G.R.A.S.
SOUND & VIBRATION

Instruction Manual

44AA Mouth Simulator according to ITU-T Rec. P51 with built-in power amplifier

44AB Mouth Simulator according to ITU-T Rec. P51

LI0079 – 14 June 2017

Revision History

Revision	Date	Description
1	14 June 2017	Extracted from Earbook as separate document. Fig.6: Added info about speaking positions Section about avoiding hum added.

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

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Contents

Introduction

The Mouth Simulator 44AA (and 44AB) is a sound source which simulates the sound field around the human mouth at close quarters. It is for testing telephone mouthpieces as well as microphones similarly used in vocal-communication networks and complies with the requirements of:

- IEEE 269, 661.
- ITU-T Rec. P51.

At the mouth reference point (MRP), which is 25mm from the detachable lip ring (35mm from the simulator's mouth), the maximum continuous equalised signal it can produce in ⅓-octave bands is 100 dB re. 20 µPa in the frequency range 100 Hz to 16 kHz.

Difference between 44AA and 44AB

44AA

The 8 Ω loudspeaker of the 44AA accepts an external signal (applied via the BNC socket shown in Fig. 1) either:

a) directly, or

b) via the built-in power amplifier (10 dB gain).

The built-in power amplifier switches on automatically when energised by an external 24 V DC supply, e.g. via the Mains/line Power Supply AB0012 (included with the 44AA).

44AB

The 8 Ω loudspeaker of the 44AB accepts an external signal directly (applied via the BNC socket shown in Fig. 1). It has no built-in power amplifier.

Components

The Mouth Simulator comprises the following main-components:

- GR0591K Housing (for 44AA)
- GR0717K Housing (for 44AB)
- GR0700 Mouth Piece

Fig. 1. *44AA and 44AB Mouth Simulators*

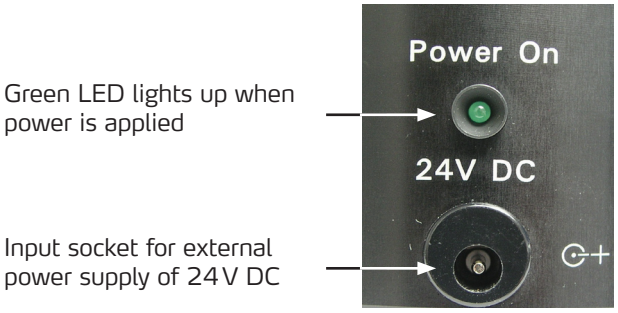

Fig. 2. *Power input for the power amplifier of the 44AA*

- RA0106 Lip ring
- RA0104 Jig for ITU-T Rec. P51 Calibration
- RA0105 Jig for IEEE 269 Calibration
- AB0012 Mains/line Power supply (for 44AA)

The Mouth Simulator is delivered as shown in Fig. 1. An exploded view of its user-serviceable components is shown in Fig. 3.

Fig. 3. *Exploded view of all the user-serviceable components of the Mouth Simulator (if required the mouth piece GR0700 can be replaced by the earlier conical version RA0110 available from G.R.A.S.)*

Earlier Mouthpiece

An earlier conical mouth piece RA0110 (Fig. 4) is available and can be delivered with the Mouth Simulator for users who require it, e.g. for historical reasons. It comes without the four holes for mounting the lip ring.

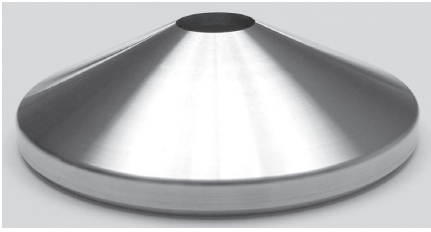

Fig. 4. *RA0110 earlier conical mouth piece available from G.R.A.S.*

Additional Equipment

Common to Calibration and Testing

1) Suitable power amplifier
2) Audio signal generator capable of:
   - generating logarithmically swept tones within the audio frequency range [3]
   - equalising in real time for the fluctuations of the true response of the Mouth Simulator

This audio signal is fed (directly or indirectly) to the Mouth Simulator.

3) Audio frequency analyser

The audio analyser receives the signal picked up either by the telephone handset (Fig. 7) under test or the microphone in a calibration set-up (Fig. 10) and measures its response to the Mouth Simulator.

Items 2 and 3 could be combined in the same unit, e.g. a computer fitted with suitable hardware and software for A/D and D/A conversions in order to simulate both a signal generator and an analyser.

Telephone Testing

4) A suitable fixture for holding the Mouth Simulator and telephone as shown in Fig. 5. The correct relative positions of these two are shown in Fig. 6.

Fig. 7 shows a block diagram of a possible set-up for testing the microphone of a telephone handset.

Calibration

5) Preamplifier and microphone as shown in:
   - Fig. 8 for calibrating according to according to ITU-T Rec. P51
   - Fig. 9 for calibrating according to IEEE 269
6) Power supply for a ¼" Preamplifier 26AC,
   e.g. the 12AK Power Module

Fig. 10 shows a block diagram of a possible set-up for making calibrations according to IEEE 269. A set up such as this is used for the calibration chart of a G.R.A.S. Mouth Simulator.

[3] For example from 50 Hz to 10 kHz

Testing a Telephone or Calibrating the Mouth Simulator

The following applies to the set-ups shown in Fig. 7 and Fig. 10.

In both cases a swept signal (equalised for the fluctuations of the true response of the Mouth Simulator, see Fig. 11.) is fed to the Mouth Simulator and the resulting sound is picked either by:

a) the microphone of a telephone handset (Fig. 7)

Or

b) the microphone used for calibrating the Mouth Simulator (Fig. 10)

It is assumed that the generator and analyser work to produce constant-confidence results (i.e. maintaining a constant β T product) in real time throughout the frequency range of interest and make the measurement data available graphically and numerically.

Procedure

With everything set up as described above, proceed as follows:

a) set the generator to oscillator mode

b) set the analyser to flat response

c) initiate a logarithmic sweep [4] on the generator

The analyser will follow the response of the microphone to the Mouth Simulator throughout the sweep and record and display the results accordingly.

In case of telephone tests, curves showing the upper and lower tolerance levels for the frequency range of interest could be superimposed on the graphical displays.

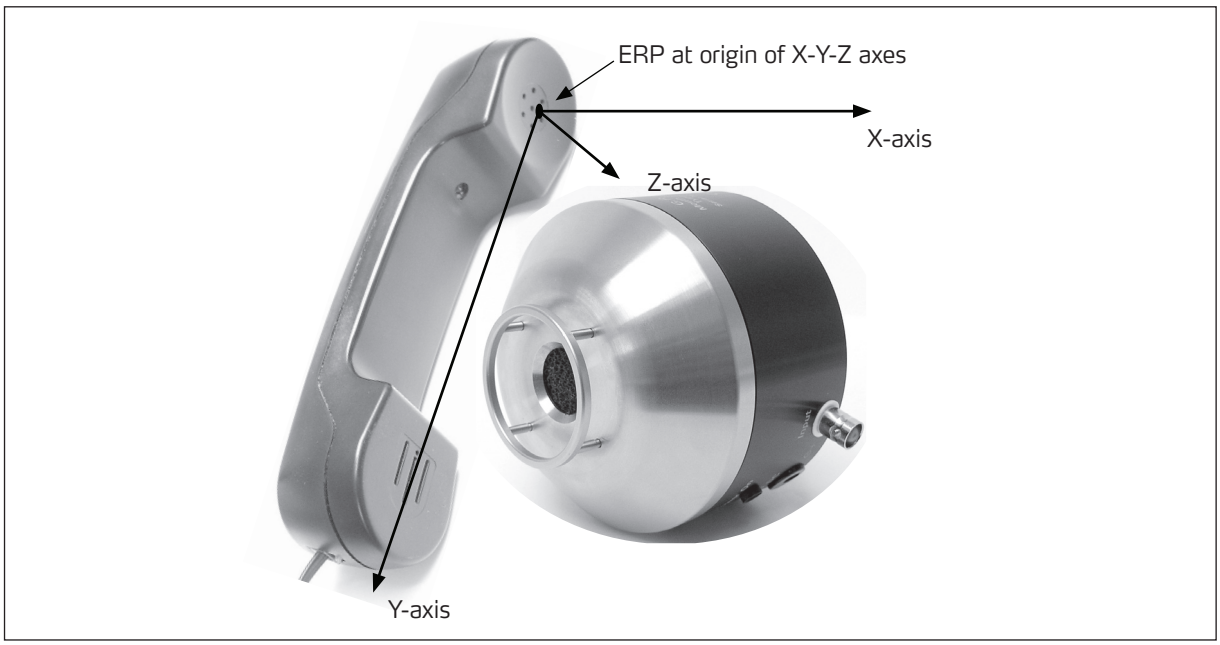

Fig. 5. *Showing the basic configuration for testing the microphone of a telephone handset. The ear piece lies in the plane of the Y-Z axes. See Fig. 6 for geometrical details*

[4] For example from 50 Hz to 10 kHz

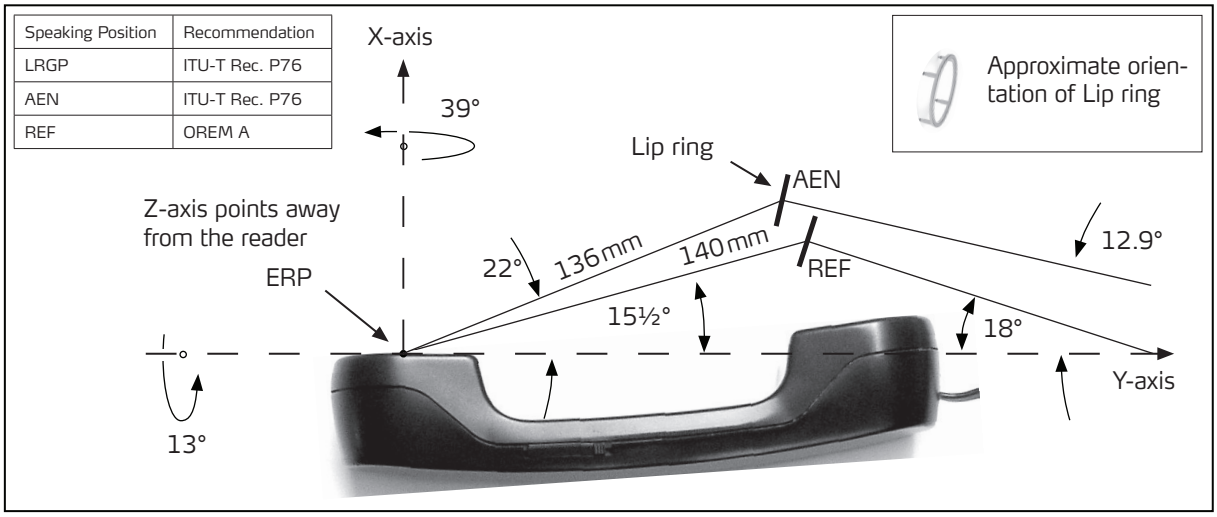

Fig. 6. *Showing where the Lip-ring should be for both AEN and REF positions. The angular distances of 39° and 13° (in that order) will move the handset from the AEN position to the LRGP*

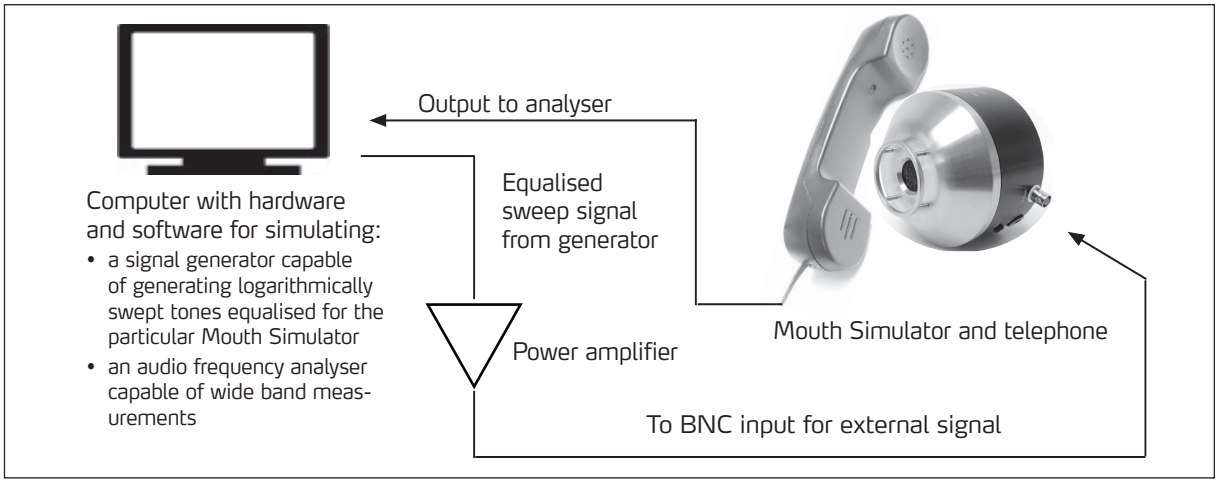

Fig. 7. *Block diagram of a set-up for testing the microphone of a telephone handset. See also Fig. 12 for a complete set-up using the G.R.A.S. 45AA Telephone Test Head*

Fig. 8. *Set-up for calibrating the Mouth Simulator according to ITU-T Rec. P51*

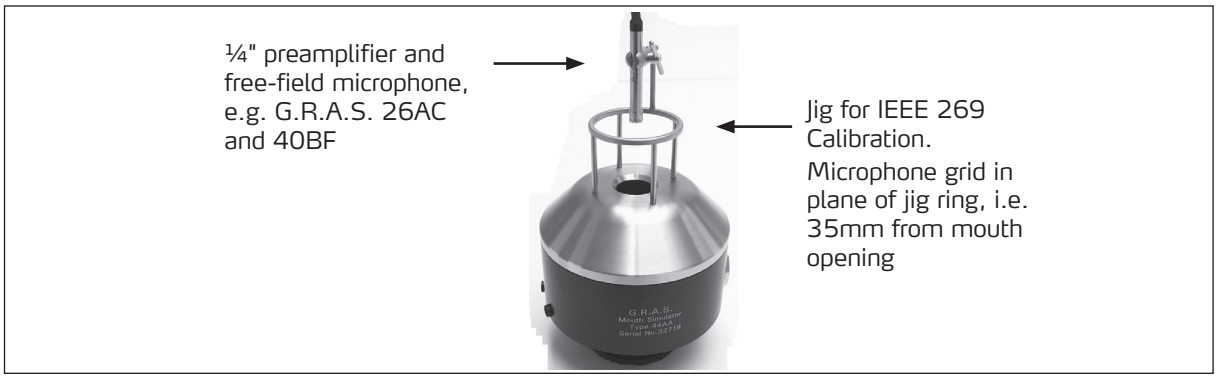

Fig. 9. *Set up for calibrating the Mouth Simulator according to IEEE 269*

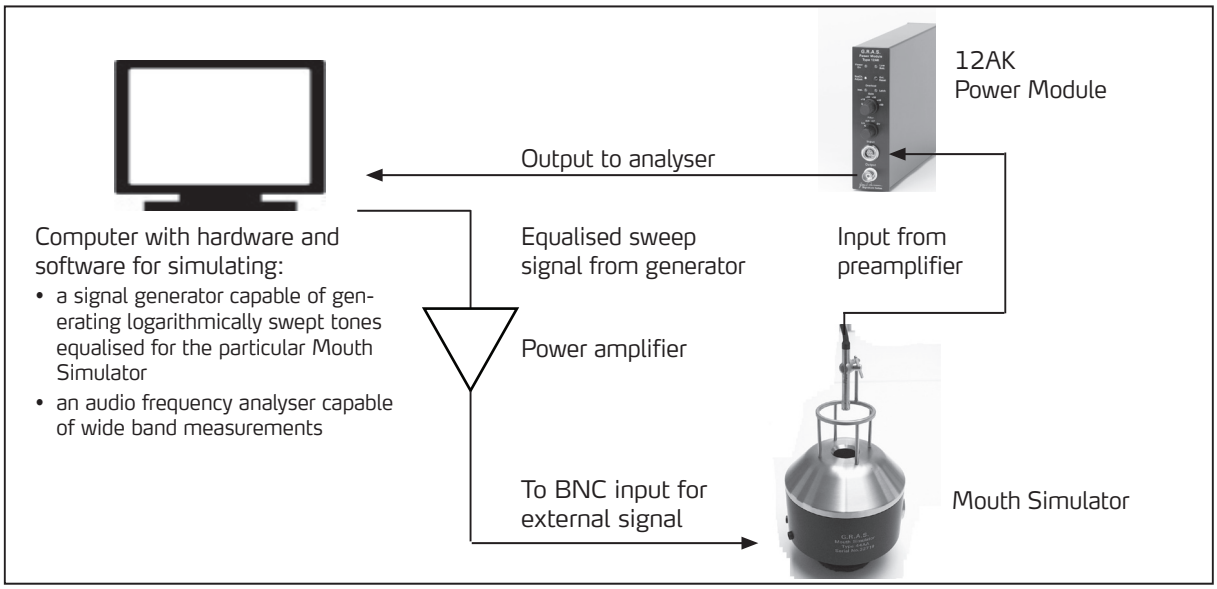

Fig. 10. *Block diagram of a set-up for calibrating the Mouth Simulator according to IEEE 269*

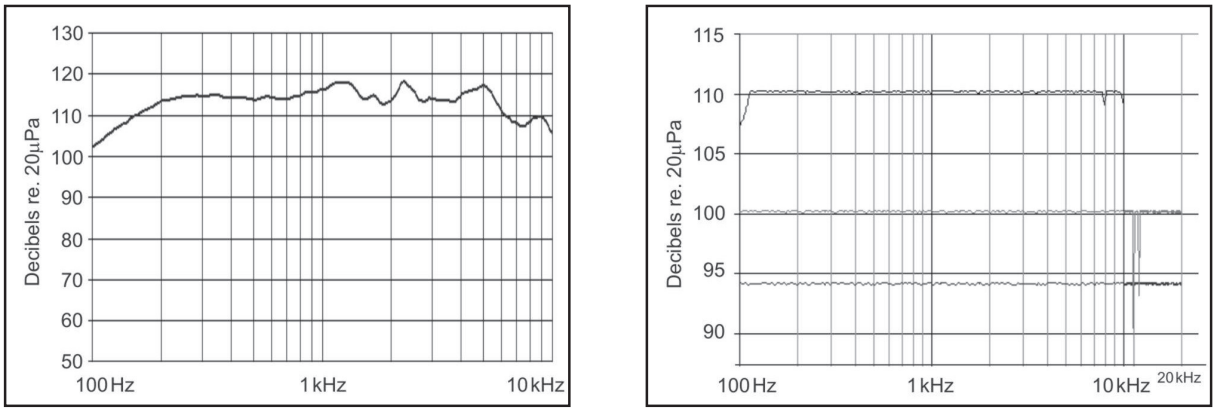

Fig. 11. *Typical frequency-response measurements of a 44AA using the IEEE 269 set up shown in Fig. 9.*
Left: true response for a 1 V RMS input to the built-in power amplifier. Note: an input of 3.16 V RMS would be required for the 44AB (and 44AA without using its built-in power amplifier), to give an equivalent result.
Right: equalised response at the Mouth Reference Point for 94dB, 100dB, and 110dB SPLs

Avoiding Hum when Connecting the 44AA

Important. The input of the 44AA is floating with respect to ground. Therefore, if you switch it on without a signal source connected to it, you may likely experience a little hum. This hum will disappear once 44AA is properly connected to a signal source that provides the necessary connection to ground. This means that if your signal source provides a choice of floating ground this should NOT be selected.

45AA Telephone Test Head

The G.R.A.S. 45AA Telephone Test Head (Fig. 12) is a fixture for testing the acoustic performance of telephone handsets in accordance with international standards and recommendations. Its design combines precision with a robust construction to ensure stability and reproducible test results with a minimum of acoustic interference.

When used with a 43AD Ear Simulator Kit or a 43AE Ear Simulator Kit and a 44AA or 44AB Mouth Simulator, it can be set up for testing telephone handsets in accordance with ITU-T recommendations. Contact G.R.A.S. for full details.

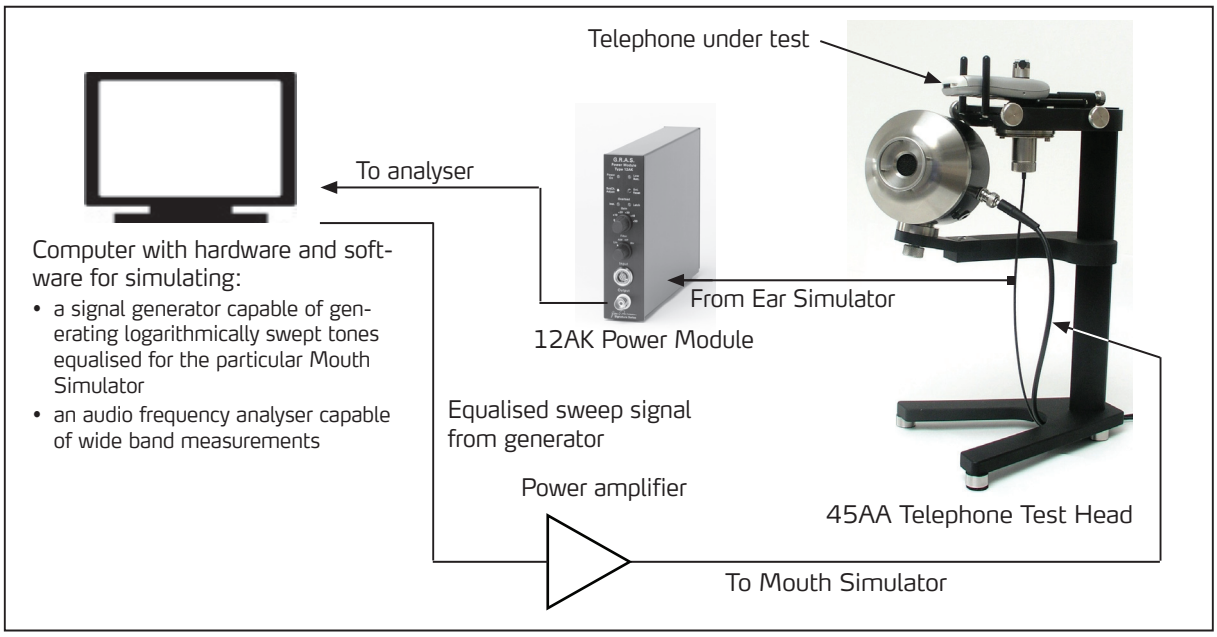

Fig. 12. *Block diagram of a set-up using the 45AA Telephone Test Head for testing a complete telephone handset. Both Mouth and Ear Simulators can be mounted on the Telephone Test Head in accordance with all current standards.*

Specifications

Max. continuous output level at MRP:

200 Hz - 6 kHz:	110 dB re. 20 µPa
100 Hz - 16 kHz:	100 dB re. 20 µPa
Distortion (94 dB re. 20 µPa at MRP):	
250 Hz - 8 kHz:	typically 1%, max. 1.5%

Loudspeaker:

Impedance:	8 Ω
Maximum power:	
continuous:	10 W
pulsed:	50 W (for 2 sec)

Amplifier *:

Automatically enabled when external power is applied and is fully protected against overload.

gain:	10 dB
input impedance:	20 kΩ
max. input voltage:	2 V RMS
max. consumption:	24 V DC, 1000 mA

Mouth opening:

Diameter:	20 mm

Lip ring:

External diameter:	48 mm
Distance from mouth	10 mm

Dimensions:

Diameter:	104 mm
Height (with lip ring):	114 mm

Weight:

Type 44AA	1.3 kg
Type 44AB	0.93 kg

Accessories included:

Jig (CCITT P51)	RA0104
Jig (IEEE 269)	RA0105
Power supply *	AB0012

Accessories available:

Conical mouthpiece	RA0110

* Not applicable to 44AB

Warranty, Service and Repair

Calibration

Before leaving the factory, all G.R.A.S. 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 G.R.A.S. 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 G.R.A.S. 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

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