GRAS 146AE

1/2'' CCP Free-field Microphone Set

Freq range: 3.15 Hz to 20 kHz
Dyn range: 18 dB(A) to 133 dB
Sensitivity: 50 mV/Pa
Temperature: -40 to +125°C
Humidity: 10 – 90%
IP67

The GRAS 146AE is a 1/2" free-field measurement microphone set for measurements in extreme environments. It is terminated with a BNC connector and is optimzed for use under rough conditions at temperatures from -40 to 125°C. It provides accurate data under the most challenging conditions - it can resist shock, vibration, water, dust and extreme temperatures.

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Introduction

GRAS 146AE is a rugged microphone specifically developed for harsh environments like Automotive testing. It combines the high precision and stability of a laboratory microphone with an unprecedented level of ruggedness, i.e. ability to work properly under adverse conditions such as shock, high temperatures, moisture, water spray, oil mists, and dust.

A new Paradigm for Automotive Testing

With the accuracy of an IEC 61094-4/WS2F measurement microphone and ruggedness combined in one microphone, you can now use a state of the art microphone that provides the advantage of quality and stability over an extended period of time, even when subjected to rough conditions.

You can make critical quality measurements without having to replace the microphones, and in this way enhance the confidence in your measurements while at the same time minimizing downtime and maintenance costs. Not having to reconfigure the measurement setup, again and again, reduces costs and makes measurements easily comparable.

This microphone is specifically designed to resist vibrations, shock, and drop, and to produce accurate and repeatable measurements under harsh conditions. Application-specific test fixtures, cables, and accessories ensure easy positioning and handling.

An integrated PowerOn LED indication shows when the microphone is connected and ready to measure. If there is a faulty connection the LED will not be lit during power-up. Finally, it will light up when the TEDS chip is read. This feature makes it possible to run a full "are we ready to measure?" test of all connected microphones by sequentially activating their TEDS.

The 146AE is IP67 rated. All exposed parts are protected by water and oil repellent coating, which also is easy to clean. The coating can withstand heat and chemicals.

In addition to the microphone set's basic resilience against shock, dirt, and moisture a replaceable protective grid with water and dust filter adds an extra layer of flexible protection, including protection against high-velocity particles. This makes the microphone specifically well suited for high humidity, oil splash or outdoor measurement conditions. Simply replacing the filter-grid assembly will add to the time the microphone set can be mounted in the same test configuration.

The 146AE has the same low-temperature coefficient as a standard measurement microphone set as for example GRAS 46AE but can withstand permanent exposure to temperatures from -40 to 125°C with no permanent change to its sensitivity.

Comprehensively Tested

HALT

At GRAS we know that in order for you to trust your measurement results, signal quality, stability and robustness are essential. And because we also know how you handle and use the microphones in your daily work, we conduct a series of Highly Accelerated Lifetime Tests (HALT) to make sure that they perform under real-life conditions.

For the new rugged line of microphones, we have made our HALT even more challenging to reflect the extremely harsh environments and conditions in NVH measurements. It is vibrated for 60 hours at 8g, kept in temperatures varying from -40°C to +125°C, dropped horizontally and vertically from 150 cm on a

hard surface and put through a tumbling test randomly falling 100 cm on a floor 100 times.

IP67 Certification

Furthermore, the 146AE is certified water and dust-proof (IP67).

Typical Applications and Use

The 146AE is a free-field microphone set designed for use in rough conditions such as NVH testing in the automotive industry.

It is specifically designed for applications such as:

- Engine noise vibration testing
- Acoustic performance testing
- Pass by noise testing
- Power train induced noise
- Computer Model Validation/CAE validation
- Accelerated Life Cycle Testing
- Interior noise (Roof, AirCon, Squeak, and Rattle)
- Entertainment and Communication, Voice control
- Vehicle component evaluations and certifications (Brake, Tire, Exhaust)
- Testing at temperatures up to 125°C

Design

The GRAS 146AE is a high-performance 1/2" Constant Current Power (CCP) free-field rugged microphone set. As a CCP type microphone set it ensures simple cabling and stable connection setup, reducing costs. CCP connection standard is at the same time interchangeable with accelerometers and pressure sensors, giving a low multi-channel cost for combined Automotive and NVH testing.

The microphone set is designed to be extraordinarily robust against strong vibrations, shock, drop, high temperatures, and wet or dusty conditions. Among the most important design features are the following:

- The microphone set is a tightly sealed unit, and all exposed parts are protected by a water and oil repellent coating.
- New methods and materials have been used for the interior of the microphone to improve its ability to absorb shock and vibrations, while the microphone housing is still made by the same well-proven type of stainless steel that is used for our standard measurement microphones.
- The diaphragm is more robust than what is usually used in measurement microphones. This, in combination with the coating, makes it easier to clean the diaphragm without damaging it. The diaphragm can be replaced during repair, keeping repair-cost to a minimum.
- The microphone grid is made from special materials and furnished with a coating, and especially robust to drop and scratches.
- New materials and mounting methods have been used for the preamplifier section, making it more resistant to being dropped repeatedly.
- The microphone has two venting holes, reducing the risk of water or oil drops from blocking the venting. The venting holes are protected by a unique filter, and the measurement set is IP67 rated.
- Together with a GRAS BNC coax cable with waterproof sealing, your whole measurement setup is IP67 rated.
- The ruggedness of the basic microphone set is further enhanced by the replaceable, special shock-absorbing protection grid with an integrated filter that protects against oil, moisture, dirt and high-velocity particles.

146AE is a free-field microphone. If you need to use it in a random incidence sound field, the RA0357 Random Incidence Corrector will change the response up to 10 kHz to diffuse field. Read more here.

Replaceable Grid with Enhanced Protection

The grid is scratch resistant and comes with a

protective coating.

The grid has a slightly larger diameter than the IEC grids used on standard microphone sets like the GRAS 46AE, and therefore a dedicated calibration adapter is required. This adapter is part of the delivery.

Dust and Water Resistant Filter

The grid has an integrated filter that is made from an acoustically transparent mesh. This mesh offers protection against dust, dirt and high-velocity particles. It is water and oil repellant while remaining acoustically transparent. This filter protects the microphone in environments where very high humidity or direct water spray is present. It also protects against condensing. The filter is IP55 rated.

Comprehensive Mounting Options

An adapter for use with GoPro™ mounting devices is available as an accessory. In this way, you get a vast variety of mounting options using widely accepted mounting methods, e.g. Picatinny.

Low Cost of Ownership

The comprehensive precautions we have taken to make the 146AE immune to adverse test conditions result in a number of benefits that all translate into low costs of ownership. 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.

- The same microphone set can remain mounted in a test configuration for extended periods of time.
- Separate test results are immediately comparable because the same stable microphones are used.
- The protection grid with its protective filters can easily be replaced, for example before dirt and oil fog are clogging the meshes.
- The CCP (Constant Current Power) technology allows for low cost per measurement channel.

Combining these advantages you will obtain a lower cost of ownership, while at the same time enjoying the accuracy and stability of a laboratory microphone. This is also due to lower failure rates and improved productivity due to easier handling and control of your measurement setup.

Compatibility

The 146AE is terminated with a BNC connector and requires a constant current of typically 4 mA.

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

The 146AE 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.

System Verification

The integrated PowerOn indication and the functionality of TEDS are very useful to determine which microphone is connected to which input channel. However, it is not a check of whether the microphone is within specifications or not.

For daily verification and check of your measurement setup, we recommend using a sound source like the GRAS 42AG Multifunction Sound Calibrator with the calibration adapter that is part of the delivery. For proper sensitivity calibration, we recommend using a reference sound source like the GRAS 42AP Intelligent Pistonphone.

Calibration Data

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.grasacoustics.com/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, specify this when ordering.

All parts are manufactured and assembled at the factory in Denmark by skilled and dedicated operators in a verified clean-room environment.

Thanks to the high quality, our warranty against defective materials and workmanship is 5 years.

Specifications

Polarization/Connection		0 V / CCP
Frequency range (±1 dB)	Hz	5 to 10 k
Frequency range (±2 dB)	Hz	3.15 to 20 k
Dynamic range lower limit with GRAS preamplifier	dB(A)	18
Dynamic range upper limit with GRAS preamplifier	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		Rear
IEC 61094-4 Designation		WS2F
Temperature range, operation	°C / °F	-40 to 125 / -40 to 257
IEC 61672 compliance		Class 1
Temperature range, storage	°C / °F	-40 to 85 / -40 to 185
Temperature coefficient @250 Hz	dB/°C / dB/°F	0.01 / 0.006 (typically)
Static pressure coefficient @250 Hz	dB/kPa	-0.003
Humidity range non condensing	% RH	10 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	35 / 1.23
IP rating		IP67***
Influence of humidity @250 Hz (10 -90% RH)	dB	<-0.3

GRAS HALT Test Parameters*

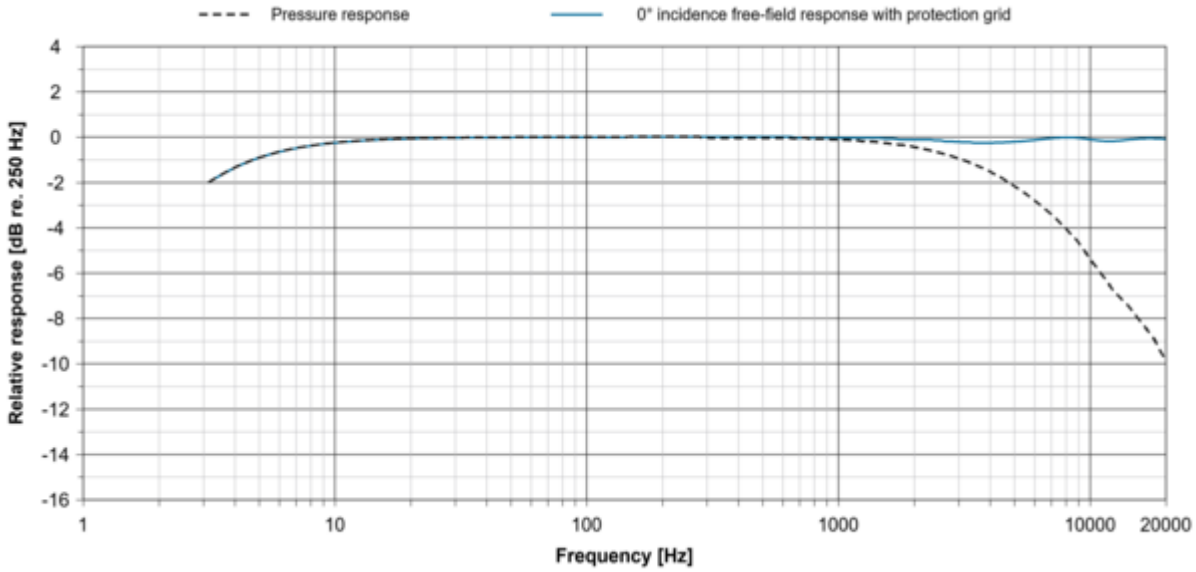
Humidity 90%	@50°C	48 hours
Drop - horizontal orientation of microphone, attached to 2 kg load	m	1.5
Drop - vertical, grid downwards, attached to 2 kg load	m	1.5
Drop - tumbling 1 meter	times	100
Vibration - horizontal and vertical	@8g	60 hours
IP rating**		IP67***

*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.

IP test according to IEC 60529:2013 performed by DELTA - a part of FORCE Technology, Venlighedsvej 4, 2970 Hørsholm, Danmark. www.delta.dk

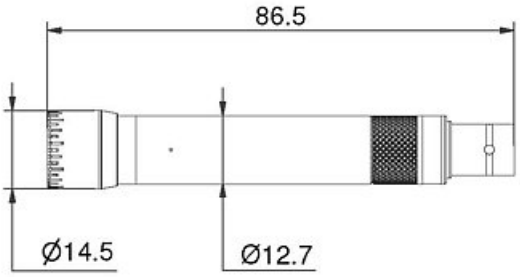


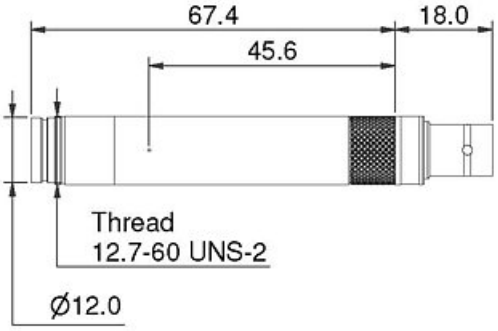
Typical free-field response.

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

Dimensions

Dimensions in mm





GS0847
146AE

Included items

GRAS RA0341	Calibration Adapter

Optional items

GRAS RA0357	Random Incidence Corrector for 146AE
GRAS RA0504	GoPro adapter
GRAS RA0340	Dust, Oil and Water resistant protection grid
GRAS RA0354	Dust, Oil and Water resistant protection grid, package with 5 PCS
GRAS AM0391-1	High-Temperature Windscreen for 146AE, Click-Mount
GRAS AM0391-2	High-Temperature Windscreen for 146AE, Click-Mount, 5 pcs
GRAS AA0102	3 m BNC-BNC waterproof 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 AA0109	10 m waterproof/high temperature BNC-BNC cable
GRAS AA0110	30 m waterproof/high temperature BNC-BNC cable
GRAS CA2300	Accredited Calibration

GRAS Worldwide

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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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