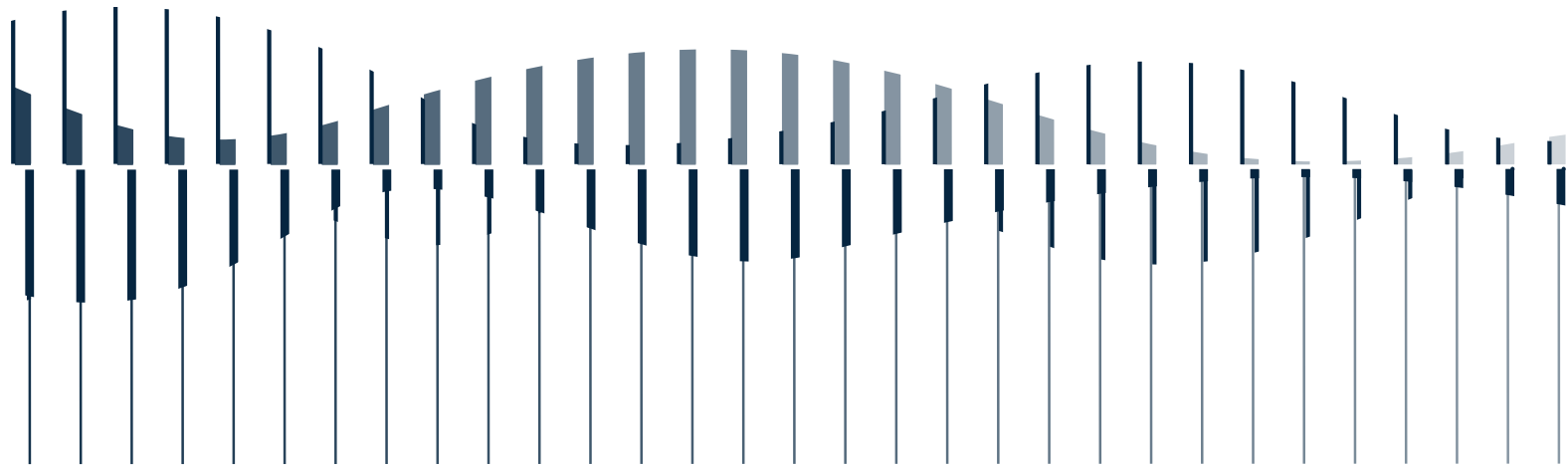




Instruction Manual

GRAS 42AG Multifunction Calibrator



Revision History

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

Revision	Date	Description
1	23 May 2017	First edition
2	19 July 2017	Caution about the speaker diaphragm added
3	27 March 2019	Changes re. the status indicator LED
4	26 August 2020	Warranty information: "refer to gras.dk/42ag "

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Introduction





Main Features

The 42AG Multifunction Calibrator is a portable, battery operated precision instrument for calibrating microphones and sound level meters. It produces an output level of either 94 dB or 114 dB at 250 Hz or 1 kHz.

It is designed for use in the field and comes with a protective casing. It provides display of ambient calibration conditions, with pressure, temperature and humidity. It is delivered with an individual calibration certificate. Its main features are:

- Specifications according to IEC Standard 60942 (2003), Class 1 sound calibrator.
- Calibration at two different frequencies:
 - 250 Hz or 1 kHz.
- Calibration at two different levels:
 - 94 dB or 114 dB.
- 1" microphones fit directly in the calibrator coupler. Adapters for ½", ¼" microphones and ⅛" microphones are included in the delivery.
- Provided a microphone is mounted in the coupler, the Green LED lights and confirms that calibration level is OK, otherwise the LED lights red.
- Automatic compensation for ambient air pressure, temperature and humidity.
- Measurement of ambient air pressure, temperature (in °C or °F) and humidity.
- Automatic shut off when batteries are too low.

About this Manual

This manual contains the main sections listed below. When referring to 42AG's buttons, these symbols are used:    . See "Description" on page 6.

Introduction

This section outlines how the 42AG works. Also, the user interface, the battery compartment and the location of the calibration button are described.

Using the 42AG

This section describes how 42AG is operated and discusses the factors that must be considered to achieve a correct calibration result.

Maintenance and Calibration

This section explains how to change batteries and how to calibrate the 42AG.

Delivered Items and Specifications

These two sections list the items delivered with 42AG and its technical specifications.

Principles of Operation

The 42AG consists of a sound source – a small loudspeaker – a reference microphone, and an electronic control circuit. The special reference microphone is extremely stable and independent of variations in barometric pressure, temperature, and humidity. Together, the reference microphone and control circuit maintain a constant sound pressure level inside the calibration coupler, making it possible to calibrate without separately accounting for the ambient calibration conditions and changes to the load volume.

For proper operation, the feedback circuit that ensures that the correct pressure is maintained in the coupler requires that a microphone is mounted.

42AG can produce a sinusoidal signal of 250 Hz or 1 kHz at 94 dB or 114 dB. The environmental conditions: air pressure, temperature and humidity can be displayed.

The calibrator complies with IEC 60942 (2003), Class 1 and has been designed to serve 1" and smaller microphones and sound level meters equipped with such microphones.

42AG is designed for use in the field. The accuracy that can be achieved is within ± 0.2 dB which is more than adequate for field checks.

For proper laboratory calibration, we recommend the use of a pistonphone, or sending the microphone to a calibration laboratory.

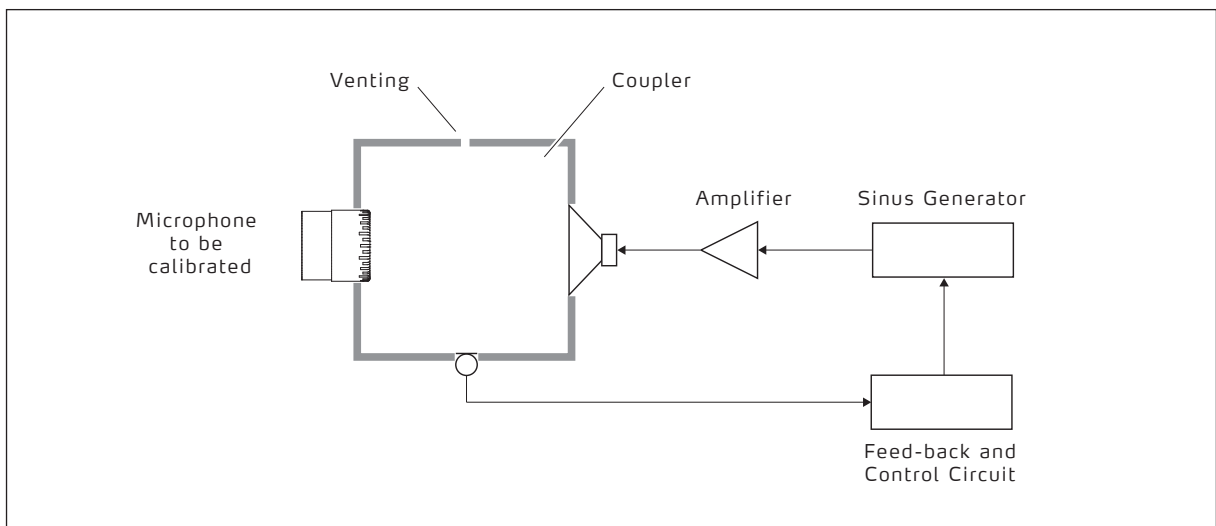


Fig. 1. Simplified block diagram illustrating 42AG's principles of operation.

Caution. The loudspeaker inside the calibration coupler is not protected. Therefore, do not touch the diaphragm and also take care to prevent any hard objects from entering the coupler as this may deform or damage the diaphragm.

Description

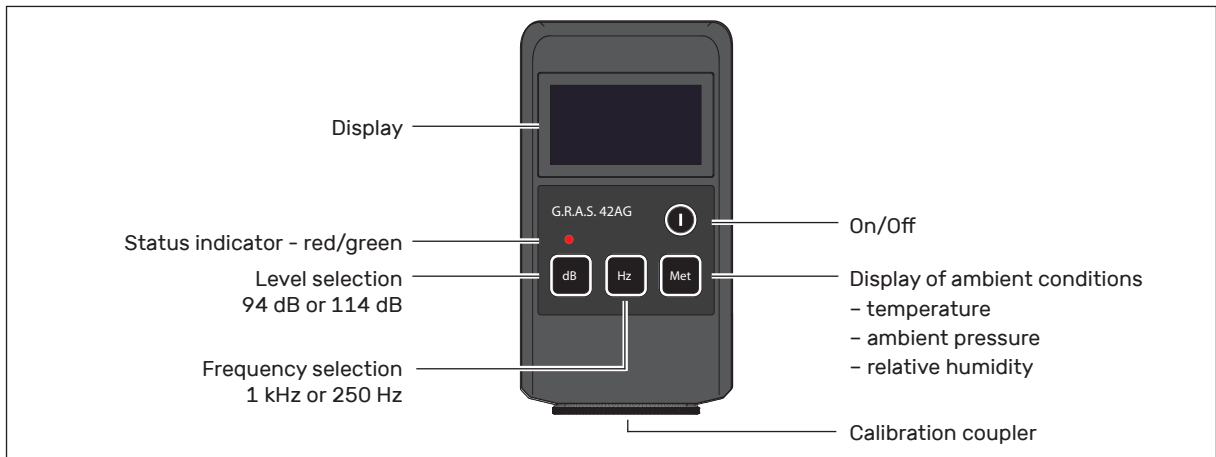






Fig. 2. 42AG's user interface.

 Switches 42AG on and off.

 Displays temperature ($^{\circ}\text{C}$ or $^{\circ}\text{F}$), ambient pressure and relative humidity. The temperature may be displayed in either degree Celsius ($^{\circ}\text{C}$) or degree Fahrenheit ($^{\circ}\text{F}$). To change the unit, keep the button  depressed during power on.

 Toggles between 1 kHz and 250 Hz. Default is 1 kHz.

 Toggles between 94 dB and 114 dB. Default is 94 dB.

Status Indicator. Lights green when the pressure in the coupler has stabilized.

(Note. Microphone must be mounted).

Display. Displays the actual values for calibration and ambient conditions.

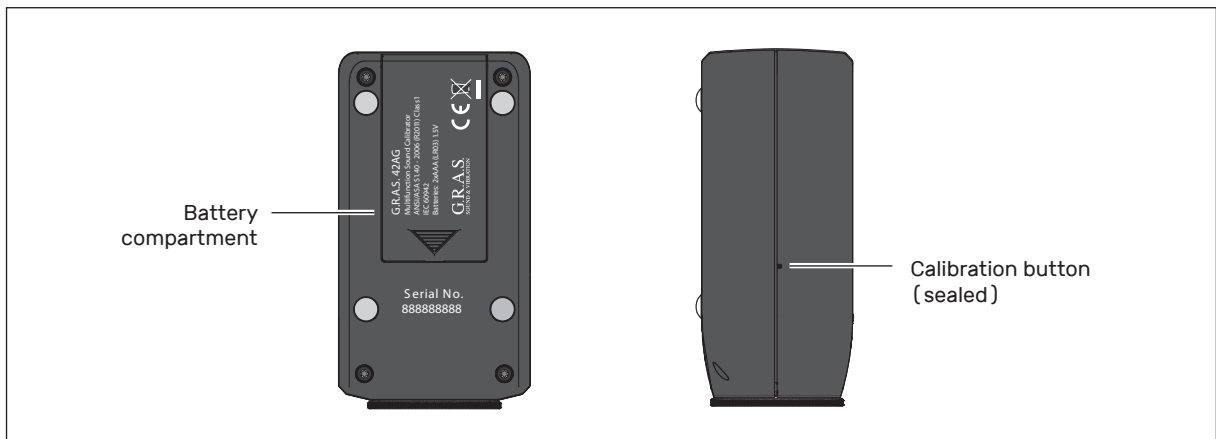


Fig. 3. Battery compartment and Calibration button.

Battery Compartment. Holds two LR03/AAA batteries.

The Calibration Button. This button is used when 42AG must be calibrated.

Using the 42AG

Microphone Calibration

Adapter Selection

From the factory, the 42AG has a 1" calibration coupler mounted with an adapter for the 1/2" microphone typically used with Sound Level Meters.

If you are going to calibrate a 1" microphone, remove the 1/2" adapter. For 1/4" and 1/8" microphones, mount the appropriate adapter, RA0049 or RA0069. These are included in the delivery.



Calibration

The microphone must be placed in the acoustic coupler of the calibrator before the calibrator is switched ON. If you are going to calibrate a sound level meter, turn it on and let it stabilize before calibration. At least three minutes are required.

1. Place the microphone to be calibrated in the coupler of the calibrator. Use a suitable adapter, if necessary.

Use a slow movement, since a fast movement may create an excessive pressure which temporarily may change the sensitivity of the microphone. Wait a few seconds for the pressure equalization to stabilize.

2. Press . Wait for the LED above the  button to change from red to green.

The level and frequency is indicated in the display of the calibrator. After powering the sound calibrator, the first combination of frequency level is 94 dB re. 20 μ Pa and 1 kHz. Select the appropriate level and frequency for your calibration by pressing  or , respectively.

Normally the background level should be more than 20 dB lower than the level from the calibrator in order to not influence the reading. Therefore it is considered good practice to notice the indicated sound level before the sound calibrator is switched on.

3. Press  to switch frequency. Press  to switch level.


4. Press the  to display the environmental conditions: air pressure, temperature and humidity.

The temperature and humidity is measured in the acoustic coupler. Note that due to heat generated by the calibrator's electronics the temperature may rise above the ambient condition after longer time of operation (typically one degree °C) affecting both the temperature and the humidity indication.

It is therefore considered good practice to measure the conditions shortly after powering the unit. The temperature may be displayed in centigrade (Celsius) or in degree Fahrenheit. The rising temperature does not affect 42AG's output.

5. Press  again for returning to the sound calibrator mode.

6. Press  for switching the calibrator off.

The calibrator shuts off by itself after ten minutes. However, if the level has not reached stability (indicated by red LED), the unit will switch off after approximately 10 to 20 seconds. The automatic power off may be deactivated by keeping the  button depressed for more than 3 seconds when the unit is switched on.

Calculation of Microphone Sensitivity

The sensitivity of a microphone under test can be calculated via a measurement of the microphone's output voltage. If the measured output voltage is V_o , and the sound pressure level in the Pistonphone's coupler is L_c (decibels), the microphone sensitivity S is given by:

$$S = \frac{V_o}{20 \mu\text{Pa} \cdot 10^{L_c/20}}$$

The value $20 \mu\text{Pa}$ is the standard reference sound pressure. The result here includes the loading effect of the preamplifier's input impedance as well as the gain or attenuation within the preamplifier.

To measure the "Open Circuit Sensitivity" of the microphone (i.e. when the microphone's output is not affected by the load of a preamplifier), a special preamplifier, for example the G.R.A.S. 26AG 1/2" Insert Voltage Preamplifier with Integrated Connector, should be used.

Such measurements can be performed using 42AG, but would normally be considered outside the intended use for an instrument primarily designed for field use.

Calibration Considerations

Accuracy

42AG is a precision instrument with an accuracy better than ± 0.2 dB. Calibration of the sound calibrator at regular intervals will ensure that drift does not occur and that it performs within specifications.

If an accuracy better than ± 0.2 dB is desired, we recommend using a GRAS 42AP Intelligent Pistonphone, Class 0 where an accuracy better than 0.09 dB can be obtained.

Background Noise

It is always good practice to verify that the background noise level is sufficiently below the calibration level to not influence the calibration. It must be at least 20 dB below the calibration level.


Corrections

Ambient Calibration Conditions

The 42AG Sound Calibrator automatically adjusts the calibration level to the nominal level.

Nevertheless, it is considered good practice to note the ambient calibration conditions as part of each calibration routine.

Temperature

The temperature may be displayed in either degree Celsius ($^{\circ}\text{C}$) or degree Fahrenheit ($^{\circ}\text{F}$). In order to change the unit, keep the button  depressed during power on.

Load Volume

Various types and makes of microphones may have different effective load volume. Due to its working principle, the 42AG has a large effective coupler volume. The variations in sound pressure level due to variations in effective load volume among microphones are therefore for most applications insignificant.

Weighting Network

The stated levels for calibrator 42AG are all unweighted levels for the two calibration frequencies, 250 Hz and 1 kHz.

All sound level meters shall display at least the A-weighted sound pressure level. The A-weighting is a standardized, frequency dependent weighting which originally was developed to mimic our auditory organ and is specified in the standards for a sound level meter. The nominal attenuation of an A-weighting network is 0 dB at 1 kHz (reference frequency) and 8,6 dB at 250 Hz.

The nominal A-weighted sound pressure levels for the calibrator will therefore at 250 Hz be 85,4 dB and 105,4 dB, respectively. The attenuations of the C-weighting are for both frequencies 0,0 dB and C-weighted levels therefore correspond to the unweighted levels.

Free-field Microphones

A free-field microphone is designed to compensate for the pressure build-up that takes place when it is used in a free-field. When calibrated with a sound calibrator at 1 kHz, the output from the microphone will be lower compared to the output at free field conditions because the calibrator performs a pressure calibration of the microphone. Therefore, the result of a calibration of a free-field microphone must be corrected, for a 1/2" microphone (type WS2F) the pressure increase at free field conditions will typically be 0.15 dB at 1 kHz.

Most sound level meters are designed to show the correct free field sound pressure level. This means that the indication shall correspond to the level in a free, progressive field before the sound level meter was placed in the field. The size of the microphone but also the sound level meter body will modify the pressure just in front of the microphone - especially at higher frequencies. Your sound level meter should therefore be adjusted to 93,8 dB for a 94 dB, 1 kHz calibration signal.

Maintenance and Calibration

Replacing Batteries

42AG uses two 1.5 V AAA size cells. Remove the batteries as soon as they are discharged or if the 42AG is stored for a prolonged period of time. Leakage from the batteries may otherwise destroy the electronic components.

To change the batteries:

1. Remove the rear cover by pulling it straight backwards.
2. Pull out the batteries from the battery compartment.
3. Replace them with two fully charged batteries.
4. Install the rear cover.

Calibrating the 42AG Sound Calibrator



At regular intervals proper operation of the sound calibrator should be verified, preferably by an accredited acoustic calibration laboratory or the G.R.A.S. factory. A calibration at least once a year is recommended. The calibration should be performed as specified for periodic verification in the international standard for sound calibrators 60942 (2003), Class 1.

The level should preferably be measured with a laboratory standard microphone type LS2, according to IEC 61094-1, where the pressure sensitivities at the different frequencies are known with a sufficiently high accuracy

Adjusting the 42AG's Levels

Caution. It is possible to adjust 42AG's levels: the SPL, the displayed temperature, air pressure and relative humidity. However, if you do this, you will invalidate the factory calibration and break the link to previous measurements. For this reason, we have sealed the access to this function which should only be used by authorized personnel at a calibration facility. If you nevertheless choose to enter the calibration mode, do not do this without access to reliable references.

Adjusting the Sound Pressure Level










1. Place the reference microphone in the coupler and select the appropriate frequency.
2. Press the **Calibrator button** (See Fig. 3 on page 6 – use an end of a paper clip or similar) for about one second until the display starts flashing and the **Status indicator** turns red. The **Calibration button** is accessible through a small hole in the left-hand side. Use a paper clip or similar
3. While the display is flashing, press  to increase the level or  to reduce the sound pressure level. The level is changed in steps of about 0.02 dB.

When the correct level is obtained, press the calibrator button for returning to normal operation.

Adjusting the Displayed Temperature, Air Pressure and Relative Humidity

1. Press the calibration button for about one second until the display starts flashing and the LED turns red.

The calibration button is accessible through a small hole in the left-hand side of the cabinet. See Fig. 3 on page 6. Use an end of a paper clip or similar.

2. Press  and the temperature value starts flashing.
3. While the display is flashing, press  to increase the reading or  to reduce the reading.
4. When the correct value is displayed, press  and the value for air pressure starts to flash.
5. While the display is flashing, press Hz to increase the reading or  to reduce the reading.
6. When the correct value is displayed, press  and the value for humidity start to flash.
7. While the display is flashing, press  to increase the reading or  to reduce the reading.
8. When the correct value for humidity is displayed, press  to terminate calibration of the 42AG and return to normal operation mode.

Delivered Items

42AG	
Sound Calibrator	42AG
1/2" Adapter	RA0297
1/4" Adapter	RA0049
1/8" Adapter	RA0069
LR6-AA alkaline cells	EL0001

Technical Specifications

42AG	
Standards	IEC 60942 (2003) ANSI/ASA S1.40 (2006)
Frequency	250 Hz (251.19 ±0.30) 1000 Hz (± 1 Hz)
Level	94 dB ±0.2 dB 114 dB ±0.2 dB
Distortion	< 2.0%
Sensitivity to environmental conditions	IEC 60942 Class 1
Display of temperature, air pressure and humidity	
<i>Temperature</i>	-10°C to +50°C; accuracy ±2°C, resolution 0.1°C
<i>Atmospheric pressure</i>	65 kPa to 108 kPa; accuracy ±0.4 kPa, resolution 0.1 kPa
<i>Relative humidity</i>	25% to 90%, accuracy ±6%, resolution 1%
Microphone sizes	1", 1/2", 1/4", 1/8"
Power	Two 1.5V LR03/AAA Size alkaline cells
Display	Monochrome OLED with 128 x 64 resolution
Weight	124 g

Warranty, Service and Repair

Calibration

Before leaving the factory, all GRAS products are calibrated in a controlled laboratory environment using traceable calibration equipment.

We recommend a yearly recalibration, depending on the use, measurement environment, and internal quality control programs.

We recommend calibration prior to each use to ensure the accuracy of your measurements.

Warranty

GRAS products are made of components from our proven standard portfolio and are all manufactured of high-quality material and branded parts that were chosen and processed to ensure life-long stability and robustness.

The warranty does not cover products that are damaged due to negligent use, an incorrect power supply, or an incorrect connection to the equipment.

The warranty period can be found at gras.dk/42AG.

Service and Repairs

All repairs are made at GRAS International Service Center located in Denmark. Our Service Center is equipped with the newest test equipment and staffed with dedicated and highly skilled engineers. Upon request, we make cost estimates based on fixed repair categories. If a product covered by warranty is sent for service, it is repaired free of charge, unless the damage is the result of negligent use or other violations of the warranty. All repairs are delivered with a service report, as well as an updated calibration chart.

Manufactured to conform with:

CE marking directive:
93/68/EEC



WEEE directive:
2002/96/EC



RoHS directive:
2002/95/EC



GRAS Sound & Vibration continually strives to improve the quality of our products for our customers; therefore, the specifications and accessories are subject to change.