

Instruction Manual

*G.R.A.S. 40LA 1/4" CCP Precision Surface
Microphone, High Pressure*



Revision History

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

Revision	Date	Description
1	18 June 2012	First version
2	10 September 2013	Optional customized cable length added
3	24 November 2014	Information about customized mounting added Calibration kits OP0025 and OP0025 added

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Contents

Introduction	4
Physical Properties	4
Electrical Properties	4
Delivered Items.....	6
Mounting the 40LA	7
Introduction	7
Mounting with Rubber Fairing and Self-adhesive Pads.....	8
Mounting with Aluminum Fairing	10
Mounting in a Customized Assembly	11
Calibration	12
Sensitivity Calibration	12
Frequency Calibration	13
Specifications	14
What to Order.....	15

Introduction

Physical Properties

1/4 inch Microphone

The G.R.A.S. 40LA High-Precision Surface Microphone is a prepolarized 1/4" pressure microphone mounted in a housing designed for noninvasive mounting or screw-secured mounting on flat and curved surfaces. The height is 2.5 mm. The diameter, including a fairing for smoothing the profile, is 42 mm. The small dimensions make it easy to obtain a very low profile even on curved surfaces.

It is ideally suited for applications in the automotive industry for wind tunnel testing, wind turbine industries for testing of turbulence related noise, and the aerospace industry for examination of true surface pressure, turbulence, aerodynamic noise etc. under real flight conditions.

Low Weight and Profile

Its low weight and small dimensions means that it can be attached to very light structures without significantly altering the weight and behavior of the structure in question. Because of its lightness, the 40LA can be readily mounted with the GR1252 Fairing using a thin double-sided adhesive pad. The low and smooth profile means that it has very little influence on the sound field.

Pressure Equalisation

Pressure equalisation is obtained via a frontal vent close to the diaphragm. In addition to providing static-pressure equalization, the frontal vent ensures that 40LA can be used on aircraft and on road vehicles in mountainous country and for applications exposing the microphone to turbulent pressure fluctuations that can cause rapid changes in static pressure.

Ruggedness

The 40LA is a rugged and stable construction. The diaphragm is made of stainless steel alloy and the housing of high-grade stainless steel that can withstand adverse weather conditions. If the diaphragm is damaged, the design allows for replacement.

The diaphragm is unprotected, and care must be taken to avoid damage.

Electrical Properties

CCP – Constant Current Power

The 40LA is a prepolarized condenser microphone with an integrated CCP (Constant Current Power) preamplifier. CCP is also known as IEPE (Integrated Piezo-Electric) and CCLD (Constant Current Line Drive) and is compatible with many other constant current driven products, such as Deltatron® (Brüel & Kjær), ISOTRON® (Endevco Corp), etc. The built-in CCP preamplifier is capable of driving long cables. It uses standard coaxial cables. The CCP design is one reason why the 40LA is ideal for multichannel measurement applications where many microphones are hooked up simultaneously.

It has a nominal sensitivity of 0.5 mV/Pa and a dynamic range from below 56 dB(A) to 178 dB. It has a wide frequency range from 5 Hz to 70 kHz. The 40LA must be connected to an analyzer with an input stage capable of powering a CCP microphone. In order to obtain the full dynamic range, the power supply of the input module of the analyzer must be able to handle a peak-to-peak signal of $\pm 8V$ without clipping.

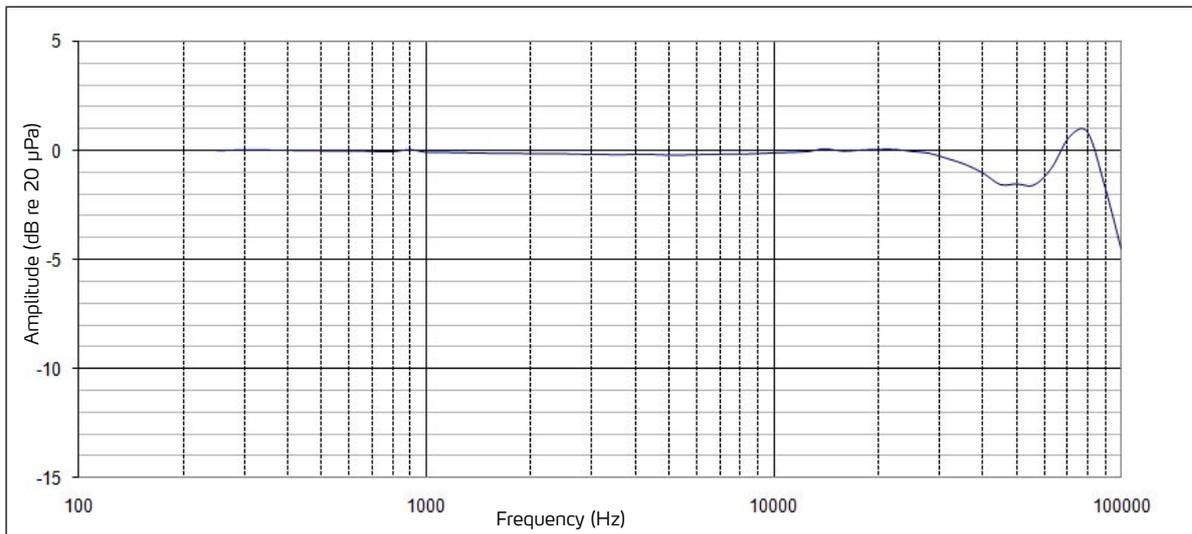


Fig. 1. Typical pressure frequency response of 40LA.

TEDS – Transducer Electronic Data Sheet

The 40LA has a built-in TEDS chip for plug and play identification when connected to a TEDS enabled analyzer/input module. The TEDS – Transducer Electronic Data Sheet – conforms with the IEEE 1451.4. Standard for adding plug-and-play capabilities to analogue transducers.

The TEDS resides in an embedded memory in the preamplifier and contains the information needed by an instrument/measurement system to identify and properly use the signal from the microphone.

- The TEDS preamplifier/microphone combination is factory-calibrated as a combined unit and the calibration data are stored in the built-in TEDS.
- The TEDS also contains all necessary identification data, including manufacturer, type and serial number.

When connected to a TEDS enabled analyzer, each microphone is identified as a unique sensor, making multichannel measurements easier to set up, because accounting for the properties of each sensor is automated. Cabling errors are thus easily avoided and in combination with the embedded information about the microphone's sensitivity, true plug and play connectivity in a multichannel setup is ensured.

Delivered Items

The 40LA is delivered with the items shown in Fig. 2. When properly handled, the 40LA is a both stable and robust device that can withstand normal handling and adverse weather conditions.

Caution: Before unpacking the 40LA, please bear in mind that the 40LA basically is a “naked” microphone without protection grid. Take care NOT to subject the parts to physical abuse and undue strain. Be careful to protect the diaphragm from contact with sharp objects and do not remove the protective cap before it is necessary.

- Do not remove the protective cap unless necessary.
- Do not expose the cable to strain as this can result in loss of connection.



Fig. 2. 40LA and delivered items

Mounting the 40LA

Introduction

The 40LA is designed for non-intrusive and intrusive surface mounting. For mild to moderate wind speeds, the 40LA can be secured using the included double-sided pad and top pad. For securing the 40LA in more difficult conditions, a strong glue or a bolt-on type fastening need to be considered. As much will depend on specific factors (the shape and material of the mounting plane, the anticipated air flow, etc.), it is not possible to issue general guidelines for what type of mounting that must be used. Please contact G.R.A.S. for further information. Therefore the guidelines below are just that - guidelines.

Mild to Moderate Air Flow

In conditions with moderate air flow, the 40LA can be secured in place using the included double-sided adhesive pad (possibly trimmed to match the size of the microphone) and the GR1252 Fairing that ensures a smooth air flow around the microphone and reduces the risk of wind tearing off the microphone. A self-adhesive top pad can be added to further secure the mounting.

On a plane surface, the adhesive strength of a mounting using this method will be sufficient to withstand the forces generated by wind speeds of up to >200 – 240 km/h / 125 –150 mph. However, the stability of such a mounting method will largely depend on the exact properties of the surface in question and how it is located in relation to the overall wind speed and any local turbulence.

Strong Air Flow

For applications involving stronger air flow (i.e. more than 200 – 240 km/h / 125 –150 mph, e.g. on high-speed trains or the fuselage of a test aeroplane), it is probable that other types of mounting must be considered: either a solution involving a special glue or a mounting where a metal fairing (GR1297 or custom built) is bolted onto the test surface.

On curved surfaces, a customized metal fairing may be necessary for this type of mounting. Please contact G.R.A.S. for further information

On the following pages some of the mounting methods are listed.

Mounting with Rubber Fairing and Self-adhesive Pads

For applications involving light to moderate air flow, noninvasive mounting using self-adhesive pads and a rubber fairing is recommended.

1. Clean the surface where the 40LA is to be mounted using the Cleansing Tissue (MI0031) provided (alternatively use isopropanol or cleaning benzine). Allow time for the surface to dry up.
2. GR0934 Double-sided Adhesive Pad: Peel off the white protective sheet to expose one adhesive surface and press the pad firmly in place.



Fig. 3. Mounting the 40LA with double-sided adhesive pad for securing the fairing.

Important. Ensure that the whole area of the pad is firmly secured to the structure. There must be no bubbles. The perimeter must be firmly attached to the structure, ensuring that the yellow protective layer later on can be peeled off without affecting the proper fixture of the pad.

3. Remove the black protective cap of the microphone – be careful NOT to touch the diaphragm.
4. Place the microphone on a flat surface and line-up the slit of the Fairing (GR1252) with the microphone's cable and press the fairing down over the microphone.

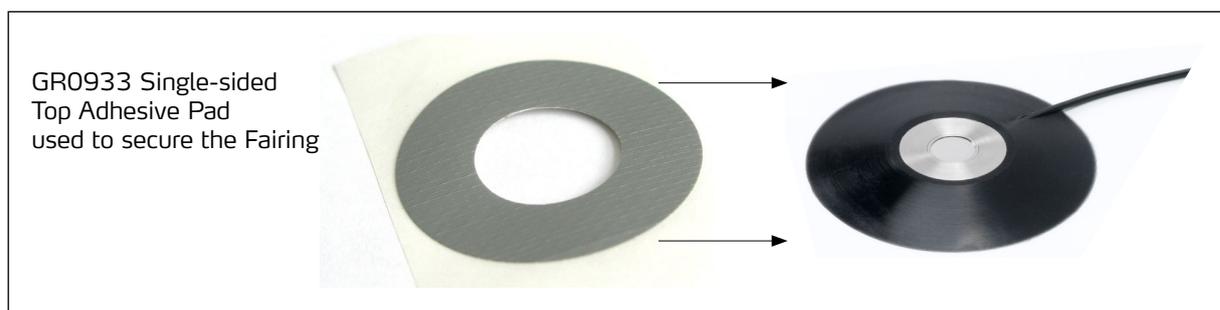


Fig. 4. Mounting the 40LA with Top pad (self-adhesive) for securing the fairing.

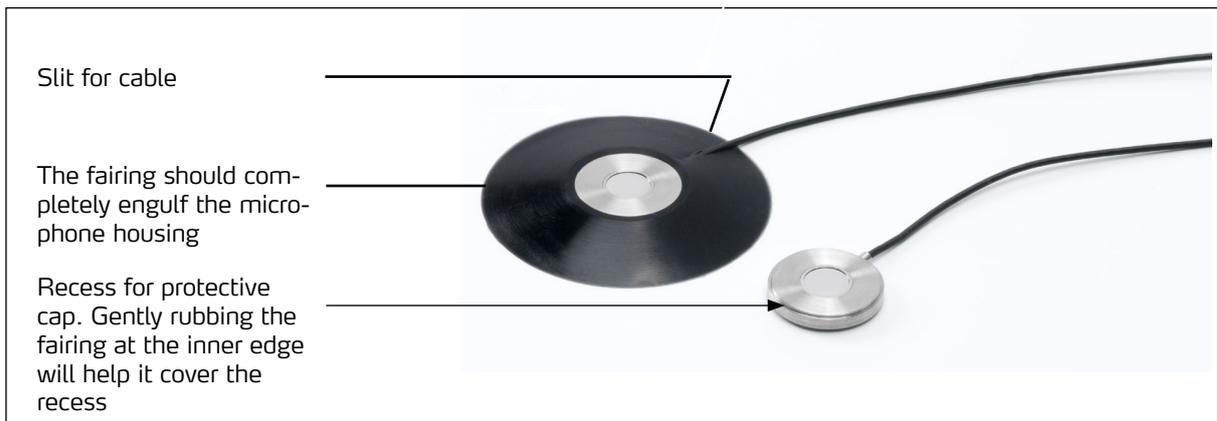


Fig. 5. Mounting the 40LA: Mounting the rubber fairing.

Important. The recess for the protective cap should be fully covered by the fairing. This can be ensured by gently rubbing the fairing towards the centre of the microphone. Peel off the yellow paper to expose the top-side adhesive surface.

Getting hold of the yellow paper and peeling it off can be tricky. Use a nail and push the yellow paper at the outer edge of the handle towards the centre until a part comes off. If this does not work, use a scalpel to gently lift off the yellow paper at the outer edge of the handle.

5. Press microphone and fairing down onto the exposed adhesive surface. Smoothen the fairing so that it is flush with the microphone, leaving no part of the recess for the protective cap exposed.

Important. Be sure NOT to touch the diaphragm, apply pressure only to the housing.

6. GR0933 Single-sided Adhesive Pad: Peel off the protective layer to expose its adhesive surface and press it firmly to secure the fairing and seal off its perimeter.

Mounting with Aluminum Fairing

For applications involving strong air flow (i.e. >200 – 240 km/h / 125 –150 mph), e.g. on the fuselage of a test aeroplane, the GR1297 Fairing and three M2 bolts can be used. Alternatively, a custom designed fixture is needed. See “Mounting in a Customized Assembly” on page 11 for further information.

Mounting Using the GR1297 Fairing

For applications involving strong air flow, the self-adhesive pads and the silicone rubber fairing must be replaced with a more robust fixture. For this purpose, a special aluminum fairing, GR1297 can be ordered from G.R.A.S. The fairing is similar in shape to the rubber fairing used for light air flow applications. The advantage of the aluminum fairing is that it uses the recess for the protective cap and three bolts to hold the 40LA firmly in place. If you can get access to the rear of the mounting plane, the fairing can be mounted from the rear using the three M2 threaded holes. Alternatively, (correctly selected) glue can be used.

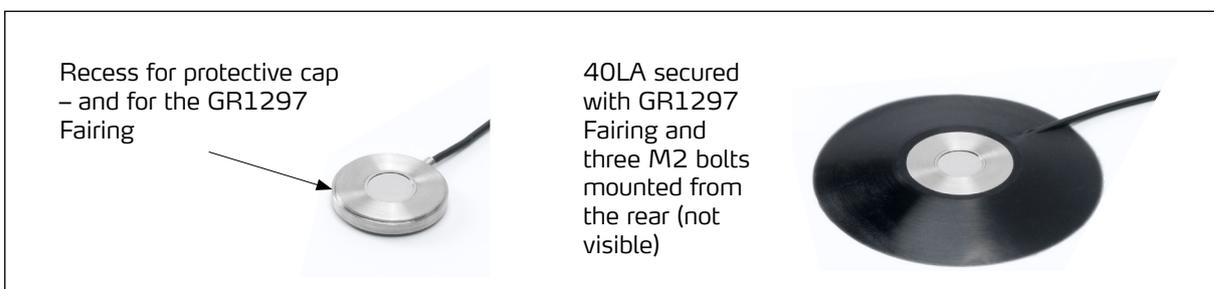


Fig. 6. Mounting the 40LA using the GR1297 Fairing.

In order to drill holes for mounting bolts, the 1:1 template below can be used.

Caution: The M2 bolts and the fine threads in the fairing require that only little torque is used when securing the bolts – do not overtighten.

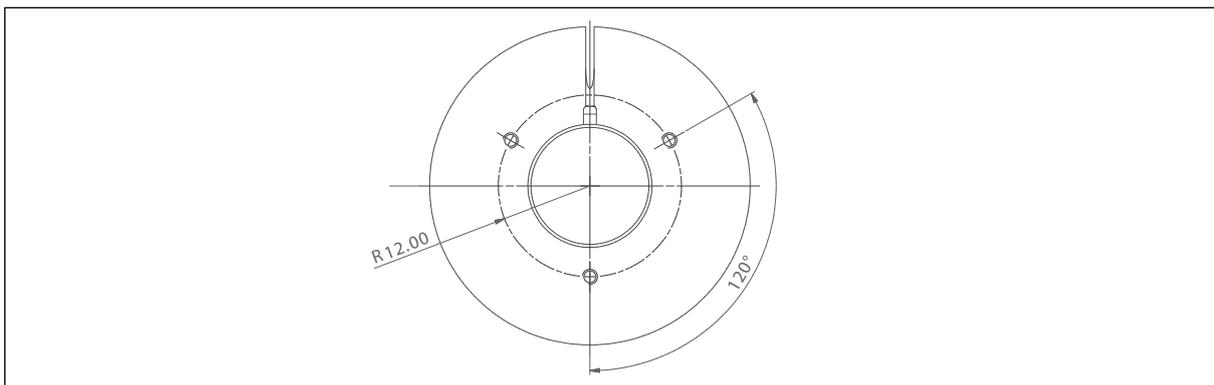


Fig. 7. Drilling template for the GR1297 Fairing. The threads in the plate are for M2 bolts. All measures are millimeters.

Mounting in a Customized Assembly

Mounting Considerations

If you design your own assembly/fairing system, it is important to ensure that the force used to hold the 40LA does not disturb the parts inside the microphone housing, as this could lead to malfunction.

The 40LA's housing consists of two parts, an upper and a lower housing, as shown in Fig. 8. If the lower housing is subjected to a force greater than 10 N, this could cause it to dislocate and/or damage some of the interior parts. Therefore, it is important that you follow the recommendations in the illustrations below.

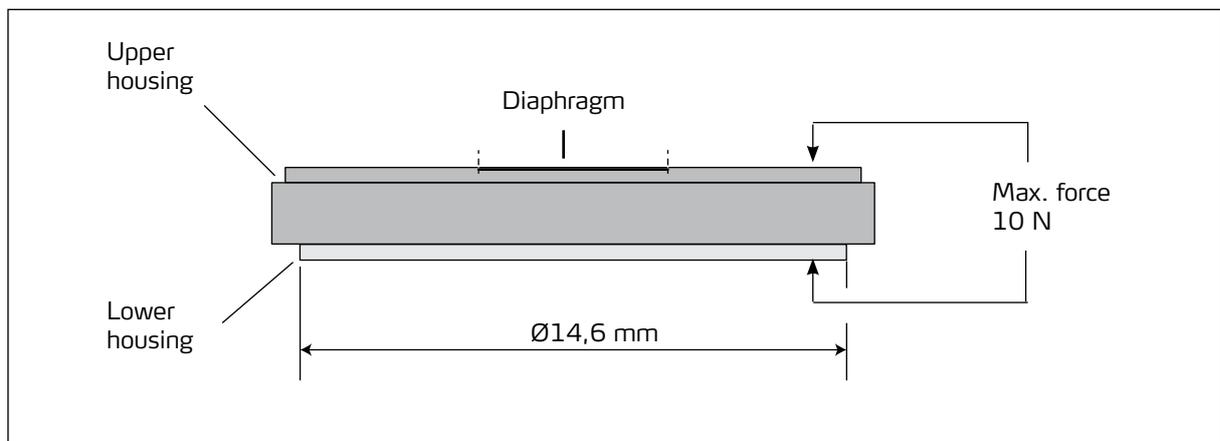


Fig. 8. Side view of the 40LA.

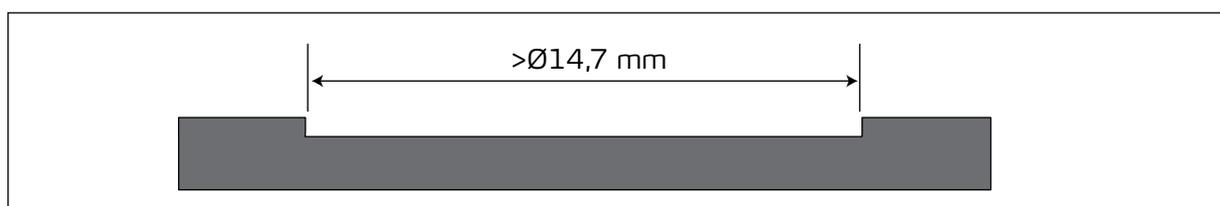


Fig. 9. A retaining plate for the 40LA must have an opening wider than the diameter of the 40LA's lower housing.

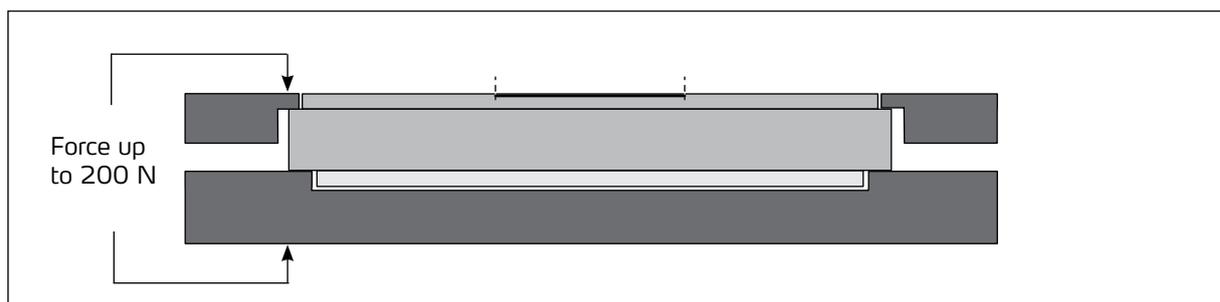


Fig. 10. Example of a mounting method where force is applied only to the upper housing.

Calibration

We have determined that it is not possible to achieve satisfactory results with in-situ calibration, or in-situ verification as we would prefer to call it when done outside a laboratory environment. The results that can be achieved without dismounting the 40LA are not accurate enough and repeatability is poor.

Therefore, we can only recommend a proper acoustic calibration with the 40LA dismounted. We have developed two adapters for calibration of the 40LA in a laboratory environment.

- The OP0025 kit for sensitivity calibration with a pistonphone calibrating at 250 Hz.
- The OP0026 kit with electrostatic actuator and mounting adapter for frequency calibration.

Sensitivity Calibration

For sensitivity calibration, you need a G.R.A.S. pistonphone and the G.R.A.S. OP0025 Kit for Sensitivity Calibration of Surface Microphone Sets. This Kit contains an RA0202 Adapter for calibration of the 40LA with a pistonphone. Please note that a 1 kHz sound calibrator cannot be used.

Description	GRAS number
Intelligent Pistonphone, Class 0	42AP
Pistonphone, Class 1	42AA
Kit for Sensitivity Calibration of Surface Microphone Sets, comprising:	OP0025
Adapter	RA0202

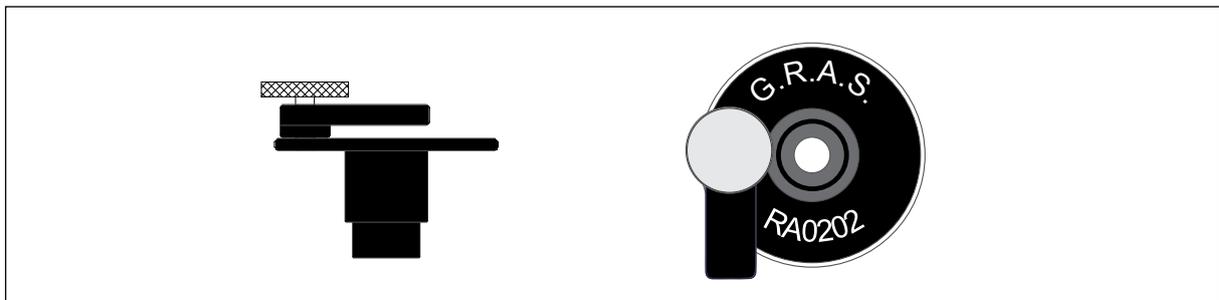


Fig. 11. Side and top view of the RA0202 Adapter.

For further instructions, refer to the manual for your pistonphone and for the OP0025 Kit. Instructions can be downloaded from gras.dk:

- OP0025 Kit: gras.dk/op0025.html.
- 42AP pistonphone: <http://www.gras.dk/42ap.html>.
- 42AA pistonphone: <http://www.gras.dk/42aa.html>.

Frequency Calibration

For frequency calibration, you need the G.R.A.S. OP0026 Kit for Frequency Calibration of 1/4" Surface Microphone Sets. This Kit contains an electrostatic actuator and an adapter that will enable correct frequency calibration of the 40LA when it is mounted in the AL0021 Calibration Stand and the actuator is powered by a G.R.A.S. 14AA Electrostatic Actuator.

Description	GRAS number
Electrostatic Actuator Amplifier	14AA
Calibration Stand	AL0021
Kit for Frequency Calibration of 1/4" Surface Microphone Sets, comprising:	OP0026
Electrostatic Actuator	RA0284
Surface Microphone Calibration Holder	RA0291



Fig. 12. Electrostatic Actuator and Surface Microphone Calibration Holder.

For further information, refer to the manuals for the 14AA Electrostatic Actuator Amplifier and the OP0026 Kit for Frequency Calibration 1/4" Surface Microphone Sets. Instructions can be downloaded from gras.dk:

- 14AA Electrostatic Actuator: gras.dk/14aa.html.
- OP0026 Kit: gras.dk/op0026.html.

Specifications

Nominal sensitivity	
at 250 Hz	0,5 mV/Pa
Frequency response	
±1 dB	10 to 20 kHz
±3 dB	5 to 70 kHz
Upper Limit of Dynamic Range	
Max. without clipping	178 dB re. 20 µPa
Lower Limit of Dynamic Range	
Thermal noise	< 56 dB(A) re. 20 µPa
Temperature Range	
Operation [°C / °F]	-55 to 100 / -67 to 212
Storage [°C / °F]	-40 to 85 / -40 to 185
Output impedance	
	< 50 Ω
TEDS	
TEDS UTID (IEEE 1451.4)	27 v 1.0
Cable	
	Integral coaxial cable with Microdot 10/32 connector
Length	1.5 m / 4.92 feet
Diameter	1.1 mm / 0.043 inch
Custom length, up to 5 meters	On request
Thickness	
	2.5 mm / 0.1 inch
Diameter	
With fairing	42 mm / 1.65 inch
Without fairing	16.2 mm / 0.63 inch
Weight	
Weight [g / oz]	3 / 0.101
Power supply	
	2 mA to 20 mA (typically 4 mA)
CE/RoHS compliant/WEEE registered	
	YES/YES/YES

What to Order

Order information can be found at <http://www.gras.dk/40la.html>.

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.