

SV 31

Acoustic calibrator

User's manual

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1.Introduction

1.1. Calibration

One of the fundamental questions that are most frequently asked while taking a measurement is whether its result is accurate. Proceeding with a measurement without having a positive answer to this question may result in obtaining data of no practical use and wasting our time. However, we may easily obtain the answer by performing a calibration of the sound level meter together with the microphone and its preamplifier. Calibration of the measurement device may be done in two ways: by comparing the calibrated device with a reference device of known parameters; or using a template of the measured quantity to perform a reference measurement. Acoustic devices are usually calibrated in the latter fashion with so-called, acoustic calibrators. Acoustic calibrator is a device, which produces acoustic pressure of defined level and frequency. In other words, such calibrator is a template of acoustic pressure. With help of such a template we can check the accuracy of the measurements performed with the sound level meter and/or calibrate it if the error occurs.

1.2. Accuracy of calibration

Each measurement performed with any measurement device is burdened with an error. Result obtained from such measurement is only an estimate of the real value of the measured quantity. It is impossible to remove the error completely, as the values given by the meter are discrete whereas the measured quantity is of continuous nature. Hence, the purpose of calibration is to limit this inevitable error to a certain acceptable level. Maximum absolute value of the error of measurement (or of the generated signal in the case of the calibrator) is called the tolerance and is strictly defined by the standards for the given type of device.

A sound level meter is calibrated correctly if and only if the measurement error is within the range of tolerance defined by the standards for the meter of a given class.

1.3. Classification of sound level meters and acoustic calibrators

The acoustic calibrators (see IEC 60942: 2003) and the sound level meters (see IEC 61672: 2002) are divided into classes and types respectively, according to their accuracy. Type 0 imposes the strictest requirements on the device. Devices of this class are ranked as the most precise. Each of the following types (1, 2 and 3) allows for the wider range of tolerance (see Table 1).

Table 1. Tolerance values for the given types of acoustic devices excluding maximum expanded uncertainty of measurement ($f = 1$ kHz)

Class / Type	LS	1	2
Sound level meter, [dB]	-	0.7	1.0
Acoustic calibrator, [dB]	0.10	0.25	0.40

As indicated in Table 1, an acoustic calibrator has significantly lower tolerance than a sound level meter of the same class. Intuitively, we understand, that the calibrator, as a reference for acoustic pressure must be more precise than a measurement device.

Taking acoustic measurements according to norms and standards imposes the requirement of calibrating the measurement channel before each measurement or measurement session and very often as well after the measurement for result verification purposes.

2. Acoustic calibrator SV 31

2.1. General description

The SV 31 acoustic calibrator is a small, portable one-range Type 1 device (sound source), see Picture 1. Powered by two LR03/AAA batteries, it contains a loudspeaker producing acoustic pressure, reference microphone for monitoring generated level, pressure and temperature sensors for measurements of atmospheric conditions and a microprocessor system controlling the operation of the calibrator. Sinusoidal waveform of 1 kHz frequency is digitally generated and feeds the loudspeaker. Sampled signal from the reference microphone indicates the level of currently generated signal in a feedback loop. On the basis of information about the level of the signal, actual values of pressure and temperature, microprocessor adjusts amplification of the loudspeaker signal in order to produce appropriate sound pressure level in the calibrator's chamber.

Due to the feedback regulation loop the SV 31 calibrator does not require adjusting and operates in a wide range of temperatures and humidity (see SV 31 Datasheet).



Picture 1. Acoustic calibrator SV 31

The SV 31 is designed for calibration of sound level meters with $\frac{1}{2}$ " and $\frac{1}{4}$ " microphones. Picture 2 shows the calibration procedure of Type 1 sound level meter SVAN 945A with a $\frac{1}{2}$ " microphone.



Picture 2. Calibration of the SVAN 945A sound level meter with a $\frac{1}{2}$ " measurement microphone



Notice: For calibration of a meter with a $\frac{1}{4}$ " microphone the SA 30 reduction adapter must be applied.

Picture 3 presents the calibration procedure of Type 2 sound level meter SVAN 943B

with a ¼” microphone.



Picture 3. Calibration of the SVAN 943B sound level meter with a ¼” measurement microphone

2.2. Usage of the calibrator

2.2.1. Automatic calibration

The SV 31 calibrator is equipped with an optical system which detects the presence of a microphone in the calibrator’s chamber. That allows the calibrator to be switched on automatically, when it is placed on the microphone and to be switched off when it is dismounted. For this reason, usage of the SV 31 calibrator is as simple as putting it on the microphone, performing the calibration and taking it off the microphone.

2.2.2. Button functions

The SV 31 calibrator is equipped with a multifunctional button for controlling operation of the device. There are two functions of the button (see Table 2). First of all the button is used to turn ON and OFF the device. In this case the button pushing has immediate effect.

Either when the SV 31 is ON or OFF pressing the button over 10 seconds and releasing it will cause full reset of the system. Normally this function is not necessary. It has been implemented in the case of inappropriate operation of the calibrator caused by external (EM radiation, subnormal atmospheric conditions, etc) or internal (inappropriate system reset as a result of battery replacement, etc) factors.

The operation time of the calibrator with a microphone put inside its chamber is limited to 3-5 minutes. This functionality was added in order to save the battery, e.g. when the calibrator is accidentally left with the microphone inside.



Notice: Leaving the SA 30 reduction adapter in the chamber of the calibrator is equivalent with the state of the microphone being left inside. Hence, the calibrator will switch off automatically after 3-5 minutes from the moment the adapter is put inside the calibrator

Table 2. Functional description of the calibrator's button

Button press	Function description
Short, less than 10 sec.	Turn on/off the device
Over 10 sec.	Full reset of the system

2.2.3. Indicators

There are two LED to indicate the state of the SV 31 calibrator. One of them is titled "114 dB" and shows the state of the generated level.

After the calibrator is put on the microphone or switched on, acoustic pressure inside the calibrator's chamber is adjusted to the desired level. During that process "114 dB" diode blinks with a frequency of approx. 2 Hz.

Device is ready when this diode burns with continuous light.



Notice: Calibration should not be performed until the "114 dB" diode is burning with continuous light.

The diode called "LOW. BAT." presents the batteries status. The batteries voltages under 2.1 V cause "LOW. BAT." blinking with approximately 2 Hz frequency. It is recommended to not use the SV 31 calibrator in this state as the generated level may differ from the declared values.



Notice: Replace the batteries, when diode "LOW. BAT." blinks.



Picture 4. The top view of the SV 31 calibrator with one burning diode

2.3. Replacing the battery

The battery should be replaced as follows:



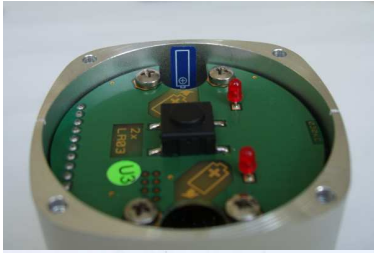
a) remove the rubber cover on the button and diodes' side



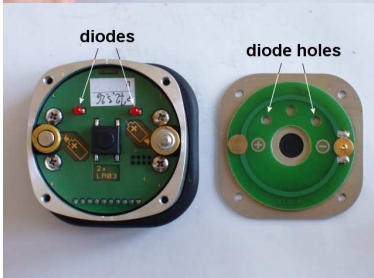
b) holding the cover unscrew four fixing screws with your fingers



c) take off the cover and remove discharged batteries



d) put new batteries in place of the discharged ones with polarization as indicated on the printed board and calibrator's case



e) put on the cover so that the diodes fit the corresponding holes in it



f) holding the cover with one hand fasten the fixing screws



g) put on the rubber cover

3.SV 31 Datasheet

Output signal

Sound Pressure Level (SPL):	114 dB, with respect to 20 μ Pa in reference conditions
Accuracy:	IEC 60942: 2003 standard, Type 1
SPL Accuracy:	± 0.3 dB
Frequency accuracy:	± 0.02 %
Total Harmonic Distortions (THD):	< 0.75 %

Reference conditions

Temperature:	23 °C
Atmospheric pressure:	101.3 kPa
Humidity:	30-80 % RH
Effective microphone load volume:	250 mm ³ , microphone type: 4134, SN: 1591010

General data

Effective load volume sensitivity:	0.00027 dB / mm ³
Level stabilization time:	typical 7 sec., max. 10 sec.
Microphone dimensions:	1/2" and 1/4" with reduction adapter SA 30
Storage temperature range:	-25 °C do + 70 °C
CE classification:	EMC: EN 50081-1, EN 50082-1 Safety: EN 61010-1: 2001

Working conditions

Temperature range:	from -10 °C to +50 °C
Atmospheric pressure range:	from 65 kPa to 108 kPa
Humidity range:	up to 90 % RH

Environmental conditions influence (typical)

Temperature coefficient:	$\pm 5 \cdot 10^{-3}$ dB/°C
Pressure coefficient:	$\pm 1 \cdot 10^{-4}$ dB/hPa
Humidity coefficient:	$\pm 1.25 \cdot 10^{-3}$ dB/%

Power supply

Battery type:	two LR03 (IEC)/AAA (ANSI) alkaline batteries
Continuous operation time:	30 hours
Standby mode: approx.	2 years
Minimal working voltage:	2.1 V

Dimensions and weight

Weight:	305 g with batteries
Dimensions:	65 x 65 x 70 mm