

# ***Instruction Manual***

*G.R.A.S. 45AA Telephone Test Head*



## Revision History

Any feedback or questions about this document are welcome at [gras@gras.dk](mailto:gras@gras.dk).

Revision	Date	Description
1	9 July 2008	First release
2	28 September 2015	Removal of end stop added to page 13

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## 1. General Description

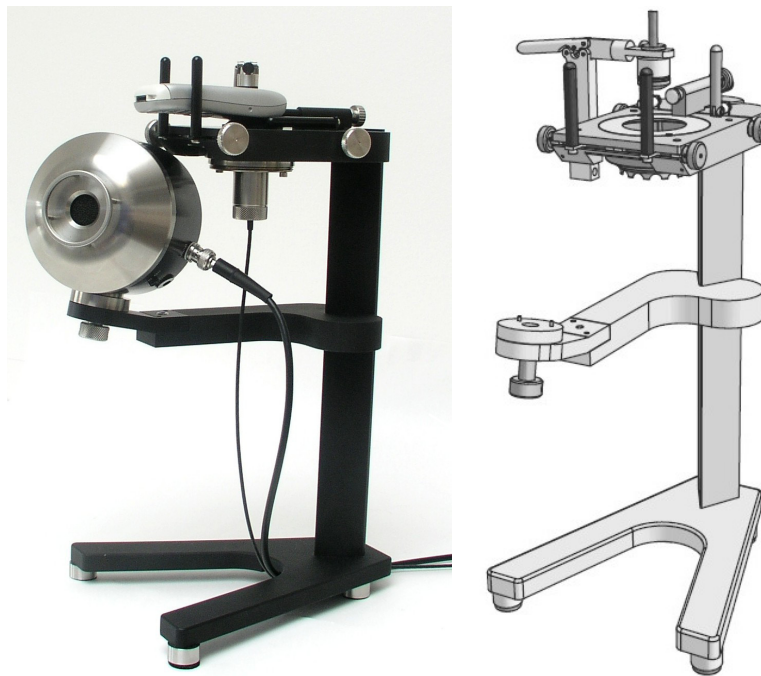
The G.R.A.S. Telephone Test Head Type 45AA (Fig. 1.1) is a tailor-made fixture for testing the acoustic performance of telephone handsets in accordance with international standards and recommendations.

Its design combines precision with a robust construction to ensure stability and reproducible test results with a minimum of acoustic interference.

When used with an Artificial Ear Type 43AD or an Ear Simulator Type 43AE, and a Mouth Simulator Type 44AA or 44AB, it can be set up for testing telephone handsets in accordance with ITU-T recommendations.

### 1.1 Positioning of the Mouth

Four different, detachable brackets are provided for mounting the Mouth Simulator according to the standardised positions shown in Table 1.1 for speaking into a telephone. These positions are maintained to within an accuracy of 1 mm. Reference gauges (RA0141) are available for verifying this.



*Fig. 1.1 Telephone Test Head Type 45AA showing:  
Left; fitted with a G.R.A.S. Mouth Simulator and IEC 318  
Ear Simulator Type 43AD  
Right; computer rendering outlining its chief components*

Speaking Position	Recommendation
LRGP	ITU-T Rec. P76
AEN	ITU-T Rec. P76
HATS	ITU-T P58
REF	OREM A

*Table 1.1 Speaking positions according to current recommendations*

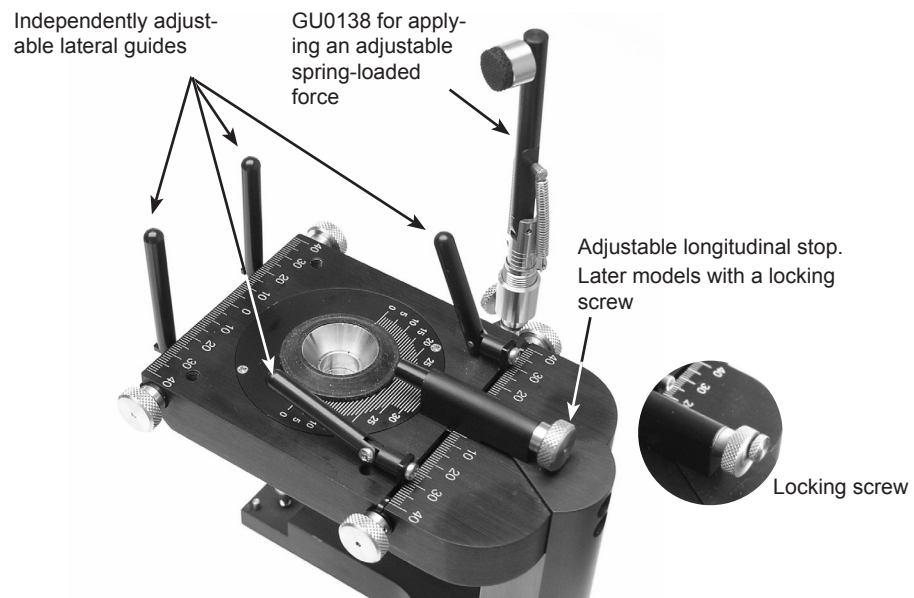
## 1.2 Anti-vibration Mounts

The Type 45AA stands on four anti-vibration mounts to isolate it from extraneous vibrations which could otherwise lead to spurious measurement results.

## 1.3 Handset Alignment

The Type 45AA is provided with graduated guides and stops for aligning a telephone handset correctly in position over the Artificial Ear. Lateral guides are independently adjustable to cater for both symmetrical and asymmetrical handsets - see section 1.4.

Once aligned, an adjustable spring-loaded, rubber pad will hold the handset in position (see Fig. 1.2). As specified in some tests, an adjustable force can be applied by adding only a small mass to the measurement object. Alternatively, the clamping arrangement shown in Fig. 2.11 may be used.



*Fig. 1.2 Showing graduated stops and guides for aligning a telephone handset*



*Fig. 1.3 Close-up of the longitudinal stop*

## 1.4 Modifying the lateral guides to adjust independently

The lateral guides are factory-set to adjust symmetrically (to accommodate symmetric handsets).

To modify the lateral guides to adjust independently (to accommodate asymmetric handsets), remove the coupling keys (D in Fig. 1.4), which couple each pair's right-hand and left-hand shafts together.

### Procedure

1. Adjust the lateral guides to their extreme positions with maximum distance between them.
2. On the right-hand side, remove the grub screw, A, using the supplied minimum-sized allen key.
3. Pull out the shaft, B, and the shaft centre-bearing, C.
4. Remove the coupling key, D, located in the slot at the end of the shaft. If the coupling key stayed inside the shaft tunnel, tilt the complete stand slightly until it drops out.  
NB! Store the coupling key safely, e.g. in the plastic bag together with the allen keys.
5. Remount the shaft, B, and the centre-bearing, C.
6. Tighten the grub screw, A.

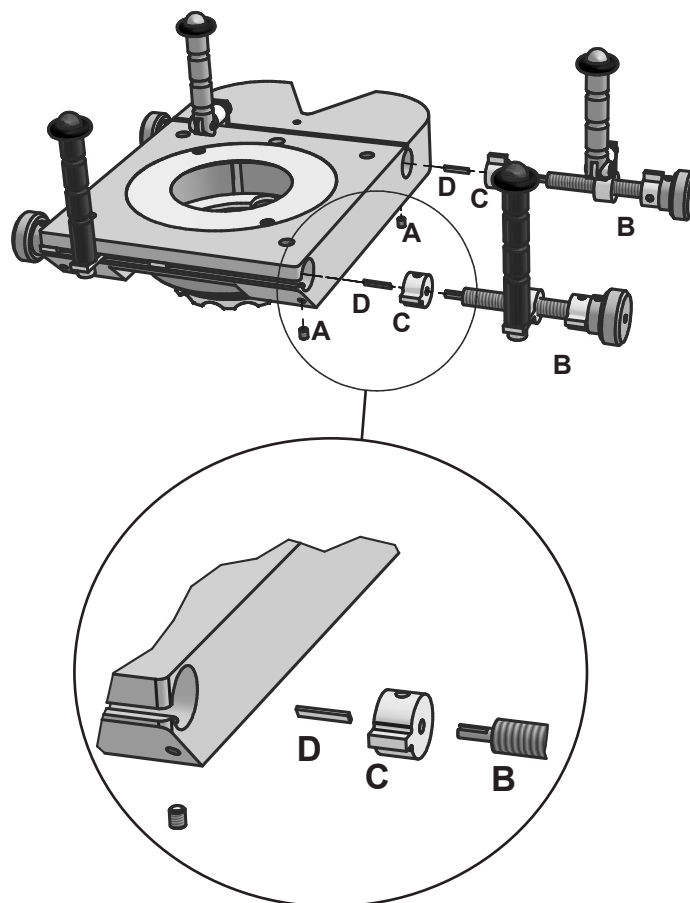


Fig. 1.4 Removing the coupling key, D.

## **2. Physical Set-ups**

### **2.1 Introduction**

The Telephone Test Head Type 45AA can be set up physically to accommodate standardised measurements using accordingly any of the following:

#### **G.R.A.S. Ear Simulators**

- Type 43AD (IEC 60318)
- Type 43AE<sup>1</sup> (IEC 60711)

#### **G.R.A.S. Mouth Simulators**

- Type 44AA
- Type 44AB

mounted for any of the following:

#### **Speaking positions**

- LRGP
- AEN
- HATS
- REF

Two clamping arrangements are provided for holding a telephone handset in position once the lateral guides and longitudinal stop (Figs. 1.2 and 1.3) have been adjusted.

### **2.2 Mounting a G.R.A.S. Ear Simulator**

#### **2.2.1 IEC 60318**

Fig. 2.1 shows an exploded view of how to mount the IEC 60318 Ear Simulator on the Telephone Test Head.

#### **2.2.2 IEC 60711**

Fig. 2.2 shows an exploded view of how to mount the IEC 60711 Ear Simulator on the Telephone Test Head.

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<sup>1</sup> Alternatively, a combination of ½-inch Preamplifier Type 26AK, Ear Simulator RA0045 and Pinna Simulator RA0056 (Fig. 2.2)

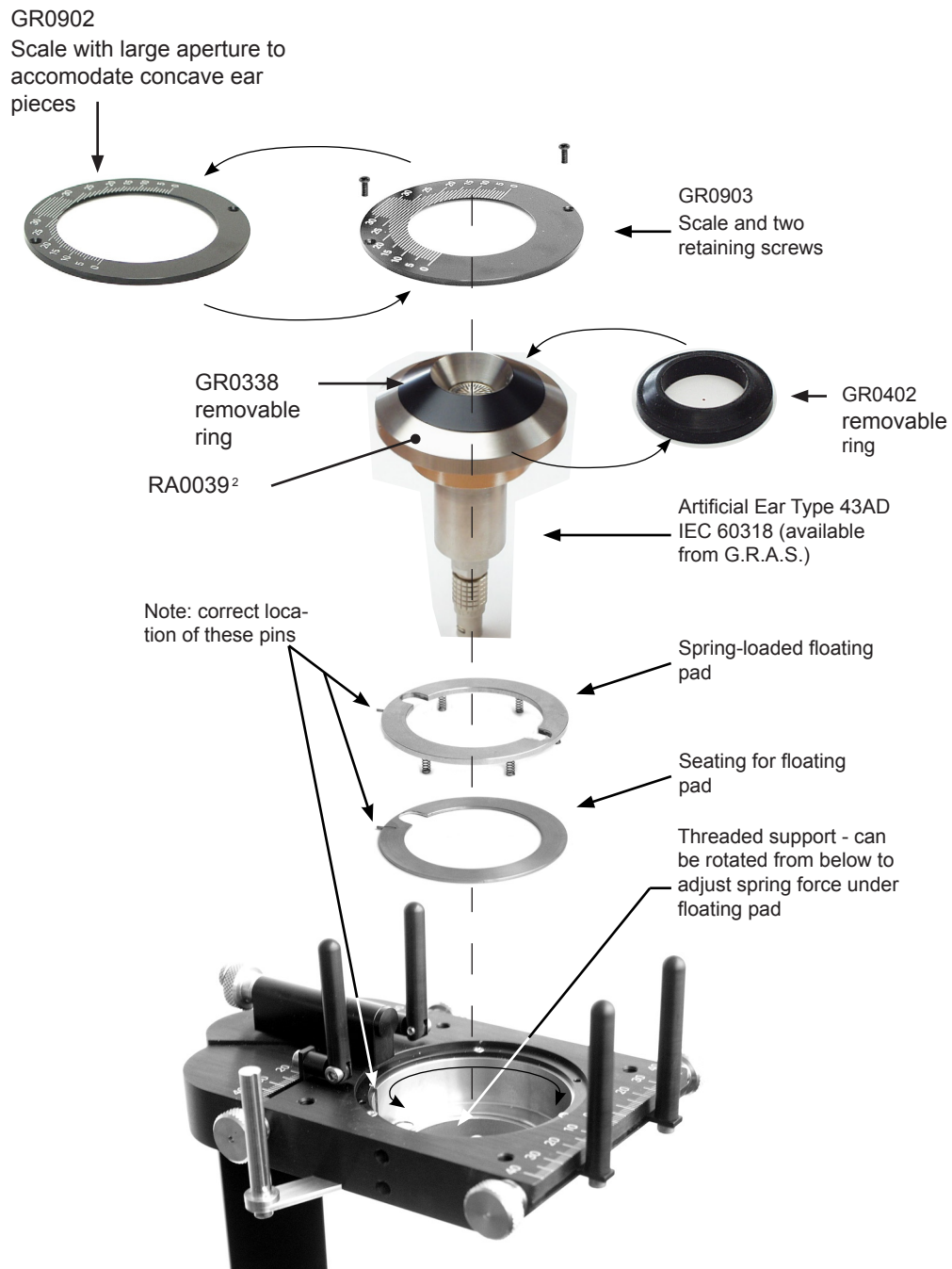


Fig. 2.1 Exploded view of a set up using an IEC 318 Artificial Ear (available from G.R.A.S.)

<sup>2</sup> The Type 43AD uses a G.R.A.S. Ear Simulator RA0039. This can be substituted by a G.R.A.S. Ear Simulator RA0137 which has a built-in sound source in the form of a small loudspeaker. Signals are applied to this loudspeaker via an SMB connector. This feature is for detecting the occurrence of any changes in sound leakage (with respect to an expected amount) between the Ear Simulator and, say, a badly-positioned handset.



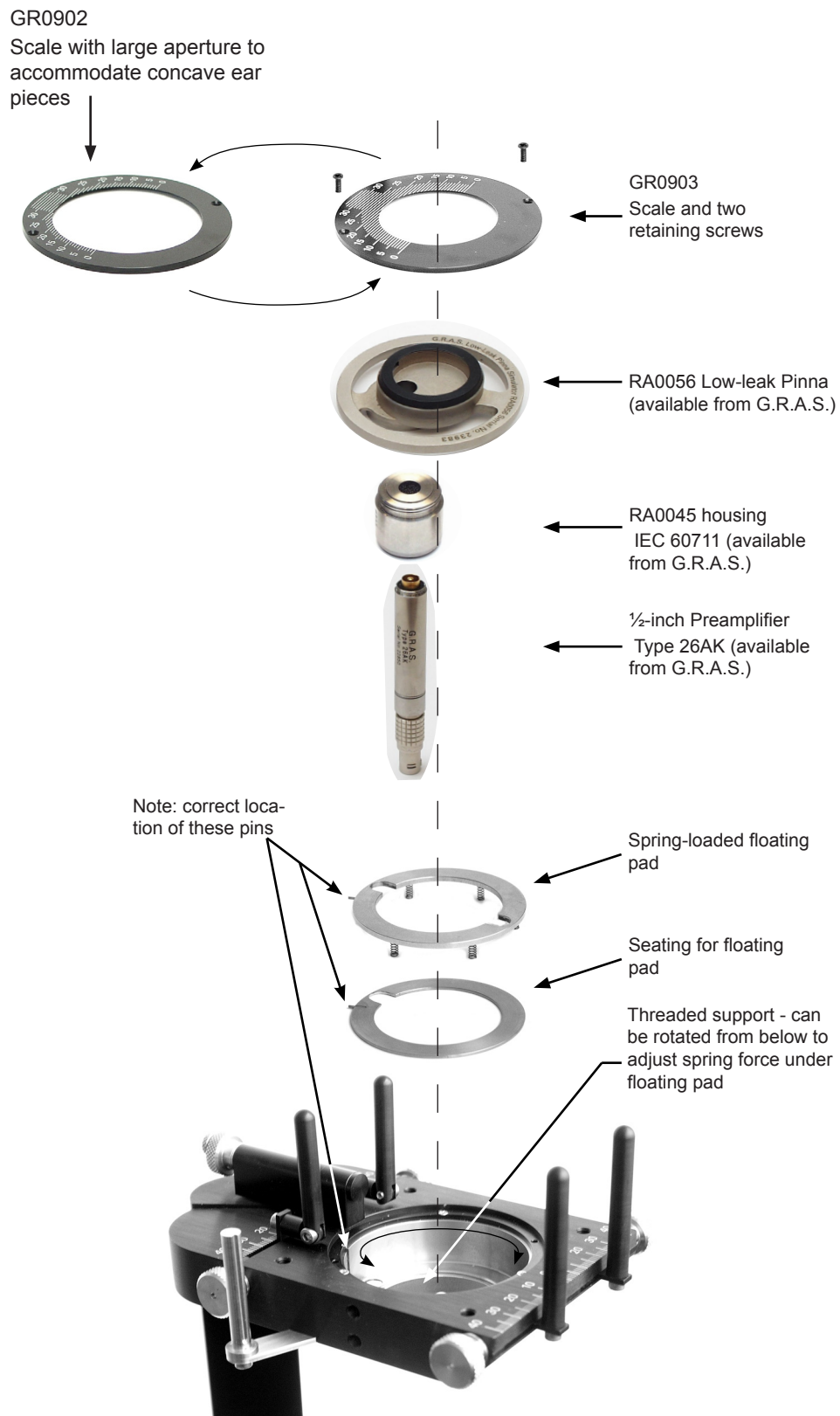


Fig. 2.2 Exploded view of a set up using an IEC 711 Ear Simulator (available from G.R.A.S.)

### 2.3 Mounting a G.R.A.S. Mouth Simulator

A Mouth Simulator can be mounted four different ways depending on which speaking position is required. The Telephone Test Head is delivered with four different brackets, one for each speaking position, see Fig. 2.3.

Fig. 2.4 shows an exploded view of how to mount the Mouth Simulator on the Telephone Test Head.

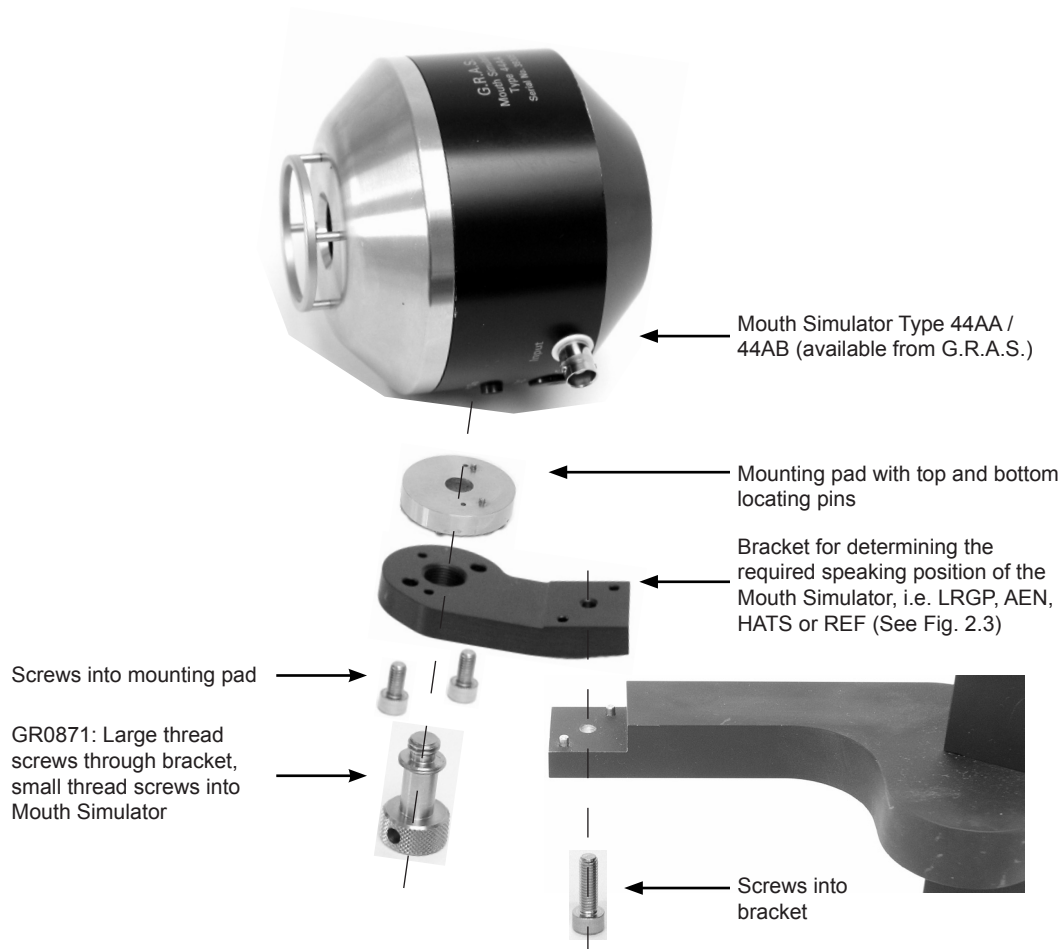
It is easier to start by first attaching the bracket for the required speaking position to the Mouth Simulator then mounting the assembly on the Test Head.



*Fig. 2.3 Brackets for determining the various standard speaking positions of the Mouth Simulator, i.e. LRGP, AEN, HATS and REF*

Fig. 2.5 shows the standard speaking position of the Mouth Simulator for each of the brackets shown in Fig. 2.3.

An optional guage (RA0141) is available from G.R.A.S. for checking the AEN and REF speaking positions. See section 2.4.



**Fig. 2.4** Exploded view showing details of mounting a Mouth Simulator on the Telephone Test Head. Start by first attaching the bracket to the Mouth Simulator

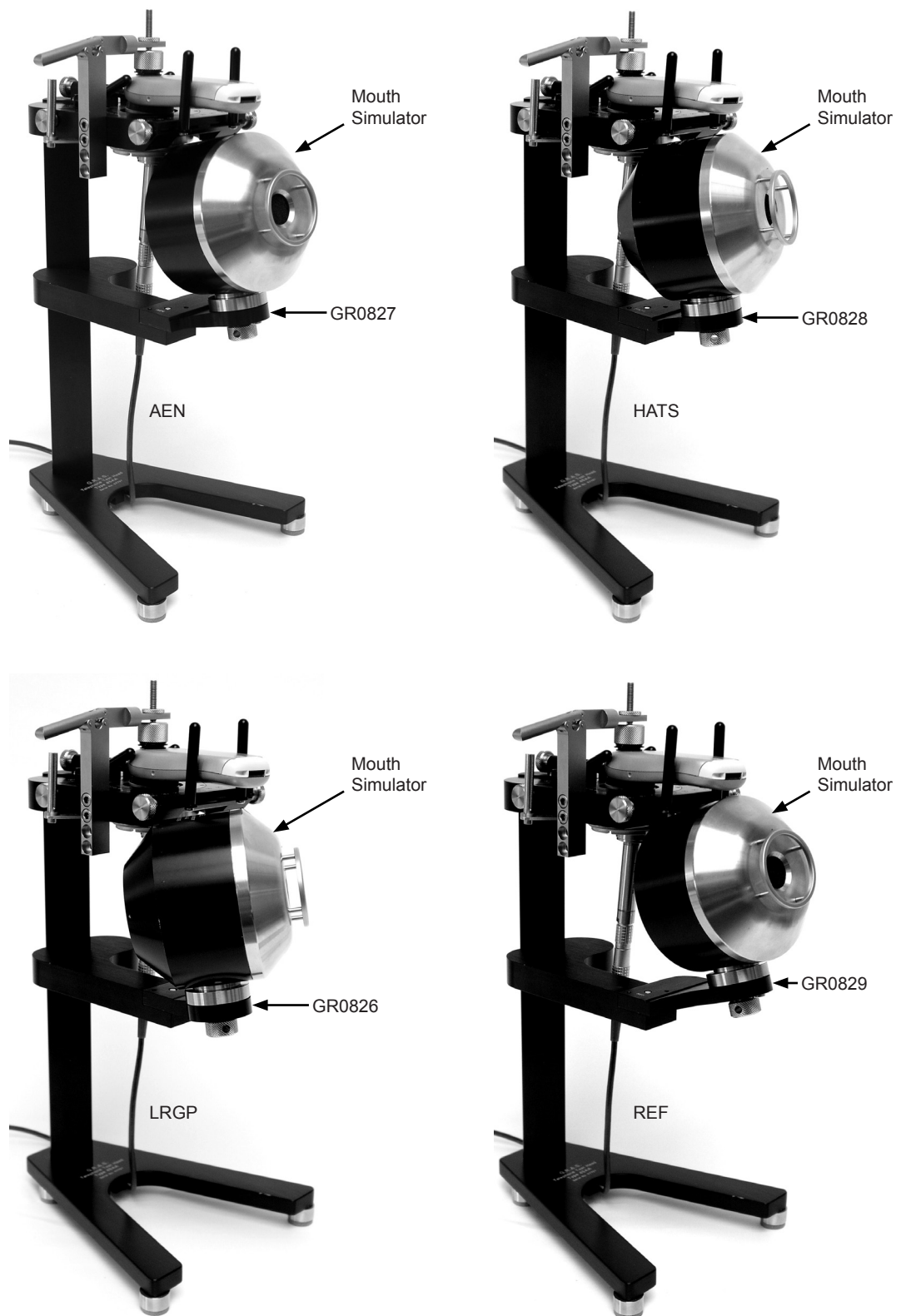
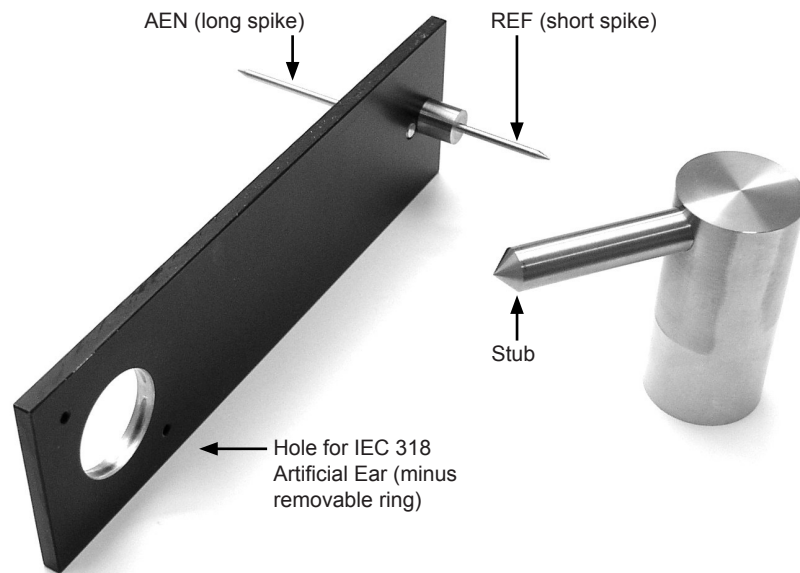


Fig. 2.5 Showing the standard speaking position of the Mouth Simulator (available from G.R.A.S.) when mounted on each of the brackets shown in Fig. 2.3

## 2.4 Checking Speaking Positions

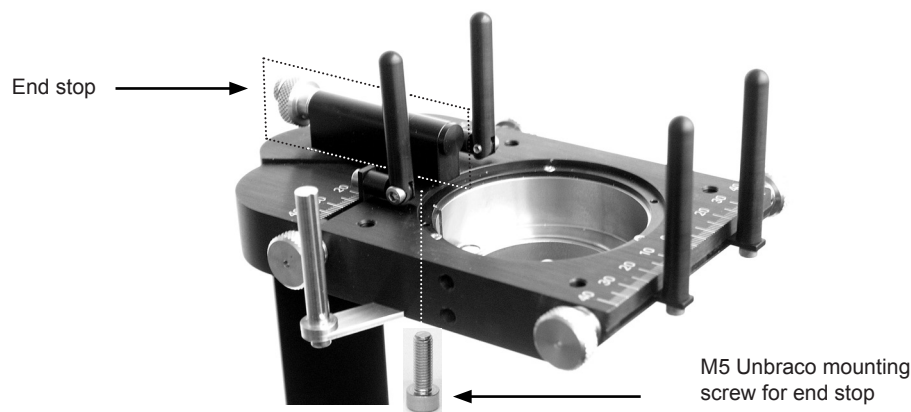
The Test Head is robust and is physically stable. Therefore, checking the speaking positions would not normally be necessary if it is treated properly. However, if there is reason to believe that it has been damaged (e.g. falling off a bench), a special gauge (RA00141) is available from G.R.A.S. for checking the AEN and REF speaking positions, see Fig. 2.6.

Figs. 2.7 and 2.8 show how this gauge should be used. The speaking position is where the tips of the spike and stub meet. They must meet within at least 1 mm distance between them to signify that the Test Head is in working order.



*Fig. 2.6a The two components of the guage RA0141 (available from G.R.A.S.) for checking the AEN and REF speaking positions*

Before mounting the RA0141 gauge, the end stop must be removed. The end stop and its housing is mounted with an M5 bolt from the underside as shown in Fig. 2.6b.



*Fig. 2.6b The end stop mechanism and its M5 Unbraco mounting screw.*

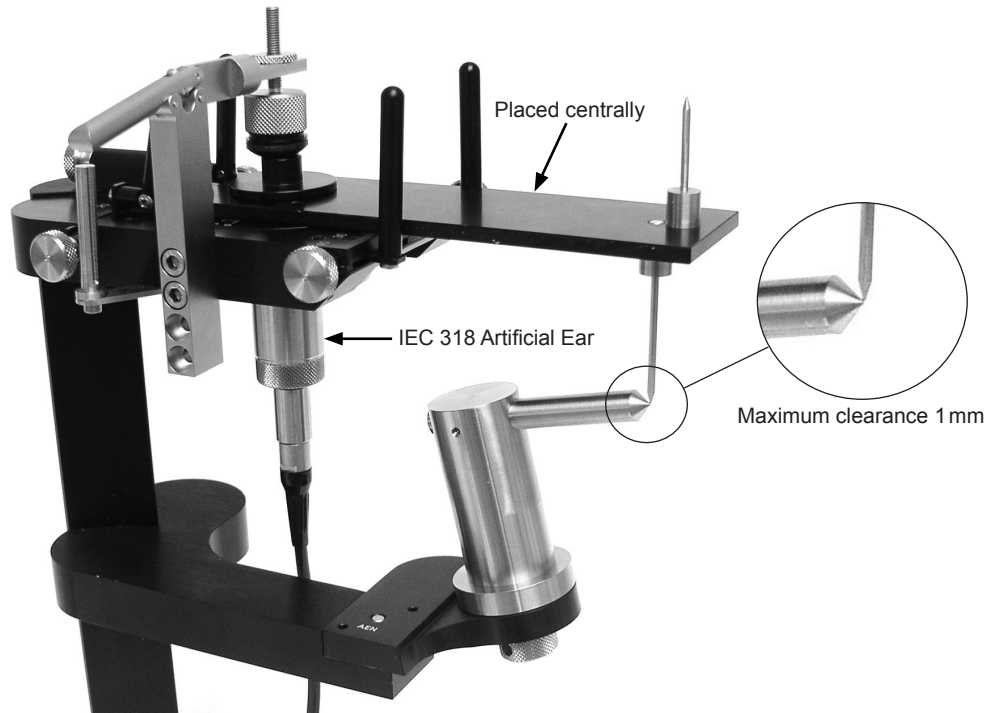


Fig. 2.7 The gauge RA0141 (available from G.R.A.S.) set up for checking the AEN speaking position (IEC 318 Artificial Ear minus its removable ring). Note: the same speaking position will be indicated by the LRGP bracket which in effect moves the position of the handset through the angular distances shown in Fig. 2.9. NOTE: The end stop must be removed, see Fig 2.6b.

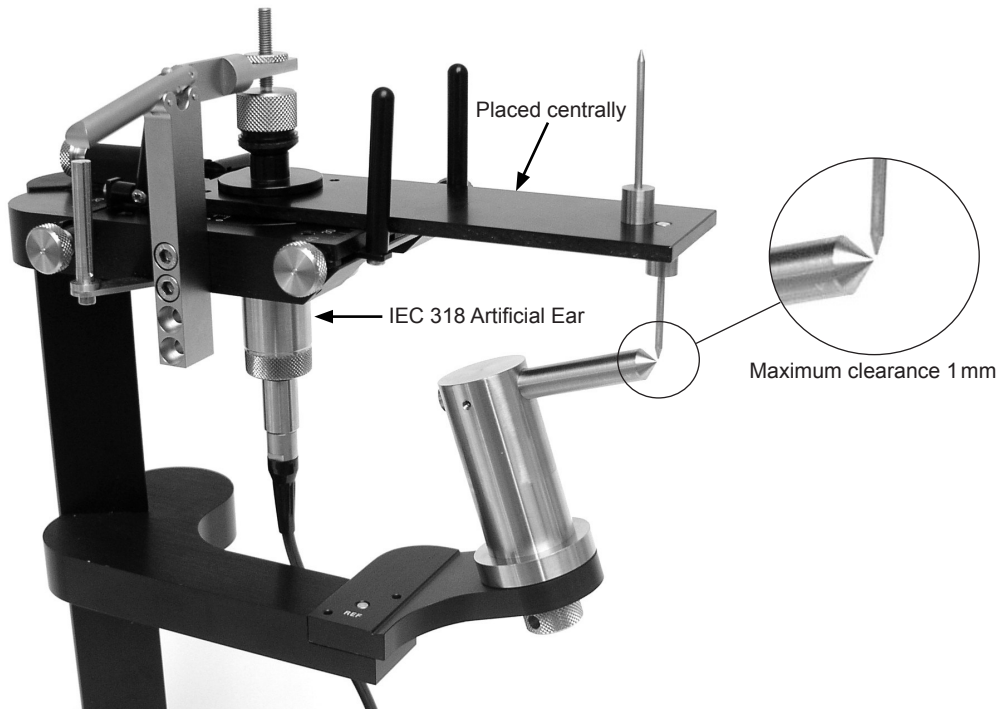
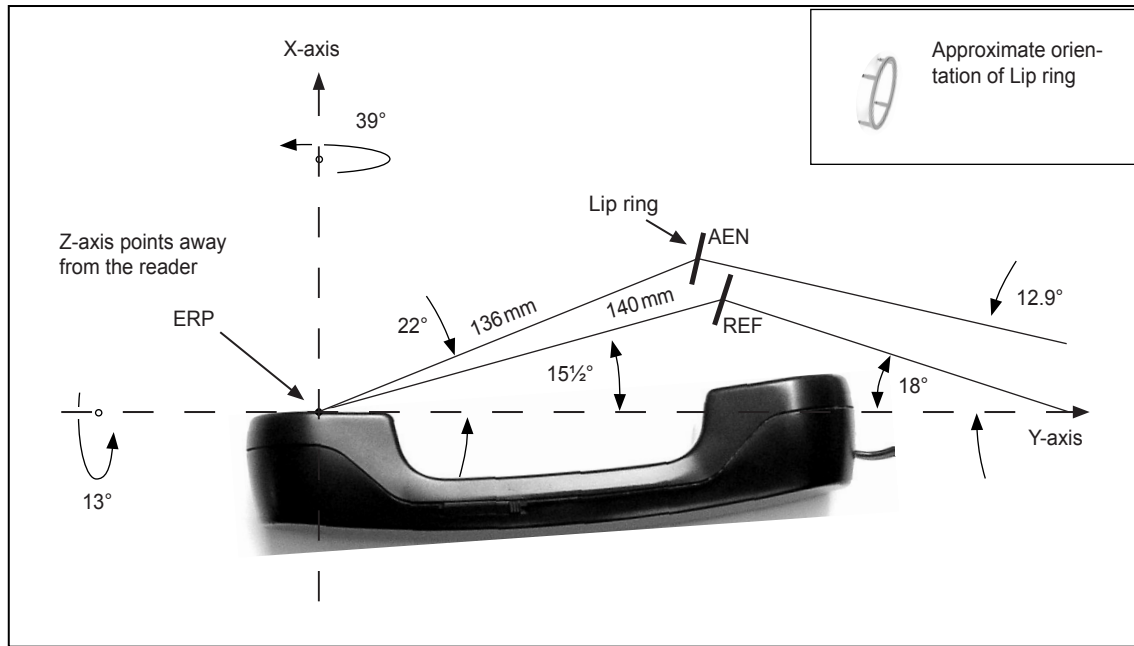


Fig. 2.8 The gauge RA0141 (available from G.R.A.S.) set up for checking the REF speaking position (IEC 318 Artificial Ear minus its removable ring)



**Fig. 2.9** Showing where the Lip-ring (of the Type 44AA / 44AB) 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

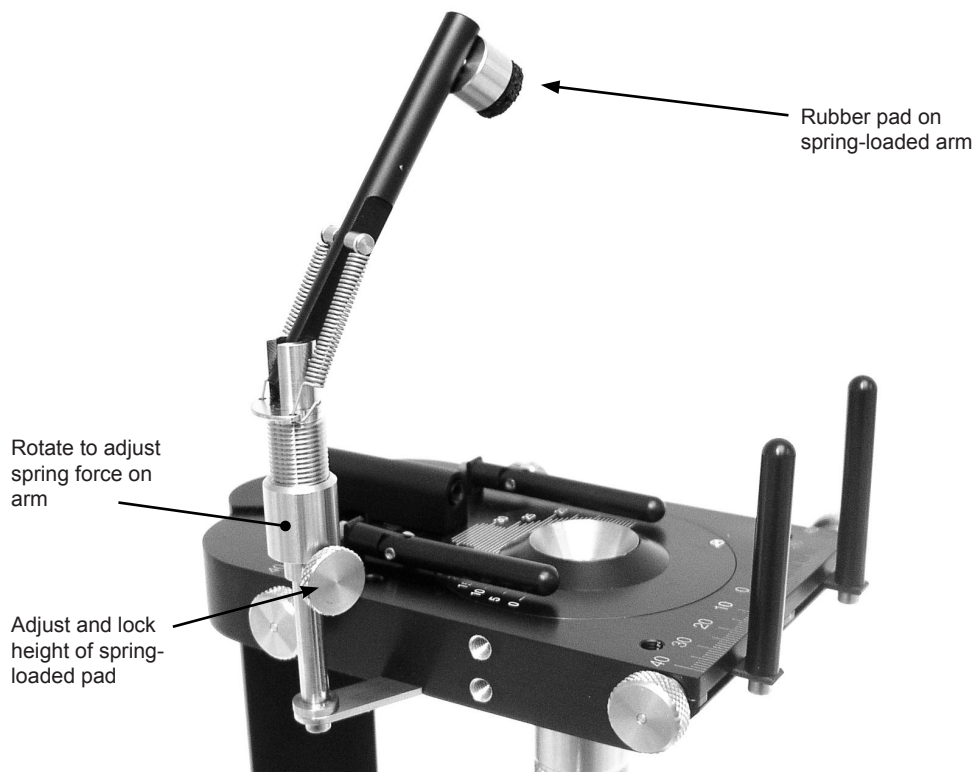


## 2.5 Clamping Arrangements

Two detachable clamping arrangements are provided. Each is attached to the Test Head by a pair of screws. Do not attempt to use then both clamping arrangements at the same time since the point of contact with the telephone handset is the same.

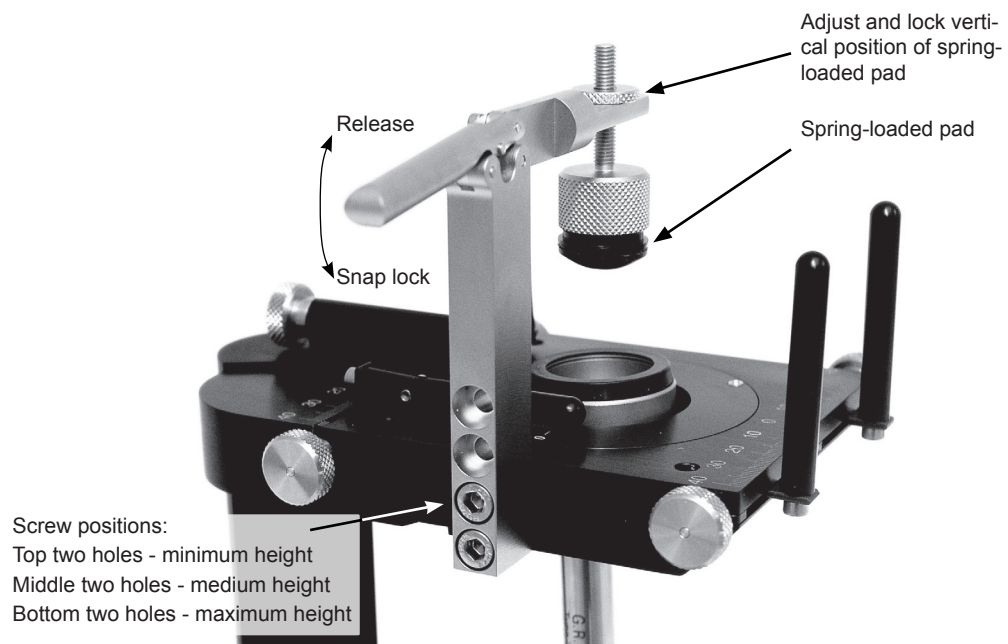
The two clamping arrangements are:

- Spring-loaded Clamp GU0138 (see Fig. 2.10)  
For testing telephone handsets and mobile telephones during their development.
- Snap Clamp GU0133 (see Fig. 2.11)  
For routinely testing batches of telephone handsets and mobile telephones.



*Fig. 2.10 Clamping arrangement using the Spring-loaded Clamp GU0138*





*Fig. 2.11 Clamping arrangement using the Snap Clamp GU0133*

### **3. Test Set-ups and Calibration**

#### **3.1 Test Set ups**

Using any one of the physical set-ups described in chapter 2, the Telephone Test Head Type 45AA can be used for testing the performance of both the ear and mouth pieces of a complete handset or mobile telephone.

Two examples of test set-ups using additional G.R.A.S. equipment<sup>1</sup> are shown in Figs. 3.1 and 3.2.

Fig. 3.1 shows a block diagram of a set-up for testing a complete telephone handset. This arrangement is probably better suited to tests in connection with developing a new hand set or mobile telephone.

Fig. 3.2 shows a block diagram of a computer-controlled set-up for routinely testing complete telephone handsets. This arrangement is probably better suited to tests in connection with checking batches of hand sets or mobile telephones.

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<sup>1</sup> Separate data sheets are available for all the G.R.A.S. equipment shown Figs. 3.1 and 3.2

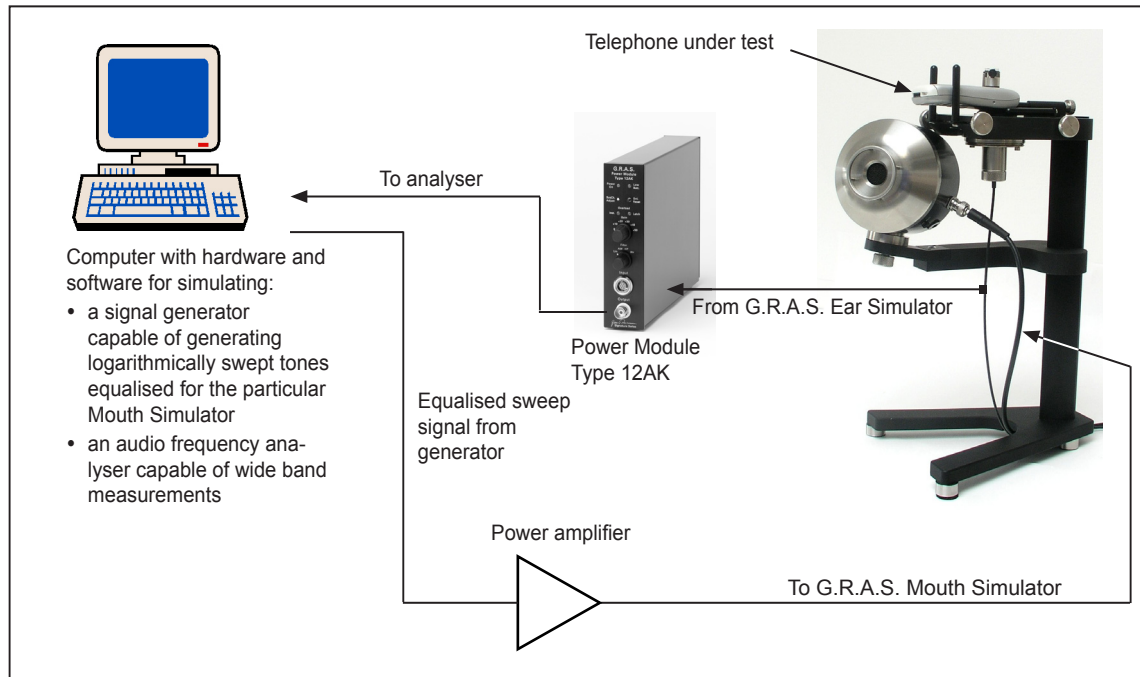


Fig. 3.1 Block diagram of a set-up for testing a complete telephone handset

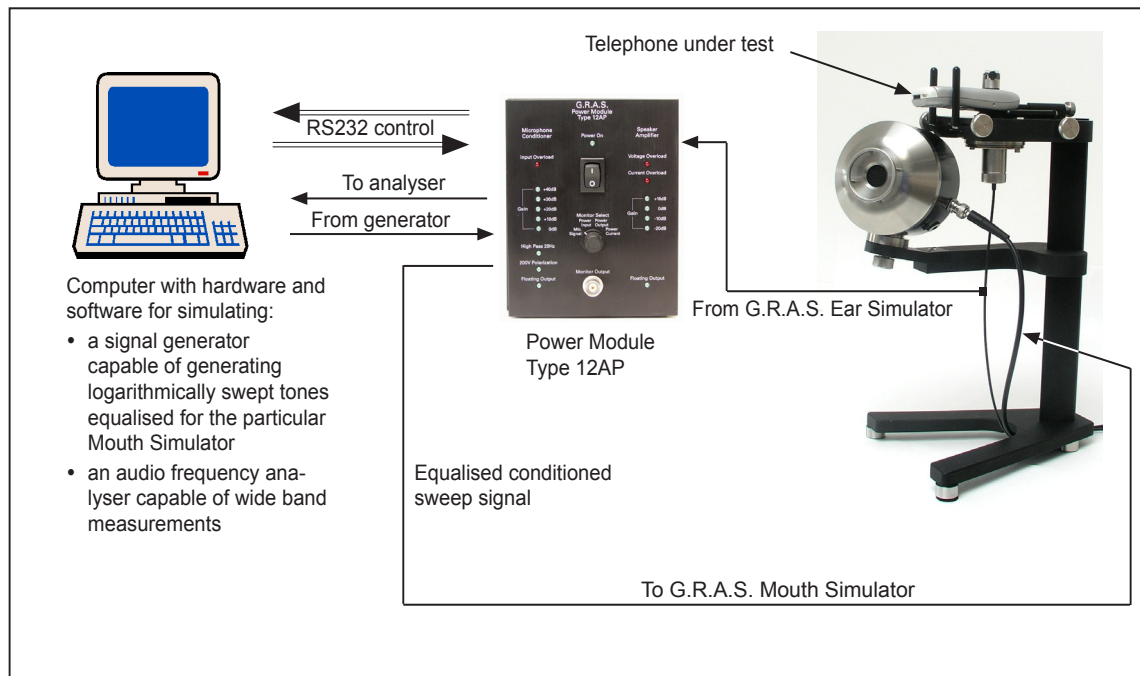


Fig. 3.2 Block diagram of a computer-controlled set-up for routinely testing complete telephone handsets

## 3.2 Calibration and Calibration Check

### 3.2.1 Calibration of an IEC 60318 Set up (see Fig. 2.1)

For this, access to the microphone is necessary.

- 1) Twist open the two halves of the snap coupling as shown in Fig. 3.3.
- 2) Gently push the microphone into the Pistonphone's coupler until it reaches the stop (Fig. 3.4).
- 3) Switch the Pistonphone on.
- 4) Set the analyser (Fig. 3.1) to either wide band or to the  $\frac{1}{3}$  octave band whose centre frequency is 250 Hz.
- 5) When conditions are stable, adjust the analyser so that it correctly gauges the Pistonphone signal (nominally 114 dB). See Pistonphone manual for making barometric corrections.
- 6) Switch the Pistonphone off and remove it from the microphone.
- 7) Re-assemble the Artificial Ear.

### 3.2.2 Calibration Check of an IEC 60711 Set up (see Fig. 2.2)

**Important!** do not extract the microphone housed in the RA0045 Coupler since this could invalidate the factory calibration of the Coupler. If it ever becomes necessary to extract the microphone, use the special tool RA0071 available from G.R.A.S.

The following procedure, using a G.R.A.S. Pistonphone, should preferably be carried out at the following times:

- a) before a first-time use of an IEC 60711 Ear Simulator to establish a baseline for subsequent checks
- b) thereafter at appropriate intervals to check for repeatability

The Pistonphone must be fitted with a 1-inch Microphone Coupler RA0023 and used with a special Adapter RA0119 (available from G.R.A.S.) for the IEC 60711 Ear Simulator.

- 1) The set up for the calibration check is shown Fig. 3.5 (showing a set up for a G.R.A.S. IEC 60711 Ear Simulator Type 43AE).
- 2) Make sure that the rubber seal of the Pinna Simulator seats firmly inside the Adapter.
- 3) Switch the Pistonphone on.
- 4) Set the **Gain** on the Type 12AK (Fig. 3.1) to **0**.
- 5) Set the analyser (Fig. 3.1) to either wide band or to the  $\frac{1}{3}$  octave band whose centre frequency is 250 Hz.
- 6) When conditions are stable, note the reading in millivolts.

For a microphone of nominal sensitivity (12.5 mV/Pa) and a nominal Pistonphone signal of 114 dB, an approximate value for the Low-leak Pinna Simulator RA0056 is:

- 95 mV (representing a drop of  $\approx 2.4$  dB)

- 7) Repeat, if required, with the High-leak Pinna Simulator RA0057 fitted, a corresponding approximate value is:

- 15 mV (representing a drop of  $\approx 18.4$  dB)



Fig. 3.3 Showing the two halves of the snap coupling to give quick access to the microphone



Fig. 3.4 Gently push the microphone into the Pistonphone's coupler until it reaches the stop



Fig. 3.5 Calibration-check set-up. Make sure that the rubber seal of the Pinna Simulator seats firmly inside the Pistonphone Adapter

## 4. Specifications

### Mouth positions:

Speaking Position	Recommendation
LRGP	ITU-T Rec. P76
AEN	ITU-T Rec. P76
HATS	ITU-T P58
REF	OREM A

### Accuracy:

direction of mouth axis:-  $\pm 1$  mm  
 plain of mouth:-  $\pm 2$  mm

### Handset alignment:

Four lateral guides independently adjustable over 35 mm to cater for asymmetrical handsets.  
 Longitudinal stop adjustable over 35 mm. All adjustments relative to centre of coupler aperture.  
 Two types of adjustable padded clamps are provided.

### Dimensions:

Height: 375 mm (14.8 in)  
 Width: 180 mm (7.1 in)  
 Depth: 200 mm (7.9 in)  
 Weight: 2.3 kg (5.6 lb)

### Accessories included:

Detachable brackets for speaking positions

LRGP: GR0826  
 AEN: GR0827  
 HATS: GR0828  
 REF: GR0829

Adjustable detachable clamps

Spring loaded: GU0138  
 Snap: GU0133

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**5. Accessories**

## Mouth Simulators

with amplifier Type 44AA

without amplifier Type 44AB

IEC 60318 Artificial Ear Type 43AD

IEC 60711 Ear Simulator Type 43AE

Low-leak Pinna Simulator RA0056 (incl. in Type 43AE)

High-leak Pinna Simulator RA0057 (incl. in Type 43AE)

Pistonphones: Type 42AA (114 dB *re.* 20  $\mu$ Pa 250 Hz)Type 42AP (114 dB *re.* 20  $\mu$ Pa 250 Hz)Calibrator: Type 42AB (114 dB *re.* 20  $\mu$ Pa 1000 Hz)

Power Modules Type 12AK, Type 12AQ

Reference Gauges RA0141