required, the use of the IEC 60318-1 ear simulators also mean that testing according to IEC 60318-1, IEC 60268-7 and ITU-T Recommendations P.57 is possible.

45CC Configured with Mouth Simulator and 1/2" Microphones

45CC-5 with Mouth Simulator and Ext. Polarized 1/2" Microphones

45CC-6 with Mouth Simulator and Prepolarized 1/2" Microphones

45CC configured with 1/2" externally polarized or prepolarized microphones and the GRAS 44AA Mouth Simulator is primarily intended as a tool for QC and PL testing of communication headsets.

45CC Configured with Mouth Simulator and Ear Simulators

45CC-7 Mouth Simulator, IEC 60318-1 Ear Simulators and Ext. Polarized 1/2" Microphones

45CC-8 Mouth Simulator, IEC 60318-1 Ear Simulators and Prepolarized 1/2" Microphones

45CC configured with IEC 60318-1 ear simulators, 1/2" externally polarized or prepolarized microphones and the GRAS 44AA Mouth Simulator is primarily intended as a tool for QC and PL testing of communication headsets. Where the acoustical load from an ear simulator is required, the use of the IEC 60318-1 ear simulators also mean that testing according to IEC 60318-1 and ITU-T Recommendations P.57 is possible.

45CC Configured with 1/4" Microphones

45CC-9 with Externally Polarized 1/4" Microphones

45CC-10 with Prepolarized 1/4" Microphones

45CC configured with 1/4" externally polarized or prepolarized microphones extends the frequency range to 70 kHz for high frequency testing.

45CC Configured with Mouth Simulator and 1/4" Microphones

45CC-11 with Mouth Simulator and Ext. Polarized 1/4" Microphones

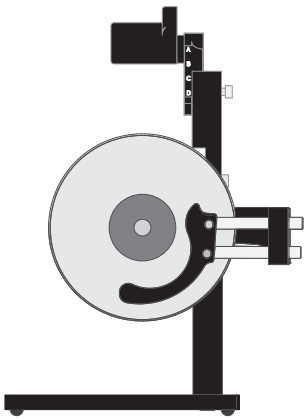

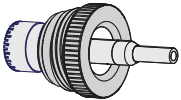




45CC-12 with Mouth Simulator and Prepolarized 1/4" Microphones

45CC configured with 1/4" externally polarized or prepolarized microphones and the GRAS 44AA Mouth Simulator extends the frequency range to 70 kHz for high frequency testing of communication headsets. The frequency range of the GRAS 44AA Mouth Simulator is 100 Hz to 16 kHz.

Delivered Items

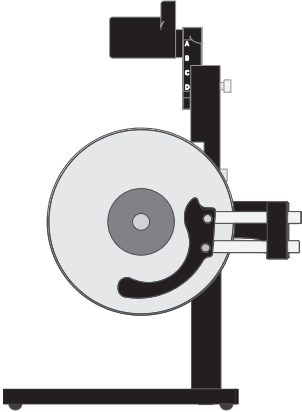


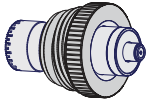



This section lists the main components that are delivered with each configuration. It can be used to verify your delivery and to identify parts that are mentioned in this manual.

45CC-1 Externally Polarized 1/2" Microphones

Included Items		
	Headphone Test Fixture	45CC
	Allen Key, 4 mm	YY0013
	1/2" Microphone Assembly*	2 x 69CC-1
The 69CC-1 Microphone Assembly		
	1/2" Externally Polarized Microphone	2 x 40AG
	1/4" Preamp with 3 m integrated cable	2 x 26AC
	1/2" to 1/4" Adapter	2 x GR0010
	1/2" Microphone Holder	2 x GR2013

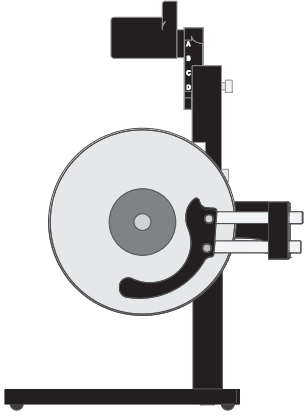


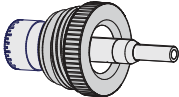




*The parts are glued together and must not be disassembled

45CC-2 Prepolarized 1/2" Microphones

Included Items		
	Headphone Test Fixture	45CC
	Allen Key, 4 mm	YY0013
	Microdot-BNC Cable	2 x AA0070
	1/2" Microphone Assembly*	2 x 69CC-2
The 69CC-2 Microphone Assembly		
	1/2" Prepolarized Microphone	2 x 40AO
	1/2" CCP Standard Preampifier with Microdot Connector, Very Short	2 x 26CK
	1/2" Microphone Holder	2 x GR2013

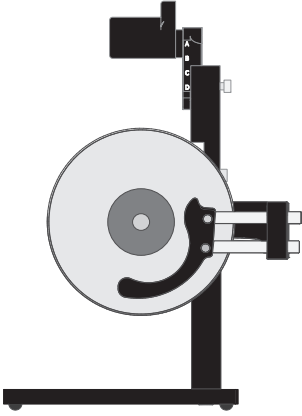



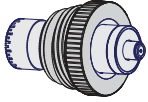



*The parts are glued together and must not be disassembled

45CC-3 60318-1 Ear Simulators and Externally Polarized 1/2" Microphones

Included Items		
	Headphone Test Fixture	45CC
	60318-1 Ear Simulator	2 x RA0039
	Allen Key, 4 mm	YY0013
	1/2" Microphone Assembly*	2 x 69CC-1
The 69CC-1 Microphone Assembly		
	1/2" Externally Polarized Microphone	40AG
	1/4" Preamp with 3 m integrated cable	26AC
	1/2" to 1/4" Adapter	GR0010
	1/2" Microphone Holder	GR2013

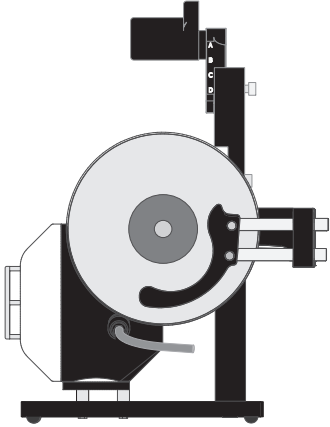
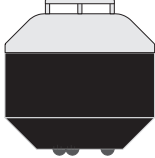



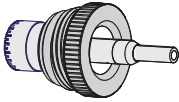




*The parts are glued together and must not be disassembled

45CC-4 60318-1 Ear Simulators and Prepolarized 1/2" Microphones

Included Items		
	Headphone Test Fixture	45CC
	60318-1 Ear Simulator	2 x RA0039
	Allen Key, 4 mm	YY0013
	Microdot-BNC Cable	2 x AA0070
	1/2" Microphone Assembly*	2 x 69CC-2
The 69CC-2 Microphone Assembly		
	1/2" Prepolarized Microphone	40AO
	1/2" CCP Standard Preamp with Microdot Connector, Very Short	26CK
	1/2" Microphone Holder	GR2013

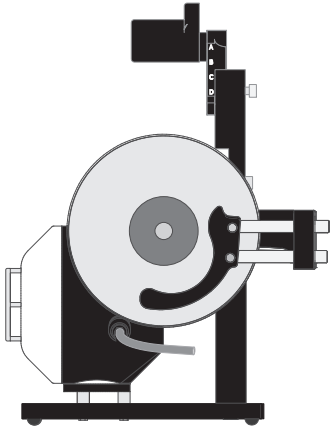
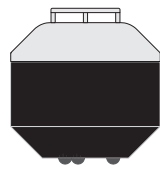




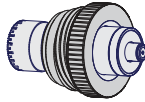



*The parts are glued together and must not be disassembled

45CC-5 Mouth Simulator and Externally Polarized 1/2" Microphones

Included Items		
	Headphone Test Fixture	45CC
	Mouth Simulator according to ITU-T Rec. P51 with built-in power amplifier	44AA
	Allen Key, 4 mm	YY0013
	5 mm socket screw driver	YY0034
	BNC-BNC Cable	AA0035
	1/2" Microphone Assembly*	2 x 69CC-1
The 69CC-1 Microphone Assembly		
	1/2" Externally Polarized Microphone	40AG
	1/4" Preamp with 3 m integrated cable	26AC
	1/2" to 1/4" Adapter	GR0010
	1/2" Microphone Holder	GR2013

*The parts are glued together and must not be disassembled

45CC-6 Mouth Simulator and Prepolarized 1/2" Microphones

Included Items		
	Headphone Test Fixture	45CC
	Mouth Simulator according to ITU-T Rec. P51 with built-in power amplifier	44AA
	Allen Key, 4 mm	YY0013
	5 mm socket screw driver	YY0034
	Microdot-BNC Cable	2 x AA0070
	BNC-BNC Cable, 3 m	AA0035
	1/2" Microphone Assembly*	2 x 69CC-2
The 69CC-2 Microphone Assembly		
	1/2" Prepolarized Microphone	40A0
	1/2" CCP Standard Preamp with Microdot Connector, Very Short	26CK
	1/2" Microphone Holder	GR2013

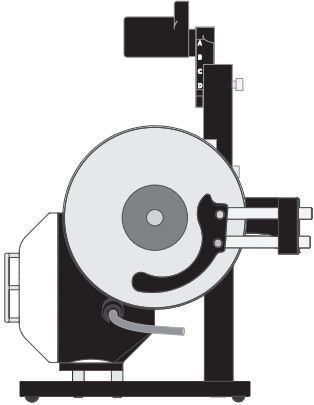
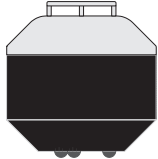
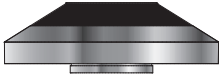




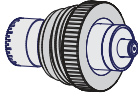



*The parts are glued together and must not be disassembled

45CC-7 Mouth Simulator, 60318-1 Ear Simulators and Ext. Pol. 1/2" Microphones

Included Items		
	Headphone Test Fixture	45CC
	Mouth Simulator according to ITU-T Rec. P51 with built-in power amplifier	44AA
	60318-1 Ear Simulator	2 x RA0039
	Allen Key, 4mm	YY0013
	5 mm socket screw driver	YY0034
	BNC-BNC Cable	AA0035
	1/2" Microphone Assembly*	2 x 69CC-1
The 69CC-1 Microphone Assembly		
	1/2" Externally Polarized Microphone	40AG
	1/4" Preamplifier with 3 m integrated cable	26AC
	1/2" to 1/4" Adapter	GR0010
	1/2" Microphone Holder	GR2013

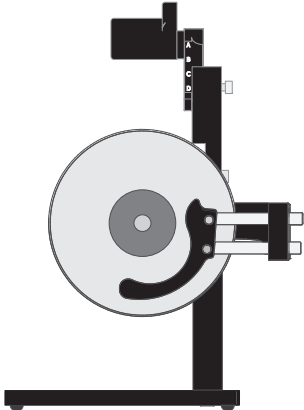

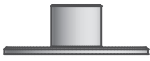
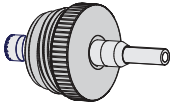


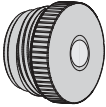
*The parts are glued together and must not be disassembled

45CC-8 Mouth Simulator, 60318-1 Ear Simulators, Prepolarized 1/2" Microphones

Included Items		
	Headphone Test Fixture	45CC
	Mouth Simulator according to ITU-T Rec. P51 with built-in power amplifier	44AA
	60318-1 Ear Simulator	2 x RA0039
	Allen Key, 4 mm	YY0013
	5 mm socket screwdriver	YY0034
	Microdot-BNC Cable	2 x AA0070
	BNC-BNC Cable	AA0035
	1/2" Microphone Assembly*	69CC-2
The 69CC-2 Microphone Assembly		
	1/2" Prepolarized Microphone	40AO
	1/2" CCP Standard Preamplifier with Microdot Connector, Very Short	26CK
	1/2" Microphone Holder	GR2013

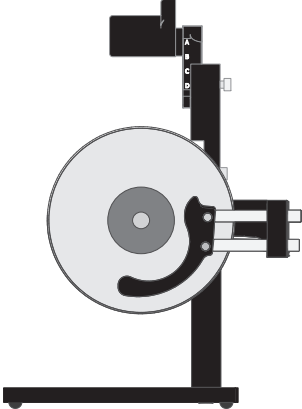



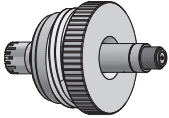


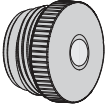
*The parts are glued together and must not be disassembled

45CC-9 Externally Polarized 1/4" Microphones

Included Items		
	Headphone Test Fixture	45CC
	Allen Key, 4 mm	YY0013
	1/4" Calibration Adapter	RA0331
	1/4" Microphone Assembly*	2 x 69CC-3
The 69CC-3 Microphone Assembly		
	1/4" Externally polarized Microphone	40BP
	1/4" Preamp with 3 m integrated Cable	26AC
	1/4" Microphone Holder	GR2039

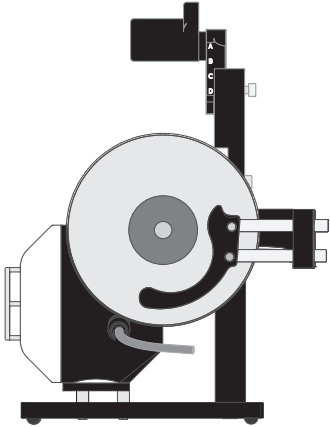
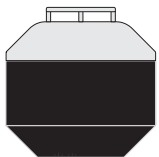



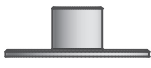
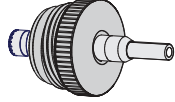


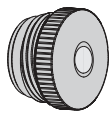
*The parts are glued together and must not be disassembled

45CC-10 Prepolarized 1/4" Microphones

Included Items		
	Headphone Test Fixture	45CC
	Allen Key, 4 mm	YY0013
	Microdot-BNC Cable	2 x AA0070
	1/4" Calibration Adapter	RA0331
	1/4" Microphone Assembly*	2 x 69CC-4
The 69CC-4 Microphone Assembly		
	1/4" Prepolarized Microphone	40BD
	1/4" CCP Standard Preamp Very Short	26CS
	1/4" Microphone Holder	GR2039

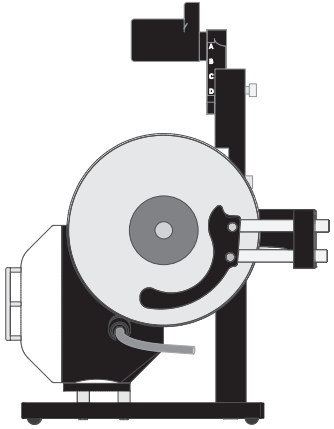
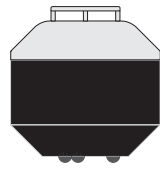



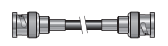
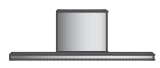
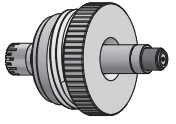


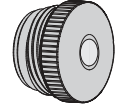
*The parts are glued together and must not be disassembled

45CC-11 Mouth Simulator and Externally Polarized 1/4" Microphones

Included Items		
	Headphone Test Fixture	45CC
	Mouth Simulator according to ITU-T Rec. P51 with built-in power amplifier	44AA
	Allen Key, 4 mm	YY0013
	5 mm socket screwdriver	YY0034
	BNC-BNC Cable	AA0035
	1/4" Calibration Adapter	RA0331
	1/4" Microphone Assembly*	2 x 69CC-3
The 69CC-3 Microphone Assembly		
	1/4" Externally polarized Microphone	40BP
	1/4" Preamplifier with 3 m integrated Cable	26AC
	1/2" Microphone Holder	GR2039

*The parts are glued together and must not be disassembled

45CC-12 Mouth Simulator and Prepolarized 1/4" Microphones

Included Items		
	Headphone Test Fixture	45CC
	Mouth Simulator according to ITU-T Rec. P51 with built-in power amplifier	44AA
	Allen Key, 4 mm	YY0013
	5 mm socket screwdriver	YY0034
	Microdot-BNC Cable	2 x AA0070
	BNC-BNC Cable	AA0035
	1/4" Calibration Adapter	RA0331
	1/4" Microphone Assembly*	2 x 69CC-4
The 69CC-4 Microphone Assembly		
	1/4" Prepolarized Microphone	40BD
	1/4" CCP Standard Preamplifier Very Short	26CS
	1/4" Microphone Holder	GR2039

*The parts are glued together and must not be disassembled

General Description

This section describes how the 45CC is designed. Instructions on how to assemble and make adjustments are given in the section “Assembly and Adjustments” on page 25 onwards.

Front View

Fig. 1 shows the main height and width adjustments possible with the 45CC. The **Headband Holder** has 4 fixed positions on the vertical Neck superimposed on a continuous adjustment of 20 mm for any position within 60 mm from bottom to top position. The top position is 135 mm over the center of the Ear Plates, the lowest position is 60 mm below the top position.

The distance between the **Ear Plates** can be adjusted from 130 to 170 mm, in compliance with ANSI S12.42 and IEC 60318-7.

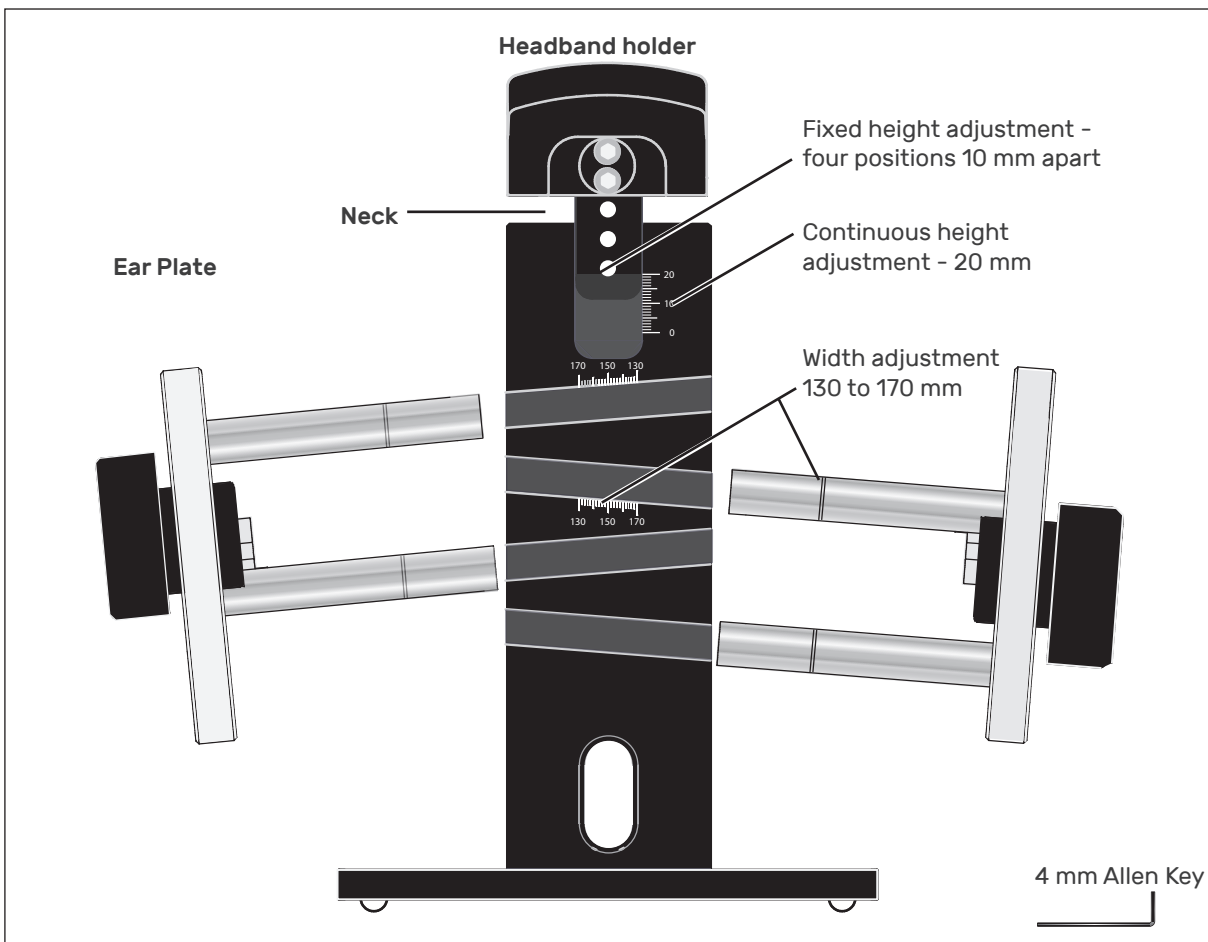


Fig. 1. Front view of 45CC.

Side View

Below is shown a side view of the 45CC configured with a **44AA Mouth Simulator** is shown. The Headband Holder can be adjusted relative to the Ear Plates both horizontally and vertically. Horizontally it can be fixed in three positions, the adjustment range is 10 mm. This makes it possible to test headphones with narrow, mid-sized or wide headbands. The vertical adjustment is 60 mm from top to bottom. See page 27 for instruction on how to make these adjustments.

The **Positioning Guide** is described in detail on page 24. How you can adjust it for different headphone sizes is shown on page 28.

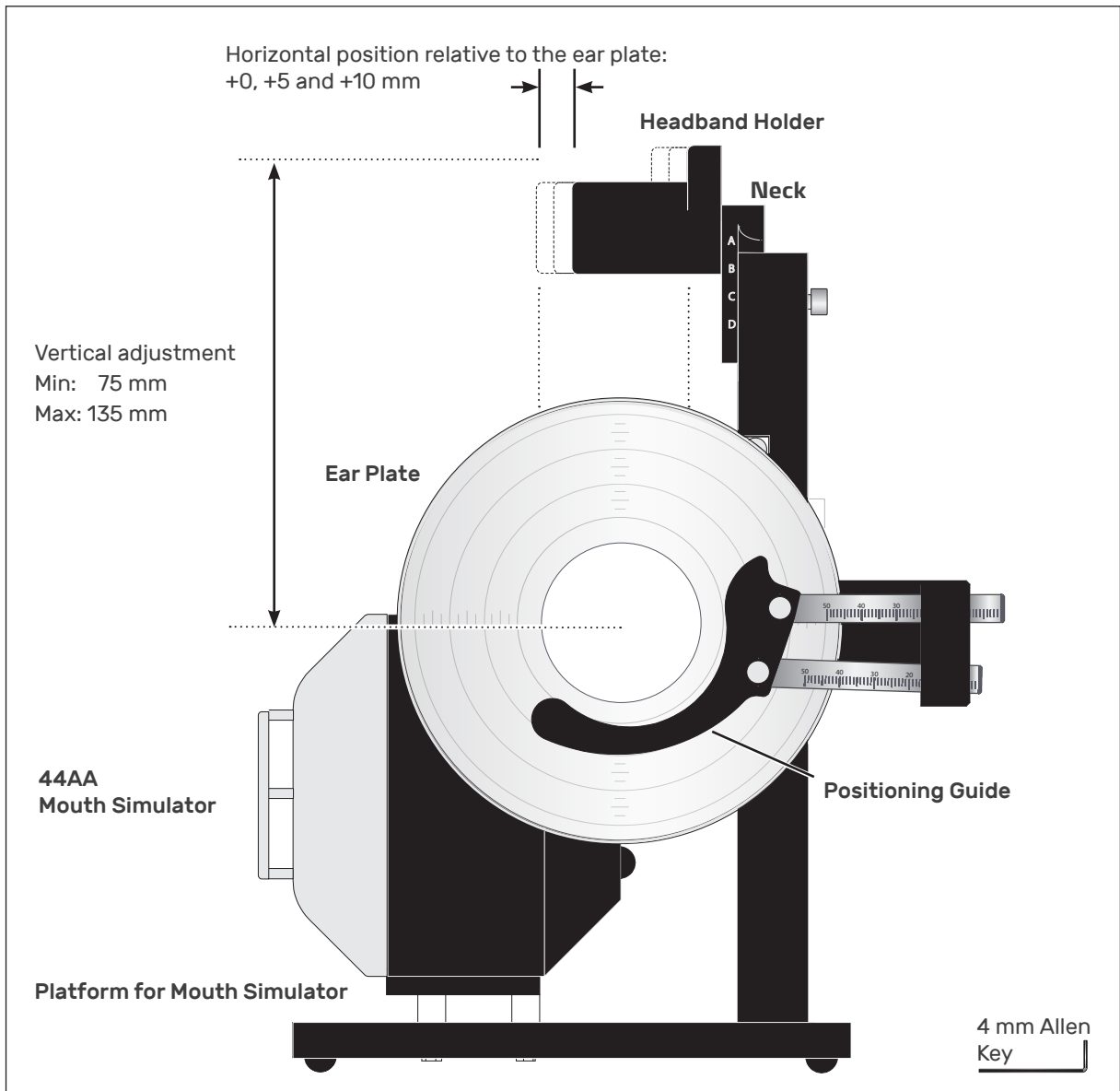


Fig. 2. Side view - here with mouth simulator.

Rear View

Fig. 3 shows a rear view of 45CC without configuration specific parts. The screws needed for adjustment of the width between the **Ear Plate Assemblies** and the 20 mm continuous adjustment of the Headband Holder height are all accessed on the rear.

Note also the screws for adjusting the **Positioning Guides**. See the section “Adjusting the Positioning Guides” on page 28 for instructions on how to adjust the Positioning Guides to fit different sizes of headphones.

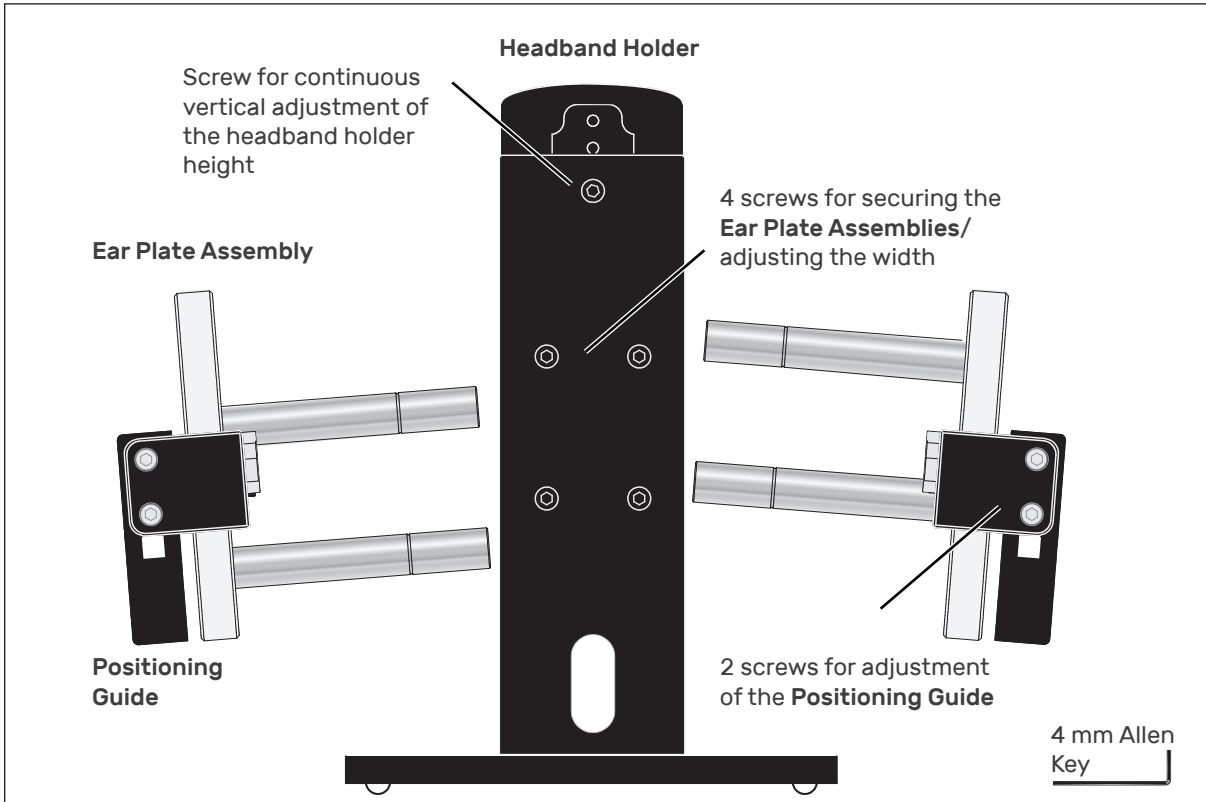


Fig. 3. Rear view of the 45CC with the screws for adjustment of width between ear plates and vertical adjustment of the headband holder.

Ear Plate Assemblies

On the inside of the Ear Plates, the Fittings for 60218-1 Ear Simulator and Flanges for 1/2" and 1/4" microphones are mounted as shown in Fig. 4. On the outside a positioning system for holding the cups of the headphones are mounted. This is shown in Fig. 6 on page 24.

The Fittings for Microphone Mounting

As can be seen from Fig. 4 below, the microphones are mounted from the inside. The **Ear Plate** can accommodate the Ear Simulator or the Flanges for 1/2" or 1/4" microphones. These have the same outer dimensions and are mounted the same way, with three screws and fasteners. Therefore, it is fairly easy to reconfigure a 45CC, for example from a version with 1/2" microphones to IEC 60318-1 ear simulators.

The **GR1997 Holder** is used with the RA0039 Ear Simulator only, as the thread it provides is an integral part of the two flanges.

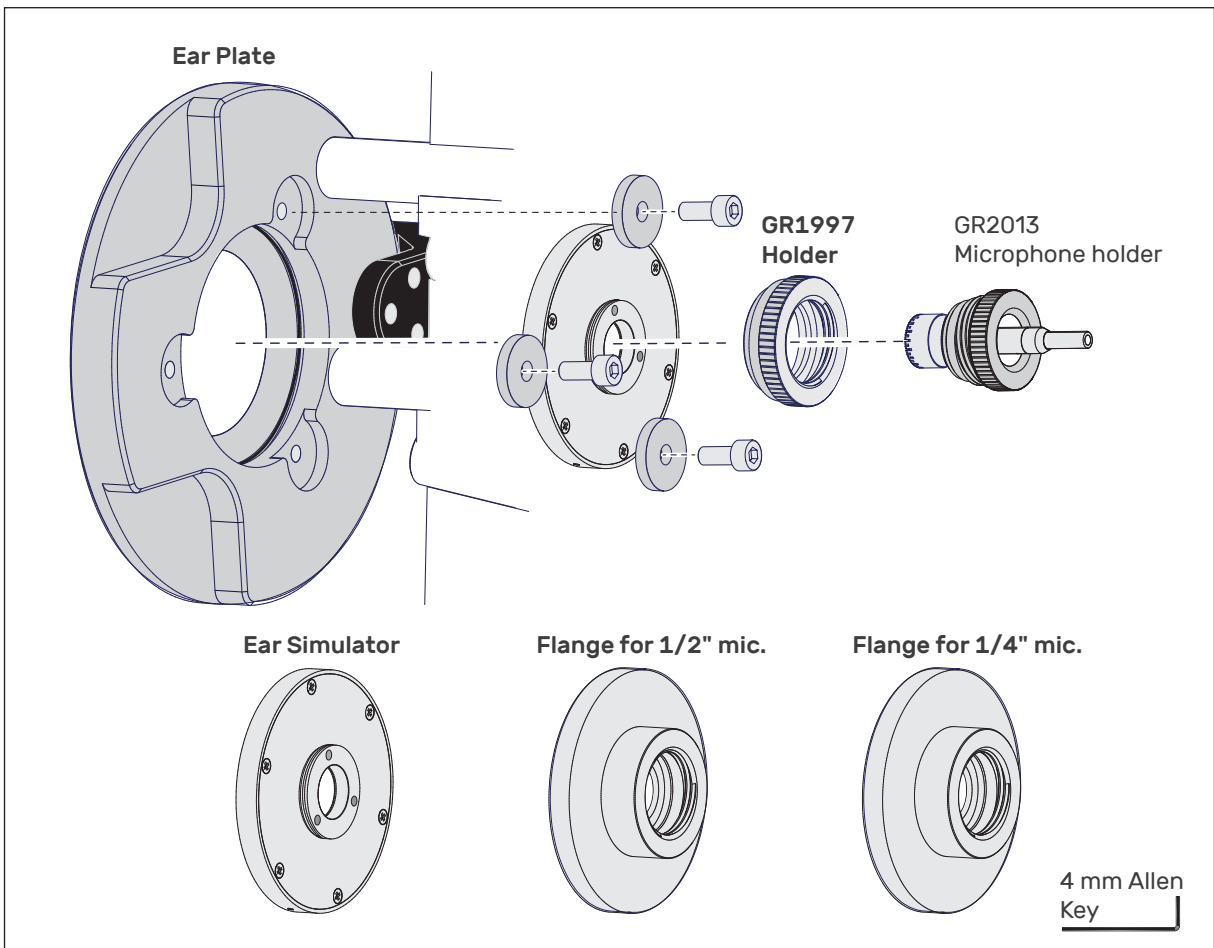


Fig. 4. Detailed view of the fittings for ear simulator mounting. The mounting of the 1/2" and 1/4" Microphone Flanges is similar, except that the GR1997 Holder in the middle is an integral part of the two flanges.

The Microphone Holder

The microphone and preamplifier are already assembled in the microphone holder that is used for mounting in the 45CC. They are calibrated as a whole, and each assembly has its serial number engraved on the rear face of the holder. (The engraving is not shown below).

Important. These parts are glued together and must not be disassembled.

How this assembly is mounted in the ear plate assembly is shown in Fig. 4. When you need to calibrate, simply remove it from the ear plate by turning it half a turn.

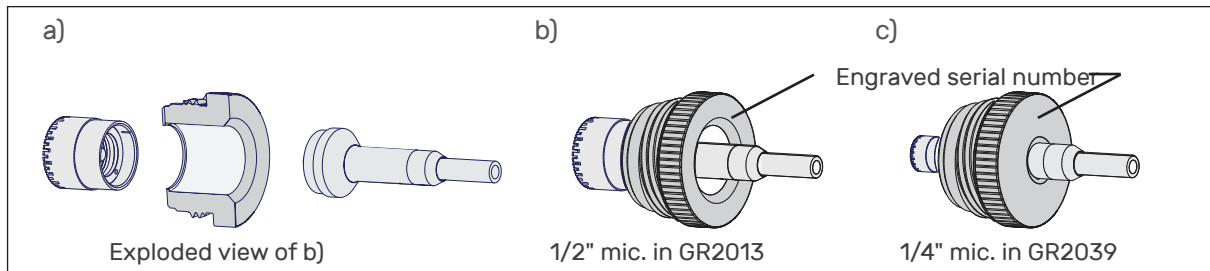


Fig. 5. 1/2" and 1/4" microphone mounted in microphone holder. Do not disassemble as shown in a).

The Positioning Guide

The **Positioning Guide** can accommodate headphones of much different sizes. Engraved Scales on the **Ear Plates** make it easy to center the headphone over the microphone, scales on the **Positioning Guide Rods** help set up and reproduce distance and angle for the **Positioning Guide**.

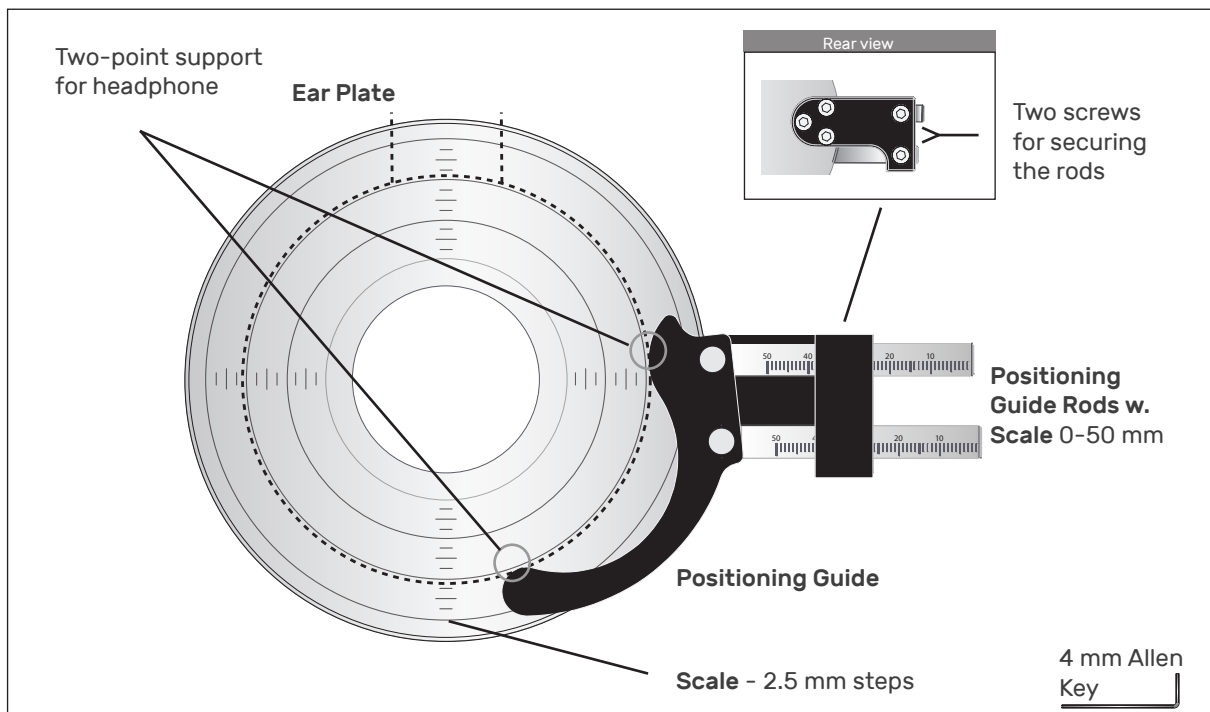


Fig. 6. Positioning guide with adjustments for horizontal and vertical alignment of headphone.

Assembly and Adjustments

Assembling the 45CC

The test fixture is partially assembled at the factory, but the user needs to mount the two **Ear Plate Assemblies** in **Slots** in the fixture. As shown in Fig. 7 below, the ear plates have two long **Rods** that can be pushed into the **Slots** and secured each with two screws from the rear.

Mounting the Ear Plate Assemblies

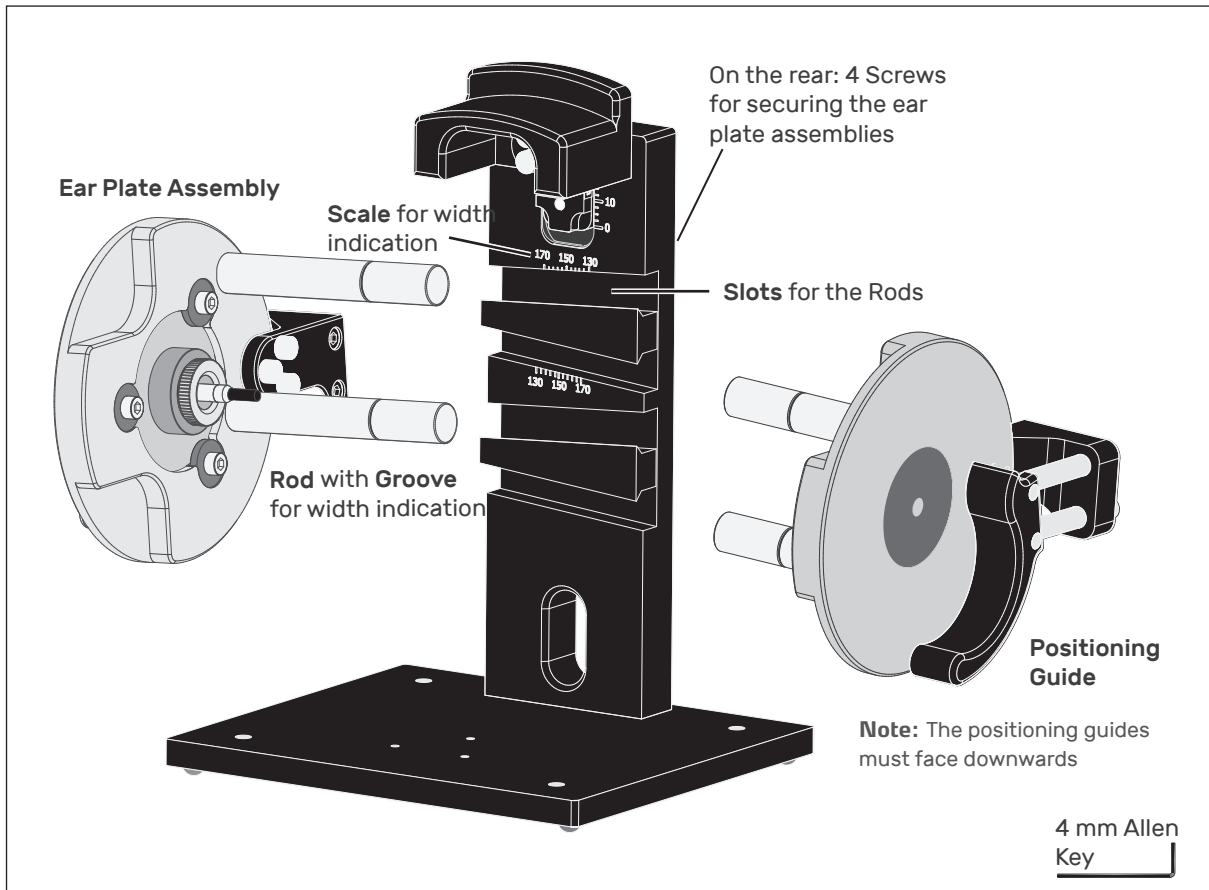


Fig. 7. Mounting the ear plate assemblies in the test fixture.

If necessary, loosen the four screws on the back of the fixture. These are shown Fig. 3 on page 22. The distance between the ear plates can be adjusted from 130 to 170 mm. Two mm **Scales** on the fixture and a **Groove** on each of the rods are used to set the position.

Slide in the **Ear Plate Assemblies** with the headphone Positioning Guides facing downwards.

3. Tighten the four screws on the back of the unit.

Mounting the Mouth Simulator

The **44AA Mouth Simulator** assembly is attached to the 45CC with three **Nuts** that are fastened from the underside of the 45CC's **Base plate**.

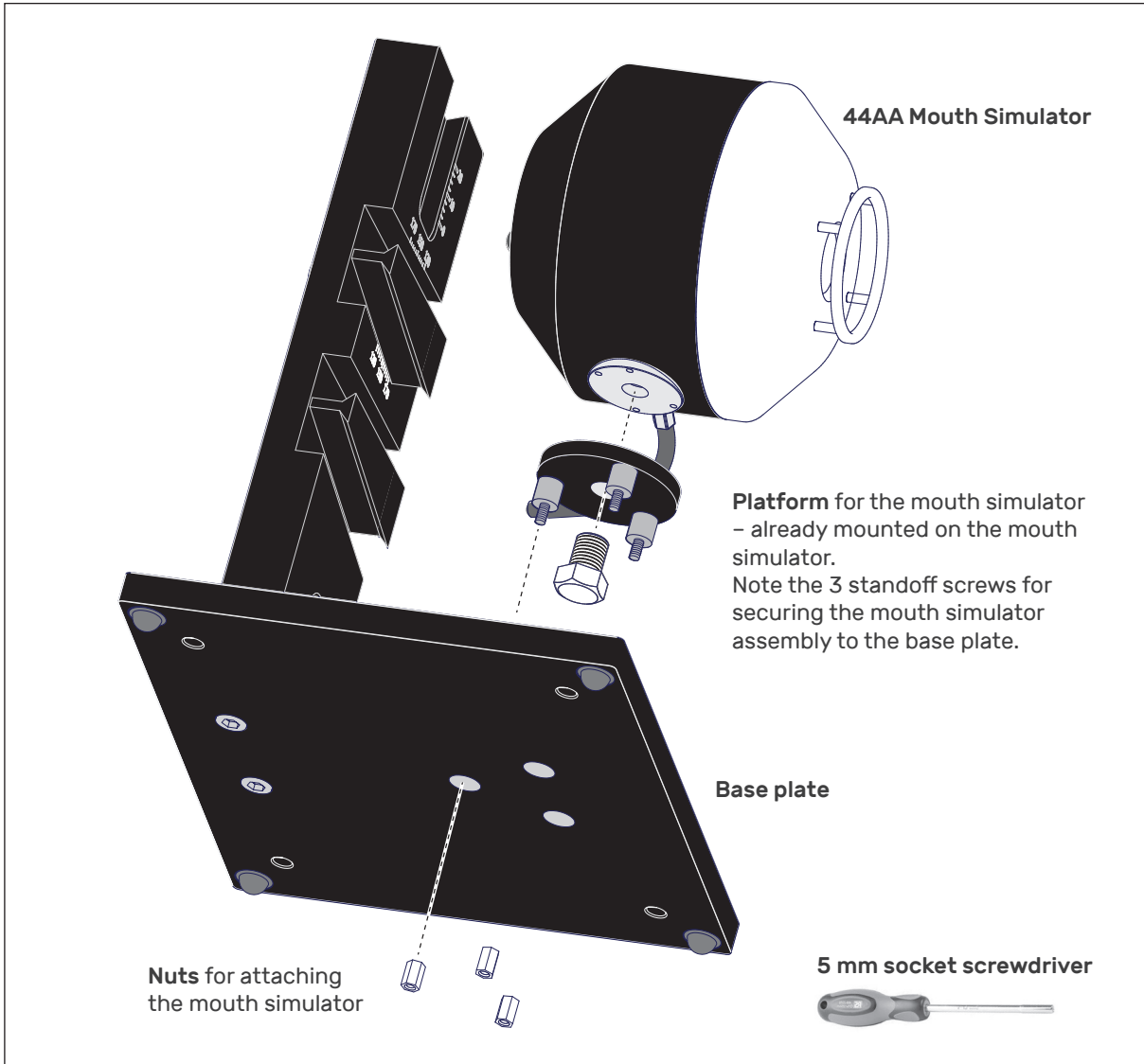


Fig. 8. Mounting the mouth simulator.

1. Place the 45CC in a way that lets you access the **Base plate** (“foot”) from the underside.
2. Guide the three **Nuts** through the three holes in the base plate.
3. Fasten the nuts using the YY0034 socket screwdriver.

Adjusting the Headband Holder Height

The **Headband Holder** is mounted on a sliding bar (‘‘neck’’) that allows for a continuous height adjustment of 20 mm. In addition to this, the headband holder can be mounted at four different positions on the bar, adding up to another 40 mm to the adjustment range. In the lower position, the distance to the center of the ear plate assembly is 75 mm, in the top position it is 135 mm.

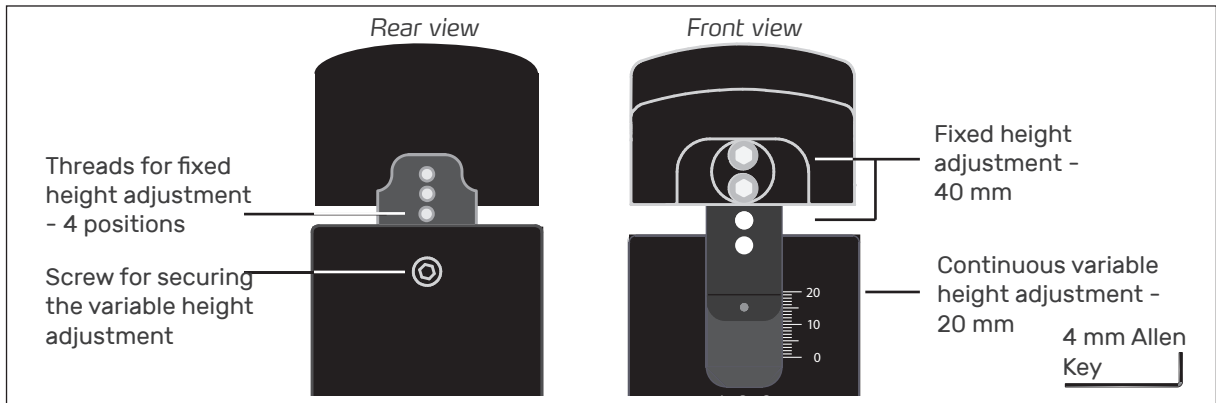


Fig. 9. The height adjustment of the headband holder – here it is shown in its top position.

Adjusting the Horizontal Position

The head band holder’s horizontal position can be adjusted by 0, +5 mm or + 10 mm relative to the neck/the center of the ear plate. This is done by changing the position of two 5 mm spacers, as illustrated below.

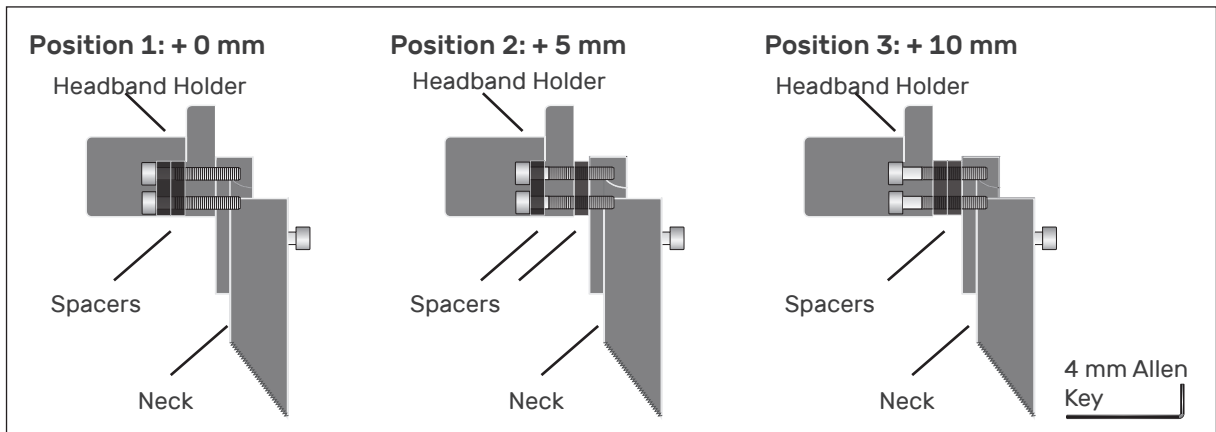


Fig. 10. The 3 horizontal positions of the headband holder.

Position 1: + 0 mm. In this position the headband holder is attached directly to the neck. The two spacers are used to ensure that the length of the two screws fit the depth of the threads.

Position 2: + 5 mm. One spacer is used between headband holder and neck, the other is used to ensure that the length of the two screws fit the depth of the thread in the neck.

Position 3: + 10 mm. Both spacers are used between headband holder and neck.

Adjusting the Positioning Guides

To help position the headphones, the ear plate assemblies are furnished with an adjustable positioning system. Engraved scales on the ear plates can help you center the headphones accurately over the microphone.

As shown in the positioning system can be adjusted to support virtually all headphone sizes.

The positioning system is described in detail in Fig. 6 on page 24.

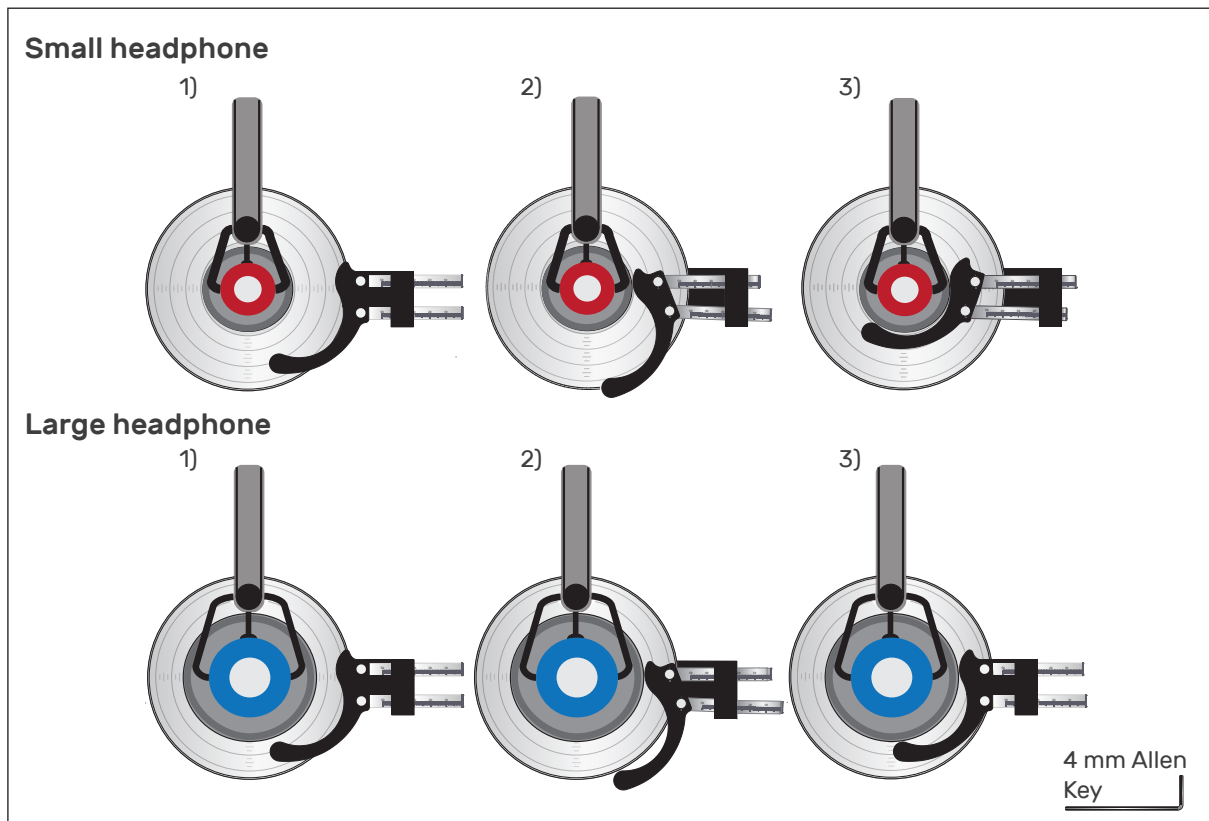


Fig. 11. Example of positioning of a headphone using the 45CC's positioning system.

1. Position the headphone so it is centered over the microphone.
2. Push the upper part of the guide until it touches the headphone, without dislocating it, as shown in 2), and secure the position by fastening the screw on the rear.
3. Push the lower part of the guide until it supports the Device Under Test, as shown in 3), and fasten.

The scales on the two rods do not indicate the distance to the DUT. They are meant as a means to make it easy to document and repeat the settings onto more 45CC Headphone Test Fixtures.

Calibration

To calibrate the microphones, you must first remove them from the ear plates.

This is done very simply by turning the microphone assembly half a turn counterclockwise. In the illustration below the microphone is removed from the IEC 60318-1 Ear Simulator.

The method for removing the microphones from the other configurations is the same.

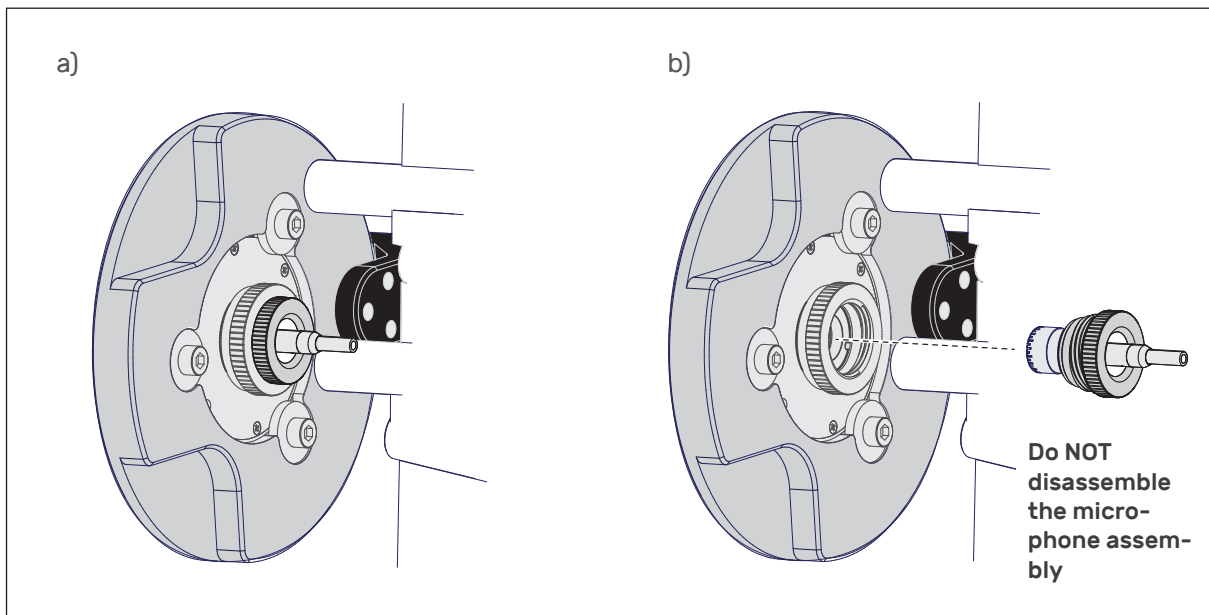


Fig. 12. Removing a microphone assembly for calibration. When removed from the assembly (b), it is ready for calibration.

Important. The parts of the microphone assembly – microphone, microphone holder, 1/2" to 1/4" adapter and preamplifier – are glued together and should under no circumstances be disassembled. If a need for this arises, you must send it to GRAS for service.

You can calibrate using a pistonphone, a sound calibrator or an electrostatic actuator. See the manual(s) for your calibration equipment for further information.

For level calibration with a pistonphone or sound calibrator, 1/2" and 1/4" calibration adapters are required as described on page 28.

Level Calibration with a Pistonphone

Level calibration with a pistonphone requires that a calibration adapter is used.

- For 1/2" microphones, the RA0048 1/2" Calibration Adapter must be used. It is an accessory included with your pistonphone.
- For 1/4" microphones, the RA0331 1/4" Calibration Adapter must be used. It is part of the 45CC-configurations that use 1/4" microphones.

Important. It is important that the adapter is pushed as far down into the pistonphone as it will go. To ensure this, you must either tighten the pistonphone's collar to ensure that it is in its lowest possible position, or remove it entirely, as shown below.

The adapters have identical outer dimensions, and the procedure for mounting them is the same.

1. Select the appropriate adapter for the microphone you want to calibrate.
2. Remove the pistonphone collar by turning it counterclockwise and lifting it up.
3. Remove the O-ring mounted in the pistonphone coupler entrance.
4. Push the adapter as far down into the pistonphone as it will go.

You are now ready to mount the microphone into the adapter.



Fig. 13. Removing the collar before mounting the adapter

For further information, see the manual for your pistonphone.

Level Calibration with a Sound Calibrator

- For 1/2" microphones, the RA0297 1/2" Calibration Adapter must be used when. It is an accessory included with your calibrator.
- For 1/4" microphones, the RA0331 1/4" Calibration Adapter must be used. It is part of the 45CC-configurations that use 1/4" microphones.

For further information, see the manual for your calibrator.

Technical Specifications

45CC			
Width between ears	Adjustable from 130 to 170 mm		
Height of headband holder (measured from plane between ears)	Adjustable from 75 to 135 mm		
Ear plate angle	4.5° (ISO 4869-3)		
Diameter of ear plate	128 mm		
Microphones	IEC 61094-4 1/2" WS2P pressure microphones in the ear plate plane IEC 60318-1 ear simulators in the ear plate plane IEC 61094-4 1/4" WS3P pressure microphones in the ear plate plane		
Input dynamic range	69CC-1	25 dB (A) - 164 dB (ext. polarized)	3.15 Hz - 20 kHz
	69CC-2	25 dB (A) - 150 dB (prepolarized)	3.15 Hz - 20 kHz
	69CC-3	39 dB (A) - 169 dB (ext. polarized)	4 Hz - 70 kHz
	69CC-4	44 dB (A) - 166 dB (prepolarized)	4 Hz - 70 kHz
Sound source	GRAS 44AA Mouth Simulator According to ITU-T P51. Placed in accordance with ITU-T P58		
Cross feed damping	28 dB (20-500 Hz) >45 dB (500 - 20 kHz)		
Weight (without microphones or mouth simulator)	3 kg		

Full specifications for microphones and mouth simulator can be found at gras.dk

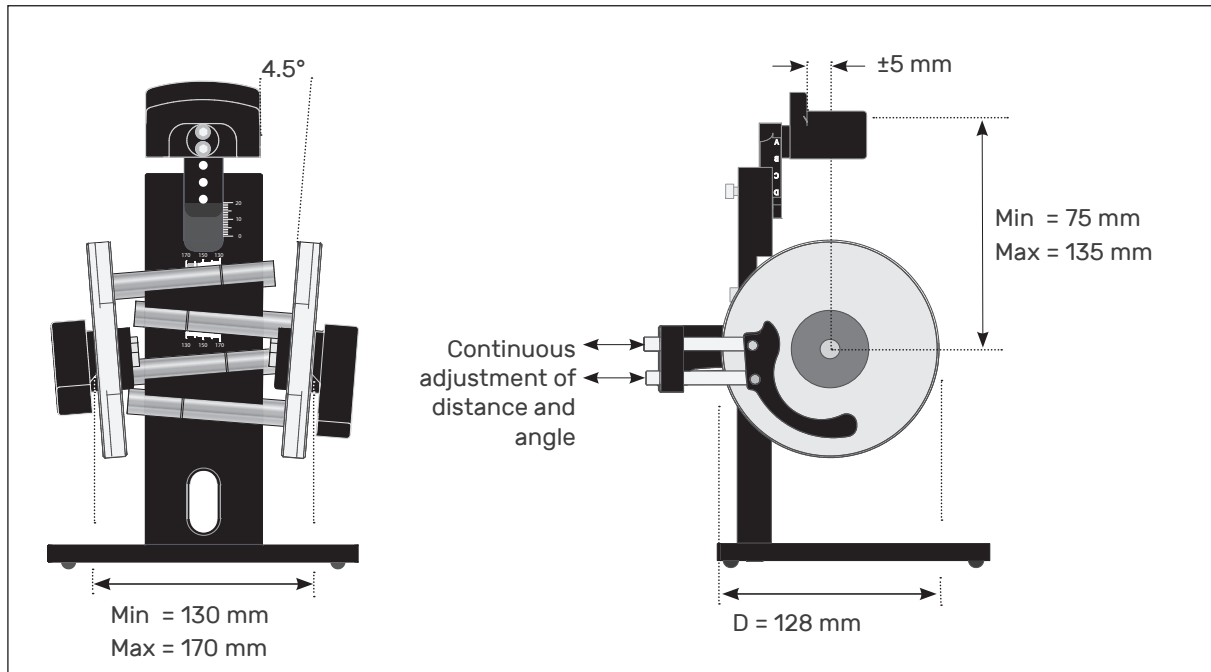


Fig. 14. 45CC's key adjustments for different headphone sizes

Warranty, Service and Repair

Calibration

Before leaving the factory, all GRAS products are calibrated in a controlled laboratory environment using traceable calibration equipment.

We recommend a yearly recalibration at minimum, depending on the use, measurement environment, and internal quality control programs.

We recommend calibration prior to each use to ensure the accuracy of your measurements.

Warranty

Damaged diaphragms in microphones can be replaced. The microphone diaphragm, body, and improved protection grid are made of high-grade stainless steel, which makes the microphone resistant to physical damage, as well as corrosion caused by aggressive air or gasses. This, combined with the reinforced gold-plated microphone terminal which guarantees a highly reliable connection, enables GRAS to offer 5 years warranty against defective materials and workmanship.

The warranty does not cover products that are damaged due to negligent use, an incorrect power supply, or an incorrect connection to the equipment.

Service and Repairs

All repairs are made at GRAS International Service Center located in Denmark. Our Service 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.