

Instruction Manual

High-Precision Surface Microphone 40LS



Revision History

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

Revision	Date	Description
1	14 March 2011	First version
2	18 June 2012	Second version. Added information about mounting.

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Introduction: Design philosophy

Physical Properties

1/4 inch Microphone Unit

The G.R.A.S. 40LS 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. When mounted, the maximum 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 almost flush mounting of the 40LS 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

The low weight and small dimensions means that it can be attached to very light structures without significantly altering the weight and behaviour of the structure in question. Because of its lightness, the 40LS 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 40LS 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 40LS 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.

Electrical properties

CCP – Constant Current Power

The 40LS 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 40LS is ideal for multichannel measurement applications where many microphones are hooked up simultaneously.

It has a nominal sensitivity of 1,8 mV/Pa and a dynamic range from below 50 dBA to 164 dB at 3% distortion. It has a wide frequency range from 5 Hz to 70 kHz. The 40LS 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.

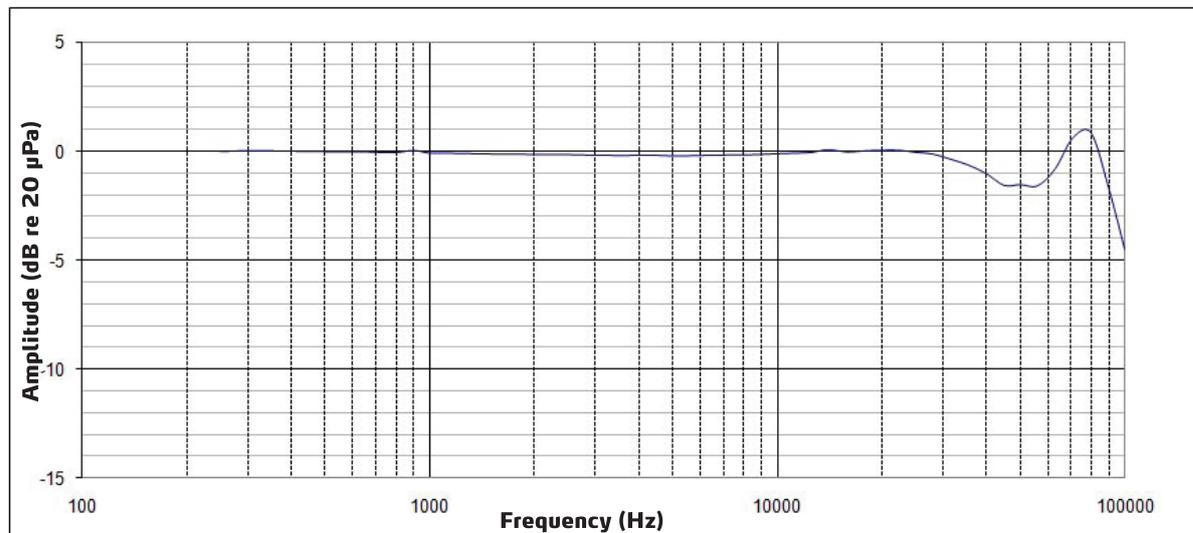


Fig. 1. Typical pressure frequency response of 40LS.

TEDS – Transducer Electronic Data Sheet

The 40LS 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 contain 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 and Accessories

The 40LS is delivered with the items shown in figure 2.1. When properly handled, the 40LS is both stable and robust device that can withstand normal handling and adverse weather conditions.

Important: Before unpacking the 40LS, please bear in mind that the 40LS basically is a "naked" microphone without protection grid. Please 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 necessary.

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



Fig. 2. Surface microphone and accessories included.

Optional accessories

For securing the 40LS to be used in applications with strong air flow, using the adhesive pads may not ensure a sufficiently secure mounting.

On flat surfaces, the Mounting Plate GR1297 can be used. For applications with curved surfaces, e.g. testing of aircraft, using a strong glue or a custom designed plate/ fixture with screws can be the best/only solution. Please contact G.R.A.S. for further information.

The Adapter RA0202 must be used for calibration with a pistonphone with a ½" coupler.

GR1297 Mounting Plate
with three threaded holes
for M2 bolts for rear-
mounting (not visible)



RA0202 Adapter for
calibration with a piston-
phone with ½" coupler



Fig. 3. GR1297 Mounting Plate (available from G.R.A.S.) for screwing the 40LS firmly in place. The RA0202 Adapter is for pistonphone calibration with a ½" coupler.

Mounting the 40LS

Introduction

The 40LS is designed for non-intrusive and intrusive flush mounting. For mild to moderate wind speeds, the 40LS can be secured using the included adhesive tape and top pad. For securing the 40LS in more difficult conditions, a strong glue or a bolt-on type fastening need to be considered. As much will depend on purely specific factors (the shape and material of the mounting plane) 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 40LS 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.

Below some of the possible methods are listed. Whatever mounting is used, the profile of the mounted 40LS will not exceed 2.5 mm.

Invasive mounting An invasive mounting on a flat surface involving a metal fairing that is fastened to the structure with bolts, the GR1297 (see Fig 2.2) Aluminium Mounting Plate and three M2 bolts or a custom designed mounting plate are needed. Please contact G.R.A.S. for further information.

Procedure for Mounting using Self-adhesive Pads

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

1. Clean the surface where the 40LS Surface Microphone is to be mounted using the Cleansing Tissue (MI0031) provided (alternatively use isopropanol or cleaning benzene). 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. 4. Mounting the 40LS 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.

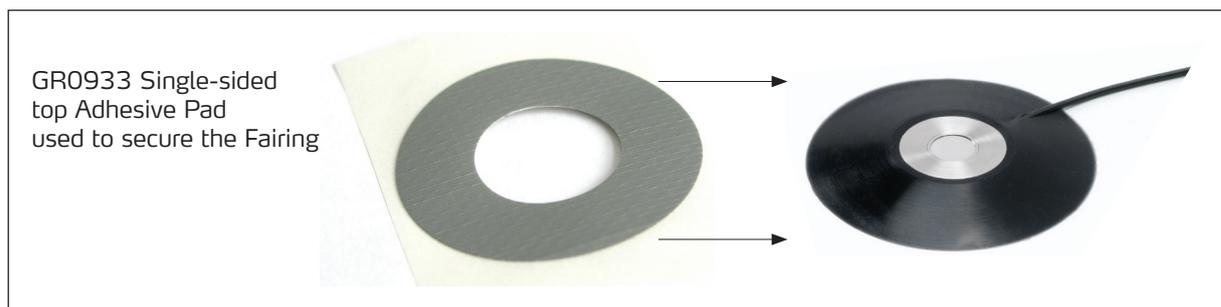


Fig. 5. Mounting the 40LS with Top pad (self-adhesive) for securing the fairing.

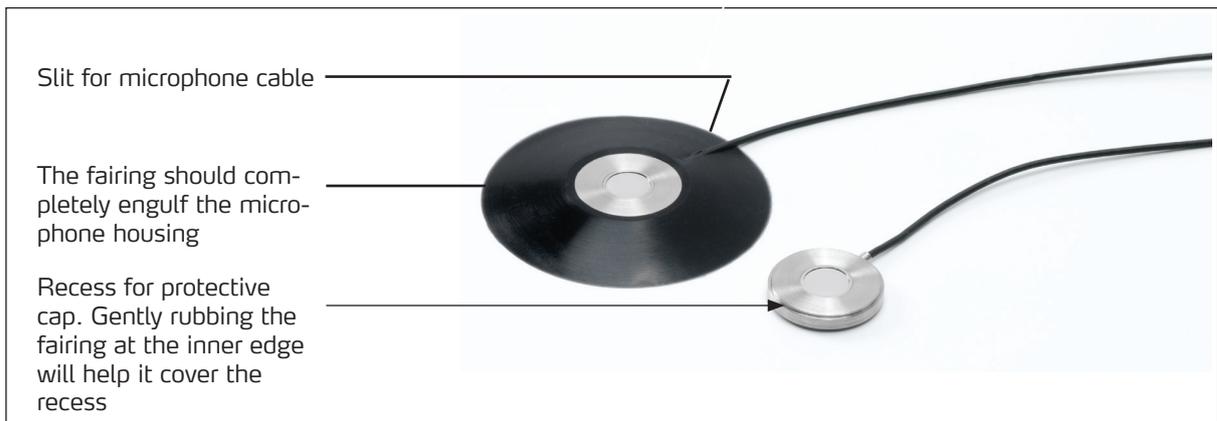


Fig. 6. Mounting the 40LS. Mounting the rubber fairing.

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.

Note. 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. 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 the 40LS for Applications with Strong Air Flow

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 Aluminium Mounting Plate and three M2 bolts can be used. Alternatively, a custom designed fixture is needed, please contact G.R.A.S. for further information.

Mounting using the GR1297 Mounting Plate

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 aluminium 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 aluminium fairing is that it uses the recess for the protective cap and three bolts to hold the 40LS 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, (carefully selected) glue can be used.

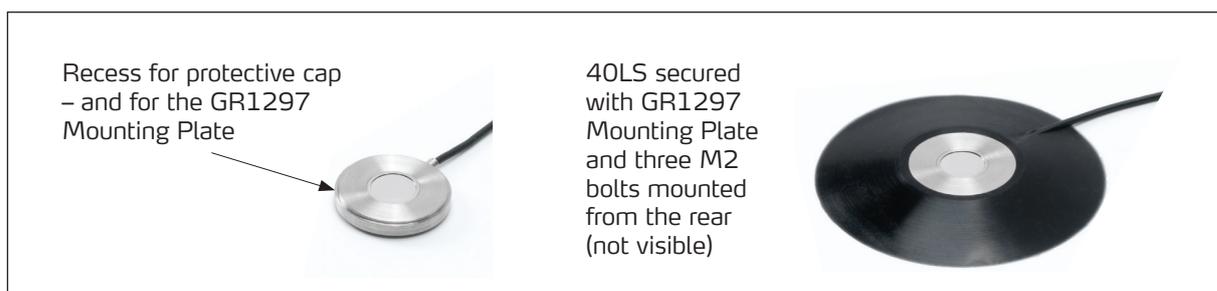


Fig. 7. Mounting the 40LA. Securing the fairing using the GR1297 Mounting Plate.

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

Important: the M2 bolts and the fine threads in the mounting plate require that only little torque is used when securing the bolts.

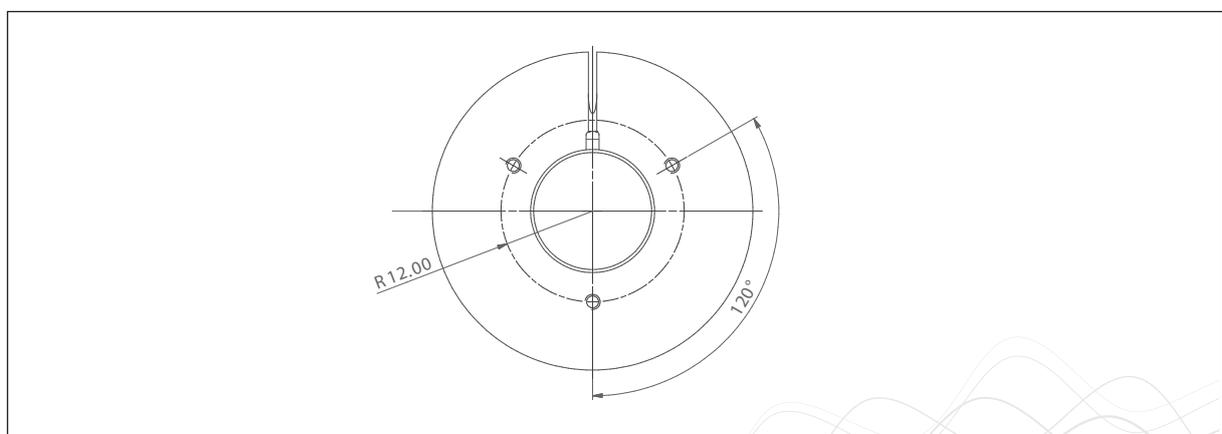


Fig. 8. Drilling template for the GR1297 Mounting Plate. The threads in the plate are for M2 bolts.

Calibration

For calibration of the 40LS, the Adapter RA0202 shown in Fig. 9 (available from G.R.A.S.) is required. As sound source for the calibration, the 42AA, the 42AC or the 42AP Pistonphones can be used.

- Make sure the 40LS is connected to your analyzer/input module.
- Loosen the collar of the pistonphone.
- Push the adapter as far as possible into to the coupler entrance of the pistonphone and lightly tighten the collar of the pistonphone.
- Remove the fairing and place the 40LS into the recess of the Adapter RA0202. Hold the pistonphone and surface microphone together as shown in Fig. 9 and switch on the pistonphone. Keep holding the two together until calibration is completed.
- When conditions are stable, adjust the analyzer to the pistonphone signal (nominally 114 or 134 dB re. 20 μ Pa depending on the pistonphone. See pistonphone manual for making barometric corrections).



Fig. 9. Calibration using a pistonphone.

In-situ Verification

If the fairing has not been secured with the GR0933 Top Adhesive Pad, it is possible to perform an in-situ verification. When the fairing is removed, it is possible to gently place the preassembled pistonphone + adapter over the microphone and perform a verification very much similar to the calibration described in Section 4.

- For this, the Adapter RA0202 shown in Fig. 10 (available from G.R.A.S.) is required.
- Make sure the Type 40LS is connected to your analyzer/input module.
- Remove the fairing from the surface microphone.
- Loosen the collar of the pistonphone.
- Push the adapter as far as possible into to the coupler entrance of the pistonphone and lightly tighten the collar of the pistonphone.
- Gently slide the pistonphone + the adapter onto the microphone. You can verify the correct positioning of the pistonphone by gently turning/wriggling it. Doing this, you can feel the pistonphone touching the perimeter of the microphone.
- Turn on the pistonphone. When conditions are stable, adjust the analyzer to the pistonphone signal (nominally 114 or 134 dB re. 20 μ Pa depending on the pistonphone used). See pistonphone manual for making barometric corrections.

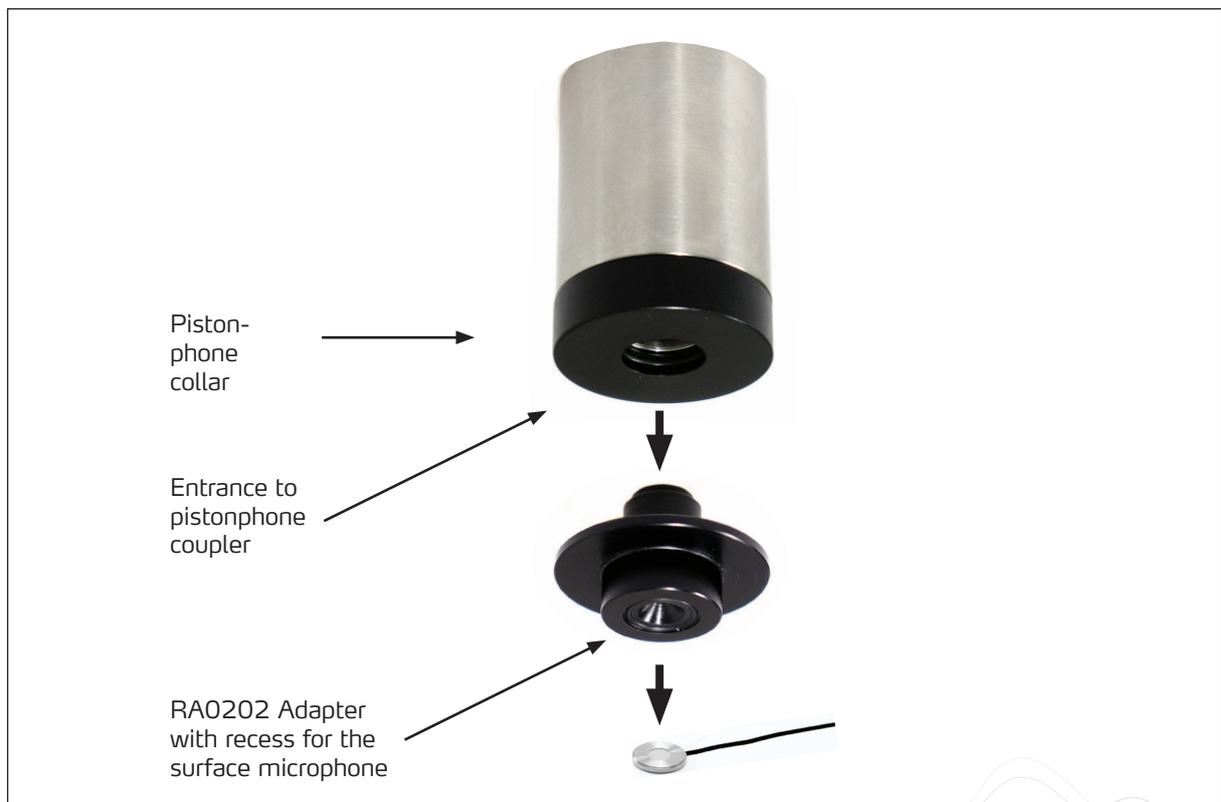


Fig. 10. In-situ verification using a pistonphone.

Specifications

Nominal sensitivity	
at 250 Hz	1,8 mV/Pa
Frequency response	
±1 dB	10-20 kHz
±3 dB	5-70 kHz
Upper Limit of Dynamic Range	
Max. without clipping	164 dB re. 20 µPa
Lower Limit of Dynamic Range	
Thermal noise	< 46 dB(A) re. 20 µPa
Temperature Range	
	- 55°C to +100°C
Output impedance	
	< 50 Ω
Output	B
	Integral coaxial cable with microdot connector
Cable	
length	1.5 m/4.92 feet
diameter	1.1 mm/0.043 inch
special	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	
	3 g
Power supply	
	2 mA to 20 mA (typically 4 mA)
Accessories included	
Fairing	GR1252
Top adhesive pad (0.5 mm)	GR0933 (pre-cut, single-sided)
Base adhesive pad (0.13 mm)	GR0934 (pre-cut, double-sided)
Cleaning tissue	MI0031
Adapter	AE0046 (BNC male to microdot female)

Accessories

Accessories included	Part number
Fairing:	GR1252
Top adhesive pad (0.5 mm)	GR0933 (pre-cut, single-sided)
Base adhesive pad (0.13 mm)	GR0934 (pre-cut, double-sided)
Cleaning tissue	MI0031
Adapter	AE0046 (BNC male to microdot female)

Available accessories	Part number
Calibration adapter	RA0202 (for use with Pistonphone)
Aluminium mounting plate	GR1297
Pistonphones	Types 42AA/42AC/42AP
CCP power modules	Type 12AL/12AQ
Miniature Connector, Microdot compatible	AE0046 (BNC male to microdot female)
Coax cable, Ø 2mm	EW0061
Plug Assembly Tool, for mounting AE0067 on to coax cable EW0061	RA0207

Manufactured to conform with:

CE marking directive:
93/68/EEC



WEEE directive:
2002/96/EC



RoHS directive:
2002/95/EC



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