

# | Special Microphones

Special microphones are often required for applications where there are particular requirements surrounding the methods of measurements and configurations.

**Surface microphones** are for general purpose measurements on planar and curved surfaces, with a wide useful frequency range reaching up to 70 kHz and a large dynamic range topping at around 178 dB.

**Array microphones** are for situations where concurrent measurements are required at several points in an array.

For example in the analyses of:

- ✓ Sound fields
- ✓ Sound power
- ✓ Transients

Close manufacturing tolerances together with the advantages of TEDS provide GRAS array microphones with a high degree of interchangeability. This is a major advantage when they are used in multiples forming arrays and matrices. All have a coaxial SMB output connector.

**Flush-mount microphones** have very low installation height to fit the sensors into very confined spaces and narrow structures, e.g. in acoustic antennas and beams. With an installation height of less than 10 mm and thin coax wiring, the GRAS flush-mount series can be integrated into literally any design without sacrificing aero-dynamic properties.

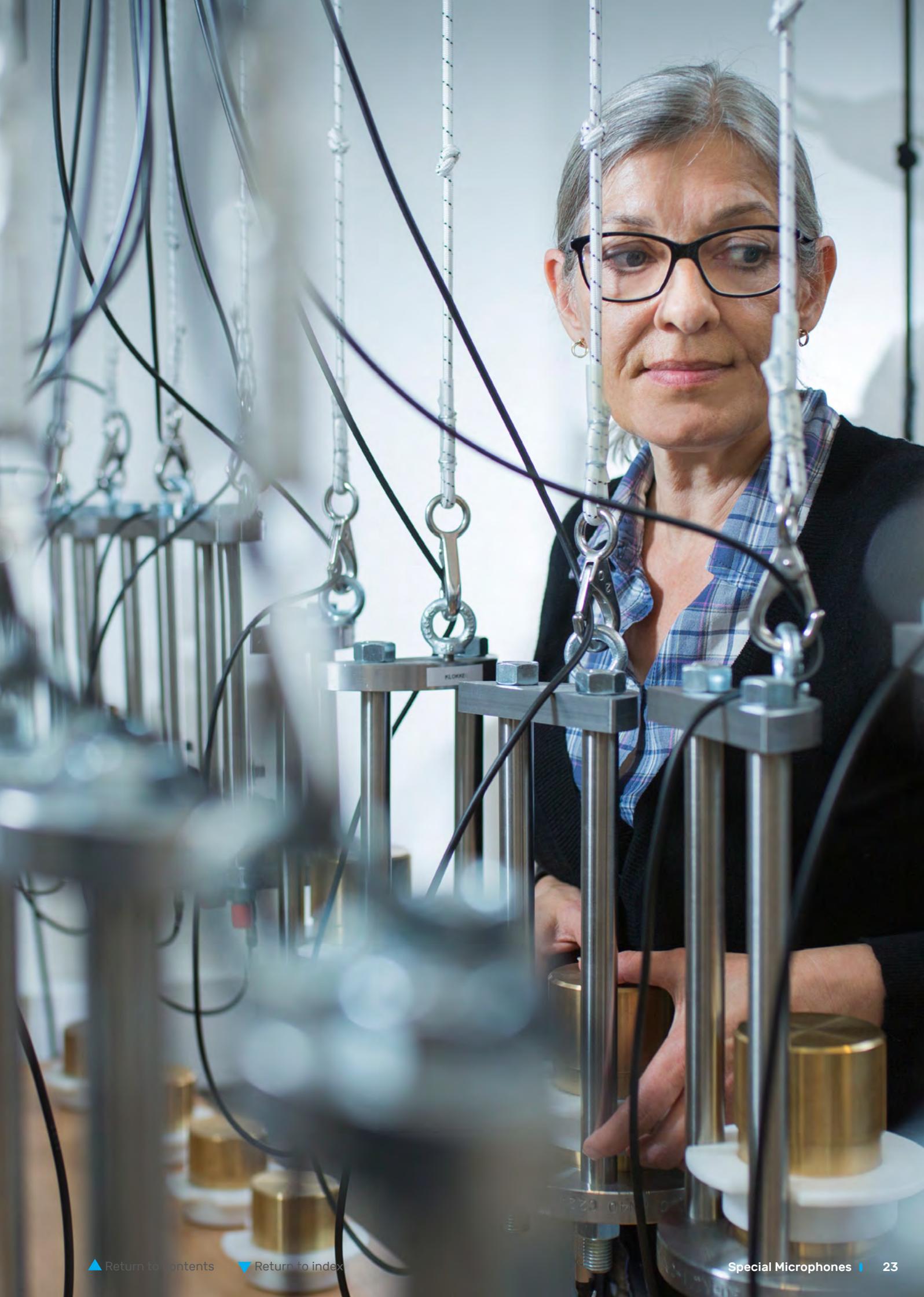
**Probe microphones** are for measurements in difficult or inaccessible situations, for example at high temperatures or in conditions of airflow. Their right-angled design makes them particularly well suited for measurements in exhaust systems and machinery in general, as well as for scanning surfaces such as loudspeakers and cabinets. The small size, low weight and all stainless steel design of the probe's tip make it robust, durable, easy to handle and simple to mount.

**Turbulence Screens** are for aeroacoustic testing in solid-walled wind tunnels. The hydrodynamic component of turbulence is attenuated up to 25 dB. Thereby the acoustic signals of interest can be identified and diagnosed with a reliable resolution.

**Ground array** microphone kits are developed for fixed-wing aircraft and rotorcraft flyover measurements in phased arrays, where the noise is mapped for research or approval purposes. They offer a practical alternative to the conventional upside-down microphone setup.

**Infra-sound microphones** have a very low low-frequency cut-off down to 0.09 Hz. They consist of a special microphone combined with a special pre-amplifier and a low-frequency adapter. To account for pressure variations close to 0 Hz, a special ambient pressure equalization system is used.

**GRAS hemisphere kits** are compliant with the ISO 3744, 3745 and 3746 (ANSI S12.54, S12.55, S12.56) standards for sound power measurements and accommodate for 4, 10 and 20 microphone positions.



## Surface Microphones



### GRAS 40LS

#### CCP Precision Surface Microphone



40LS is a high precision microphone for measurements on airplane surfaces, vehicle surfaces, critical measurements in wind-tunnel as well as general measurements on planar and curved surfaces. It has a wide frequency range reaching up to 70 kHz and a large dynamic range topping at around 167 dB.

40LS is based on high performance measuring microphone technique, which makes the microphone very precise, robust and reliable. The microphone is an integrated unit consisting of the microphone capsule itself and a CCP preamplifier including TEDS for easy access of identification data and calibration data.

### GRAS 40LA

#### CCP Precision Surface Microphone, High Pressure



40LA is a high precision surface microphone with a very low sensitivity 0.5 mV/Pa (178 dB).

### GRAS 40PS-1

#### CCP Surface Microphone



40PS-1 Surface Microphone is a low-profile, light surface microphone for general purpose measurements on planar and curved surfaces exposed to slipstreams.

Specifications	40LA	40LS	40PS-1
Nominal Sensitivity	0.5 mV/Pa	1.8 mV/Pa at 250 Hz	15 mV/Pa at 250 Hz
Frequency Range	10 Hz - 20 kHz ( $\pm 1$ dB) 5 Hz - 70 kHz ( $\pm 3$ dB)	10 Hz - 20 kHz ( $\pm 1$ dB) 5 Hz - 70 kHz ( $\pm 3$ dB)	10 Hz - 12 kHz (+1, -2 dB) 10 Hz - 20 kHz (+1, -6 dB)
Upper Limit of Dynamic Range	178 dB re. 20 $\mu$ Pa	167 dB re. 20 $\mu$ Pa	145 dB re. 20 $\mu$ Pa
Output connector	Microdot 10/32	Microdot 10/32	Microdot 10/32
Lower Limit of Dynamic Range	< 56 dB(A) re. 20 $\mu$ Pa (thermal noise)	< 46 dB(A) re. 20 $\mu$ Pa (thermal noise)	< 27 dB(A) re. 20 $\mu$ Pa (thermal noise)
Temperature Range	-55 °C to +100 °C	-50 °C to +100 °C	-0 °C to +50 °C
Output Impedance	< 50 $\Omega$	< 50 $\Omega$	< 50 $\Omega$
Diameter (with fairing) (without fairing)	42 mm 16.2 mm	42 mm 16.2 mm	40 mm 12.5 mm
Thickness	2.5 mm	2.5 mm	2.8 mm
Weight	3 g	3 g	1.5 g
Cable Length	1.5 m	1.5 m	2 m
Cable Diameter	1.1 mm	1.1 mm	1.1 mm

## GRAS 40PH

### CCP Free-field Array Microphone



Cost-effective free-field microphone for general purpose measurements in arrays and matrices with a nominal sensitivity of 50 mV/Pa. It has a wide frequency range up to 20 kHz and a dynamic range from 32 dB(A) to 135 dB. Its integrated CCP preamplifier and built-in TEDS enables it to be used with TEDS compatible input modules.

## GRAS 40PL

### CCP Free-field Array Microphone, High Pressure



Cost-effective microphone for general purpose measurements in arrays and matrices with a nominal sensitivity of 10 mV/Pa.

It has a wide frequency range up to 20 kHz and a large dynamic range from 32 dB(A) to 150 dB. Its integrated CCP preamplifier and built-in TEDS enables it to be used with TEDS compatible input modules.

## GRAS 40PP

### CCP Free-field QC Microphone



40PP is designed for on-line test of products, where the focus is on acoustically correct setup with as little as possible disturbance of the acoustic field and DUT.

## GRAS 40PK

### CCP Free-field QC Microphone, Short



The 40PK is designed for on-line test, but in confined spaces, where the focus is not so much on the correct acoustical performance as on the available test space.

40PP and 40PK microphones are CCP supplied and specified for measurements with relatively wide tolerances. They are smart-transducers and thereby allow for fast and easy exchange, provided the test equipment is TEDS compatible.

For tighter tolerances, higher transducer linearity and data resolution, we recommend to use our standard high quality measurement microphones.

The QC microphones can be sensitivity calibrated and fully repaired.

Specifications	40PH	40PL	40PP	40PK
Sensitivity at 250 Hz	50 mV/Pa (nominal)	10 mV/Pa (nominal)	50 mV/Pa (nominal)	18 mV/Pa (nominal)
<b>Dynamic Range</b>				
Lower limit	< 32 dB(A) re. 20 µPa	< 32 dB(A) re. 20 µPa	< 32 dB(A) re. 20 µPa	< 26 dB(A) re. 20 µPa
Upper limit	135 dB re. 20 µPa	150 dB re. 20 µPa	128dB re. 20 µPa	145 dB re. 20 µPa
<b>Frequency Range</b>				
± 1 dB	50 Hz - 5 kHz	50 Hz - 5 kHz	20 Hz - 10 kHz	-
± 2 dB	5 kHz - 20 kHz	5 kHz - 20 kHz	10 Hz - 20 Hz, 10 kHz - 20 kHz	10 Hz - 10 kHz
± 3 dB	10 Hz - 50 Hz	10 Hz - 50 Hz		10 kHz - 20 kHz
Output Impedance	< 50 Ω	< 50 Ω	< 50 Ω	< 50 Ω

## GRAS 47AX

### 1/2" CCP Flush-Mount Microphone Set



47AX is a low profile 1/2" precision pressure microphone set with built-in CCP preamplifier. With a height (to the diaphragm) of only 8 mm, 47AX is suitably designed for flush mounting in plates in ground array applications and other applications with size constraints.

## GRAS 47BX

### 1/4" CCP Flush-Mount Microphone Set



47BX is a low profile 1/4" precision pressure microphone set with built-in CCP preamplifier. With a height (to the diaphragm) of only 8 mm, 47BX is suitably designed for flush mounting in plates in ground array applications and other applications with size constraints.

## GRAS 47AD

### 1/2" CCP Flush-mount Microphone Set High Sensitivity



Identical to 47AX, but specifications differ - see below.

## GRAS 47DX

### 1/8" CCP Flush-mount Microphone Set



47DX is a low profile 1/8" precision pressure microphone set with built-in CCP preamplifier. With a height (to the diaphragm) of only 9 mm, 47DX is suitably designed for flush mounting in plates in ground array applications and other applications with size constraints.

Specifications	47AX	47BX
Nominal Sensitivity	12.5 mV/Pa at 250 Hz	1.6 mV/Pa at 250 Hz
Frequency Response	3.15 Hz - 20 kHz ( $\pm 2.0$ dB) 5 Hz - 12.5 kHz ( $\pm 1.0$ dB)	4 Hz - 70 kHz ( $\pm 2.0$ dB) 10 Hz - 25 kHz ( $\pm 1.0$ dB)
Dynamic Range	Upper limit; 150 dB re. 20 $\mu$ Pa (3% distortion) Thermal noise; 22 dB(A) re. 20 $\mu$ Pa	Upper limit; 166 dB re. 20 $\mu$ Pa (3% distortion) Thermal noise; 44 dB(A) re. 20 $\mu$ Pa
Temperature	- 30 °C to + 70 °C (operation) - 40 °C to + 85 °C (storage)	- 30 °C to + 70 °C (operation) - 40 °C to + 85 °C (storage)
Static Pressure Coefficient	-0.008 dB/kPa (250 Hz / 25 °C)	-0.008 dB/kPa (250 Hz / 25 °C)
Dimensions	Diameter; Microphone: 12 mm - Preamplifier: 18 mm	
Height of Microphone Set	With grid: 9.2 mm / Without grid: 8 mm	With grid: 9.2 mm / Without grid: 8 mm
Weight	9 g	7.5 g

Specifications	47AD	47DX
Nominal Sensitivity	50 mV/Pa at 250 Hz	0.9 mV/Pa at 250 Hz
Frequency Response	3.15 Hz - 10 kHz ( $\pm 2.0$ dB) 12.5 Hz - 7 kHz ( $\pm 1.0$ dB)	10 Hz - 100 kHz ( $\pm 3.0$ dB)
Dynamic Range	Upper limit; 138 dB re. 20 $\mu$ Pa (3% distortion) Thermal noise; 18 dB(A) re. 20 $\mu$ Pa	Upper limit; 174 dB re. 20 $\mu$ Pa (3% distortion) Thermal noise; 52 dB(A) re. 20 $\mu$ Pa
Temperature	- 30 °C to + 70 °C (operation) - 40 °C to + 85 °C (storage)	- 30 °C to + 70 °C (operation) - 40 °C to + 85 °C (storage)
Static Pressure Coefficient	-0.008 dB/kPa (250 Hz / 25 °C)	-0.008 dB/kPa (250 Hz / 25 °C)
Dimensions	Diameter; Microphone: 12 mm - Preamplifier: 18 mm	Diameter; Microphone: 3 mm - Preamplifier: 12 mm
Height of Microphone Set	With grid: 9.2 mm / Without grid: 8 mm	With grid: 9.4 mm / Without grid: 9 mm
Weight	9 g	4 g

### GRAS 67TS-1-CL

#### GRAS 67TS-1-CL Turbulence Screen Kit with Flush-mount Microphone



67TS-1-CL Turbulence Screen Kit is designed for aero-acoustic testing in solid-walled wind tunnels. The hydrodynamic component of turbulence is attenuated up to 25 dB. Thereby the acoustic signals of interest can be identified and diagnosed with a reliable resolution. The 47BX-CL 1/4" CCP Flush-mount Microphone Set is included.

### GRAS 67TS

#### GRAS 67TS-1-CL Turbulence Screen Kit



67TS Turbulence Screen Kit is identical to the 67TS-1-CL, but without microphone.

## GROUND ARRAY KITS



The GRAS ground array kits are developed for fixed-wing aircraft and rotorcraft flyover measurements in phased arrays, where the noise is mapped for research or approval purposes.

The design offers a practical alternative to the conventional up-side-down microphone setup. They are based on customized versions of the 47AX or 47AD flush-mount pressure microphone set, integrated into a  $\varnothing 40$  cm POM plate, which is easy to position and calibrate in the field.



### GRAS 67AX

#### $\varnothing 40$ cm CCP Ground Array Microphone Kit



Includes the GRAS 47AX-S1 1/2" CCP Flush-mount Microphone Set, which is a rear-vented version of 47AX.

*See specifications for 47AX on page 26.*

### GRAS 67AD

#### $\varnothing 40$ cm CCP Ground Array Microphone Kit



Includes the GRAS 47AD-S1 1/2" Flush-mount Microphone Set, which is a rear-vented version of 47AD.

*See specifications for 47AD on page 26.*

## GRAS 40SA

### LEMO Probe Microphone



Small, compact unit for sound pressure measurements in small enclosures, harsh environments and very close to sound sources. The high acoustic input impedance of the probe tip has minimal influence on the acoustic field, and can withstand temperatures of up to 800 °C.

The probe microphone is constructed with a detachable stainless steel probe tip that guides the acoustic signal to a microphone inside the probe housing.

For closed-coupler measurements, the probe microphone uses internal pressure equalization to balance out static pressure differences.

## GRAS 40SC

### CCP Probe Microphone



Similar to the Probe Microphone GRAS 40SA in both size and performance but differs only in the way it is powered. The GRAS 40SC is built around a prepolarized microphone and CCP preamplifier and requires a constant-current power supply. It has a BNC output socket for making a connection to a constant-current power supply such as the GRAS 12AL CCP Power Module, or directly to a data-acquisition system that can supply constant current between 2 and 20 mA.

Both probe types are delivered with a selection of probe tips of various lengths that can be customized with the supplied set of pliers.

	Sensitivity at 250 Hz	Dynamic Range	Frequency Range ( $\pm 3$ dB)	Electrical Output Impedance	Noise Floor (typical)	
					A-weighted	Lin (20 Hz - 20 kHz)
40SA	3	40 to > 166	2 - 8 k	55	6	2
40SC	3	40 to > 160	2 - 8 k	< 50	6	3
Units	mV/Pa (nom.)	dB re. 20 $\mu$ Pa	Hz	$\Omega$	$\mu$ V	$\mu$ V

## GRAS 46AN

### 1/2" LEMO Free-field Standard Microphone Set, Low Frequency



High sensitivity microphone ideal for measuring sound at frequencies down to 0.5 Hz. This microphone is the obvious choice for infra-sound measurement. It has built-in TEDS and a 7-pin LEMO connector.

## GRAS 47AC

### 1/2" CCP Infra-Sound Microphone Set



The GRAS 47AC is a 1/2" CCP free-field microphone set optimized for infra-sound measurements down to 0.09 Hz.

## GRAS 46AZ

### 1/2" CCP Free-field Standard Microphone Set, Low Frequency



Low frequency microphone especially designed for infra-sound measurements. Frequency range from 0.5 Hz to 20 kHz. Use the dedicated GRAS 26CG 1/4" CCP preamplifier in order to obtain the low frequency response.

Specifications	46AN	46AZ	47AC
Size	12.7 (1/2") mm (housing)	12.7 (1/2") mm (housing)	12.7 (1/2") mm (housing)
Application	Free-field	Free-field	Free-field
Sensitivity	50 mV/pa	50 mV/pa	8 mV/pa
Dynamic Range	17 dB(A) - 149 dB re 20 µPa	17 dB(A) - 138 dB re 20 µPa	20 dB(A) - 148 dB re 20 µPa
Frequency Range	0.5 Hz - 20 kHz	0.5 Hz - 20 kHz	0.09 Hz - 20 kHz
Polarization voltage	200 V	0 V	0 V
IEC 61094 designation	WS2F	WS2F	WS2F