

# ***Instruction Manual***

*G.R.A.S 41AC-2 LEMO Outdoor Microphone with  
RemoteCheck for Community & Airport Noise*



## Revision History

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

Revision	Date	Description
1	26 August 2014	First edition
2	19 February 2015	Section about maintenance added
3	4 July 2017	42AG substituted for the obsolete 42AB

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## Introduction

The G.R.A.S. 41AC-2 LEMO Outdoor Microphone with RemoteCheck for Community & Airport Noise is a precision microphone set (IEC 61672-1) for monitoring community noise and the noise of overhead aircraft.

It can be used for monitoring of noise with 90 degrees of incidence, typically community noise. With the proper correction data, it can be used for 0 degrees of incidence, typically noise from overhead aircraft. A USB flash drive with correction data is part of the delivery.

It is waterproof, rated at IP-55, and can operate unattended over a wide range of weather conditions and temperatures for a very long period, i.e. a year or longer.

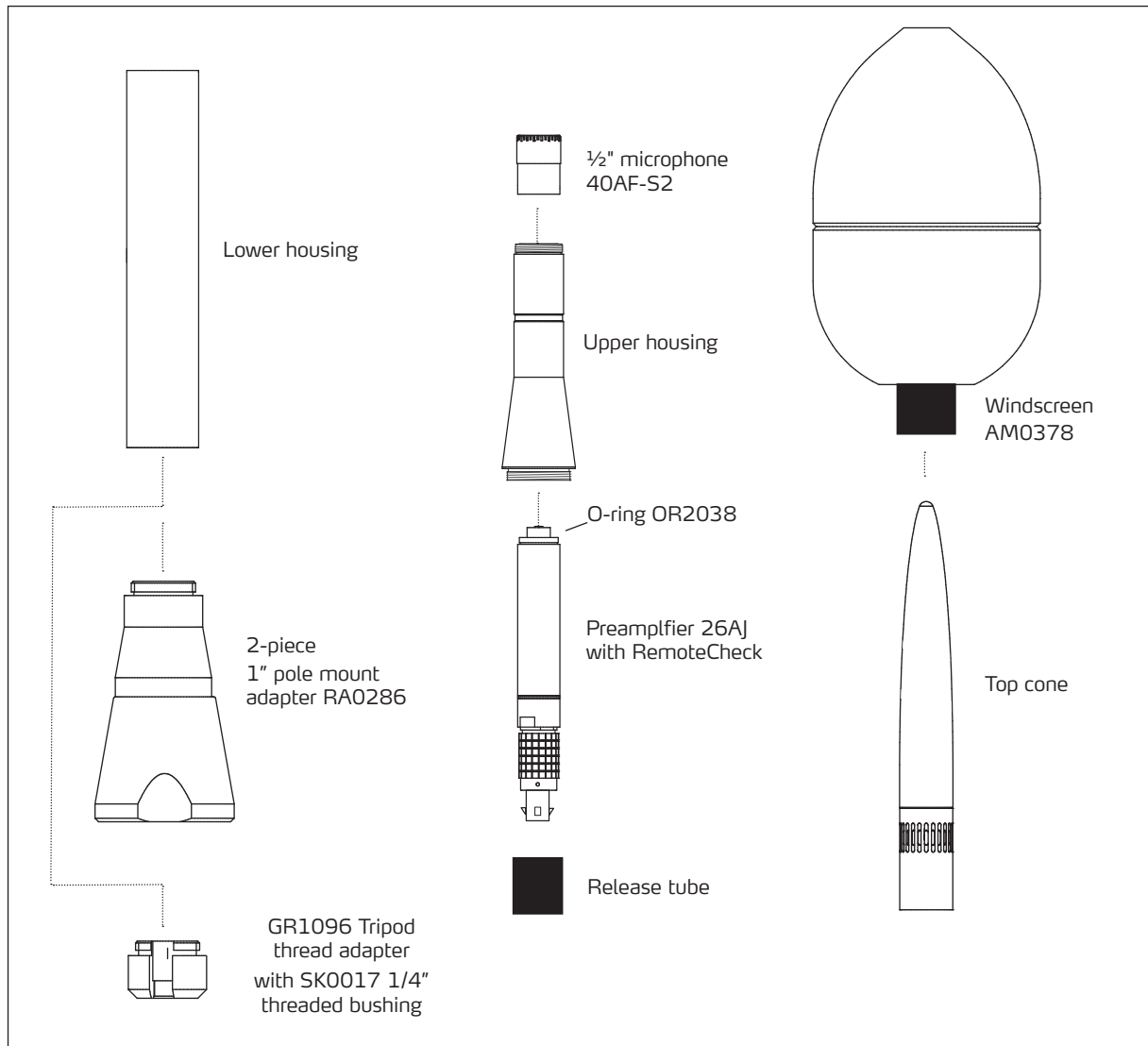
It uses a G.R.A.S. 40AF-S2 1/2" Externally Polarized Free-field Microphone, High Sensitivity and a G.R.A.S. 26AJ 1/2" RemoteCheck Preamplifier with Integrated Connector.

**Important.** The 40AF-S2 microphone and its protective grid have been modified for the 41AC-2. Therefore, microphone and grid cannot be replaced by standard items.

## Delivered Items

1/2" Ext. Polarized Free-Field Microphone, High Sensitivity	40AF-S2
1/2" RemoteCheck Preamplifier with integrated connector	26AJ
O-ring for preamplifier	OR2038
USB flash drive with correction data for 0° (resolution: 1/12 octave)	
Wind Screen	AM0378
Release Tube (for LEMO connector)	GR1794
Top cone	-
Upper housing	-
Lower housing	-
1" pole mount adapter	RA0286
Tripod Adapter	GR1096
Tripod thread adapter	SK0017

41AC-2 is delivered pre-assembled except for the windscreen and thread adapter.

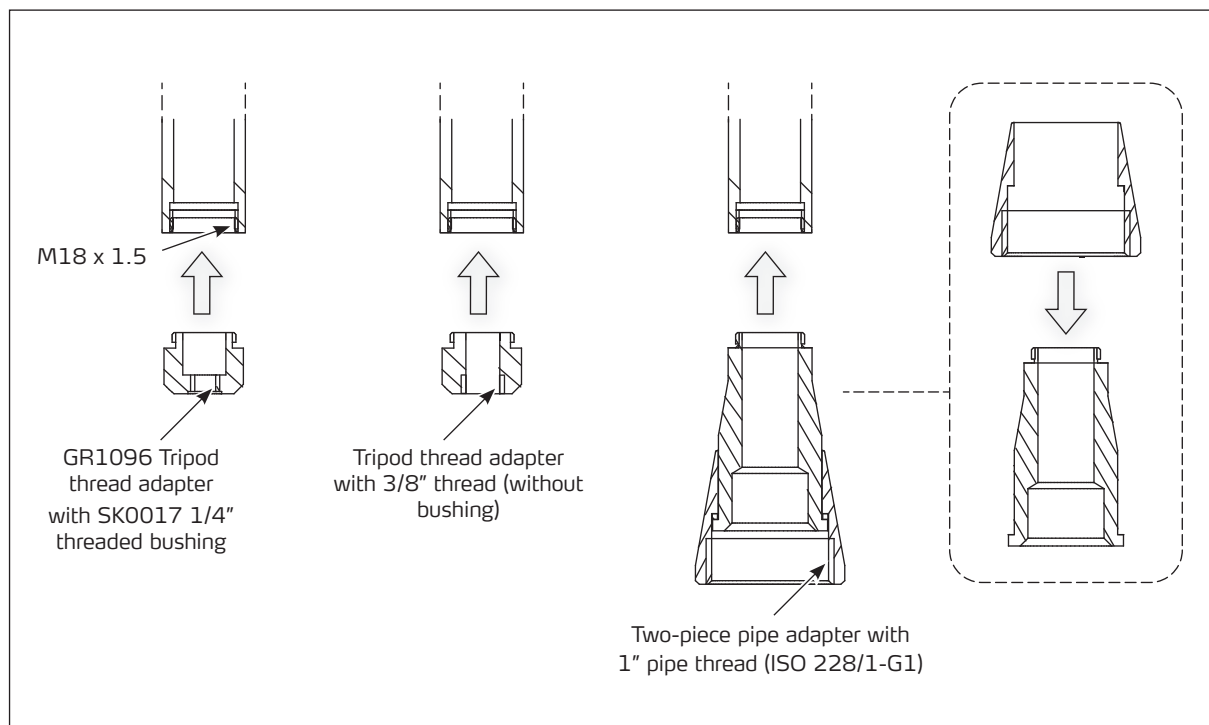


**Fig. 1.** The parts of 41AC-2.

## Installation

### Mounting 41AC-2 on Tripod or Pole Mount Adapter

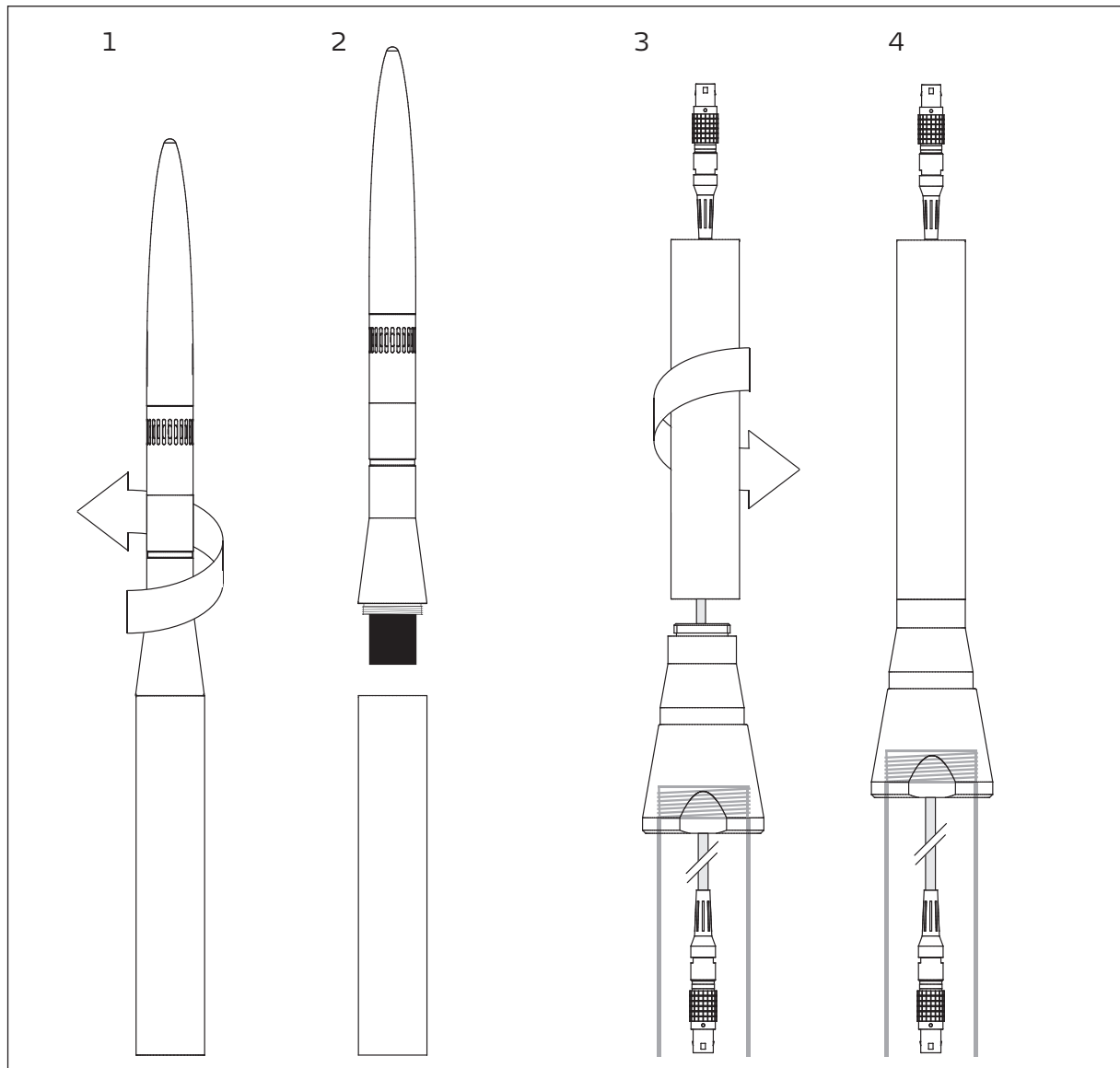
The 41AC-2 is designed for permanent installation and therefore comes with an adapter for mounting on a 1" pole. See Fig. 2 and Fig. 3, 3. The 41AC-2's housing is attached to the mounting fittings with a M18 x 1.5 thread.



**Fig. 2.** The 41AC-2 lower housing's thread and adaptors for tripod and pole mounting.

### Attaching the Lower Housing

1. Unscrew the upper part from the lower body.
2. Set the upper part aside and ensure that it is protected from dirt and moisture.
3. Slide the microphone cable through the adapter and through the lower housing, and screw the housing onto the pole mount adapter.
4. Ensure that the lower housing is properly fastened to the pole mount adapter.



**Fig. 3.** Attaching the lower part of the housing to the pole mount adapter.

### Connecting the Cable to the Preamplifier

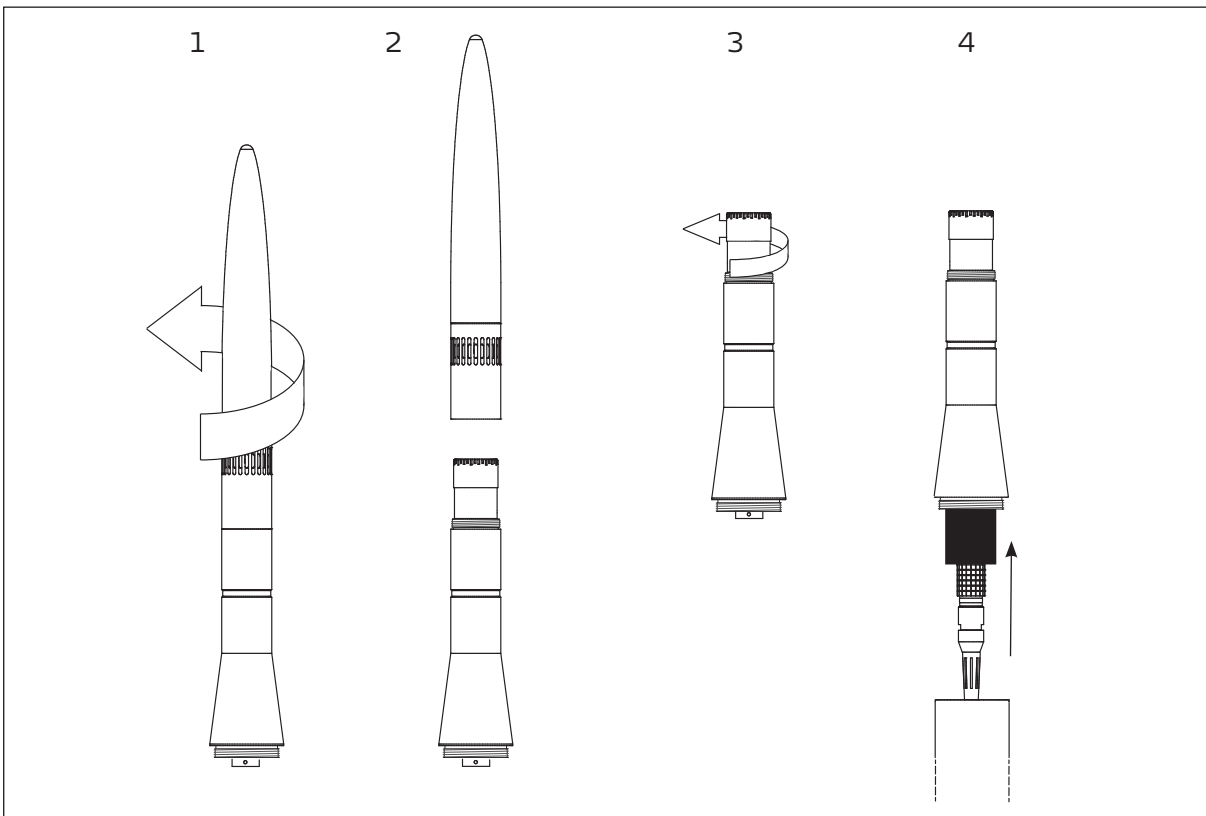
**Important.** Before connecting cable and preamplifier, you must ensure that the upper housing can turn independently of microphone, preamplifier and cable. This is done by loosening the microphone from the preamplifier by approximately half a turn.

Doing this ensures that the microphone-preamplifier and the preamplifier-cable connections are not subjected to strain when the upper housing is screwed onto the lower housing. Also it makes attachment of the cable to the preamplifier safe.

1. Unscrew the nose cone.
2. Set it aside. Make sure it is protected from dirt and moisture.
3. Loosen the microphone housing by half a turn. Hold at the preamplifier connector and the lower part of the microphone body while turning.

**Important.** Make sure to loosen the microphone housing and not only the protective grid!

4. Connect the cable to the preamplifier.



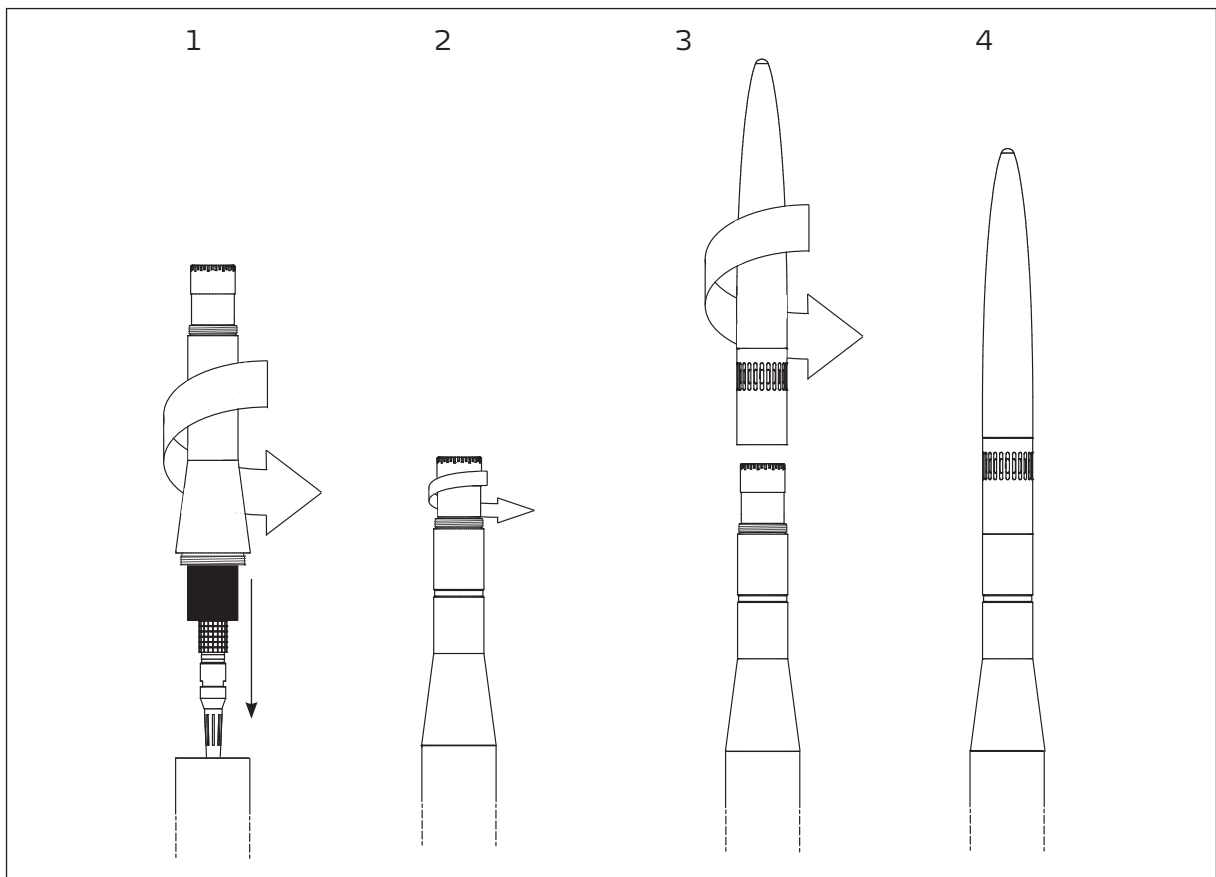
**Fig. 4.** Loosening the microphone-preamplifier: This must be done to avoid strain to the microphone-preamplifier assembly when connecting the cable and mounting the upper part.



### Mounting the Upper Housing and the Top Cone

When the microphone has been loosened from the preamplifier, you can safely mount the upper housing onto the lower housing and subsequently mount the top cone.

1. Screw the upper part of the housing onto the lower part.
2. Fasten the microphone by turning it clockwise.
3. Screw on the top cone.
4. Ensure that the top cone is properly fastened.



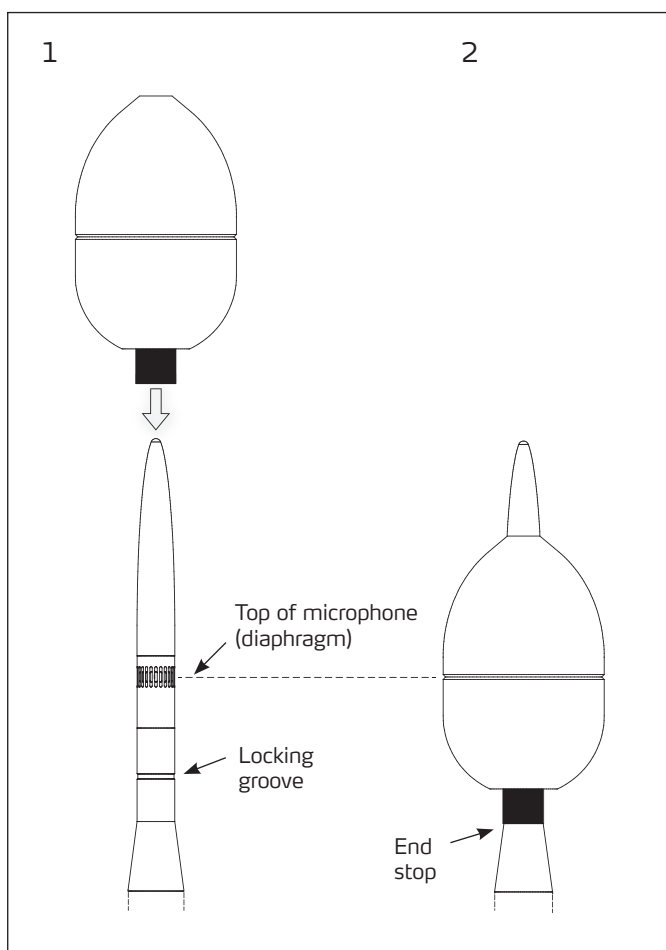
**Fig. 5.** Mounting the upper housing and the top cone.

### Mounting the Windscreen

The windscreen is glued onto a plastic tube that ensures that it can be positioned correctly:

- When pushed down, the windscreen tube is prevented from going too far by the upper housing's conical shape.
- When the windscreen is pushed as far down as it will go, it will be kept in place by a locking groove. Because of this, it cannot be dislocated unintentionally, and incorrect measurements due to an incorrectly positioned windscreen are avoided.

1. Slide the tube down over the top cone.
2. Ensure that the tube is pushed as far down as it will go.



**Fig. 6.** Mounting the wind screen. When locked in the groove, the center plane of the windscreen will be flush with the microphone diaphragm.



## Disassembly

You can disassemble the 41AC-2 by reversing the procedure described on the preceding pages.

Two points need special attention:

### Removing the Windscreen

The windscreen tube is held in place by a locking mechanism. Therefore, some force must be applied to slide the tube back up. See Fig. 7a.

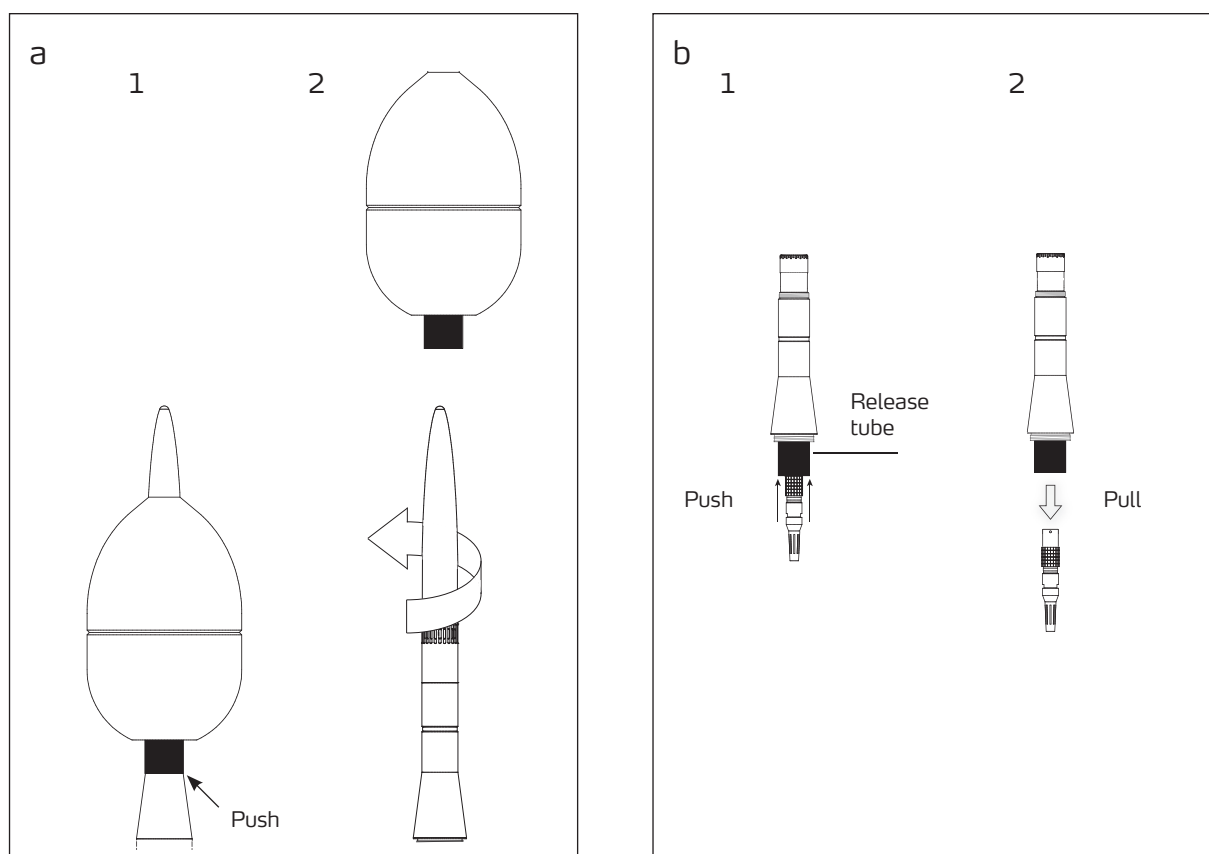
1. Push at the end of the tube with a finger nail or a piece of hard plastic.

**Caution.** Do NOT pull at the foam as this could cause it to deform or loosen it from the tube.

### Disconnecting Preamplifier and Cable

When disconnecting the cable from the preamplifier, you must push the black release tube upwards. This will cause the LEMO connector's locks to release.

1. Unscrew the top cone (see Fig. 7, a2).
2. Push the black release tube upwards. See Fig. 7b, 1.
3. Pull the cable downwards to disconnect it from the preamplifier. Fig. 7b, 2.



**Fig. 7.** Removing the wind screen and disconnecting the cable.

## System Integration

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### Setting the 41AC-2 for 90 or 0 Degrees of Incidence

The 41AC-2 is designed to be mounted vertically, as described in the previous sections. Mounted in this way, it can be set up for measurement at either 90 degrees or 0 degrees of incidence.

The correction data contained on the USB flash drive that is part of the delivery must be used if the 41AC-2 is used for 0 degrees of incidence.

The correction data are measured with a resolution of 1/12 octave.

### Polarization Voltage = 200 V

41AC-2 uses an externally polarized microphone with a 26AJ 1/2" RemoteCheck Preamplifier and must be connected to the LEMO input of an analyzer.

### Distance to the Ground

When mounted on a pipe or tripod, the distance from the bottom of the microphone to the ground reflecting surface must be at least 20 cm/7.9" to minimize the influence of ground reflections on the sound field.

### Replacing Microphone and/or its Protective Grid

The 40AF-S2 microphone and its protective grid are designed specifically for the 41AC-2. Only the 40AF-S2 will ensure the stated measurement results and water protection.

Therefore neither microphone nor its protective grid can be replaced with standard items.

## Calibration and RemoteCheck

### Introduction

41AC-2 comes with a RemoteCheck facility that makes it possible to check the integrity of the measurement chain remotely. RemoteCheck allows you to send a test signal from analyzer to microphone and record the result. It works by applying a precision AC test signal (for example a 1 kHz sine wave) to an RC network in the preamplifier. This signal is applied to pin 1 of the 7-pin LEMO cable/connector.

This method does not result in a signal proportional to the microphone's sensitivity, but it does give you a way to determine whether your system is stable and functional by comparing results over time. If the newest value differs from previous values, this indicates that the system has changed and that an error is present in the measurement chain. Note that RemoteCheck cannot replace a proper acoustic calibration of the microphone.

### Implementing RemoteCheck

Prior to implementing your RemoteCheck routine you should perform an acoustic calibration of the 41AC-2. This will provide you with a reference and can be used to establish the relation between calibration and subsequent RemoteCheck values. In this way you will have a more precise knowledge of the stability of your system.



### Calibration

An acoustic calibration with a pistonphone or a sound calibrator requires that windscreen and top cone are dismantled. How to do this is shown in Fig. 7a. Calibration can be performed using a Sound Calibrator or a Pistonphone. The G.R.A.S. 42AP Intelligent Pistonphone is recommended. The Sound Calibrator/Pistonphone must be fitted with a coupler for ½-inch microphones.

Refer to the manual for your sound calibrator or pistonphone for further information.

### Remote Check Signal Waveform and Level

The signal should be a single tone, a 1 kHz sine wave is recommended. The precision of the test signal should reflect your requirements for accuracy.

The signal will be attenuated by about 40 dB when applied to the RC network built into the preamplifier. Roughly speaking, a RemoteCheck signal of about 5 V RMS will result in a response signal corresponding to a sound level of about 94 dB SPL.

When setting up your measurement system, we recommend that you – after the acoustic calibration of the microphone – calibrate the RemoteCheck test signal. When calibrating the RemoteCheck signal, you can adjust the signal from your generator to correspond to a desired reading, for example 94 dB SPL.

### Analysis of the Remote Check Signal

RemoteCheck verification is based on comparison of historical data from frequent RemoteCheck measurements. Depending on the background noise level, the expected accuracy of the verification signal will be within 0.15 dB to 0.5 dB. If the background noise is about 60 dB SPL, the accuracy will be about 0.15 dB, if it is 70 dB SPL it will be about 0.5 dB.

To get the best possible accuracy, you must therefore monitor the background noise and select your RemoteCheck measurement values from samples obtained in situations with low levels of background noise. If background noise is still a problem, it can be minimized by using a larger RemoteCheck signal and/or use a narrow band analysis around the test frequency, and in this way you can isolate the test signal response from the background noise. In practice this should not be necessary.

### Maintenance

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Depending on local conditions, the windscreen must be cleaned or replaced. How often must be determined by visual inspection and knowledge of local weather conditions.

O-ring OR2038 (see page 5) must be lubricated with silicon grease at regular intervals. Without lubrication it must be replaced once a year.

When under power, the preamplifier emits heat. This heat is part of the 41AC's protection against moisture, and therefore the power to the 41AC should be turned on permanently.

## Accessories

These accessories must be ordered separately:

Intelligent Pistonphone	42AP
Pistonphone	42AA
Multifunction Sound Calibrator	42AG
3 m LEMO 7-pin - LEMO 7-pin Cable	AA0008
10 m LEMO 7-pin - LEMO 7-pin Cable	AA0009
30 m LEMO 7-pin - LEMO 7-pin Cable	AA0012
100 m LEMO 7-pin - LEMO 7-pin Cable	AA0014
Customized length LEMO 7-pin - LEMO 7-pin Cable, length in cm.	AA0020-CLXXXX

## Specifications

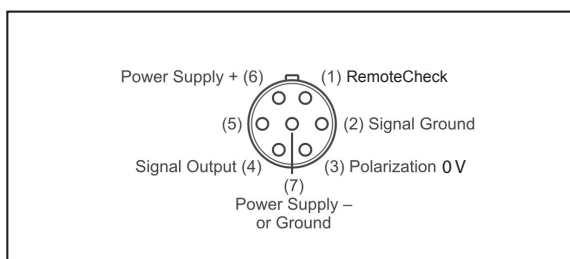
### 41AC-2

Dynamic range lower limit (microphone thermal noise)	17 dB(A)
Dynamic range upper limit (with 28 V/ $\pm 14$ V supply)	138 dB
Dynamic range upper limit (with 120 V/ $\pm 60$ V supply)	144 dB
Set sensitivity @ 250 Hz ( $\pm 2$ dB)	50 mV/Pa
Compliance	IEC 61672-1
Polarization voltage	200 V
Power supply	28 V to 120 V / $\pm 14$ V to $\pm 60$ V
Power consumption	0.7 mA ( $\pm 14$ V) / 2.3 mA ( $\pm 60$ V)
Temperature range, operation	-30 to 70 / -22 to 158
Connector type	7-pin LEMO
CE/RoHS compliant/WEEE registered	Yes/Yes/Yes
Water Resistance	IP55

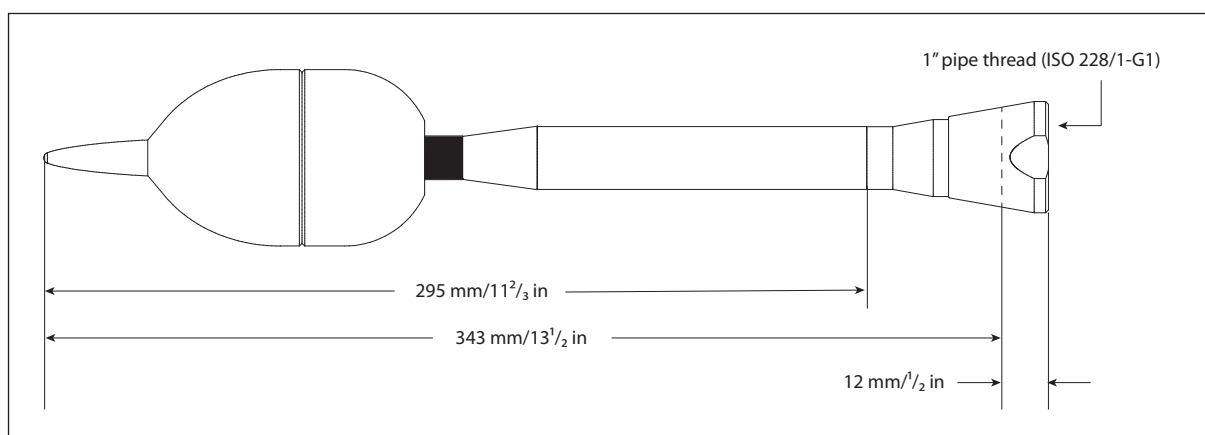


# RemoteCheck

Signal waveform	Sinusoidal
Test frequency to be used	750 to 1000 Hz
Amplitude	5 to 50 V RMS
Repeatability (depending on background noise)	0.15 dB to 0.5 dB

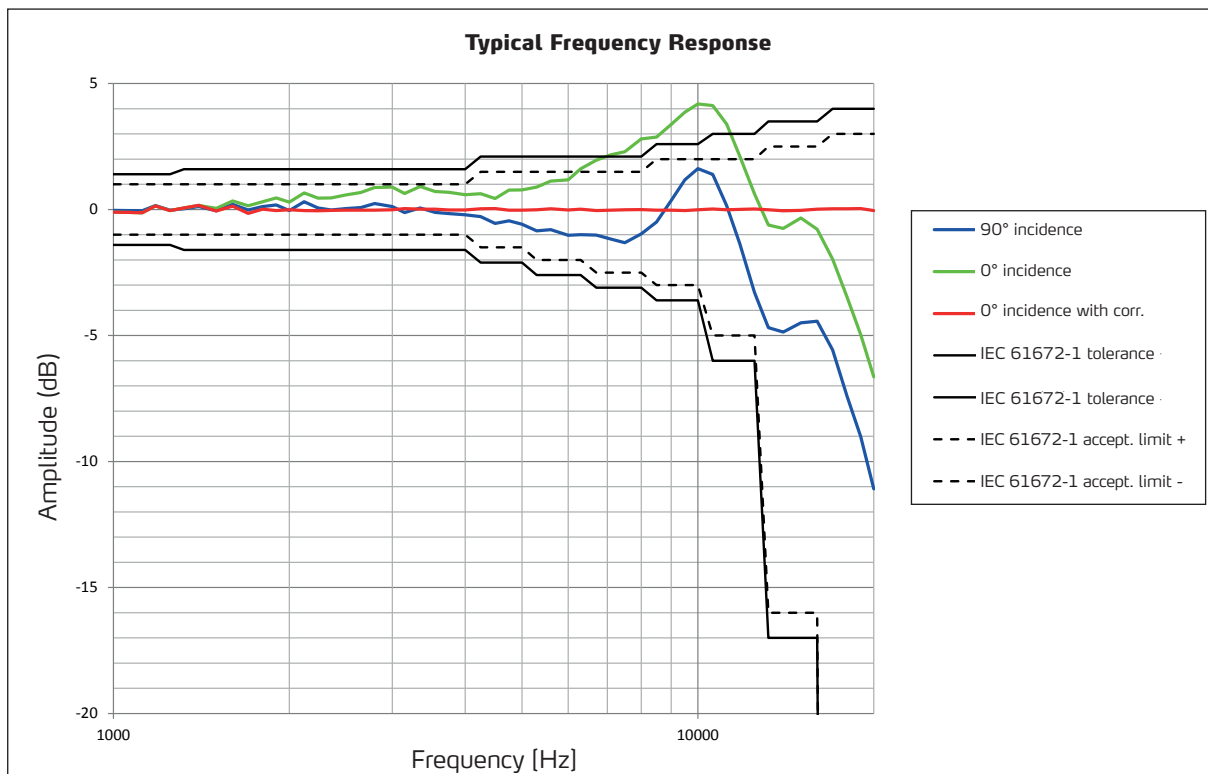


**Fig. 8.** 7-pin LEMO 1B male connector (external view) on the 41AC-2s preamplifier and output cable. The RemoteCheck signal is applied to pin 1.

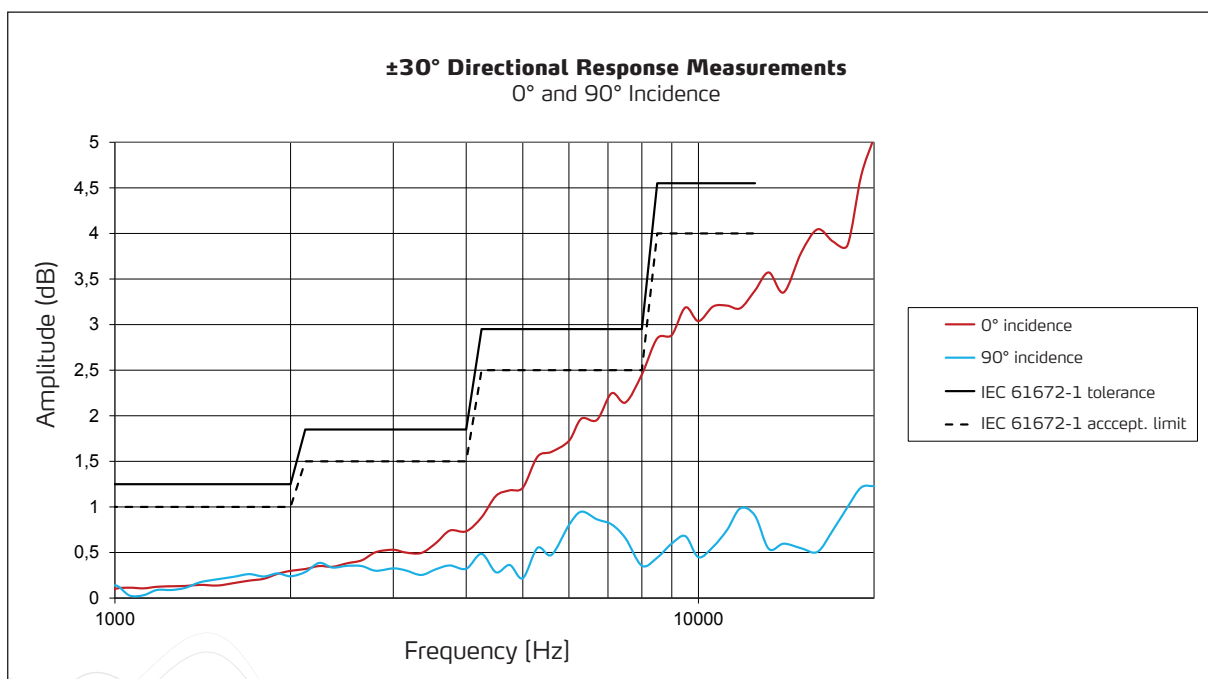


**Fig. 9.** When mounted on a pipe, the top of the 41AC will be elevated 343 mm above the pipe.

## Frequency Response and Directional Response

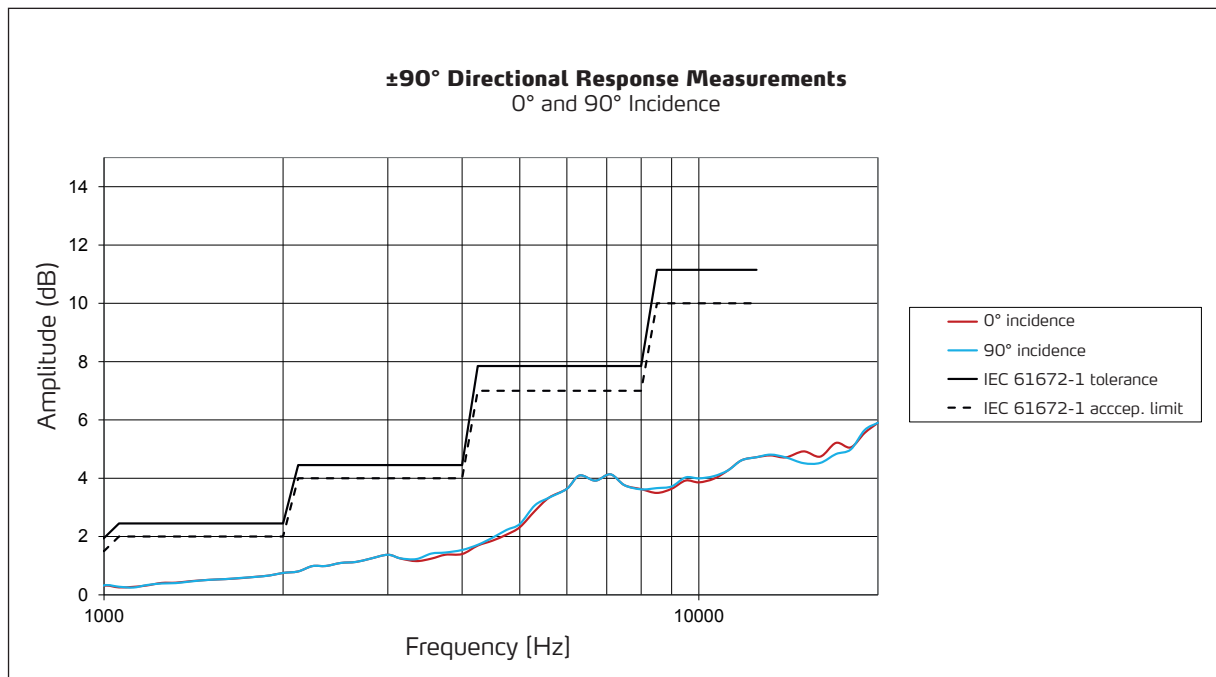


**Fig. 10.** Typical frequency response.

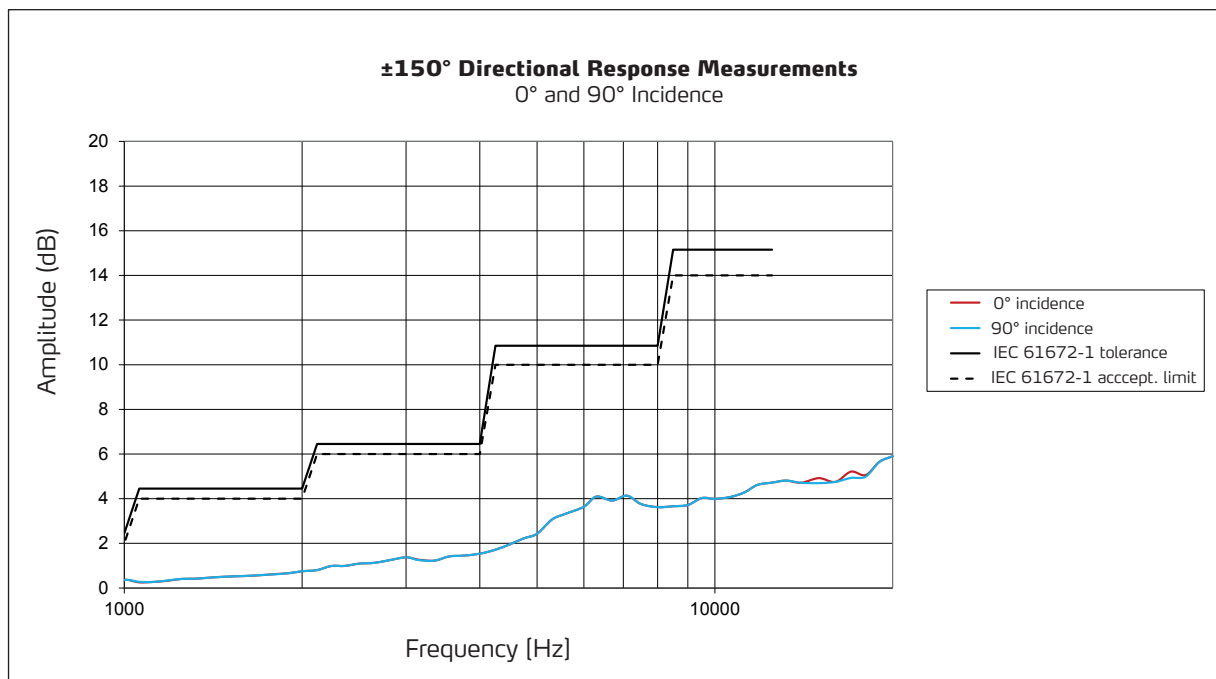


**Fig. 11.** ±30° directional response at 0° and 90° incidence.





**Fig. 12.** ±90° directional response at 0° and 90° incidence.



**Fig. 13.** ±150° directional response at 0° and 90° incidence.

## **Calibration, Warranty and Service**

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### **Calibration**

Before leaving the factory, all G.R.A.S. products are calibrated in a controlled laboratory environment using traceable calibration equipment.

An individual test certificate stating the sensitivity and frequency response is included with each product.

### **Warranty**

All G.R.A.S. products are made of high-quality materials that will ensure life-long stability and robustness. The 41AC-2 is delivered with a 5-year warranty.

The windscreen comes with a 6-month warranty, this warranty covers defective workmanship only and not the effects of normal use.

Damaged diaphragms in microphones can be replaced.

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 without notice.