GRAS 147EB-1

CCP X-Rugged Microphone Set

Freq range: 12 Hz to 20 kHz
Dyn range: 18 dB(A) to 133 dB
Sensitivity: 50 mV/Pa
Temperature: -40 to +125°C
Humidity: 0 – 90%
IEC 61672 class 2
IP67

The GRAS 147EB-1 is a free-field microphone set optimized for automotive brake noise testing. With a rugged design and extra protection of the diaphragm it is ideal for prolonged driving tests on public roads. It provides accurate data under the most challenging conditions - it can resist shock, vibration, water, dust and extreme temperatures. It has a watertight BNC connector.

GRAS Sound & Vibration
Skovlytoften 33, 2840 Holte, Denmark
www.grasacoustics.com

Introduction

147EB-1 is a free-field microphone optimized for wheelhouse brake noise testing in the automotive industry. It is designed to withstand the conditions in the wheelhouse during prolonged testing on public roads in all types of climate and weather. A rugged design that withstands shock and vibrations combined with a three-layer protection system for the diaphragm enables it to be used for realistic testing of brakes on proving grounds and public roads. The two protective grids and the customized windscreen are easily replaceable consumables. With the 147EB-1 it is now no longer necessary to use sub-standard microphones and cumbersome customized protection for acoustic road testing of brakes - it is now possible to measure without compromising data quality using a high-quality IEC 61672 class 2 microphone.

Design

Like other members of the GRAS family of microphones for automotive NVH testing, the 147EB-1 is designed to perform optimally under the rough conditions encountered in automobile NVH testing. The most important design features to accomplish this are:

Effective protection

The microphone-preamplifier assembly is effectively sealed against moisture and is IP67 rated. Special protective water and oil repellent coating adds further protection and makes it easy to clean. The microphone diaphragm is protected by two grids, a 1/2" grid inside a 1" grid. Each has a comprehensive multi-layer filtering system that ensures good protection against high-velocity particles and prevents dirt and dust from polluting the microphone. The filter in the 1/2" grid is acoustically transparent. The filter in the 1" grid is the same filter as that in the 1/2" grid supplemented by a layer of foam. The influence of the 1" grid can be compensated for with the transfer function that is included with the factory calibration. The calibration data and transfer function can be accessed online. Provided the filters are replaced at appropriate intervals this system ensures that the microphone will function properly even in very dirty conditions. The filter also protects the diaphragm against water splashes and oil mists.

Exploded view of the two-grid protection system. Both grids are furnished with filters for protection of the diaphragm.

A customized windscreen is available. Even if turbulence is not a problem it must be used as the first layer of protection and thus protect the next layer of protection against early contamination.

A large, customized windscreen takes care of turbulence but is also a very important part of the protection against moisture and dirt.

A plastic ring inside the windscreen locks the windscreen onto the microphone.

Rugged

The 147EB-1 can withstand the effects of handling, including the occasional drop. A new design of the preamplifier and other internal parts makes it resilient to shock and vibrations. It functions well under conditions with vibrations and g-forces from uneven road surfaces and other sudden directional shifts as encountered in real-life driving tests.

Even though the microphone will be firmly attached to a vibrating structure and subjected to frequent directional shifts, this fact will not interfere significantly with the measurements. If the effects of vibrations are considered to result in noise, it retains a very good signal-to-noise ratio even in vibration-rich conditions.

The most vulnerable part of any condenser microphone is the diaphragm. It can be replaced during repair, keeping maintenance costs at a minimum.

Watertight connection

When mounted in the wheelhouse, the connection between the microphone set and cable will be located very close to the road. This is why special water and heat resistant cable, AA0121, is available. The BNC connector in the microphone set end is located inside a long rubber sleeve that fits tightly around the preamplifier housing. In this way, a waterproof connection is ensured.

The cable is 5 meters long and would be a good choice for a permanent installation. Disconnecting the microphone from the cable is fairly easy.

Resists temperature changes

The microphone set works properly up to temperatures of 125°C/257°F and down to -40°C/-40°F. The cable is a high-temperature type. This means that the 147EB-1 can be mounted close to the road and used in all types of climate and seasons.

Benefits

The comprehensive precautions taken to make the 147EB-1 immune to adverse test conditions result in a number of benefits that all translate into shorter development times and lower costs of ownership.

- The same microphone set can remain mounted in a test configuration for extended periods of time or remounted very quickly.
- The protection grids with their protective filters can easily be replaced, for example when dirt and

oil mists are clogging the meshes.
- The concept with easily replaceable protection makes maintenance easy and reduces downtime.
- The CCP (Constant Current Power) technology allows for a low cost per measurement channel.
- The total life span of the microphone set will be many times that of a conventional microphone set that must be discarded due to damage from dirt, moisture, shock, and vibrations.

These advantages mean that the 147EB-1 not only ensures a low cost of ownership for your microphones but will also contribute to speeding up the development process by improving the quality of your measurements and reducing set-up time.

Compatibility

The 147EB-1 requires a constant current of typically 2 mA and is terminated with a BNC connector.

Ready to use standard coax cable assemblies of various types and lengths are available. Waterproof, heat and chemical resistant cables are also available.

The 147EB-1 is IEEE 1451.4 TEDS v. 1.0 compliant. If your measurement platform supports Transducer Electronic Data Sheets you will be able to read and write data like properties and calibration data.

Calibration

For daily verification and check of your measurement setup, we recommend using a sound source like the GRAS 42AG Multifunction Sound Calibrator.

Calibration data for each individual microphone set can be accessed online via the serial number. In this way, you can easily download and configure your analyzer with calibration data.

Accessible on-line are also correction data for the protective grid in a format that your analyzer can read at www.gras.dk/e-data.

GRAS HALT

When our R&D team develops a measurement microphone, it must undergo the most demanding tests to prove that it can withstand our customers' daily test conditions. Using a series of Highly Accelerated Lifetime Tests (HALT) we ensure that our microphones live up to the high quality and precision that our customers have come to expect and trust. Our HALT tests actively accelerate the lifetime of a microphone by simulating the handling and use it is exposed to in real-life situations. By stress testing to the limits, we have been able to optimize the design for robustness and stability.

Service, warranty and repair

When leaving the factory, all GRAS microphones have been calibrated in a controlled laboratory environment using traceable calibration equipment. Depending on the use, measurement environment and internal quality control programs we recommend that the microphone is recalibrated at least once a year.

We offer two kinds of calibration as an optional after-sales service: GRAS Traceable Calibration and GRAS Accredited Calibration.

GRAS Traceable Calibration is a traceable calibration performed by trained personnel under controlled conditions according to established procedures and standards. This is identical to the rigorous calibration that all GRAS microphones are subjected to as an integral part of our quality assurance. GRAS Accredited Calibration is performed by the GRAS Accredited Calibration Laboratory that has been accredited in accordance with ISO 17025 by DANAK, the Danish Accreditation Fund. If you want a new microphone set delivered with an accredited

calibration instead of the default factory calibration, please specify this when ordering.

All parts are manufactured and assembled in Denmark by skilled and dedicated operators in a verified clean-room environment. Our warranty against defective materials and workmanship is 5 years, the windscreen and the protective grids are consumables covered by a 6-month warranty.

The warranty does not cover damages to the protection grids caused by their intended use in the challenging conditions in the wheelhouse. GRAS offers a complete overhaul including calibration at a reasonable price.

Frequency range (±2 dB) (IEC 61672 class 2)	Hz	12 to 20 k*
Polarization/Connection		0 V / CCP
Frequency range (±1 dB)	Hz	20 to 5 k*
Dynamic range lower limit with GRAS preamplifier	dB(A)	18
Dynamic range lower limit, linear	dB	19
Dynamic range upper limit	dB	133
Set sensitivity @ 250 Hz (±2 dB)	mV/Pa	50
Set sensitivity @ 250 Hz (±2 dB)	dB re 1V/Pa	-26
Output impedance	Ω	< 50
Power supply min. to max.	mA	2 to 20
Output Voltage Swing, min. @ 28 V CCP voltage supply	Vp	8
DC bias voltage, typ.	V	14
Microphone venting		Front
IEC 61094-4 Designation		WS2F
Temperature range, operation	°C / °F	-40 to +125/-40 to 257
IEC 61672 compliance		Class 2
Temperature range, storage	°C / °F	-40 to 85/-40 to 185
Temperature coefficient @250 Hz	dB/°C / dB/°F	0.000 / 0.009 (typically)
Static pressure coefficient @250 Hz	dB/kPa	-0.003
Humidity coefficient @250 Hz	dB/25-90 % RH	< -1
Humidity range non condensing	% RH	25 to 90
Influence of axial vibration @1 m/s²	dB re 20 µPa	66
TEDS UDID (IEEE 1451.4)		I27-0-0-0U
Connector type		BNC
CE/RoHS compliant/WEEE registered		Yes/Yes/Yes
Weight	g / oz	61.5 / 2.17

* when corrected for the influence of the 1" grid.

GRAS HALT Test Parameters**

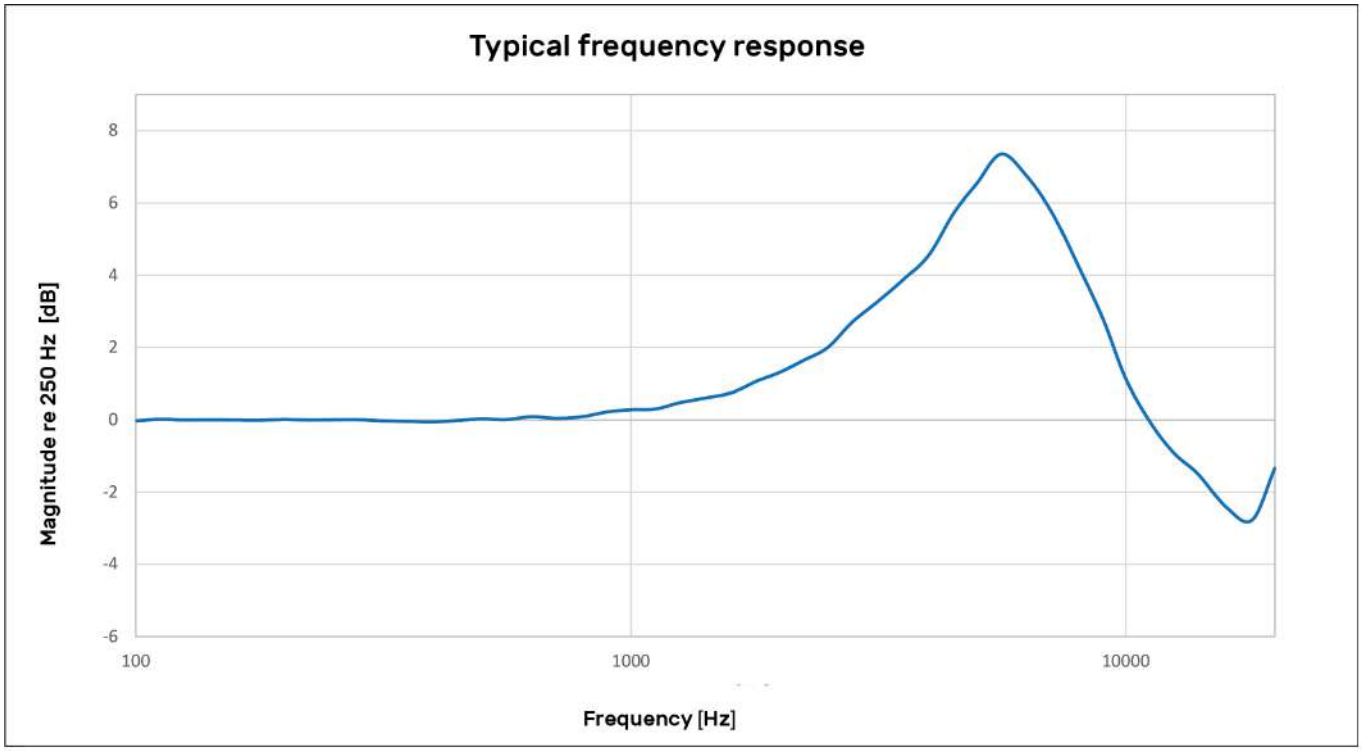
Humidity 90%	@50°C	48 hours
Drop - horizontal orientation of microphone, attached to 2 kg load	m	1.5
Drop - vertical, grid downwards, attached to 2 kg load	m	1.5
Drop - tumbling 1 meter	times	100
Vibration - horizontal and vertical	@8g	60 hours
Salt mist, IEC 60068-2-52:1996	5% NaCl, pH 6.5-7.2	3 cycles, 3 days
IP rating, IEC 60529:2013***		IP67****

**For a short introduction to HALT, see the section "GRAS HALT" above

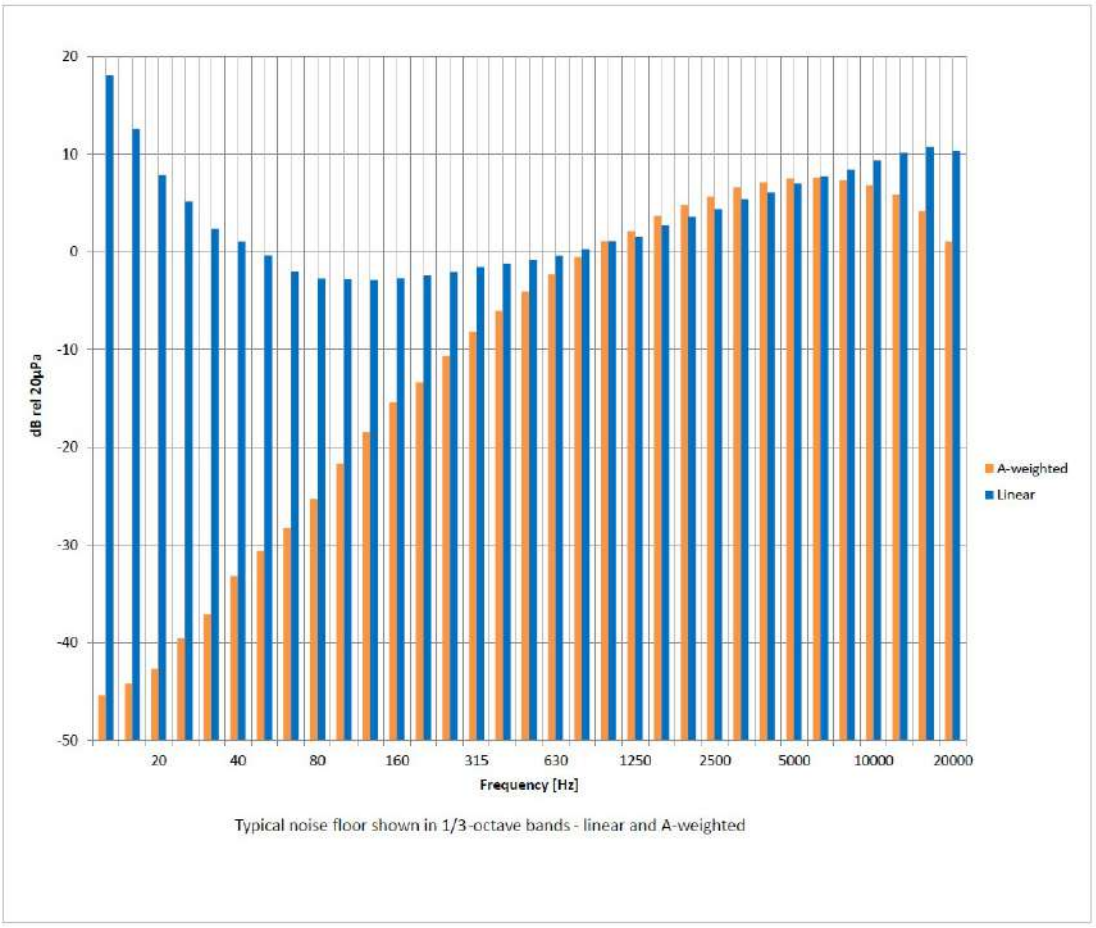
***International Protection Marking, IEC standard 60529.

****IP67: Totally protected against dust, protected against the effect of water of up to 1 m of submersion.

IP67 and salt mist tests performed by DELTA - a part of FORCE Technology, Denmark. www.delta.dk



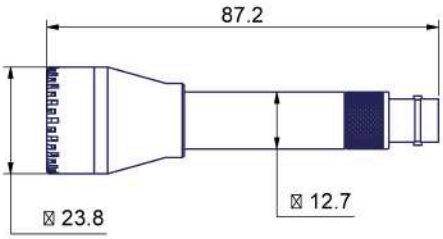
Typical frequency response.

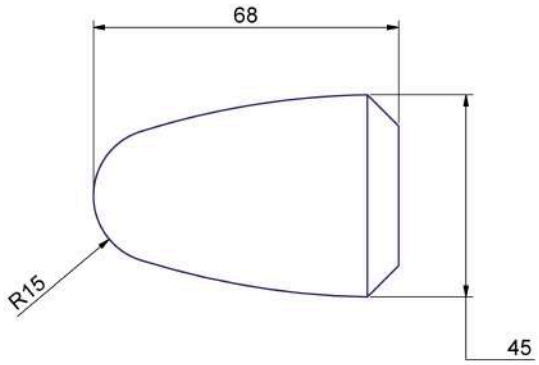


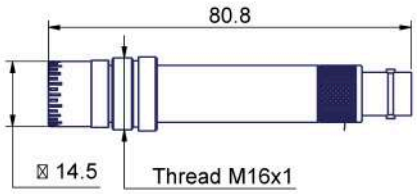
Typical noise floor, linear and A-weighted.

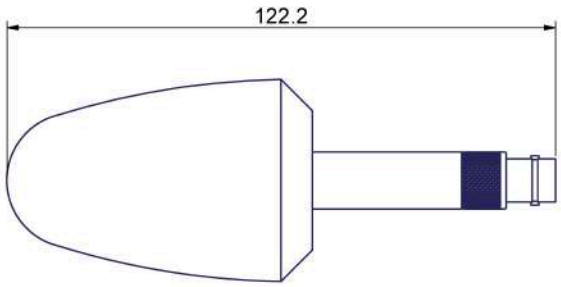
GRAS Sound & Vibration reserves the right to change specifications and accessories without notice.

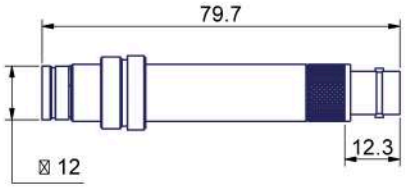
Dimensions











Included items

GRAS 147EB-1	CCP X-Rugged Microphone Set
GRAS AM0387-1	Windscreen for 147EB-1, 1 pc.

Optional items

GRAS RA0575	1/2" protection grid, dust, oil, and water resistant
GRAS RA0576	1" protection grid, dust, oil, and water resistant
GRAS AM0387-1	Windscreen for 147EB-1, 1 pc
GRAS AM0387-4	Windscreen for 147EB-1, 20 pcs.
GRAS AA0102	3 m waterproof BNC-BNC cable
GRAS AA0103	10 m waterproof BNC-BNC cable
GRAS AA0107	1 m waterproof high-temperature BNC-BNC cable
GRAS AA0108	3 m waterproof high-temperature BNC-BNC cable
GRAS AA0121	5 m waterproof high-temperature BNC-BNC cable with sleeve
GRAS AA0122	7 m waterproof high-temperature BNC-BNC cable with sleeve
GRAS AA0109	10 m waterproof high-temperature BNC-BNC cable
GRAS AA0110	30 m waterproof BNC-BNC cable
GRAS RA0341	Calibration adapter
GRAS CA2300	Accredited Calibration

GRAS Worldwide

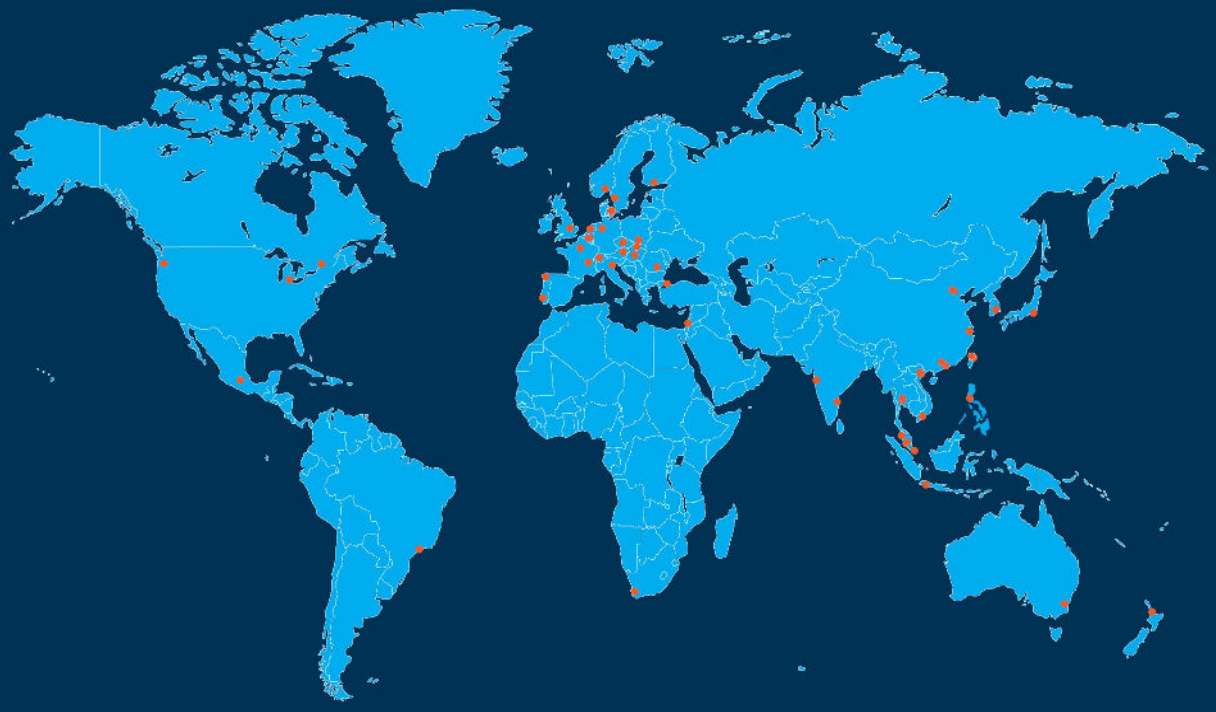
Subsidiaries and distributors in more than 40 countries

HEAD OFFICE, DENMARK
GRAS SOUND & VIBRATION
Skovlytoften 33
2840 Holte
Denmark
Tel: +45 4566 4046
www.GRASacoustics.com
gras@grasacoustics.com

USA
GRAS SOUND & VIBRATION
9290 SW Nimbus Avenue
Beaverton, OR 97008
Tel: 503-627-0832
Toll Free: 800-231-7350
www.GRASacoustics.com
sales-usa@grasacoustics.com

UK
GRAS SOUND & VIBRATION
Unit 115, Gibson House,
Ermine Business Park, Huntingdon,
Cambridgeshire, PE29 6XU
Tel: +44 (0)7762 584 202
www.GRASacoustics.com
sales-uk@grasacoustics.com

CHINA
GRAS SOUND & VIBRATION
Room 502, Building T1,
No.1398 Ali Center
Shenchang Road,
Minhang District,
Shanghai, China, 201107
Tel: +86 21 400-888-9826
www.GRASacoustics.cn
cnsales@grasacoustics.com



About GRAS Sound & Vibration

GRAS is a worldwide leader in the sound and vibration industry. We develop and manufacture state-of-the-art measurement microphones to industries where acoustic measuring accuracy and repeatability is of utmost importance in R&D, QA and production. This includes applications and solutions for customers within the fields of aerospace, automotive, audiology, and consumer electronics. GRAS microphones are designed to live up to the high quality, durability and accuracy that our customers have come to expect and trust.

GRAS Sound & Vibration is represented through subsidiaries and distributors in more than 40 countries and is part of Axiometrix Solutions, a leading test solutions provider comprised of globally recognized measurement brands. Read more at www.GRASacoustics.com

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