SVANTEK

USER MANUAL

SV 104BIS

ST 104CIS

ACOUSTIC
DOSIMETER

Warsaw, 2024-09-09
Rev. 2.01

Note: *Due to continuous product improvement SVANTEK reserves the right to make changes to product specifications without notice. To download the most up to date User Manual please visit our web site at www.svantek.com.*

*This User Manual presents the firmware revision **1.08.x**.*

The succeeding firmware revisions (marked with the higher numbers) can change the view of some displays presented in the text of this manual.

WEEE Note: *Do not throw the device away with the unsorted municipal waste at the end of its life. Instead, hand it in at an official collection point for recycling. By doing this you will help to preserve the environment.*

Trademarks

Trademarks or registered marks in this manual belong to their respective manufacturers.

Microsoft and Windows are registered trademarks of Microsoft Corporation.

The *Bluetooth®* word mark and logos are registered trademarks owned by Bluetooth SIG, Inc.

Disclaimer

Information in this document is subject to change without notice and does not represent a commitment on the part of Svantek.
Svantek provides this document “as is”, without warranty of any kind, either expressed or implied, including, but not limited to, its particular purpose. Svantek reserves the right to make improvements and/or changes to this manual, or to the products and/or the programs described in this manual, at any time.
Information provided in this manual is intended to be accurate and reliable. However, Svantek assumes no responsibility for its use, or for any infringements on the rights of third parties that may result from its use.
This product might include unintentional technical or typographical errors. Changes are periodically made to the information herein to correct such errors, and these changes are incorporated into new editions of the publication.

Technical Support Contact Information:

web: www.svantek.com/contact

GENERAL WARNINGS, SAFETY CLAUSES, AND STANDARD INFORMATION

Note: *If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.*

Note: *The* ***SV 104BIS*** *dosimeter contains no user serviceable parts. Opening product case invalidates the warranty.*

Note: *When in normal use, always fit the* ***SA 122BIS*** *windscreen provided and make sure there is no display shipping protection foil in place. See Chapters 3.3 and 4.2.*

Note: *Under no circumstances should this equipment be cleaned using a solvent based cleaner (it can affect the case polymeric materials). Clean it with water dampened cloth only.*

Note: *Battery power indicator - To improve accuracy of remaining battery life indicator, run the dosimeter until it is fully discharged; then proceed with a full charge via the dock station. The procedure is recommended before first use. Repeat this procedure every year of use to maintain more accurate current battery condition indication.*

Note: *If the dosimeter is flooded / falls into water - the device loses the intrinsically safe guarantee and cannot be used in potentially explosive atmospheres.*

Note: *The dosimeter should be periodically checked that it does not become unsealed, e.g., as a result of a fall, because then it loses IP65 (Ingres Protection) rating.*

Note: *Dosimeter incorporates Bluetooth®*[1] *wireless communication operating in 2.4GHz RF band and transmit power up to +9dBm.*

Note: *For air-transport turn off* ***Bluetooth interface*** *(see Chapters 3.8.3 and 5.8).*

[1] "The *Bluetooth®* word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by SVANTEK is under license. Other trademarks and trade names are those of their respective owners.

HAZARDOUS AREA INSTALLATIONS SPECIFIC INFORMATION

The **SV 104BIS** instrument is designed to be used in potentially explosive environments.

1. The equipment shall only be charged in non-hazardous area by manufacturer's **chargers on a fireproof surface.** The recommended charging dock stations: **SB 104B-1** and **SB 104B-5**.
2. Whenever it is likely that the correct function or operating safety of the apparatus has been impaired, it must be made inoperative and be secured against unintended operation.
3. The dosimeter should be **mounted on conductive clothes and/or with direct contact with human body**. This assures a path to remove the accumulated electrostatic charge that could be built-up on dosimeter.
4. Some parts of the enclosure are non-conducting and may generate an ignition–capable level of electrostatic charge under certain extreme conditions. The user should ensure that the equipment is not installed or used in a location where it may be subjected to extreme conditions (such as high-pressure steam), which might cause a build-up of electrostatic charge on non-conducting surfaces. Additionally, cleaning of the equipment should be done only with a water dampened cloth.
5. Before entering hazardous zone **check if there is no display shipping protection foil in place**, which is used on new products being sent to protect from accidental scratches. See Chapter 4.2.
6. The SV 104BIS instrument shall not be used in areas where a layer of coal dust may be deposited on the enclosure.
7. The microphone **windscreen and microphone should not be removed in a hazardous area.**
8. The equipment may be used with flammable gases and vapours with apparatus Groups IIA, IIB and IIC and with temperature classes T1, T2, T3 and T4.
9. The equipment is only certified for use in ambient temperatures in the range **-10°C** to **+50°C** and should not be used outside this range.
10. If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised. Aggressive substances e.g., solvents may affect polymeric materials.
11. Any substitution of components may impair intrinsic safety.
12. Repair and **battery replacement of this equipment shall only be carried out by the manufacturer or by authorized and trained service personnel.** Any adjustment, maintenance, and repair of the open apparatus under voltage must be avoided as far as possible and, if unavoidable, must be carried out only by trained service.
13. Calibration with non-intrinsically safe calibrators must only be performed on the **SV 104BIS** in a non-hazardous atmosphere.
14. The SA 123IS and SA 124IS optional mounting accessories are made of natural leather, stainless steel and EN 1149 antistatic Velcro. Because the EN 1149 test may not reflect the conditions of end use, those responsible for Health & Safety in the work environment should perform an in-use test to determine if the additional accessories being considered as part of the total earthed system, is compatible with their requirements for protection against electrostatic discharge.

SPECIAL PRECAUTIONS WHEN USING AND CHARGING LITHIUM BATTERIES

SV 104BIS contains extremely high energy density lithium-ion cell. Use special caution when working with lithium-ion cells. They are very sensitive to charging conditions and may explode or burn if mishandled.

- Do not replace the battery yourself. The battery is only manufacturer replaceable.
- Do not charge the instrument underground (mining) or in other hazardous locations.
- Always charge lithium batteries on a fire-proof surface.
- Do not charge the instrument near flammable materials such as boxes, paper and furniture.
- Immediately discontinue use of the instrument, while using, charging, or storing the instrument, if the instrument emits an unusual smell, feels hot, changes colour, changes shape, swells, or appears abnormal in any other way. Contact your sales location or **SVANTEK** if any of these problems are observed.
- Be careful not to puncture or break the instrument and cell within. Do not penetrate the instrument with nails, strike the instrument with a hammer, step on the instrument, or otherwise subject it to strong impacts or shocks.
- Do not place the instrument on or near fires, stoves, or other high-temperature locations. Do not use or store the battery inside cars in hot weather. Do not place the instrument in direct sunlight or use or store the instrument near a source of heat. Doing so may cause the battery contained inside to generate heat, explode, or ignite. Using the instrument in this manner may also result in a loss of performance and a shortened life expectancy.
- Do not place the instrument in microwave ovens, high-pressure containers, or on induction cooktop.
- Although the instrument is IP65 protected do not expose it extensively to water conditions which could cause the contained battery to get wet.
- The temperature range over which the instrument can be charged is **0°C** to **35°C**. Charging the instrument at temperatures outside of this range may cause the battery to become hot or to break. Charging the instrument outside of this temperature range may also harm the performance of the battery or reduce the battery's expectancy.

Assure that all these precautions are observed before leaving the instrument charging unattended.

- The temperature range over which the battery can be stored is -20°C to +50°C and the temperature range over which the battery can be discharged is -10°C to +50°C. Use of the battery outside of this temperature range may damage the performance of the battery or may reduce its life expectancy.
- If you notice a performance decrease of greater than 20% in instrument, the battery is at the end of its life cycle. Do not continue to use, and ensure the battery is disposed of properly. Contact your sales location or **SVANTEK**.

ENVIRONMENTAL PROTECTION MARKING OF THE UNIT

Marking on the Unit	Explanation
IP65	Dust-tight. Protected against water jets
	ATTENTION, CONSULT ACCOMPANYING DOCUMENTS
	Do not throw into standard municipal waste containers. The user is obliged to deliver used equipment to the manufacturer or to the recycling collection point
	This product has met EU consumer safety, health or environmental requirements
	This product has met ATEX explosive protection directives requirements
	This product can be recycled (sign is placed on the battery)

INDEX

U

V

W

CONTENTS

1 INTRODUCTION

Now, the **SV 104BIS** instrument is even more revolutionary approach to occupational health and safety noise monitoring offering **voice comments**, **signal recording** and **vibration shock detection** functions which are new and useful concepts in an instrument of this size. It is a cable-free dosimeter and is typically attached to the user's shoulder, close to the ear using the mounting clips supplied.

This personal dosimeter has an **incredibly robust** 1/2" MEMS microphone (part number **ST 104CIS**) enabling easy and automatic calibration using most commonly available acoustic calibrators.

The class beating, high resolution, **amazing colour OLED** screen displays information in both text and graphical form and offers excellent visibility in dark sites as well as in full daylight conditions. This makes taking noise measurement a real pleasure.

FourF independent acoustic profiles allow parallel measurements with separately defined filters and RMS detector time constants. Each profile provides an extensive number of results (like **Leq**, **Lmax**, **Lmin**, **Lpeak**, **L**, **LE**, ect.) All required weighting filters (**A**, **C, Z**) can be calculated in parallel.

For instance, it is trivial to set one profile to monitor noise parameters using the ACGIH (American Conference of Governmental Industrial Hygienists) pre-set, second profile set to OSHA HC (Occupational Safety and Health Administration - Hearing Conversation) pre-set and simultaneously monitor noise with the OSHA PEL (Occupational Safety and Health Administration – Permissible Exposure Level) settings.

Using the computational power of its digital signal processor the SV 104BIS instrument can simultaneously measure the dosimeter results and perform real time **1/1 Octave** & **1/3 Octave** analyses including calculations of statistical levels.

An inbuilt tri-axial accelerometer for **vibration shock detection** firmly places SV 104BIS as both the most technically advanced and the most robust personal dosimeter out there providing also information on the time when dosimeter is not used by the worker.

Advanced **time history logging** for each profile provides safe and complete information about measured signal in the internal **large 8GB memory**.

The instrument is powered from internal new generation Li-ion **rechargeable batteries** offering circa **45 hours**[2] of continuous operation. Ultra-low battery self-discharge is about 1% per year. The **powering and charging** of the instrument is possible with the use of **SB 104B-1** or **SB 104B-5 dock station** with the USB interface enables easy data exchange with a PC.

The instrument works with Svantek dedicated health and safety software packages – **Supervisor**, application for mobile devices - **Assistant**, and also with the full analysis package - **SvanPC++**.

Robust and lightweight design and Low Energy **Long Range Bluetooth® Smart** wireless interface enhances the exceptional features of this new generation instrument. Add to it the **automatic calibration** feature and one can say: "Never before has a noise dosimeter been so accomplished yet so affordable, making your measurements more **accurate and reliable than ever before**".

To get started quickly with SV 104BIS, the first part of the manual describes basic noise dosimetry information followed by a guide to setting up the dosimeter and running measurements.

[2] Depending on configuration.

1.1 SOUND PRESSURE

The human ear responds to audible sound pressure levels in the range from 20 µPa (hearing threshold) to 20 Pa (pain threshold), resulting in the enormous scale 1:1,000,000. Since using such a large arithmetic scale is not practical, a logarithmic scale in decibels (dB) was introduced which is also in agreement with physiological and psychological hearing sensations. Therefore, it is common that sound pressure is measured in decibels. Below there is sample information about expected sound levels for different sources.

Sound source	Sound level [dB]
Jet aircraft, 50 m away, or gunshot at close range	**140**
Threshold of pain	**130**
Threshold of discomfort	**120**
Chainsaw, 1 m distance	**110**
Disco, 1 m from speaker	**100**
Vacuum cleaner, distance 1 m	**70**
Conversational speech, 1 m	**60**
Quiet library	**40**
Rustling leaves	**10**
Hearing threshold	**0**

Table 1-1 Example sound source levels

1.2 DOSIMETRY

Noise is definitely a serious hazard in many workplaces. In case exposure to noise from machinery processes and equipment is not correctly eliminated or controlled, it may cause permanent hearing loss in workers. The, so called, inner ear is very fragile part of our hearing sense, which with current knowledge in medicine, cannot be truly repaired. Therefore, it is of great importance to protect our senses from excessive noise. Exposure to high levels of noise may also create physical and psychological stress, reduce productivity and interfere with normal communications. This may lead to accidents and injuries by making it difficult to hear moving equipment, other workers, and warning signals. Undoubtedly hearing loss has a very significant impact on the quality of life for many workers and their families.

Therefore, measuring noise exposure in the workplace is fundamental part of all good hearing conservation and noise reduction programs. The aim of taking a measurement with a noise dosimeter is to evaluate the average exposure of employees to noise during a normal shift. Wherever the worker goes the noise dosimeter goes too so that it captures all of the harmful noise during the typical day.

The dosimeter may be worn for the complete shift if the work pattern is so variable that it is difficult to predict exactly what will occur or it may be worn for a shorter but representative period and then the full day's dose extrapolated from that sample.

1.3 STANDARDS

The effects of high sound exposure on hearing have been studied for many years. As far back in 1954 AIHA (American Industrial Hygiene Association) – Rosenwinkel & Stewart – described a "new device which integrates sound energy over finite time periods." In 1956 – von Witternand & von Gierke obtained a patent for a noise exposure meter for "indicating the total time that noise exceeded a certain predetermined level". Since

then, measurements could be conducted over long periods of time and the instrument was worn by personnel under normal work conditions.

Finally, organizations developed standards to regulate personal noise exposure. International standards are specified by health and safety regulations such as the European Union Parliament and Council Directive 2003/10/EC of February 6, 2003, on minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise) or International Electrotechnical Commission IEC 61252 guidelines. The EU directive links to the ISO 9612:2009 Acoustics – Determination of occupational noise exposure – Engineering method.

In the United States, the Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910 General Industry Regulations: Standard No. 1910.95 Occupational noise exposure, the Mine Safety and Health Administration (MSHA), and the American Conference of Governmental Industrial Hygienists (ACGIH) have created slightly different regulations and limitations on tolerable noise exposure. Noise requirements are to ensure that the hazards associated with the exposure of workers to noise are eliminated or properly controlled.

Organization	Website address
ISO	http://www.iso.org
IEC	http://www.iec.ch
OSHA	http://www.osha.gov
MSHA	http://www.msha.gov
NIOSH	http://www.cdc.gov/niosh
ACGIH	http://www.acgih.org
CCOHS	http://www.ccohs.ca
…	

Table 1-2 Standardization organizations' websites

Additionally, at present dosimeters should meet relevant accuracy and performance requirements defined by:

- **IEC 61252** Personal Sound Exposure Meters
- **ANSI S1.25** Personal Noise Dosimeters

1.4 APPLICATIONS

The SV 104BIS noise dosimeter is extremely well suited to ISO, OSHA, ACGIH, MSHA, NIOSH, CFR 1910.95, HSE L108 workplace noise measurements in noise exposure assessments. NIHL: Noise Induced Hearing Loss remains noticeably significant occupational disease It is notably severe in the mining, construction, oil &gas industry but also in a wide variety of manufacturing sectors and other commercial operations. The dosimeter comes with pre-defined setups that suit different measurement requirements and offer versatile possibilities to be specifically configured by the user for special requirements if needed:

- measurement and control of the industrial noise
- work site assessments
- sites/plants/facilities survey monitoring systems
- hearing conservation compliance, noise induced hearing loss (NIHL)
- transportation noise studies
- personal noise verifications
- peak dosimeter for example in military applications.

One of the most desirable SV 104BIS features is the unique data logging function that stores significant number of noise parameters at regular intervals and superimposed random vibration shock or audio events during a measurement run.

Due to the unattended nature of noise dosimetry, it is important for workers to be fully engaged with the risk assessment process. Motion sensing (No Motion Time) is particularly useful in cases of cheating to tamper with the instrument or try to impact on the results, by for example instrument being taken off for the majority of the time.

The addition of Bluetooth® wireless connectivity and the supporting mobile devices **Assistant** application enables remote control and monitoring of the instrument's status such as battery usage, memory capacity and measurement progress without having to disturb the worker.

Noise profiled results can be easily transferred to the **Supervisor** or **SvanPC++** software packages. The noisiest times can be immediately seen in the graphical report and actions directed to the appropriate area. This makes checking for different regulatory bodies' compliance and ensuring if hearing conservation programs are needed definitely easier than ever before. SV 104BIS answers all the important questions such as WHEN and HOW did the noise exposure appear? The data logging measurements can be started immediately, or they can be pre-programmed in advance so that measurement run can begin and end automatically at a pre-set start and end time without the need for any onsite supervision.

Additionally, SV 104BIS allows for custom **voice note comments** to be added before or after the measurement run, and therefore this is the ideal instrument for the professional occupational hygienist to use for all noise exposure studies.

1.5 MEASUREMENT PROCEDURES

Preferably, when taking measurements, the noise dosimeter should be attached to the employee at the start of a shift and collected at the end of the whole shift. In case a shorter period is sampled then care should be taken to ensure that the result is representative of the full shift exposure. Shorter sampled periods require that the sampler has a deep and full understanding of the expected working tasks during the shift and the duration cycles of those tasks.

Before performing any noise measurements, ensure that employees selected for evaluation are operating equipment or performing tasks under normal (representative) conditions, and emphasise the importance of continuing to work in their usual manner (wearing the dosimeter should not interfere with normal duties). Explain the purpose and procedures of sampling to the employee who will be wearing the dosimeter and the importance of not touching, tapping or interfering with the microphone. Instruct the employee not to remove the dosimeter unless absolutely necessary.

The general procedure for taking measurements could be as follows:

1. Check that the indicated instrument battery life is at least twice the time required for the measuring period.
2. Check the instrument setup mode is appropriate and change if necessary.
3. Check the calibration of the instrument and adjust the settings if required.
4. Secure the instrument onto the shoulder of the employee selected for sampling. Refer to the chapter with specific requirements regarding orientation of the microphone.
5. Start the recording session manually if it is not programmed for an automatic timed start.
6. At the end of the measurement period, stop the recording session, and remove the dosimeter from the employee.
7. Recheck the dosimeter's calibration. If the instrument is not within the calibration limits, then the results are invalid (usually if a discrepancy is found between two successive checks of more than ± 0.5dB in the reference level, then the results of the measurements taken between the two checks should be considered invalid and the cause investigated, and the measurement repeated).
8. Follow your organisation's specific procedure for personal noise exposure recordings analysis.
9. Ensure the report is submitted to the appropriate person.
10. Distribute copies of noise exposure recordings to test participants, explain the results and ensure that their hearing protection adequately protects against the recorded noise exposure levels.

2 KIT COMPONENTS

2.1 SV 104BIS DOSIMETER SHORT FORM SPECIFICATION

- SV 104BIS dosimeter with all listed below accessories meets requirements of IEC 61672-1:2013 for Class 2 Group X instruments and IEC 61252 ed1.2 (2017) for personal sound exposure meters of one accuracy grade
- **ST 104CIS** MEMS microphone, 1/2" housing, patented
- **OLED colour display** (128 x 64 pixels) with super brightness and contrast
- Large **8 GB memory**
- Wireless connectivity with low energy **Long Range Bluetooth® Smart** (5.2) interface
- **USB 2.0** high speed interface (available only through the dock station)
- Parallel **Slow, Fast**, **Impulse** detectors for the measurements with **A**, **C**, **Z** filters
- Frequency Range **20 Hz ÷ 10 kHz**
- Measurement range better than **53 dBA RMS ÷ 143 dBA Peak**
- Dynamic Range better than **100 dB**
- Exchange rates **2, 3, 4, 5, 6**
- Measurement results: **Run Time (TIME), Lpeak, Lmax, Lmin, L, DOSE (%), D_8h, PrDOSE, Leq, LAV, LE, SEL8, E, E_8h, LEPd, PSEL, Ltm3, Ltm5, Lstat, PTC, PTP, ULT, TWA, PrTWA, Lc-a, OVL, No Motion Time**
- **Four** independent user configurable acoustic measurement profiles
- Easy in use **predefined setups**
- **Time-history data logging** of Leq/Lav/Lmax/Lmin/Lpeak with variable 0.1 s to 1 hr logger step and separate summary results intervals with statistical levels
- **1/1 Octave** real time analysis - 9 filters with centre frequencies from 31 Hz to 8 kHz (meeting Class 1 requirements of IEC 61260-1:2014) presented as a bar graph with Leq and Lmax band levels plus overall A, C and Z broadband weightings (as option called SF 104BIS OCT)
- **1/3 Octave** real time analysis - 28 filters with centre frequencies from 20 Hz to 10 kHz (meeting Class 1 requirements of IEC 61260-1:2014) presented as a bar graph with Leq and Lmax band levels plus overall A, C and Z broadband weightings (as option called SF 104BIS 3OCT)
- **Wave recording**, triggered and continuous mode, 12/24 kHz sampling rate, WAV format (as option called SF 104BIS WAV)
- **Voice Comments** records audio on demand, created before or after measurement, added to measurement file
- **Vibration shock detector** with user selectable variable threshold: 1g-15g
- **Automatic acoustic field calibration** with one touch activation before and after measurement
- Operational time **> 45 hours** *(display off, Bluetooth® off, octave analysis off)*
- Extremely **compact, lightweight** and **robust** case with **IP65** ingress protection

2.2 ACCESSORIES INCLUDED

- **ST 104CIS** ½" MEMS microphone for the SV 104BIS dosimeter
- **SA 122BIS** foam windscreen

2.3 ACCESSORIES AVAILABLE

- **SA 122BIS_3** Windscreens for the SV 104BIS dosimeter 3 pcs per pack
- **SV 34B** Class 2 acoustic calibrator: 114dB@1000Hz
- **SB 104B-1** 1-bay dock station (including **SC 16** – USB type A to USB type B cable)
- **SB 104B-5** 5-bay dock station with **SB 33** power supply (including **SC 16** – USB type A to USB type B cable)
- **SC 104BT** Equivalent Impedance for electrical calibration
- **SA 144** Carrying Case for 5 Dosimeters and Dock station for 5 Units
- **SA 147** Waterproof Carrying Case for Noise Dosimeter and Single Dock station
- **SA 123IS** Hard hat mounting accessory for the SV 104BIS dosimeter
- **SA 124IS** Harness mounting accessory for the SV 104BIS dosimeter

***Note: SV 34B**, **SB 104B-1, SB 104B-5, SB 33, SC 16, SC 158, SA 147, SA 73, SC 104BT** are not intrinsically safe and therefore cannot be used in hazardous areas (a flammable or combustible atmosphere.)*

***Note: SA 123IS** and **SA 124IS** are made of natural leather, stainless steel and EN 1149 antistatic velcro. because the EN 1149 test may not reflect the conditions of end use, those responsible for Health & Safety in the work environment should perform an in-use test to determine if the additional accessories being considered as part of the total earthed system, is compatible with their requirements for protection against electrostatic discharge.*

2.4 FIRMWARE OPTIONS AVAILABLE

- **SF 104BIS OCT** real time 9 band 1/1 octave analysis option
- **SF 104BIS 3OCT** real time 9 band 1/1 octave and 28 band 1/3 octave analysis option
- **SF 104BIS WAV** wave recording option

***Note:** Software options can be purchased in any time as only the introduction of a special code is required for their activation. The activation of the optional functions can be made with the use of the Supervisor software, see Appendix E.*

2.5 ATEX/IECEx STANDARDS AND CERTIFICATES

SV 104BIS dosimeter meets requirements of the next standards: ANSI/ASA S1.25-1991 (R2020), IEC 61010-1 (2010), ANSI/UL 61010-1 and CAN/CSA C22.2 No 61010-1; ATEX/IECEx: IEC 60079-0 ed7.0 (2017), IEC 60079-11 ed7.0 (2023), CAN/CSA C22.2 No 60079-0, CAN/CSA C22.2 No 60079-11, ANSI/UL 60079-0, ANSI/UL 60079-11.

Hazardous area installations specific information

SV 104BIS marking per ATEX/IECEx:	I M1 Ex ia I Ma, II 1G Ex ia IIC T4 Ga, -10°C < T_{amb} < +50°C,
Ingress protection:	IP65
Maximum charge input voltage:	Um=8.0V

Intrinsic safety standards that SV 104BIS complies with:

- EN IEC 60079-0:2018, EN 60079-11:2012, EN 50303:2000
- IEC 60079-0 ed7.0 (2017), IEC 60079-11 ed7.0 (2023)

The dedicated charging dock stations are **SB 104B-1** or **SB 104B-5**.

Note: *The equipment shall only be charged in non-hazardous area by manufacturer's chargers on a fireproof surface.*

The SV 104 BIS dosimeter has the following certifications:

- IECEx FTZU 20.0014X
- FTZU 19 ATEX 0120X
- QPS File No LR1356-2

Due to a limited surface area of the dosimeter, SV 104BIS is delivered with two different Identification Labels:

• Universal Model with ATEX and IECEx Certificate number and UKCA Mark for the United Kingdom.	
• Universal Model with ATEX and IECEx Certificate number, and with QPS Certification Mark and Certificate number meeting Canada and USA requirements.	

3 GETTING STARTED

3.1 SYSTEM DESCRIPTION

The following figure shows the SV 104BIS controls and ports:

Figure 3-1 SV 104BIS at a glance

3.2 INPUT / OUTPUT INTERFACES

SV 104BIS is equipped with a set of useful interfaces:

- microphone connector (essential for measuring)
- charging connector and fast communication port (reserved for dock stations)
- Bluetooth® 5.2 wireless connectivity and the supporting mobile devices **Assistant** application enables remote control and monitoring of the instrument's results and status

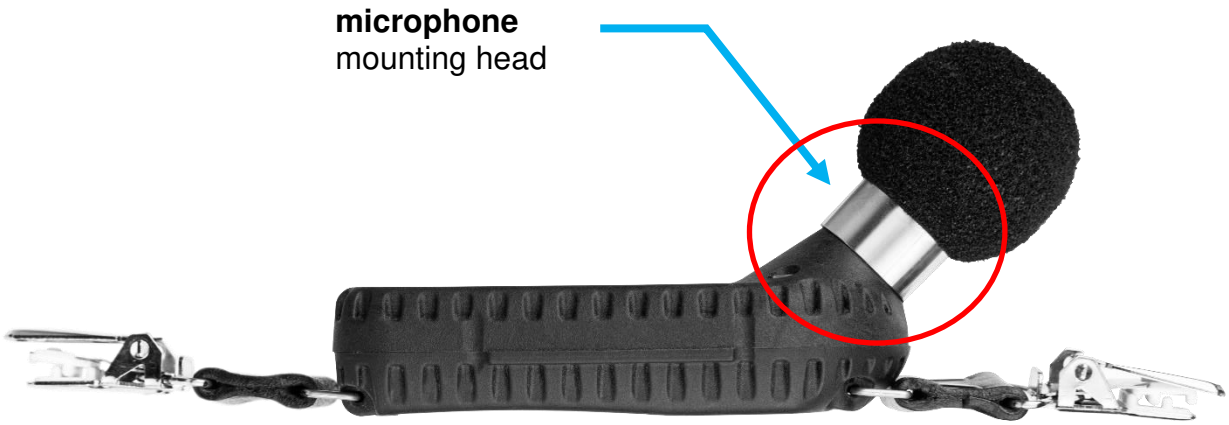


Figure 3-2 SV 104BIS side view – microphone connector

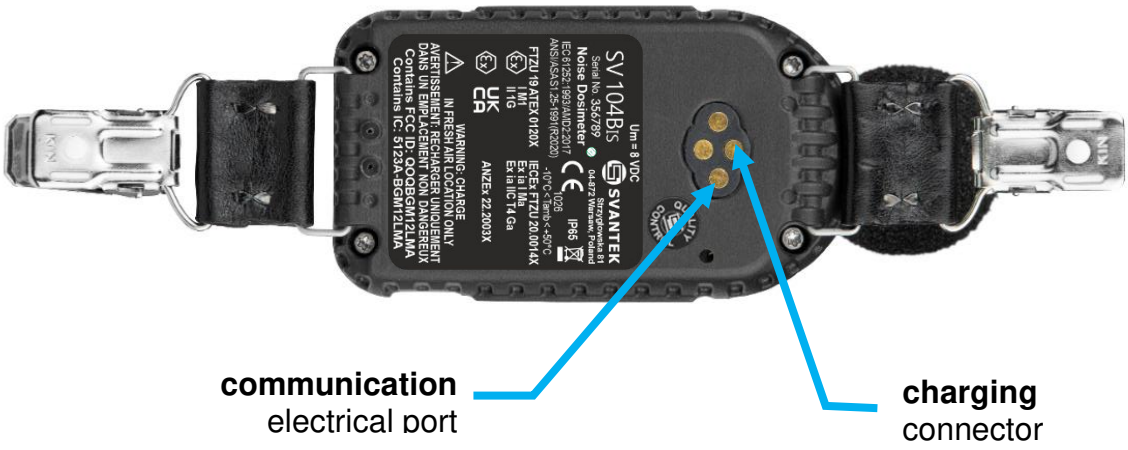


Figure 3-3 SV 104BIS back view - charging and communication port (reserved for dock stations)

Note: *Full description of the connectors is given in Appendix C.*

3.3 WINDSCREEN

During use, it is strongly recommended that SV 104BIS is fitted with the supplied **SA 122BIS** antistatic windscreen. To calibrate the dosimeter, it is necessary to remove the windscreen to gain access to the microphone. It is not necessary to remove the windscreen to record the voice note comments.

SV 104BIS uses windscreen with reliable screwed technique to fit tightly onto the microphone housing. To remove the windscreen just unscrew it by holding the lower half of the foam and windscreen housing. See the markings engraved to unscrew. Once SV 104BIS has been calibrated, refit the windscreen by carefully screw it back over the microphone again.

Figure 3-4 SA 122BIS windscreen

3.4 MOUNTING CLIPS

Upon delivery, SV 104BIS will be fitted with the standard mounting clips made of natural leather. Mounting clips can be changed using pliers.

Figure 3-5 SV 104BIS standard mounting clips

3.5 MOUNTING AND POSITIONING SV 104BIS

Unless specified by local legislation, personal noise dosimeters should always be mounted on the shoulder, circa 10 cm from the most exposed ear, with the microphone approximately a few cm above the shoulder. SV 104BIS shape and microphone height ensures proper instrument position, see figure below.

Figure 3-6 SV 104BIS positioning

Note: *The dosimeter should be mounted on conductive clothes and/or with direct touch to human body. This assures a path to remove the accumulated electrostatic charge that could be built-up on dosimeter.*

3.6 LED STATUS INDICATOR

There is a three-colour instrument LED status indicator, located to the right of the microphone mounting head and above the display. Table below explains conditions under which the specific LED colour appears.

LED status indication	Description
GREEN flashing once per second	Indicates the **measurement is running** and the dose alarm level has not been exceeded.
AMBER flashing once per over a dozen seconds	Indicates the **measurement is stopped** and the dose alarm level has not been exceeded.
RED single isolated flashes with a duration of nominally one second	Indicates **vibration shock threshold has been detected**. This will go off once the high vibration shock has ceased.
RED flashing quickly, four times per second	Indicates the **alarm conditions**: for instance: the dose has exceeded the alarm level.

Table 3-1 LED status description

3.7 STATUS BAR ICONS

The upper part of the display is designed as basic status information provider. See the description below.

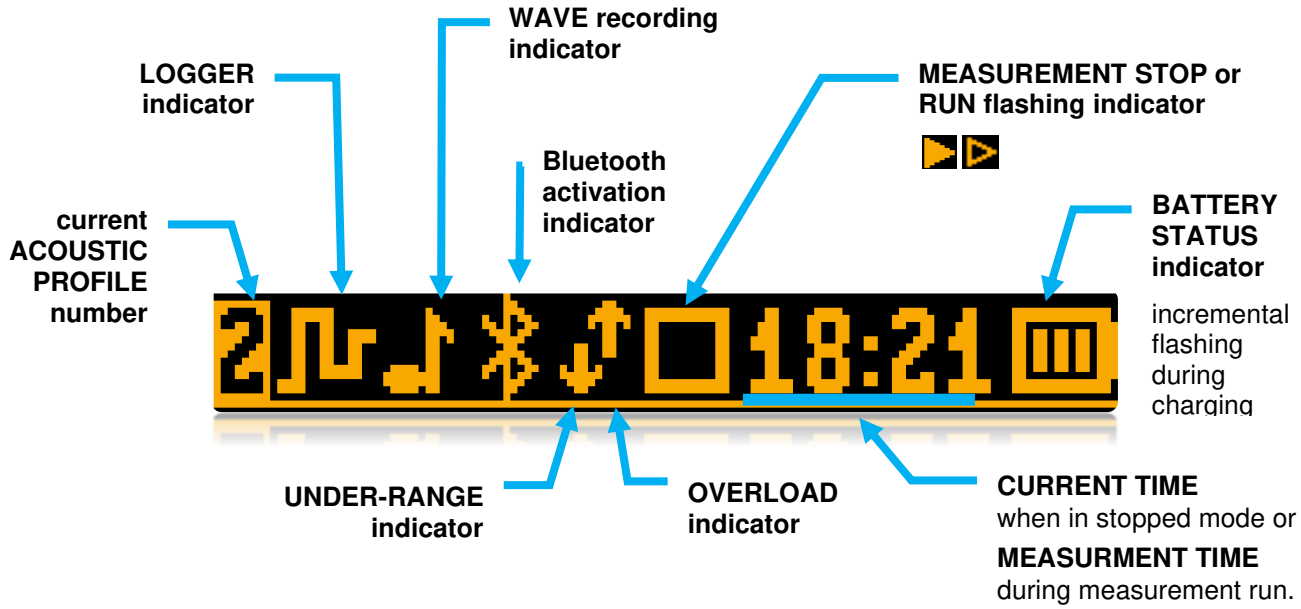


Figure 3-7 SV 104BIS display icons description

Overload detector

The instrument has the built-in overload detectors. Both A/D converter and input amplifier overload conditions are detected. The overload in the measurement channel (in its analogue part) and the overload of the analogue / digital converter are both detected. The “overload” indication appears when the input signal amplitude is 0.5 dB above the declared “Peak measurement range”. This condition is checked once per second or with the Logger Step if it is less than 1 second.

An overload is indicating by the flashing icon which is displayed during the period from the overload detection till the end of the Integration Period. If the overload disappears to the Integration Period end, the overload icon will not be displayed from the start of the next measurement cycle.

When an overload is detected, the special marker will be recorded to the logger file with the data logging step.

The overload time is measured by the OVL result during the Integration Period and is saved in the logger file as part of Summary Results.

Underrange detector

The instrument has the built-in underrange detector. The “underrange” indication appears when the RMS value for the elapsed time is below the lower linear operating range. This is checked once per second.

An underrange is indicating by the flashing icon which is displayed during the period of the underrange detection. When an underrange is detected till the Integration Period, the special marker will be recorded to the logger file with the Integration Period step. If during the Integration Period the signal level increases and the total RMS is greater than the minimum, the icon stops displaying and the underrange marker is not recording.

3.8 MANUAL CONTROL OF THE INSTRUMENT

Although the Instrument is small, its keypad is designed to be minimal, but still highly ergonomic and easy to use providing effective operational capabilities. Thanks to that, the number of the control keys of the instrument is reduced to only three.

Generally, the user can operate the instrument by:

- changing the **VIEW** mode with the key
- selecting the required **ACOUSTIC PROFILE** with the key
- scrolling through the results with the key.

Note: *To save power consumption and extend battery life SV 104BIS will automatically switch off the display after 30 seconds if no button on the keypad is pressed. The LED indicator will still inform the user about the current state of operation and any possible alarm conditions. Press any key, to reactivate the display.*

3.8.1 Primary key functions

On the front panel of the instrument the following control keys are located. See below for primary (short press) key functions description:

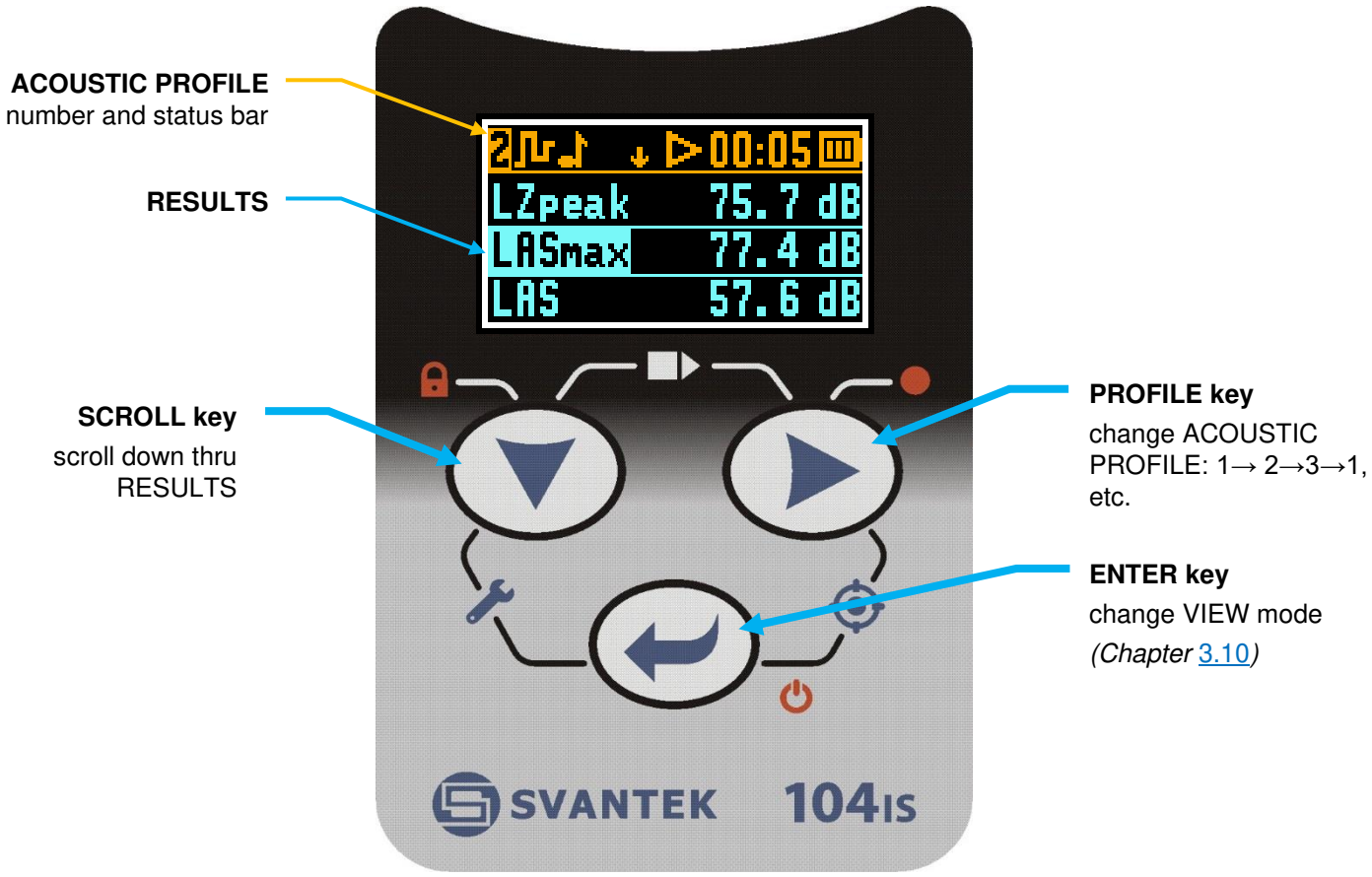


Figure 3-8 Control keypad on the front panel – primary key functions

3.8.2 Alternate key functions

Alternative **long press of a single key** (keypad icons marked with red colour) allows quick access to special functions:

- **POWER ON/OFF** the unit by holding down the key
- Record the **VOICE COMMENT** by holding down the key
- **LOCK** keypad and screen by holding down the key.

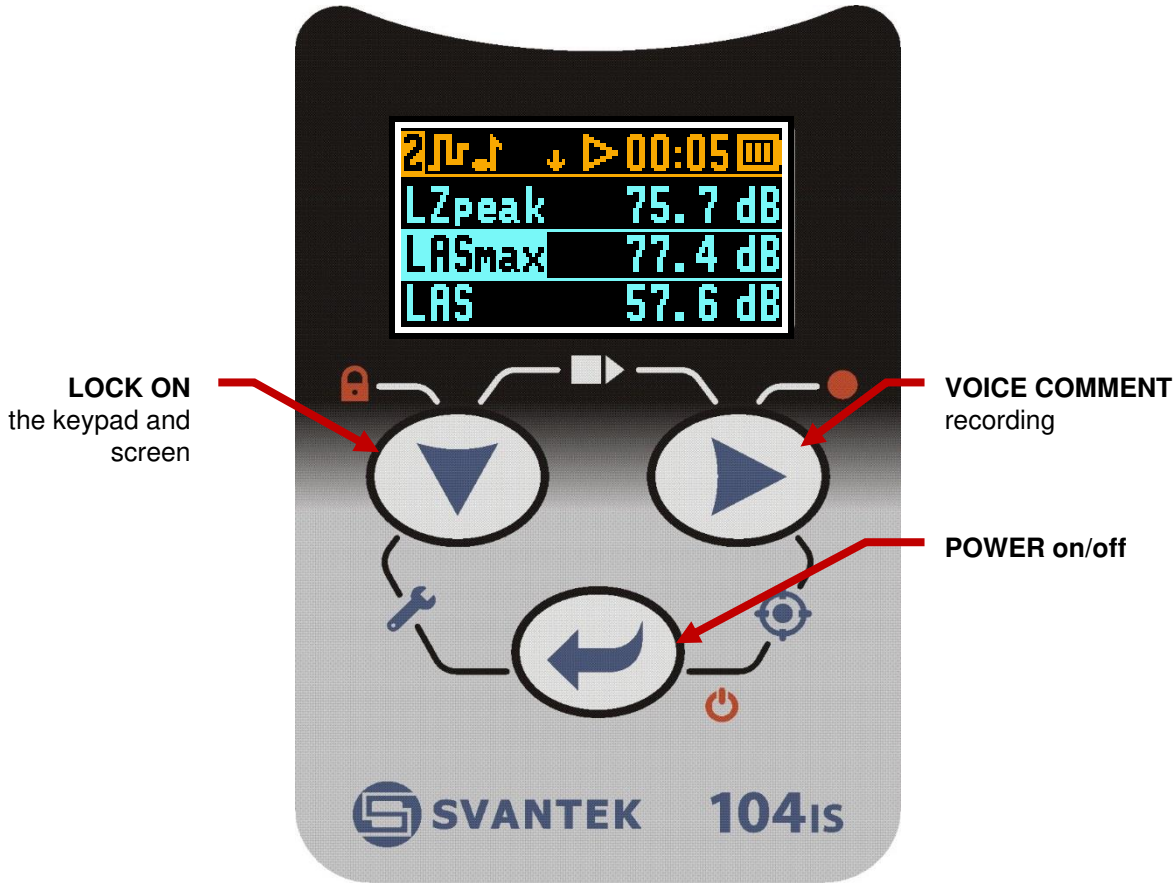


Figure 3-9 Control keypad on the front panel – alternate key functions

Holding down individual key for few seconds during which a countdown is displayed, SV 104BIS gives you time to decide if you really wish to access the function that is going to be executed:

- Shutting down 3… 2… 1… for the key
- Keyboard lock 3… 2… 1… for the key
- Voice comment 3… 2… 1… for the key.

If you release the key too early, SV 104BIS returns to the last used **VIEW** mode and the selected control is not executed.

3.8.3 Alternate combined keys functions

Additionally, **combined short press of two keys simultaneously** (keypad icons marked with white colour) allow quick access to even more functionalities.

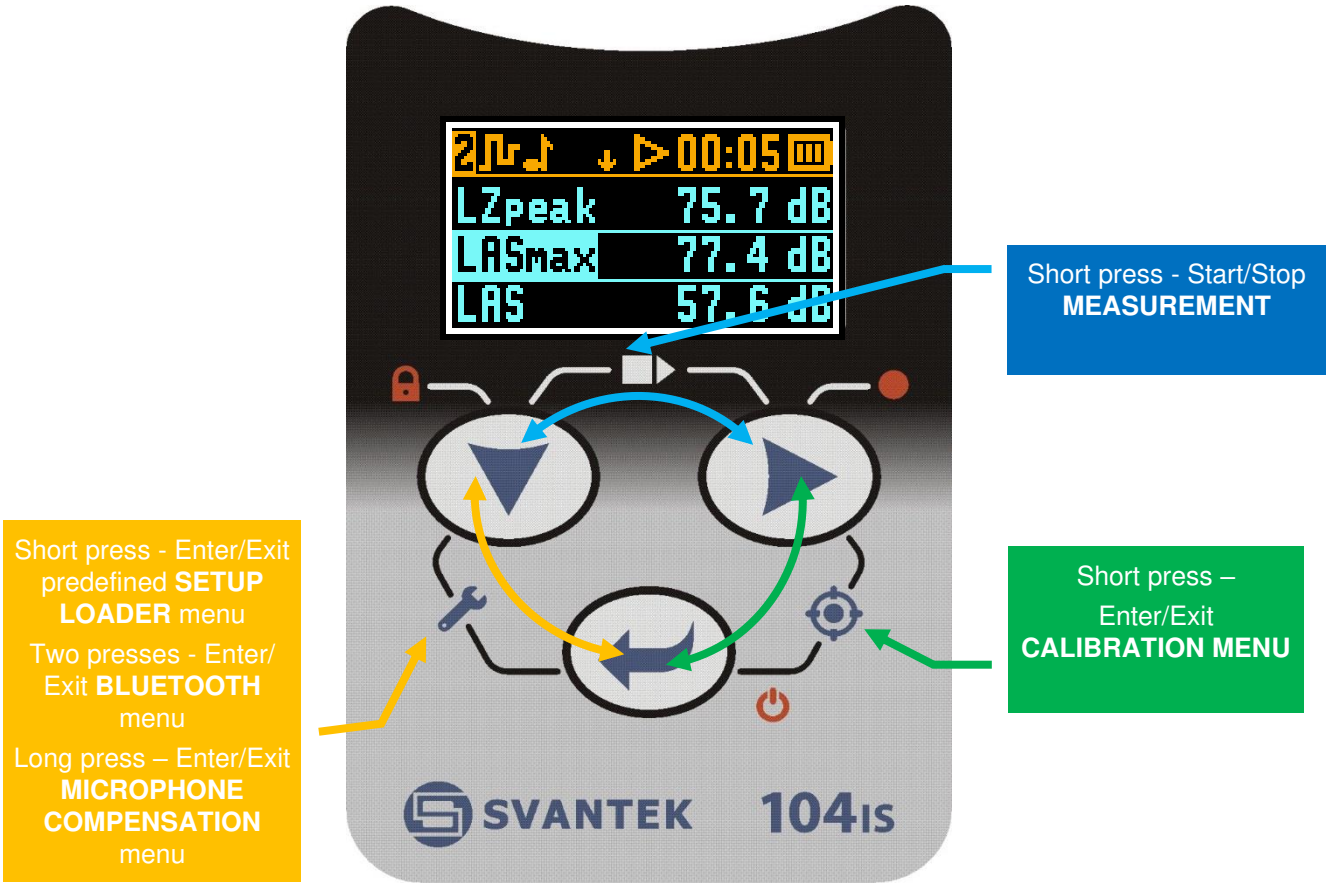


Figure 3-10 Control keypad on the front panel – alternate combined keys function

Note: *Extra additional keypad functionality is also available to display the instrument's* ***Unit Label*** *screen showing the current firmware revision number. It is accessible by a* ***short press of all three keys at once****.*

Note: *Press the ▼ and ↵ keys simultaneously* ***twice*** *to access Bluetooth menu.*

Note: *Microphone compensation settings are accessible by holding down the ▼ and ↵ keys simultaneously for three seconds.*

Warning: *Changing microphone compensation filter setting is not recommended for purposes other than laboratory calibration!*

3.9 THREE INSTRUMENTS IN ONE – ACOUSTIC PROFILE CONCEPT

SV 104BIS is able to monitor and log noise by allowing up to four different parameter configuration settings, also known as "**ACOUSTIC PROFILE**". Profile 1 can be set to perform measurements using the OSHA HC (Occupational Safety and Health Administration - Hearing Conversation) parameters, while Profile 2 can be set to monitor the noise using the OSHA PEL (Occupational Safety and Health Administration – Permissible Exposure Level) parameters, Profile 3 can be using the ACGIH parameters and Profile 4 can be set using the Nordic standard parameters. This is truly four instruments in one.

3.10 THE VIEW MODE PRESENTATION CONCEPT

Such an advanced noise dosimeter as SV 104BIS offers a large number of parameters for the operator to inspect. Therefore, all information is divided in a neatly organized manner as **VIEW** modes for each profile.

The **VIEW** mode is a way in which the measurement parameters are presented to the operator. In other words, when you change the VIEW mode, specific measurement parameters and status information will be presented in different manner as distinct screen content.

SV 104BIS features the following VIEW modes, where most of them can be individually disabled:

- Running instantaneous SPL view mode (Chapter 3.10.1) - *can be disabled with PC software*
- Primary "one-result" parameters view mode (Chapter 3.10.2) - *cannot be disabled*
- Results list view mode (Chapter 3.10.3) - *can be disabled with PC software*
- 1/1 octave analysis spectrum LEQ view mode (Chapter 3.10.4) - *can be disabled with PC software*
- 1/1 octave analysis spectrum MAX view mode (Chapter 3.10.4) - *can be disabled with PC software*
- 1/3 octave analysis spectrum LEQ view mode (Chapter 3.10.5) - *can be disabled with PC software*
- 1/3 octave analysis spectrum MAX view mode (Chapter 3.10.5) - *can be disabled with PC software*
- Instrument Status view mode (Chapter 3.10.6) - *can be disabled with PC software*

3.10.1 Running SPL view mode

The Running SPL view mode is used when measurement run is not actually running, that is when the instrument is in standby mode before or after a measurement. In this mode the current SPL result is calculated and displayed, but not stored in the instrument's memory. The purpose of this information is to give the user a first indication of the sound levels about to be measured. This can be useful for some measurements. The instrument behaves as a simple general-purpose sound pressure level meter in this view mode.

Figure 3-11 Running SPL view mode screen

3.10.2 Primary "ONE RESULT" view mode

The One Result view mode is always available in all measurement modes and cannot be disabled. In the one result mode, any measurement result, selected with the ▼ key, may be presented. The user may change the actual profile view by pressing the ▶ key. This view mode is useful if in low vision conditions or is suitable for operators with some visual impairment.

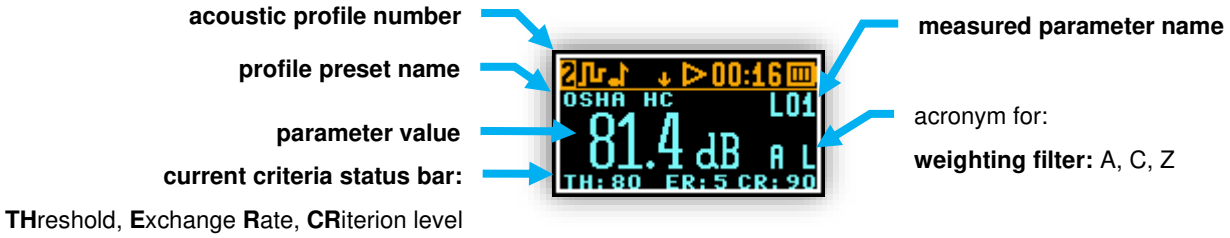


Figure 3-12 Primary ONE RESULT view

3.10.3 RESULTS LIST view mode

To get information about a number of results at one time it is handy to switch to the “results list” view mode. Up to three parameters at a time are accessible for the operator. In this view the user can scroll the list of results starting from the profile name and configuration with the ▼ key.

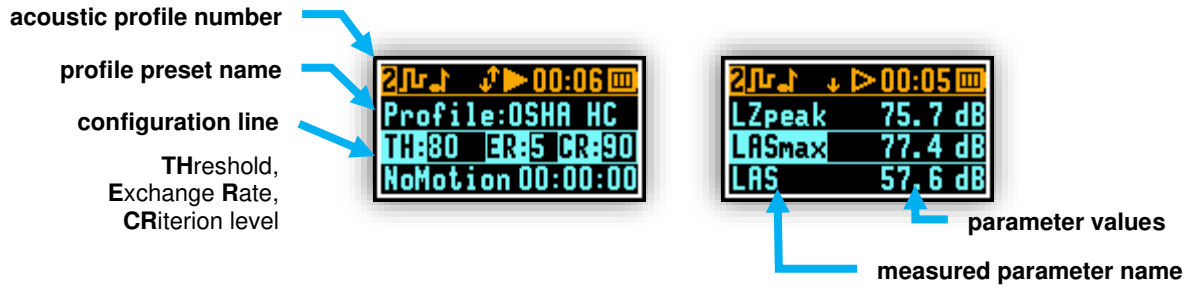


Figure 3-13 RESULTS LIST view

3.10.4 1/1 octave analysis spectrum view mode

Note: *The 1/1 octave analysis is switched on with the use of the dedicated software, see Appendix E.*

Note: *The 1/1 octave analysis is an optional function and should be activated before use. Activation of the optional functions can be made with the use of the Supervisor software, see Appendix E.*

The instrument operates as a real time 1/1 octave band analyser (RTA). In addition, and if enabled, 1/1 octave analysis is performed in parallel with the dosimeter operations. All 1/1 octave digital pass-band filters (with 9 centre frequencies from 8 kHz down to 31.5 Hz; in base 10 system) are working in real-time with the broadband frequency weighting filters (Z, A or C) and the linear LEQ detector. This enables the user to pre-weight a spectrum with one of the selected broadband frequency curves if required for a particular application such as the provision of hearing protectors in the control of high workplace noise levels.

Note: *The three overall TOTAL LEQ results are measured with the weighting filters (A, C, Z) without taking into account the settings of the level meters for profiles. The spectra are always linearly averaged. Thus, the TOTAL values from 1/1 octave band analysis can be different from those obtained for the profiles (if the LEQ Integration was set as Exponential).*

The results of 1/1 octave analysis (so-called spectrum) can be examined by the user on a display in the **Spectrum** VIEW presentation mode. 1/1 octave spectra for all 9 centre frequencies of pass-band filters together with the 3 TOTAL overall values measured with the user selected frequency weighting filters are presented in the Spectrum mode, if enabled in the configuration setup. Spectrum cursor can be moved left and right with the ▼ and ▶ keys respectively.

With the use of the dedicated software, the user can select which spectrum (**LEQ**, **MAX** or both) will be available for view, see Appendix E.

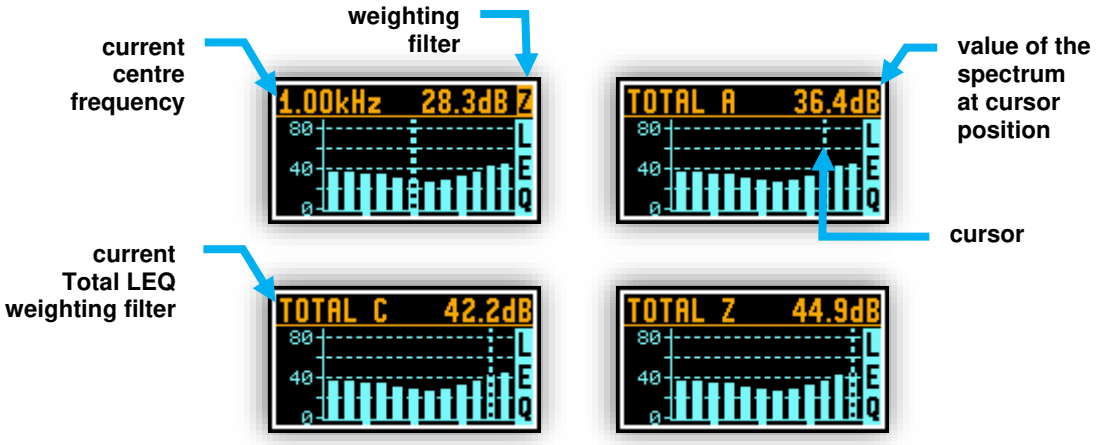


Figure 3-14 1/1 octave analysis LEQ spectrum graph view

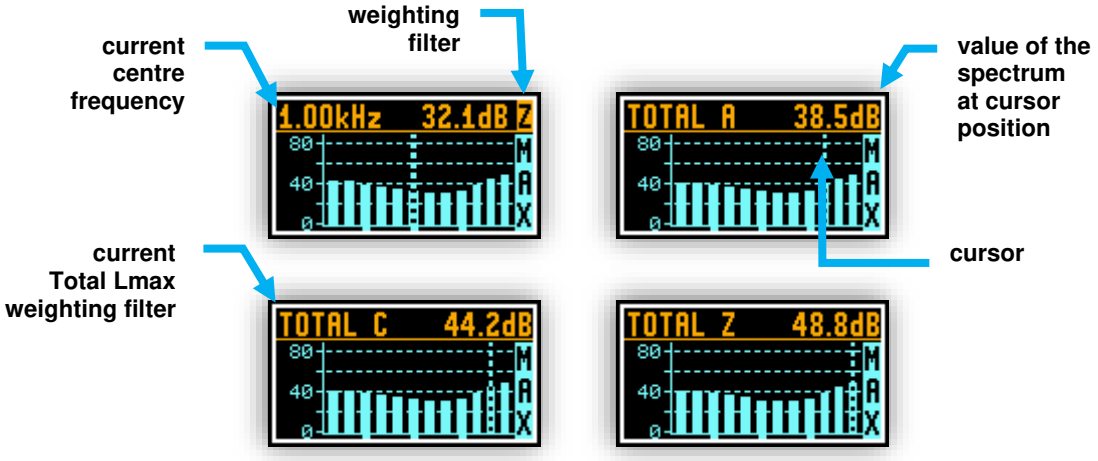


Figure 3-15 1/1 octave analysis MAX spectrum plot view

3.10.5 1/3 octave analysis spectrum view mode

Note: *The 1/3 octave analysis is switched on with the use of the dedicated software, see Appendix E.*

Note: *The 1/3 octave analysis is an optional function and should be activated before use. Activation of the optional functions can be made with the use of the Supervisor software, see Appendix E.*

The instrument can also operate as a real time 1/3 octave band analyser (RTA). In addition, and if enabled, 1/3 octave analysis is performed in parallel with the dosimeter operations. All 1/3 octave digital pass-band filters (with 28 centre frequencies from 10 kHz down to 20 Hz; in base 10 system) are working in real-time with the broadband frequency weighting filters (Z, A or C) and the linear LEQ detector. This enables the user to pre-weight a spectrum with one of the selected broadband frequency curves if required for a particular application such as the provision of hearing protectors in the control of high workplace noise levels.

Note: *The three overall TOTAL LEQ results are measured with the weighting filters (A, C, Z) without taking into account the settings of the level meters for profiles. The spectra are always linearly averaged. Thus, the TOTAL values from 1/3 octave band analysis can be different from those obtained for the profiles (if the LEQ Integration was set as Exponential).*

The results of 1/3 octave analysis (so-called spectrum) can be examined by the user on a display in **Spectrum** VIEW presentation mode. 1/3 octave spectra for all 28 centre frequencies of pass-band filters together with the 3 TOTAL overall values measured with the user selected frequency weighting filters are presented in the Spectrum mode, if enabled in the configuration setup. Spectrum cursor can be moved left and right with the and keys respectively.

With the use of the dedicated software, the user can select which spectrum (**LEQ**, **MAX** or both) will be available for view, see Appendix E.

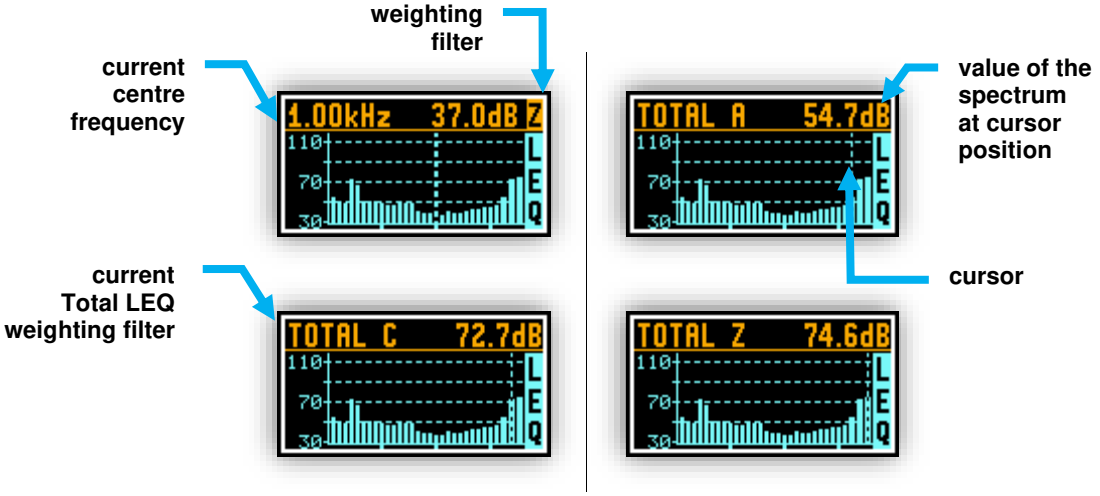


Figure 3-16 1/3 octave analysis LEQ spectrum plot view

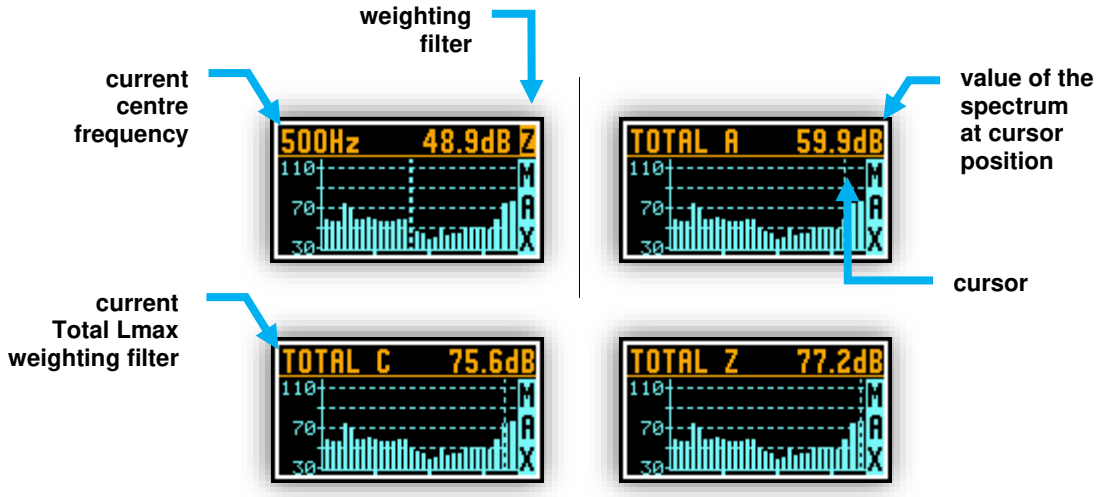


Figure 3-17 1/3 octave analysis MAX spectrum plot view

3.10.6 INSTRUMENT STATUS view mode and Bluetooth security PIN code

The Instrument Status view presents:

- the battery charge status (**Bat.Charge**) along with estimated working time which is left until the battery is expected to be completely drained (**Bat.Left**)
- current configuration information (**Setup**),
- Bluetooth status (**On** or **Off**) and PIN code,
- Timer status (**On** or **Off**) and time left to start.

The Instrument Status screen is moved down and up with the and keys respectively.

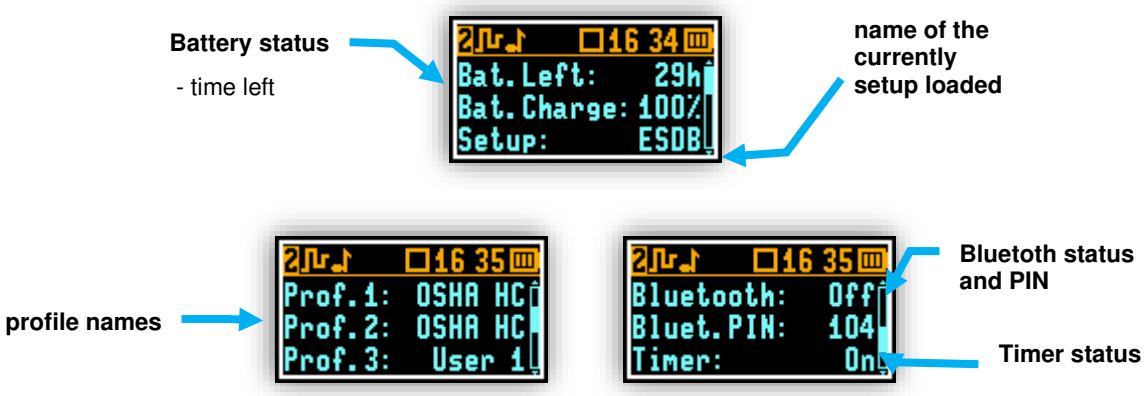


Figure 3-18 INSTRUMENT STATUS view mode screens

The Bluetooth security PIN enables the user to protect the instrument's access via Bluetooth® by **Assistant** mobile application. PIN is defined in the dedicated software, see Appendix E.

When **Timer** is **On** there are additional positions in the Status list with time left to start.

Figure 3-19 Timer information

3.11 ALARM SCREEN REVIEW

Apart from simple LED alarm indications (Chapter 3.6) there are a few alarm conditions when ALARM presentation screens will appear. During a measurement run SV 104BIS will immediately turn on the display at the time that the programmable alarm condition is exceeded. The detailed alarm state condition for each profile is presented to the user. Press any key, to confirm the information.

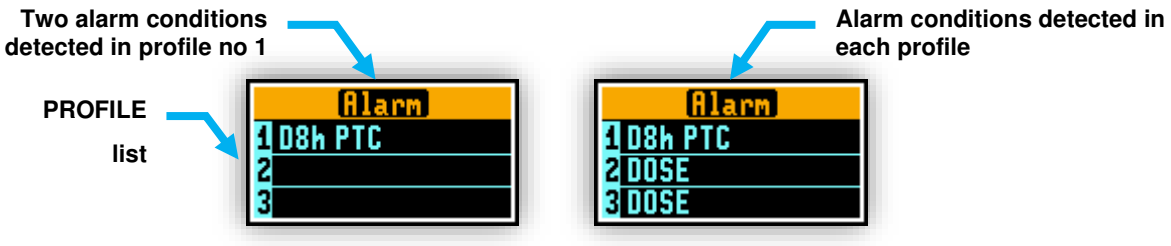


Figure 3-20 ALARM view screens

Note: *At any time when battery power is almost exhausted the "low battery" alarm screen may inform you about immediate recharging requirement.*

4 RUNNING AND OPERATING BASIC PROCEDURES

4.1 CHARGING SV 104BIS

SV 104BIS can be charged only with the use of dock station for a single unit (1-bay dock station **SB 104B-1**) or for five units (5-bays dock station **SB 104B-5**).

Both dock stations are equipped with the USB Type B connector and can be connected to a PC for data transfer with the **SC 16** cable. SB 104B-1 is also powered via the USB port whilst SB 104B-5 is powered by the **SB 33** power supply (9V AC/DC).

Figure 4-1 1-bay and 5-bay dock station (SB 104B-1 and SB 104B-5)

To charge SV 104BIS place it onto the dock station charger and ensure the power cable is connected. SV 104BIS will automatically turn on the display during charging and present how much charge is within the instrument. SV 104BIS will display 'Charging completed' once charging is completed. This should take approximately 7 hours from a fully discharged state. A charging time of about 2 hours will be sufficient to perform greater than 10 hours of measurement. A fully charged instrument holds enough charge to run for approximately 45 hours.

Note that once disconnected from the dock station, the dosimeter will automatically switch off. If put again onto the dock station the internal battery is float charged. This keeps the battery performance in steady condition. If the battery is fully discharged prior to being placed on a charger, it trickles charges for a maximum 1h time prior to the fast charge cycle, this prevents damage to the batteries.

Dock stations are equipped with the LED. Table below describes LED statuses of the Dock station.

Charger LED status indication		Description
SB 104B-1	**OFF**	Dock station is not powered on
	GREEN	Indicates the dock station is powered on and fully operational
	RED	Dock station is powered on, but not fully operational
	RED flashing quickly, 2 times per second	Charging error – ambient air temperature limit exceeded
SB 104B-5 *LED on the top*	**OFF**	Dock station is not powered on
	GREEN	Indicates the dock station is powered on and fully operational
	RED	Dock station is powered on, but not fully operational
SB 104B-5 *LED on the side*	**RED flashing quickly,** 2 times per second	Charging error – ambient air temperature limit exceeded

Table 4-1 Dock station LED status description

When the dosimeter is on the dock station, its LED shows its charging status.

LED status indication	Description
GREEN continuous	Dosimeter is charged.
RED continuous	Dosimeter is charging.
RED flashing quickly, 2 times per second	Charging error - temperature limits inside the dosimeter exceeded.
Not lit	Not charging but not charged (communication is on) *If so, probably the battery may be damaged or unusable, because charger IC in dosimeter has time limiter and turns off LED when charging is impossible.*

Table 4-2 LED status description of the SV 104BIS when dosimeter is on the Dock station

Note: *The battery inside SV 104BIS uses lithium-ion technology which requires special consideration and handling techniques due to the extremely high energy density (see "SPECIAL PRECAUTIONS WHEN USING AND CHARGING LITHIUM BATTERIES" clause on page 5). Ensure the SV 104BIS is fully charged prior to use by installing it(them) at the Dock Station.*

Note: *Charging is allowed only in safe area. See the SPECIAL PRECAUTIONS WHEN USING AND CHARGING LITHIUM BATTERIES clause on page 5.*

Note: *To charge a fully discharged battery, it would take approximately 8 hours.*

Note: To charge dosimeters with the use of SB 104B-5*, it is necessary to use 9V AC/DC power supply such as the* ***SB 33*** *to provide enough current performance. USB connection doesn't ensure enough power to charge dosimeter(s) with the use of SB 104B-5.*

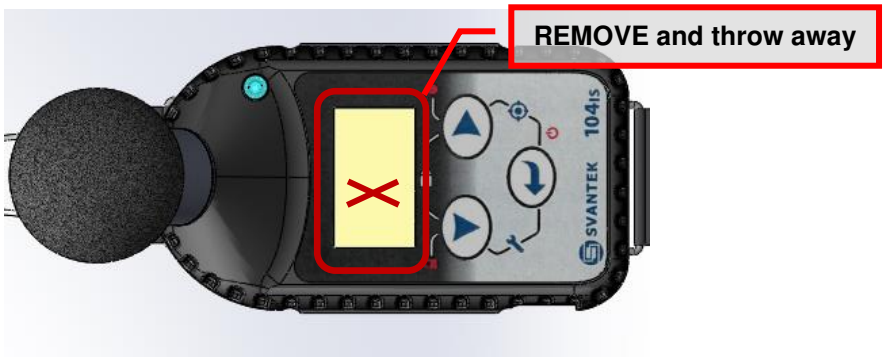
4.2 BEFORE YOU TURN THE INSTRUMENT ON

There are only a few things to remember:

- Make sure the microphone is properly fastened onto mounting head before turning on the instrument.
- When in use for a measurement run, always use the **SA 122BIS** windscreen provided.

Note: *On new products there is a display shipping protection foil which is used on new products being sent to protect from accidental scratches. It is ~25x15mm foil rectangle.*

Peel off the protection foil and throw away.



4.3 TURNING ON/OFF

TURNING ON: To switch the power on the operator should hold the key for a couple of seconds. The instrument switches on and goes the self-test routine (during this time the manufacturer's logo, the name of the instrument and firmware version is displayed).

If testing is successful SV 104BIS will run through a short start-up sequence, showing the current configuration setup loaded along with the names of all of four profiles, followed by battery state screen. After this, the instrument will enter the stopped (ready to measure) mode and enter the running SPL mode if it was enabled.

Note: *Warm up time - After power on, the instrument should be warmed up for at least 30 seconds before starting measurement.*

Note: *If you leave the instrument in stopped (ready to measure) mode, the display will be switched off after 30 seconds, and the unit will turn off after approximately 5 minutes of no keypad activity to save the batteries.*

Note: *SV 104BIS will show a warning screen if the battery capacity is below 2 hours of potential measurement time.*

TURNING OFF: To shut down the instrument the operator should hold the key for a couple of seconds during which a countdown ("Shutting down" 3… 2… 1…) is displayed. Thus, SV 104BIS gives you time to decide if you really want to turn off the instrument. If you release the key too early, SV 104BIS returns to the last presented **VIEW** mode.

If enabled in the configuration setup there may be presented an additional, double-check, warning screen. This is for the operator to be aware and convinced the instrument is really to be turned off. See figure below:

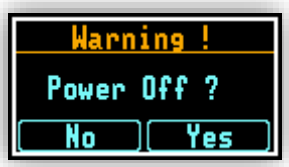


Figure 4-2 Power-off warning screen

Note: *SV 104BIS will automatically shut down after 5 minutes in the stopped mode.*

Note: *If* ***auto-run*** *(timer) mode is active, SV 104BIS will automatically stop the measurement when the set time is over and then turn off. If no* ***auto-run*** *mode is used and specific time has not been preset, the unit will continue to measure until the battery is exhausted. Just before switching off, the measurement run will be stopped and all data until that point will be saved securely for later download to the PC.*

4.4 BATTERY CHECK

Observe the battery icon in the instrument's icon status bar or press the key until the Instrument Status view mode is presented and check the battery state. If it is too low, charge the batteries (Chapter 4.1).

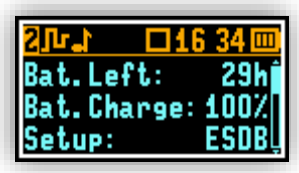


Figure 4-3 Instrument Status - Battery state

Battery status screen is moved down and up with the and keys.

Press to change to the next **VIEW** mode.

Note: *Battery state of charge calculation is based on internal charge counter and should be considered only as an overall, not very precise estimation. Therefore, the time left could be noticeably different. Although the newest technology cells are used the slight degradation over time is inevitable thus aging requires occasionally factory based (or authorised service centre) replacement of the rechargeable battery cells.*

Note: *Battery power indicator - To improve accuracy of remaining battery life indicator, run the dosimeter until it is fully discharged; then proceed with a full charge via dock station. The procedure is recommended before first use. Repeat this procedure every few months of use to maintain more accurate current battery condition indication.*

4.5 REVIEWING UNIT LABEL

Unit label screen provides information about elementary dosimeter properties such as:

- Copyrighted manufacturer name: **SVANTEK (C)**
- Instrument name: **SV 104BIS**
- Unit serial number: **SN XXXXX**
- ST 104CIS microphone serial number: SN ST104CIS XXXXX
- Unit name: **XXXXXXX** *[user programmable name]*
- Firmware version: **Version X.XX.X**
- File system version: **FS Version X.XX**
- CRC value: **CRC(OK) XXXX**
- Standards list, that the dosimeter conforms to

To access the **Unit Label** screen short press altogether three keys: , and at the same time.

The following screen will be presented:

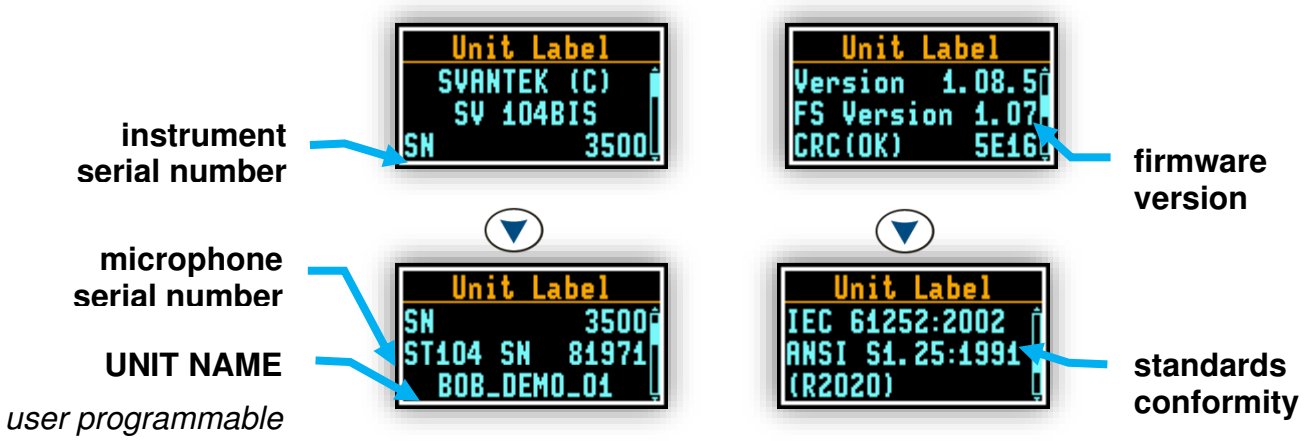


Figure 4-4 Unit label screens

Unit label screen is moved with the ▼ or ▶ keys.

To exit the Unit Label screen just shortly press the ↵ key. Then SV 104BIS will return to the last presented **VIEW** mode.

Note: *The personalized* ***Unit Name*** *can be set arbitrarily with* ***Supervisor*** *software.*

4.6 MEASUREMENT SETUP - BASIC CONFIGURATION

Press two keys ▼ and ↵ at the same time. The **Load Setup** menu will appear with the list of loaded configuration setups to choose.

Figure 4-5 Load setup menu

To abandon setup selection, press again ▼ and ↵ at the same time. Otherwise select the required configuration setup with the ↵ key navigating thru the list with the ▼ or ▶ key.

The following screen will appear, that will allow you to confirm you really want to load the selected setup or cancel the selection and return to configuration setup list:

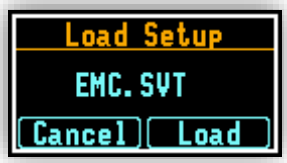


Figure 4-6 Load setup confirmation

Press the key to cancel the setup loading, or the key to confirm loading selected setup configuration. Confirming the loading of configuration setup leads to the screen with status of the loading procedure:

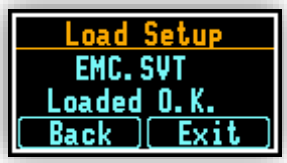


Figure 4-7 Status of setup loading

After successfully setup loading it is possible to return back to the list of predefined setups by pressing the key or go further to the measurement screen by pressing the key.

Note: *Detailed description of uploading setup files onto SV 104BIS can be found in Chapter 5.6 of this manual.*

4.7 CALIBRATION

The SV 104BIS dosimeter is offered with the dedicated **ST 104CIS** MEMS microphone with ½" housing. The instrument is factory calibrated with the supplied microphone for the standard environmental conditions. Because the microphone sensitivity is a function of the temperature, ambient pressure and humidity, the absolute calibration of the measurement channel should be performed locally.

Svantek offers the **SV 34B** sound calibrator 114dB@1000Hz for the SV 104BIS instruments.

Note: *Calibration with use of SV 34B is allowed only in a safe area.*

The instrument has an automatic calibration function, which can be enabled or disabled with the use of the dedicated software, see Appendix E. One of the important instrument settings is the sound pressure level generated by the calibrator. By default, the automatic calibration is enabled, and the calibrator signal level is set to 114 dB.

If the automatic calibration is enabled the instrument performs the acoustic calibration automatically when the calibrator is placed over the microphone (first remove the windscreen). The calibrator level is automatically detected, and the calibration procedure is started.

The user simply has to press the key to confirm the calibration results. Calibration is only allowed in the stopped mode. A sound measurement cannot be in progress while the calibration is being performed.

Note: *During the calibration measurement, the instrument automatically changes the setting to filter C, switches Microphone compensation on and switches Free Field compensation off (see Chapter 4.15). When the calibration measurement is complete, the previous settings are restored.*

Note: *It is advised to perform an acoustic calibration of the instrument each time before and after the measurement run. A single calibration at the start of each day of use is usually sufficient for most regulations.*

Note: *The calibration factor is always added to the results in the Dosimeter or 1/1 octave or 1/3 octave analyses modes.*

Note: *The manufacturer's recommended factory calibration interval is every 12 months for this instrument to be confident in its continuing accuracy and compliance with the international specifications. Please contact your local SVANTEK distributor for further details.*

To calibrate the instrument manually the user must enter the **Calibration** menu.

1. Adjust the actual calibration level of the calibrator to be used with the and keys.

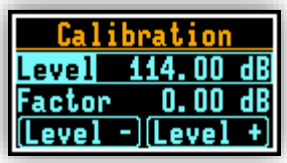


Figure 4-8 Calibration menu

2. Attach the acoustic calibrator **SV 34B** (or equivalent 114dB@1000Hz) carefully yet tightly over the microphone of the instrument.

Note: *It is also possible to use an electro-mechanical pistonphone, which generates the signal (ca 124 dB) or different type of acoustic calibrator dedicated for ½" microphones with an alternative output level such as 94 dB at 1 kHz. In any case, before starting the calibration measurement, the user has to set the level of the signal generated by the given calibrator (Level position), which is stated in the calibration certificate of the unit (the default expected value of the Calibration Level set by the manufacturer of SV 104BIS is equal to 114 dB).*

3. Switch on the calibrator and wait ca 30 seconds for the tone to stabilise before starting the calibration measurement.
4. Start the calibration measurement by pressing the key.
5. The calibration measurement time is set to 1 second with 3 seconds' delay. Calibration stops when either 5 consecutive results will not differ from themselves by more than 0.02 dB, or 10 consecutive results will not differ from themselves by more than 0.05 dB. It is possible to stop the calibration measurement by pressing two keys at the same time and .

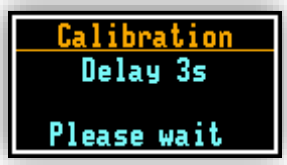


Figure 4-9 Calibration - initial delay screen

6. Delay before starting calibration measurement is counted down on the display. After the measurement, its result is presented on the display.

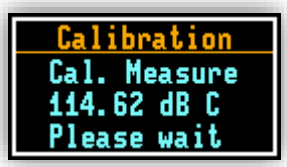


Figure 4-10 Calibration in progress screen

Note: *To quit the calibration procedure without saving the calibration factor press at the same time* ▶ *and* ↵ *.*

7. It is recommended to repeat the calibration measurement few times. The obtained results should be almost the same (with ±0.1 dB difference). The reasons for the unstable results are as follows:
   - the calibrator is not properly attached to the instrument
   - there are external acoustic disturbances such as high noise levels close by
   - the calibrator or the measurement channel (for example the microphone) is damaged.

Note: *During the calibration measurement, the external disturbances (acoustic noise or vibrations) should not exceed a value of 100 dB (when using a calibrator that generates a level of 114 dB).*

8. Press ↵ to accept the measurement result.

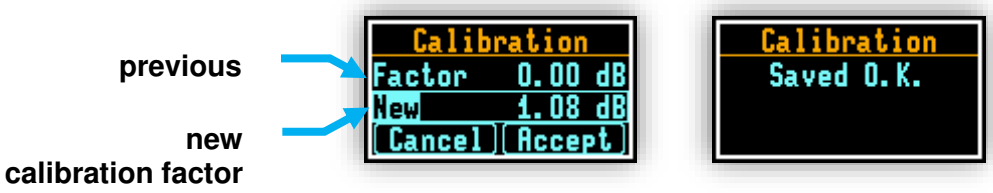


Figure 4-11 Calibration confirmation screen

Note: *If a calibration factor does not meet tolerance criteria ±2 dB, you still can manually accept the microphone, but the results could possibly be affected, see Figure below.*

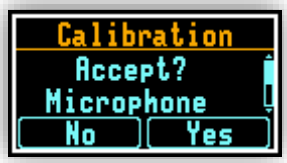


Figure 4-12 Calibration - microphone not in tolerance screen

9. Post calibration. If enabled remotely, the post processing is performed automatically under acceptance of the calibration measurement. SV 104BIS automatically adds the results to the previously saved files. Before saving the calibration factor, the text "**Post Calibration**" appears.

4.8 VOICE COMMENTS RECORDING

In order to record a comment, the user should press the key for a few seconds during which a countdown ("Voice comment" 3… 2… 1…) is displayed. Thus, SV 104BIS gives you time to decide if you really want to record a voice comment. In case you release the key too early, SV 104BIS returns to the last used **VIEW** mode.

Entering the voice comment recording usually brings up a window with a question to which logger file the voice comment is to be linked - to the previous or to the next one. NOTE: This window will be skipped if there are no previous logger files, or the unit is just turned on.

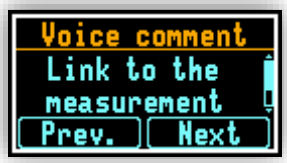


Figure 4-13 Voice comment linking screen

After selecting an answer by pressing the or the key the record command window will open.

Figure 4-14 Voice comment recording command screen

After starting the recording with the key flashing circle that indicates recording in progress will appear on the screen.

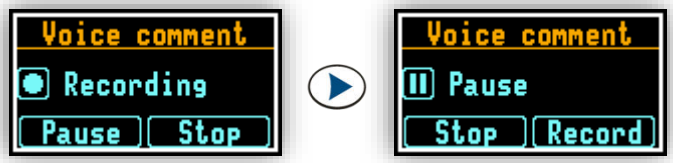


Figure 4-15 Voice comment recording in progress screens

Further, one can continue to record a comment about the measurement and press the key to finish recording. The recording end will be confirmed with the screen comment "Saved O.K.".

Figure 4-16 Voice comment record confirmation screen

Note: *The voice comment can be recorded before or after the measurement run takes place and linked to the Previous or the Next measurement run. But be beware, that linking to the previous measurement will not be possible in case when the unit is switched off and on again or there are no previous logger files. In this case the recording screen will appear (with default linking the comment to the next logger file).*

4.9 BEFORE AND AFTER MEASUREMENT RUN

Before starting a measurement ensure:

1 the instrument is turned on (Chapter 4.3)
2 there is sufficient battery operating life and free memory by checking the status screen (Chapter 3.10.6)
3 required configuration setup is selected (Chapter 4.6)
4 SV 104BIS is calibrated, because it affects the results (Chapter 4.7)
5 the windscreen is put on because it protects the microphone from industrial environment such as dust and moisture or from effects of impact (Chapter 3.3).

After stopping the measurement run, make sure:

1 the calibration is still maintained (Chapter 4.7)
2 the data is properly downloaded to PC for further analysis (Chapter 4.16)
3 the instrument is turned off (Chapter 4.3).

4.10 STARTING AND STOPPING MEASUREMENT RUN

START:

To start measurements the user has to press the  and  keys at the same time. The results of the measurement are displayed in the last used result's display view mode. As an example, ONE RESULT view mode is displayed. ONE RESULT view mode is always available for most functions of the instrument. The results of the measurements can also be presented in other view modes, which can be enabled or disabled and adjusted to the user's needs.

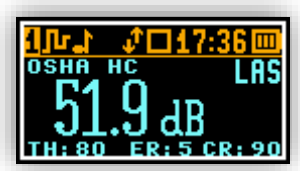


Figure 4-17 One profile mode screen view

STOP:

The same combination of keys:  and  allows the user to stop the measurement run. All run results are always saved automatically, there is no need to save them manually.

Note: *The instrument can be started or stopped remotely thru wireless Bluetooth® interface, see the mobile application description in Appendix E.*

4.11 AUTO-RUN MODE INFORMATION

Note, that when auto-run mode (timer and/or pause) is configured, there is information on the screen available for the user. There is no need to turn on the instrument manually. All the timer procedures can be easily pre-programmed with the use of the **Supervisor** software.

Figure 4-18 Auto-run mode – timer and programmable pause screen

4.12 SECURITY LOCK

Please consider locking the keypad and display during the measurement to prevent the wearer or anybody else from tampering with the measurement run. SV 104BIS can be set up to automatically go into locked mode when it starts (see Appendix E). That automatically prevents any tampering, but the unit can still be unlocked, if necessary, with proper sequence of key presses.

Locking SV 104BIS: To lock the instrument the operator should hold the key for a couple of seconds during which a countdown ("Keyboard lock" 3… 2… 1…) is displayed and the unit gives you time to decide if you really want to activate security lock. If you release the key too early, SV 104BIS returns to the last presented **VIEW** mode.

Unlocking SV 104BIS: To unlock the instrument the operator should press the keys in the correct sequence. The sequence is pre-programmed in the configuration setup (see Appendix E).

Figure 4-19 Unlocking the unit sequence screens

Note: *The instrument is automatically unlocked when it is placed on the dock station.*

4.13 REVIEWING MEASUREMENTS

Most of the parameters can be inspected in real-time during either measurement run or stopped mode of operation. If the display screen is turned off just press any key (but watch notice below).

The keys on the keypad of the instrument enable you to navigate thru most of the parameters. For specific information on the **VIEW** modes, see Chapter 3.10.

- Use the key to move down the list through the various measurements.
- Use the key to change the ACOUSTIC PROFILE you would like to inspect.
- Use the key to change the VIEW mode.

Note: *In most cases the keypad will be probably locked. To gain access to the results and unlock the keypad see Chapter 4.12.*

Note: *After reviewing results remember to lock the keypad again in order to maintain the integrity of the measurement run by preventing uncontrolled access to the instrument.*

4.14 CONTROL OF THE INSTRUMENT VIA BLUETOOTH® WIRELESS INTERFACE

The Long-Range Bluetooth® Low Energy wireless connectivity and the supporting **Assistant** mobile application enables remote control and monitoring of the instrument's status such as battery usage, memory capacity and measurement progress and results without having to disturb the worker. You can be sure, that confidence in the measurement minimizes the likelihood of having to repeat an examination due to potentially impaired data and therefore maximizes your performance. For more detailed description of the remote-control, see Appendix E.

Note: *After reviewing results remember to lock the keypad again in order to maintain the integrity of the measurement run by preventing uncontrolled access to the instrument.*

The Bluetooth connection between the instrument and **Assistant** mobile application can be established after setting up the PIN code. PIN code is defined through the dedicated software, see Appendix E.

By pressing the ▼ and ↵ keys simultaneously **twice** the user can enter the **Bluetooth** menu. Pressing the ▶ key the user can turn the Bluetooth® on or off. Press ↵ and **Accept** to confirm selection.

Figure 4-20 Switching the Bluetooth® on

Note: *By default,* ***Bluetooth®*** *is disabled. For Air-transport* ***Bluetooth® should be disabled****. Make sure that correct settings file is applied or switch it off manually - see Chapter 3.8.3.*

4.15 SWITCHING OFF MICROPHONE COMPENSATION

The ST 104CIS microphone is digitally compensated. In addition to it the free filed and the SA 122BIS windscreen effects are compensated with the Free Field compensation filter. By default, both compensations are active.

For laboratory approval testing or calibration measurements it is necessary to disable one or both compensation filters (see Appendix C).

To access the **Microphone** menu, press the ▼ and ↵ keys simultaneously and keep them pressed for 3 seconds. Pressing the ▶ key the user can switch on or off the compensation. Press ↵ and **Accept** to confirm selection.

Figure 4-21 Disabling the Free Field filter

4.16 DATA DOWNLOADING AND UPLOADING

Downloading and uploading data can be done with the use of dock stations and the *Supervisor* software or via Bluetooth with the use of the *Assistant Pro* mobile application (see Appendix E).

The dock stations exchange data with a PC by the USB protocol.

Both dock stations are equipped with the USB-B plug and require the **SC 16** cable.

Figure 4-22 USB connections of the SB 104B-1 and SB 104B-5 dock station

In the case data transmission is failed, dock stations should be reset. To reset the dock station, disconnect all cables from the dock station to cut off the power.

4.17 RESETTING THE DOSIMETER

- **FACTORY SETTINGS:** clears any setup configuration and brings back the default factory settings. You can reset the factory settings with the use of the dedicated software (see Appendix E).
- **HARDWARE RESET:** internal hardware reset; the setup configuration is not changed. Hold down the  key for about 30 seconds and then release it. If the instrument was switched on, the screen will shut down after approx. 20 seconds. Turn on the instrument as usually (Chapter 4.3).

Note: *Hardware reset is only to be used in extreme situations such as an instrument hang-up. Be aware, that a hardware reset:*

- will stop any pre-programmed auto-run modes
- will stop measurement run
- HARDWARE RESET works, even if the keyboard becomes locked out!

5 SV 104BIS MAINTENANCE

5.1 GENERAL RECOMMENDATIONS FOR USE

- Do not disassemble or modify the instrument. The battery inside contains safety and protective devices, which, if damaged, may cause the battery to generate heat, explode or ignite.
- It is not recommended to leave the instrument nor accessories in direct sunlight conditions for prolonged periods of time. Doing so may cause the battery contained inside to generate heat, explode, or ignite. Using the instrument in this manner may also result in a loss of performance and a shortened life expectancy.
- Do not keep the instrument for a long time discharged (see Chapter 0).
- Charge the SV 104BIS instrument in a dock station before attempting to turn it on if the dosimeter has not been used for a prolonged period or was stored in a low battery state condition.
- To improve accuracy of remaining battery life indicator, run the dosimeter until it is fully discharged; then proceed with a full charge with use of the **SB 104B-5** or **SB 104B-1** dock station. The procedure is recommended before first use. Repeat this procedure year of use to maintain more accurate current battery condition indication.
- Use dock station charger only in a safe area.

5.2 CLEANING

Few things to remember:

- Every time SV 104BIS gets too dirty, clean the surface of the dosimeter with water damp soft cloth. Under no circumstances should this equipment be cleaned using a solvent based cleaner (it can affect the case polymeric materials).
- Pay special attention that the provided SA 122BIS windscreen is clean because dirtiness can affect the measurements. Take off the windscreen, shake off any dirt, and clean it with damp cloth. If necessary, change the windscreen to a new one. The foam windscreen is considered a consumable item and will need replacing if it becomes lost or its condition deteriorates too much. Packs of 3 replacement windscreens are available under the part number SA 122BIS_3.
- Pay special attention that the microphone front part is clean because dirtiness can affect the measurements. Avoid the small inlet hole getting too dirty. Clean carefully with a dry and soft non-fraying cloth.

5.3 IN SITU CALIBRATION

It is advised to perform an acoustic calibration of the instrument each time before and after the measurement run. A single calibration at the start of each day of use is usually sufficient for most regulations. See Chapter 4.7 for calibration details.

***Note:** With the use of the **SV 34B** calibrator the calibration can be performed only in a safe area.*

5.4 PERIODIC TESTING

The manufacturer's recommended factory calibration interval is every **12 months** for SV 104BIS to be confident in its continuing accuracy and compliance with the international specifications.

Note: *Please contact your local SVANTEK distributor for further details on traceable recalibrations that are recommended by most regulatory authorities.*

5.5 CHANGING THE MICROPHONE AND WINDSCREEN

Note: *Changing the microphone and/or windscreen is only allowed in a safe area.*

In case the windscreen is destroyed/lost by any accident, or it gets too dirty to afford the microphone the best protection then SVANTEK offers **SA 122BIS_3** three pcs per pack (windscreens for the SV 104BIS dosimeter).

To change the microphone, unscrew the windscreen first (Chapter 3.3). Then unscrew the microphone protective sleeve and pull the microphone to extract it.

To attach a new microphone, insert the new microphone to the socket and screw the microphone protective sleeve on clockwise until it fits tightly. Be gently and be aware not to break or strip the thread. Then proceed to screw the windscreen until it stops firmly.

Note: *When the microphone is changed, the new* ***microphone serial number*** *is automatically stored into the SV 104BIS internal memory.*

5.6 FIRMWARE UPDATE

SVANTEK is committed to continuous innovation path of development, and as such reserves the right to provide firmware enhancements based on user's feedback.

To update the instrument firmware:

1. Unpack the provided firmware package (provided as a suitable compressed file).
2. Switch off the instrument and place it on the dock station, connected to a PC with the USB cable.
3. Hold down the ▶ key and press the ↵ key to turn on the instrument. This ensures the instrument will switch on and enter the special reprogramming **BOOTSTRAP** mode.
4. Run the **go-usb.bat** file. Successful firmware update will be indicated by relevant message.
5. Disconnect the instrument from the docking station and press and hold the ↵ key to turn on the instrument.

Note: *With use of* ***Supervisor*** *software, it is very easy to check if there are any new firmware releases available for download, see Appendix.*

5.7 STORING THE INSTRUMENT

- To preserve the life of the internal batteries, it is recommended that the SV 104BIS instrument is turned off when it is stored.
- It is best not to store the dosimeter for any period of time in low battery state condition.
- Generally, the SV 104BIS instrument should be stored at room temperature, charged to about 40 to 60% of capacity.
- After use, it is best to charge SV 104BIS prior to storage for a prolonged period that is longer than 3 months.
- It is recommended to turn off the Bluetooth® interface in applied settings.
- If the dosimeter is to be stored for an even longer period, it is best to take the instrument out of storage and re-charge the dosimeter every 8 months. When SV 104BIS is turned off, it still draws a small amount of battery power, so periodic recharge is to prevent battery over-discharge.

5.8 TRANSPORTATION AND CARRYING

For transportation or storage purpose, always use the packaging provided by the manufacturer. In a potentially dirty industrial environment, it is advisable to use the carrying case provided by the manufacturer **SA 144**, which ensures excellent mechanical and environmental protection and long-term storage conditions. The temperature range over which the device can be stored/transported is -20°C to +50°C.

Note: *For Air-transport Bluetooth® should be turned off !*

5.9 TROUBLESHOOTING

1. Upon connection onto the dock station port, if automatic charging is not started: check the dock station LED colour for state of charging (Chapter 4.1).
2. If the incorrect time or date is displayed when turning on the instrument connect the device to the computer and use the *Supervisor* software to set the time and date (see) ensuring PC clock is set correctly.
3. In case the instrument is not able to turn on ensure the unit is charged by connecting it to the USB charger or placing it onto the dock station. This ensures the battery is not exhausted. Then proceed with hardware reset (Chapter 4.17).
4. In case your dosimeter does not respond proceed with turn-off/turn-on procedure (Chapter 4.3), and hardware reset of the instrument (Chapter 4.17).
5. In case the measurement of the sound level is frozen or set to a fixed value proceed with turn-off/turn-on procedure (Chapter 4.3), then with hardware reset of the instrument (Chapter 4.17).
6. In case the reset does not help proceed to Chapter 7.
7. In case the instrument is discharged under conditions where the ambient temperature exceeds 35°C, when placed on the dock station it may not respond and not indicate that charging has started. In this case, place the dock station with the instrument in a place with an ambient temperature below 35°C and charge it for at least 2 hours. If the instrument is not damaged, it should indicate start of charging within 2 hours ("Bat.Charge" will then appear on the screen). If the instrument does not start charging after 6 hours, the instrument may be considered damaged.

6 RISK ASSESSMENT AND MITIGATION OF RISK

Electrical safety HAZARDS are fully addressed by 6-16 clauses of the IEC 61010-1.

Hazard locations related HAZARDS are fully addressed by IEC 60079-0 and IEC 61010-1.

For details see:

- GENERAL WARNINGS, SAFETY CLAUSES, AND STANDARD INFORMATION, page 3
- HAZARDOUS AREA INSTALLATIONS SPECIFIC INFORMATION, page 4
- SPECIAL PRECAUTIONS WHEN USING AND CHARGING LITHIUM BATTERIES, page 5
- ENVIRONMENTAL PROTECTION MARKING OF THE UNIT, page 6

HAZARDS related to reliable function, performance and wrong software setup are covered by:

- Chapter 4, RUNNING AND OPERATING BASIC PROCEDURES, page 33
- Chapter 7, SV 104BIS MAINTENANCE, page 46

7 SVANTEK SERVICE

Should your SVANTEK professional measurement equipment need to be returned for repair or for calibration, please contact the service office at the following number or contact via the SVANTEK website.

Service Office: +48 (22) 51-88-320 or +48 (22) 51-88-322.

Office hours are 9:00 a.m. to 5:00 p.m. Central European Time.

Internet: www.svantek.com

Address: SVANTEK Sp. z o.o.
Strzygłowska 81
04-872 Warszawa,
Poland

***Note:* International customers:**

Contact your local authorized distributor from whom the product was purchased. You can obtain the name and contact information of your local authorized distributor from SVANTEK by using the e-mail or telephone information listed above or use our website to find nearest distributor office.

APPENDIX A REMOTE CONTROL

USB 2.0 interface is the serial one working with 480 MHz clock which enables one to control remotely the unit. Its speed is relatively high, and it ensures the common usage of USB in all produced nowadays Personal Computers.

The functions, which are developed in order to control data flow in the serial interfaces, ensure:

- Bi-directional data transmission,
- Remote control of the instrument.

The user, in order to program the serial interface, has to:

1. send "the function code",
2. send an appropriate data file or
3. receive a data file.

A.1 INPUT / OUTPUT TRANSMISSION TYPES

The following basic input / output transmission types (called functions) are available:

#1 input/output of the control setting codes,

#2 read out of the measurement results in the **DOSE METER** mode,

#3 read out of the measurement results in the **1/1 OCTAVE or 1/3 OCTAVE** analysis mode,

#4 read out of the data file from the internal Flash-disc or RAM memory,

#5 read out of the statistical analysis results,

#7 special control functions,

#9 writing the data file into the internal flash-disk.

#D read/write the data file from the external memory (SD Card),

A.2 FUNCTION #1 - INPUT/OUTPUT OF THE CONTROL SETTING CODES

#1 function enables the user to send the control setting codes to the instrument and read out a file containing the current control state. A list of the control setting codes is given in Tab. A.1. The format of #1 function is defined as follows:

#1,Xccc,Xccc,(...),Xccc;

or

#1,Xccc,X?,Xccc,(...),X?,Xccc;

where:

X - the group code, **ccc** - the code value,

X? - the request to send the current X code setting.

The instrument outputs in this case a control settings file for all requests X? in the following format:

#1,Xccc,Xccc,(...),Xccc;

In order to read out all current control settings the user should send to the device the following sequence of characters:

#1;

The instrument outputs in this case a file containing all control settings given in Tab. A1 in the format:

#1,Xccc,Xccc,(...),Xccc;

Example: The instrument sends the following sequence of characters as an answer for the mentioned above request:

#1,U104,N12342,W1.08.1,Q0.01,M4,F2:1,F3:2,F1:3,J2:1,J3:2,J1:3,f1,C1:1,C0:2,C2:3,B0:1,B3:2,B15:3,b0,d1s,D10s,K5,L0:1,L0:2,L0:3,Y3,y0,XC115:1,XC115:2,XC115:3,XI115:1,XI115:2,XI115:3,S0,T1,e480,c1:1,c1:2,c1:3,h0:1,h0:2,h0:3,x3:1,x3:2,x5:3;

means that:

- SV 104BIS is investigated (U104);
- number is 12342 (N12342);
- software version number is 1.08.1 (W1.08.1);
- calibration factor is equal to 0.01 dB (Q0.01);
- **DOSE METER** is selected as the measurement function (M4);
- **A** filter is selected in profile 1 (F2:1);
- **C** filter is selected in profile 2 (F3:2);
- **Z** filter is chosen in profile 3 (F1:3);
- **A** Peak filter is selected in profile 1 (J2:1);
- **C** Peak filter is selected in profile 2 (J3:2);
- **Z** Peak filter is selected in profile 3 (J1:3);
- **Z** filter is selected for **1/1 OCTAVE or 1/3 OCTAVE** analysis (f1)
- **FAST** detector is selected in profile 1 (C1:1);
- **IMPULSE** detector is chosen in profile 2 (C0:2);
- **SLOW** detector is selected in profile 3 (C2:3);
- logger's buffer is not filled by the results from profile 1 (B0:1);
- **PEAK** and **MAX** values are stored in the files of the logger from profile 2 (B3:2);
- **PEAK**, **MAX**, **MIN** and **LEQ** values are stored in the files of the logger from profile 3 (B15:3);
- results of **1/1 OCTAVE** analysis are not stored in the files of the logger (b0);
- results are stored in a logger's file every 1 second (d1s);
- integration period is equal to 10 seconds (D10s);
- measurement has to be repeated 5 times (K5);
- linear detector is selected to the **LEQ** calculations in profile 1 (L0:1);
- linear detector is selected to the **LEQ** calculations in profile 2 (L0:2);
- linear detector is selected to the **LEQ** calculations in profile 3 (L0:3);
- delay of the start of the measurements is equal to 3 seconds (Y3);
- synchronization the start of measurement with RTC is switched off (y0);
- threshold level for PTC calculation in profile 1, is set to 115 dB (XC115:1);
- threshold level for PTC calculation in profile 2, is set to 115 dB (XC115:2);
- threshold level for PTC calculation in profile 3, is set to 115 dB (XC115:3);
- threshold level for ULT calculation in profile 1, is set to 115 dB (XI115:1);
- threshold level for ULT calculation in profile 2, is set to 115 dB (XI115:2);
- threshold level for ULT calculation in profile 3, is set to 115 dB (XI115:3);
- instrument is in the Stop state (S0);
- logger is active (T1);
- exposition time is set to 8 hours (e480);
- criterion level in profile 1 is chosen as 80 dB (c1:1);

- criterion level in profile 2 is chosen as 80 dB (c1:2);
- criterion level in profile 3 is chosen as 80 dB (c1:3);
- threshold level in profile 1 is None (h0:1);
- threshold level in profile 2 is None (h0:2);
- threshold level in profile 3 is None (h0:3);
- exchange rate in profile 1 is set to 3 (x3:1).
- exchange rate in profile 2 is set to 3 (x3:2).
- exchange rate in profile 3 is set to 5 (x5:3).

Note: *All bytes of that transmission are ASCII characters.*

A.3 FUNCTION #2 - MEASUREMENT RESULTS READ-OUT IN DOSE METER MODE

#2 function enables one to read out the current measurement result from the selected profile in the **SLM** mode.

Note: *This function can also be programmed while measurements are taking place. In this case, the LEQ values measured **after entering #2 function** are sent out.*

#2 function has the format defined as follows:

#2 [,<aver>] [,<profile>] [[[,X?] ,X?] ,(...)];

where:

<aver> – type of results:

i – instantaneous results, i.e. results from the current cycle (default),

a – averaged results, i.e. results from the previous cycle.

<profile> – profile number:

1, 2 or 3 – one of the profile, i.e. only results from the given profile will be sent;

X – code of the specified result (see below); if no code are specified all results will be sent;

Note: *After finishing the measurement, **#2** function is no longer active and has to be reprogrammed in order to read-out successive measurements.*

The instrument sends the values of results in the format defined as follows:

#2,p,Xccc,Xccc,Xccc,(...),Xccc; (where **p** - the number of the results set)

or

#2,?; (when the results are not available).

The codes of the results from the **DOSE METER** mode are defined as follows:

v the under-range flag (ccc equals to 0 when the overload did not occur, 2 when the under-range took place during the last measurement period but did not occur in the last second of the measurement and 3 when the under-range took place during the last measurement period and it lasted in the last second of the measurement);

V the overload flag (ccc equals to 0 or 1);

T	time of the measurement (ccc – value in seconds);
P	the **Lpeak** value (ccc – the value in dB);
M	the **Lmax** value (ccc – the value in dB);
N	the **Lmin** value (ccc – the value in dB);
S	the **L** result (ccc – the value in dB);
D	the **DOSE** result (ccc – the value in %);
d	the **D_8h** result (ccc – the value in %);
p	the **PrDOSE** result (ccc – the value in %);
A	the **LAV** result (ccc – the value in dB);
R	the **Leq** result (ccc – the value in dB);
U	the **LE** result (ccc – the value in dB);
u	the **SEL8** result (ccc – the value in dB);
E	the **E** result (ccc – the value in Pa^2h);
e	the **E_8h** result (ccc – the value in Pa^2h);
l(nn)	the **LEPd** result (ccc – the value in dB, nn – the value of Exposure Time in minutes);
J	the **PSEL** result (ccc – the value in dB);
Y	the **Ltm3** result (ccc – the value in dB);
Z	the **Ltm5** result (ccc – the value in dB);
L(nn)	the value L of the nn statistics (ccc – the value in dB);
C	the **PTC** result (ccc – the counter value);
c	the **PTP** result (ccc – the value in %);
l	the **ULT** result (ccc – value in seconds);
W	the **TWA** result (ccc – the value in dB);
w	the **PrTWA** result (ccc – the value in dB);
a	the **Lc-a** result (ccc – the value in dB);
t	no motion time (ccc – value in seconds);

The exemplary results of the instrument's response after sending to it the following sequence of characters: **#2,1;** coming from the first profile are given below:

#2,1,v1,V0,T146,P89.47,M64.73,N46.90,S56.47,D0,d0,p0,A0.00,R50.56,U72.20,u95.15,E0.00,e0.00,l(480)50.57,J27.61,Y53.92,Z54.63,L(01)60.40,L(10)49.80,L(20)48.50,L(30)47.90,L(40)47.70,L(50)47.50,L(60)47.30,L(70)47.10,L(80)46.80,L(90)46.40,C0,c0,l0,W-38.12,w0.01,a4.73,t0;

Note: *The presented above order of the measurement results sent out by the instrument does not depend about the characters sent to the unit.*

Example: After sending to the instrument the string:

#2,1,T?,R?,V?,P?,L?;

the unit sends out the results of measurement coming from the first profile in predefined, described above, order:

#2,1,V0,T146,P89.47,R50.56,L(01)60.40,L(10)49.80,L(20)48.50,L(30)47.90,L(40)47.70,L(50)47.50,L(60)47.30,L(70)47.10,L(80)46.80,L(90)46.40;

Note: *The value displayed on the screen during the result's presentation is sent out from the instrument in the case when* ***nn*** *is not given after* ***X*** *character.*

Note: *All bytes of that transmission are ASCII characters.*

A.4 FUNCTION #3 - READ-OUT OF THE MEASUREMENT RESULTS IN 1/1 OCTAVE OR 1/3 OCTAVE MODE

#3 function enables one to read out the current measurement results in **1/1 OCTAVE or 1/3 OCTAVE**

#3 function format is defined as follows:

#3;

The device responds, sending the last measured spectrum (when the instrument is in STOP state) or currently measured spectrum (when the instrument is in RUN state) in the following format:

#3;<Status Byte> <LSB of the transmission counter> <MSB of the transmission counter> <data byte> (...) <data byte>

Status Byte gives the information about the current state of the instrument.

D7	D6	D5	D4	D3	D2	D1	D0

where:

D7 = 0 means that "overload does not happen",
= 1 means that “overload appeared”,
D5 = 0 means that "spectrum is not averaged ",
= 1 means that "spectrum is averaged ",
D4 = 0 the instantaneous current result (RUN State),
= 1 the final result (STOP State),
D3 = 1 results in **1/3 OCTAVE** mode,
D2 = 1 results in **1/1 OCTAVE** mode,
D6, D3, D1, D0 reserved bits.

Note: *The measurement result is coded in binary form as dB•100 (e.g. 34.5 dB is sent as binary number 3450).*

A.5 FUNCTION #4 - READ-OUT OF THE DATA FILE FROM THE INTERNAL FLASH-DISK OR RAM MEMORY

#4 function enables the user to read-out the data file from the internal Flash-Disk or RAM memory. The data file formats are given in Appendix B.

#4 function formats are defined as follows:

#4,0,\; the file containing the catalogue,
#4,0,?; the count of the files,
#4,0,index,count; the part of the file containing the catalogue,
where:
index - first record,
count - number of records in the catalogue.

#4,1,fname; the file containing the measurement results,
#4,1,fname,?; file size,
#4,1,fname,offset,length; the part of the file containing the measurement results,

where:

fname - name containing not more than eight characters,
offset - offset from the beginning of the file,
length - number of bytes to read,

#4,4; the current settings file,

#4,4,?; size of the current settings file,

#4,4,offset,length; the part of current settings file,

where:

offset - offset from the beginning of the current settings file,
length - number of bytes to read.

Note: *The "\" character is treated as the file name of the catalogue and must be sent to the instrument.*

All data words are sent as **<LSB>**,**<MSB>**.

When an error is detected in the file specification or data, the instrument will send:

#4,?;

The catalogue of the files is a set of the records containing 16 words (16 bits each). Each record describes one file saved in the instrument's Flash-disc or RAM. The record structure is as follows:

words 0 - 3 8 characters of the file name,
word 4 file type (binary number),
word 5 reserved,
word 6 the least significant word of the file size,
word 7 the most significant word of the file size,
words 8 - 15 reserved.

A.6 FUNCTION #5 - STATISTICAL ANALYSIS RESULTS READ-OUT

#5 function enables one to read out the statistical analysis results.

#5 function format is defined as follows:

#5,p;

where:

p - the number of the profile (1, 2 or 3)

The device responds, sending the current classes of the statistics in the following format:

#5,p;<Status Byte> <LSB of the transmission counter> <MSB of the transmission counter> <NofClasses><BottomClass><ClassWidth><Counter of the class> (...) <Counter of the class>

Status Byte gives the information about the current state of the instrument.

D7	D6	D5	D4	D3	D2	D1	D0

where:

D7 = 0 means "overload does not happen",

= 1 means "overload appeared",
D6 = 1 reserved,
D5 = 0 the instantaneous current result (RUN State),
= 1 the final result (STOP State),
D0 to D4 reserved bits.

Note: *There is not any succeeding transmission in the case when the* ***Status Byte*** *is equal to zero.*

The **transmission counter** is a two-byte word denoting the number of the remaining bytes to be transmitted. Its value is calculated from the formulae:

Transmission counter = 6+n * (4 * the number of the classes in the statistics)

where:

n is the number of the transmitted statistics. For p = 1, 2 or 3 only one statistic is transmitted (n = 1).

NofClasses is a two-byte word denoting the number of classes in the statistic.

BottomClass is a two-byte word denoting the lower limit of the first class (*10 dB).

ClassWidth is a two-byte word denoting the width of the class (*10 dB).

Counter of the class is a four-byte word containing the number of the measurements belonging to the current class.

Note: *The bytes in the words are sent according to the scheme* ***<LSByte>..<MSByte>****.*

A.7 FUNCTION #7 - SPECIAL CONTROL FUNCTIONS

#7 function enables the user to perform special control functions. **Some of them should be used with the extreme care.**

#7 function formats are defined as follows:

#7,AC;	This function returns auto calibration in the format **#7,AC,x;**
#7,AC,x;	This function enables (x = 1) or disables (x = 0) the auto calibration and returns the following sequence of characters: **#7,AC;** This function is not accepted while the instrument is in the RUN state.
#7,AP;	Reserved
#7,AR;	Reserved.
#7,AS;	Get settings for the Auto-Run function.

Response format: **#7,AS,e,HH,MM,hh,mm,dW,mR;**

where:

e – On (e=1), Off (e=0),
HH – hour of the measurement start,
MM – minutes of the measurement start,
hh – hour of the measurement stop,

mm – minutes of the measurement stop,

dW – day of week in which the measurement will be done:

bit:0 – Monday,

...

bit:6 – Sunday

mR – maximum number of the measurement days,

#7,AS, e,HH,MM,hh,mm,dW,mR;

where:

e – On (e=1), Off (e=0),

HH – hour of the measurement start,

MM – minutes of the measurement start,

hh – hour of the measurement stop,

mm – minutes of the measurement stop,

dW – day of week in which the measurement will be done:

bit:0 – Monday,

...

bit:6 – Sunday

mR – maximum number of the measurement days,

Response format: **#7,AS;**

This function is not accepted while the instrument is in the RUN state.

#7,AV; Reserved.

#7,BC; The function returns the battery charge level in [mAh].

#7,BD; The function returns the total battery discharge current in [mAh].

#7,BN; This function returns the number of logger files created to the current time in the format: **#7,BN,ddddd;** (**ddddd** - number of logger files in decimal format).

#7,BS; This function returns battery state in %.

#7,BP; This function returns the Bluetooth PIN number.

Response format: **#7,BT,nnnn;**
where: **n** **-** PIN number,

#7,BP,nnnn; This function sets the Bluetooth PIN number.

where: **n** **-** PIN number,

#7,BT; This function returns the state of the Bluetooth power.

Response format: **#7,BT,n;**
where: **n** 0 – Off

1 - On,

#7,BT,n; This function sets the state of the Bluetooth power.

where: **n** 0 – Off

1 - On,

#7,BV; This function returns battery voltage in 10 mV.

#7,CH; Get number of records calibration history

Response format: **#7,CH,n;**

where: **n** – number of records calibration history,

#7,CH,n; Get one record from calibration history.

where: **n** – record number in the history of calibration,

Response format: **#7,CH,n,cT,hh,mm,ss,DD,MM,YYYY,cF,cL;**

where: **n** – record number in the history of calibration,

cT – type of calibration:

0 - none,

1 - by measurement,

2 - by sensitivity,

3 - factory calibration,

hh:mm:ss – time of calibration,

DD/MM/YYYY – date of calibration,

cF – calibration factor.

cL – calibration level.

Response #7,CH,-1; denotes incorrect data in the selected record

#7,CS; This function restores the factory settings

This function is not accepted while the instrument is in the RUN state.

#7,CT; Get date and time of last calibration;

Response format: **#7,CT,DD-MM-YYYY,hh:mm:ss,;**

where: **hh:mm:ss** – time,

DD-MM-YYYY – date.

#7,DB; Reserved.

#7,DL; Reserved.

#7,DS,file_name; This function deletes setup file in SETUP directory specified by **file_name**.

This function is not accepted while the instrument is in the RUN state.

#7,ED; This function deletes all files on sd card. The function returns **#7,ED;**

This function is not accepted while the instrument is in the RUN state.

#7,EV; This function returns external power voltage in 10 mV.

#7,FF; This function returns Free Field compensation in the format **#7,FF,x;**

#7,FF,x; This function enables (x = 1) or disables (x = 0) the Free Field compensation and returns the following sequence of characters: **#7,FF;**

This function is not accepted while the instrument is in the RUN state.

#7,FS; This function returns file system version.

#7,FT;	This function returns file system on sd card in the format **#7,FT,x;**.where **x** denotes -1: no sd card, 2: FAT32.
#7,IC;	Reserved.
#7,KL,x;	This function locks (x = 1) or unlocks (x = 0) keyboard and returns the following sequence of characters: **#7,KL;**
#7,KL;	This function returns the states of keyboard lock in the format **#7,KL,x;**
#7,LA;	This function returns current language in the format: **#7,LA,xx;** where **xx** is language codes: **GE** (German), **EN** (English), **IT** (Italian), **PL** (Polish), **RU** (Russian), **HU** (Hungarian), **TU** (Turkish),**NL** (Flemish), **FR** (French), **SP** (Spanish).
#7,LB;	This function returns the name of last logger in format **#7,LB,logger_name;**
#7,LF;	This function restore Teds factory calibration. This function is not accepted while the instrument is in the RUN state.
#7,LS,setup_name;	This function loads setup and writes settings into EEPROM. The selected file must exist. The function returns **#7,LS;** This function is not accepted while the instrument is in the RUN state.
#7,LT;	This function reloads microphone parameters from TEDS. This function is not accepted while the instrument is in the RUN state.
#7,LW;	This function returns the name of last wave file in format **#7,LW,wave_file_name;**
#7,MC;	This function returns microphone compensation in the format **#7,MC,x;**
#7,MC,x;	This function enables (x = 1) or disables (x = 0) the microphone compensation and returns the following sequence of characters: **#7,MC;** This function is not accepted while the instrument is in the RUN state.
#7,NF;	This function returns number of free sectors on sd card (-1 denotes no sd card). Sector size is 512B.
#7,NS;	This function returns number of sectors on sd card (-1 denotes no sd card). Sector size is 512B.
#7,PE;	This function returns atmospheric pressure Response format: **#7,PE,xx.x;** where: **xx.x** – atmospheric pressure in [hPa].
#7,PI;	This function returns PIC version.
#7,PN;	This function returns profile names
#7,PO;	This function powers off the instrument. This function is not accepted while the instrument is in the RUN state.
#7,RT;	This function returns current real time clock settings in the format: **#7,RT,hh,mm,ss,DD,MM,YYYY;** where **hh:mm:ss** denotes the time and **DD/MM/YYYY** gives the date.
#7,RT,hh,mm,ss, DD,MM,YYYY;	This function sets the current real time clock and returns the following sequence of characters: **#7,RT;** This function is not accepted while the instrument is in the RUN state.
#7,SC;	Reserved.
#7,SD;	Get date and time of last loaded setup file;

Response format: **#7,RT,hh,mm,ss,DD,MM,YYYY;**
where: **hh:mm:ss** – time,
DD/MM/YYYY – date.

#7,SE; Reserved.

#7,SF; Reserved.

#7,SL; This function returns all statistical levels in the format **#7,SL,sl1,sl2,sl3,sl4,sl5,sl6,sl7,sl8,sl9,sl10;**

#7,SL,sl_index,sl_level; This function sets statistical levels where **sl_index** is the statistical index, **sl_level** is the statistical level and returns the following sequence of characters: **#7,SL;**
This function is not accepted while the instrument is in the RUN state.

#7,SN; Get last loaded setup file name;

Response format: **#7,SN,name;**

where: name – setup file name.

#7,SP; Reserved.

#7,SS; This function creates setup file based on the current settings. The function returns **#7,SS;**
This function is not accepted while the instrument is in the RUN state.

#7,ST; Get Standby Delay.

Response format: **#7,ST,xxx;**

where: xxx – time to standby in [s].

#7,ST,x; Set Standby Delay.

where: xxx – time to standby in [s].

Response format: **#7,ST;**

This function is not accepted while the instrument is in the RUN state.

#7,TC; This function returns TEDS calibration factor;

#7,TF; This function returns TEDS factory calibration factor;

#7,TP; Get temperature.

Response format: **#7,TP,xx.x;**

where: **xx.x** – temperature in [˚C].

#7,TS; This function returns microphone serial number saved in TEDS memory.

#7,TT; This function returns type of microphone saved in TEDS memory. Value of -1 means unknown TEDS, value of 27 means SV27 microphone;

#7,TU; This function upload calibration factor to microphone's TEDS memory.
This function is not accepted while the instrument is in the RUN state.

#7,UF; This function returns USB speed in the format **#7,UF,x;**

#7,UF,x; This function sets USB full speed (12Mbps, x = 1) or sets usb high speed (480Mbps, x = 0) and returns the following sequence of characters: **#7,UF;**
This function is not accepted while the instrument is in the RUN state.

#7,UN; This function returns unit name;

#7,US;	This function returns unit subversion.
#7,UV;	This function returns USB voltage in 10 mV.
#7,VB;	This function returns the Bootstrap software version.
#7,VH;	This function returns the Hardboot software version.
	This function restart instrument.
#7,XR;	This function is not accepted while the instrument is in the RUN state.

For the unknown function and/or in the case of the other error, all these functions return the following sequence of characters: **#7,?;**

A.8 FUNCTION #9 - WRITE-IN THE DATA FILE INTO THE INTERNAL FLASH-DISC

#9 function enables the user to write-in the data file into the internal Flash-disc memory. The data file formats are given in Appendix B.

#9 function formats are defined as follows:

#9,FILE_TYPE,FILE_LENGTH,DATA

where:

FILE_TYPE	type of the file
	2 - setup file,
	4 - current settings file,
FILE_LENGTH	length of the file in bytes,
DATA	binary content of the file.

A.9 FUNCTION #D – READ / WRITE THE DATA FILES FROM THE EXTERNAL MEMORY (SD CARD)

<disk>	logical disk number:
	0 – SD Card,
	1 – USB Disk (not implemented),
	2 – Internal Memory (not implemented)
<address>	directory address (cluster numer) – for internal memory 0
<offsetB>	offset the first byte to read (an even number).
<nB>	number of bytes to read (an even number)
<data>	binary data.
<count>	directory size in bytes
<name>	file name in format XXXXXXXX.YYY (XXXXXXXX – file name, YYY- file name extension)
<dirName>	directory name
<nBwr>	number of bytes to write

1) #D,c,?; this function returns the list of available disks in format:

   #D,c,<disk1>[,<disk2>[,<disk3>]];

2) #D,d,?; this function returns the parameters of the working directory in format:

   #D,d,<disk>,<address>,<count>;

3) #D,d,<disk>,<address>; this function enables to change the working directory

   Response:

   #D,d; - command was executed

   #D,d,?; - command cannot be executed

4) #D,r,<disk>,<address>,<offsetB>,<nB>; function enables the user to read the file (except of internal memory):

   Response:

   #D,r,<disk>,<address>,<offsetB>,<nB>; [<data>]

5) #D,w,<name>,<nBwr>;<data> function enables the user to write the file to working directory:

   Response:

   #D,w; - command was executed

   #D,w,?; - command cannot be executed

6) #D,e,<name>; function enables the user to delete the file in working directory:

   Response:

   #D,e; - command was executed

   #D,e,?; - command cannot be executed

7) #D,e; function enables the user to delete all files in in working directory:

   Response:

   #D,e; - command was executed

   #D,e,?; - command cannot be executed

8) #D,m,<address>,<dirName>; function enables the user to create a subdirectory in the directory defined by <address>:

   Response:

   #D,m; - command was executed

   #D,m,?; - command cannot be executed

9) #D,f,<address>; function enables the user to delete directory and its contents (files and subdirectories):

   Response:

   #D,f; - command was executed

   #D,f,?; - command cannot be executed

A.10 CONTROL SETTING CODES

The control setting codes used in the SV 104BIS instrument (the internal software revision 1.07.1) are given in the table below.

Table A.1. Control setting codes

Group name	Group code	Code description
Unit type	**U**	U104 (read only)
Serial number	**N**	Nxxxx (read only)
Software version	**W**	Wyyy yyy - revision number (read only)
Calibration factor	**Q**	Qnnnn nnnn - real number with the value of the calibration factor ∈(-19.9 ÷ 19.9)
Measurement function	**M**	M2 - **1/1 OCTAVE** analyser M3 - **1/3 OCTAVE** analyser M4 - **DOSE METER**
Filter type in profile n	**F**	F1:n - **Z** filter for profile n F2:n - **A** filter for profile n F3:n - **C** filter for profile n
Filter type for Peak result calculation in profile n	**J**	J1:n - **Z** filter for profile n J2:n - **A** filter for profile n J3:n - **C** filter for profile n
Detector type in profile n	**C**	C0:n - **IMPULSE** detector in profile n C1:n - **FAST** detector in profile n C2:n - **SLOW** detector in profile n
Filter type in **1/1 OCTAVE** analysis	**f**	f1 - **Z** filter f2 - **A** filter f3 - **C** filter
Logger type in profile n	**B**	Bx:n - x - sum of the following flags flags: 1:n - logger with **PEAK** values in profile n 2:n - logger with **MAX** values in profile n 4:n - logger with **MIN** values in profile n 8:n - logger with **LEQ** values in profile n 16:n - logger with **LAV** values in profile n
Storing the results of **1/1 OCTAVE** or **1/3 OCTAVE** analysis in logger's file	**b**	bx - x - sum of the following flags flags: 8 - logger with **LEQ** values
Logger step	**d**	dnns - nn number in seconds ∈(1 ÷ 60) dnnm - nn number in minutes ∈(1 ÷ 60)

Integration period	**D**	D0 - infinity (measurement finished by pressing the **Stop** or remotely - by sending S0 control code) Dnns - nn number in seconds Dnnm - nn number in minutes Dnnh - nn number in hours
Repetition of the measurement cycles (RepCycle)	**K**	K0 - infinity (measurement finished by pressing the **Stop** or remotely - by sending S0 control code) Knnnn - nnnn number of repetitions ∈(1 ÷ 1000)
Detector type in the **LEQ** function in profile n	**L**	L0:n - **Linear detector** for profile n L1:n - **Exponential detector** for profile n
Exposure Time	**e**	ennn - nnn time in minutes ∈ (1 ÷ 720)
Criterion Level	**c**	c1:p - 80 dB c2:p - 84 dB c3:p - 85 dB c4:p - 90 dB c5:p - 60 dB c6:p - 65 dB c7:p - 70 dB c8:p - 75 dB c9:p - 87 dB c10:p - 81 dB c11:p - 82 dB c12:p - 83 dB p: 1, 2, 3 - profile number
Threshold Level	**h**	h0:p - None h1:p - 70 dB h2:p - 75 dB h3:p - 80 dB h4:p - 85 dB h5:p - 90 dB h6:p - 60 dB h7:p - 65 dB p: 1, 2, 3 - profile number
Exchange Rate	**x**	x2:p - 2 x3:p - 3 x4:p - 4 x5:p - 5 x6:p - 6 p: 1, 2, 3 - profile number
Logger	**T**	T0 - switched off (**[ ]**) T1 - switched on (**[√]**)

Delay in the start of measurement	**Y**	Ynn - nn delay given in seconds ∈ (0 ÷ 59) and (60 ÷ 3600) with step 60s
Synchronization the start of measurement with RTC	**y**	y0 - switched off (**OFF**) y1 - synchronization to 1 min. y15 - synchronization to 15 min. y30 - synchronization to 30 min. y60 - synchronization to 1 hour.
State of the instrument (Stop, Start or Pause)	**S**	S0 - **STOP** S1 - **START** S2 - **PAUSE**
Threshold level for PTC calculation	**XC**	XCnnn:p - nnn level in dB ∈ (70 ÷ 140) p: 1, 2, 3 - profile number
Threshold level for ULT calculation	**XI**	XInnn:p - nnn level in dB ∈ (70 ÷ 140) p: 1, 2, 3 - profile number

APPENDIX B DATA FILE STRUCTURES

B.1 GENERAL STRUCTURE OF THE SV 104BIS FILE

Each file containing data from the SV 104BIS instrument consists of several groups of words. In the case of the SV 104BIS (the internal file system rev. 1.09), there are two different types of files containing:

- the results stored in the file in the instrument's logger (cf. App. B.2);
- setup data (cf. App. B.3).

Each file has the following elements:

- the SvanPC file header (cf. Tab. B.1.1)
- a file header (cf. Tab. B.1.2)
- the unit and internal software specification (cf. Tab. B.1.3)
- the calibration settings (cf. Tab. B.1.4)
- the user's text (a header) stored together with the measurement data (cf. Tab. B.1.5)
- the Unit text info (cf. Tab. B.1.24)
- the parameters and global settings, common for all profiles (cf. Tab. B.1.6)
- parameters for Time-domain signal recording (cf. Tab. B.1.9)
- parameters for Wave-file recording (cf. Tab. B.1.10)
- the special settings for profiles (cf. Tab. B.1.12)
- the display settings of the main results (cf. Tab. B.1.13)
- the header of the statistical analysis (cf. Tab. B.1.14)
- header of the file from the logger (cf. Tab. B.1.15)
- contents of the file from the logger (cf. Tab. B.1.16)
- header of the Summary Results Record (cf. Tab. B.1.25)
- the main results saved in Summary Results Record (cf. Tab. B.1.17)

The other elements of the file structure are not obligatory for each file type stated above. They depend on the file type (**DOSE METER**, **1/1 OCTAVE**, **1/3 OCTAVE** file from the logger) These elements are as follows:

- statistical levels (saved in Summary Results Record) (cf. Tab. B.1.18)
- 1/1 OCTAVE analysis results (saved in Summary Results Record) (cf. Tab. B.1.19)
- 1/3 OCTAVE analysis results (saved in Summary Results Record) (cf. Tab. B.1.20)
- the results of the statistical analysis (saved in Summary Results Record) (cf. Tab. B.1.21)
- the settings of the instrument saved in the setup file (cf. Tab. B.1.22)
- the file-end-marker (cf. Tab. B.1.23)

Below, all file structure groups are described separately in Tab. B.1.1 – Tab. B.1.23. The format used in the columns, named **Comment** with the square parenthesis ([xx, yy]), means the contents of the word with; **xx** is the most significant byte (MSB) and **yy** the lowest significant byte (LSB) of the word. The format 0xnnnn means that the nnnn is four-digit number in hexadecimal form.

Table B.1.1. SvanPC file header

Word number	Name	Comment
0..2	“SvanPC”	reserved
3	26	reserved
4	32	reserved
5	4	reserved
6..15	Reserved	reserved
…	…	…

Table B.1.2. File header

Word number	Name	Comment
0	0xnn01	[01, nn=header’s length]
1..4	FileName	name of the file (8 characters)
5	Reserved	Reserved
6	CurrentDate	file creation date (cf. App. B.4)
7	CurrentTime	file creation time (cf. App. B.4)
8..13	Reserved	Reserved
…		…

Table B.1.3. Unit and software specification

Word number	Name	Comment
0	0xnn02	[02, nn=specification’s length]
1	UnitNumberL	unit number (LSB word)
2	UnitType	type of the unit: 104
3	SoftwareVersion	software version: 109
4	SoftwareIssueDate	software issue date
5	DeviceMode	mode of the instrument
6	UnitSubtype	subtype of the unit: 7 - SV 104B 8 - SV 104BIS
7	FileSysVersion	file system version: 109
8	reserved	Reserved
9	SoftwareSubversion	software subversion: 1
10..11	MicrophoneSN	the serial number of the microphone 0 - undefined
12	UnitNumberH	unit number (MSB word)
…		…

Table B.1.4. Calibration settings

Word number	Name	Comment
0	0xnn47	[47, nn=header's length]
1	PreCalibrType	type of calibration performed prior to measurement: 0 - none 1 - **BY MEASUREMENT** 3 - **FACTORY CALIBRATION**
2	PreCalibrDate	date of calibration performed prior to measurement (cf. App. B.4)
3	PreCalibrTime	time of calibration performed prior to measurement (cf. App. B.4)
4	PreCalibrFactor	factor (*100 dB) of calibration performed prior to measurement
5	PreCalibrLevel	level (*100 dB) of calibration performed prior to measurement
6	PostCalibrType	type of calibration performed after the measurement: 0 - none 1 - **BY MEASUREMENT** 3 - **FACTORY CALIBRATION** 0xFFFF - C**alibration not performed**
7	PostCalibrDate	date of calibration performed after the measurement (cf. App. B.4)
8	PostCalibrTime	time of calibration performed after the measurement (cf. App. B.4)
9	PostCalibrFactor	factor (*100 dB) of calibration performed after the measurement
10	PostCalibrLevel	level (*100 dB) of calibration performed prior to measurement
…	…	…

Table B.1.5. USER's text

Word number	Name	Comment
0	0xnn03	[03, nn=specification's length]
1…	title text	the user's text (two characters in a word) finished with one or two null bytes

Table B.1.6. Parameters and global settings

Word number	Name	Comment
0	0xnn04	[04, nn=block's length]
1	MeasureStartDate	measure start date (cf. App. B.4)
2	MeasureStartTime	measure start time (cf. App. B.4)
3	DeviceFunction	device function: 2 - **1/1 OCTAVE** analyser, 3 - **1/3 OCTAVE** analyser, 4 - **DOSE METER**

4	MeasureInput	measurement input type: 2 - **Microphone**
5	Range	measurement range: 2 - **SINGLE**
6	UnitFlags	calibration flags: b0 - if set to 1: calibration coefficient is used b3 - if set to 1: overload occurred b7,b6,b5: type of the result **Lden** 000 – **Lden** result is not available 001 – **Ld** result 010 – **Le** result 011 – **Lde** result 100 – **Ln** result 101 – **Lnd** result 110 – **Len** result 111 – **Lden** result
7	RepCycle	repetition cycle: 0 - infinity nnnn - number of repetitions $\in(1 \div 1000)$
8	NofChannel	number of channels (1)
8	NofProf	number of profiles (4)
10	StartDelay	start delay time
11..12	IntTimeSec	integration time specified in seconds
13	InterfaceMode	reserved
14	LeqInt	reserved
15	SpectrumFilter	**1/1** or **1/3 OCTAVE** analysis filter: 1 - **Z**, 2 - **A**, 3 - **C** in other cases: Reserved
16	SpectrumBuff	**1/1** or **1/3 OCTAVE** logger: sum of the following flags: 8 - logger with **Leq** values in other cases: reserved
17	ExposureTime	exposure time: 1..720 (min)
18	Leq & Lav	the method of viewing results Leq and Lav 0 - **Both** 1 - **Mutually exclusive (**visibility depends of the EXCHANGE RATE parameter**)**
19	MicComp	compensating filter for microphones: 0 - switched off, 1 - switched on
20	UL Th. Level[1]	the 1st profile threshold level for ULT calculation 70 ÷ 140 dB (*10)
21	UL Th. Level[2]	the 2nd profile threshold level for ULT calculation 70 ÷ 140 dB (*10)
22	UL Th. Level[3]	the 3rd profile threshold level for ULT calculation 70 ÷ 140 dB (*10)
23	PEAK Th. Level[1]	the 1st profile threshold level for PTC calculation 70 ÷ 140 dB (*10)

24	PEAK Th. Level[2]	the 2nd profile threshold level for PTC calculation 70 ÷ 140 dB (*10)
25	PEAK Th. Level[3]	the 3rd profile threshold level for PTC calculation 70 ÷ 140 dB (*10)
26	CriterionLevel[1]	the 1st profile criterion level (only **DOSE METER**): 60, 65, 70, 75, 80, 81, 82, 83, 84, 85, 87, 90 (*10 dB)
27	ThresholdLevel[1]	the 1st profile threshold level (only **DOSE METER**): 0, 60, 65, 70, 75, 80, 85, 90 (*10 dB)
28	ExchangeRate[1]	the 1st profile exchange rate (only **DOSE METER**): 2, 3, 4, 5, 6
29	CriterionLevel[2]	the 2nd profile criterion level (only **DOSE METER**): 60, 65, 70, 75, 80, 81, 82, 83, 84, 85, 87, 90 (*10 dB)
30	ThresholdLevel[2]	the 2nd profile threshold level (only **DOSE METER)**: 0, 60, 65, 70, 75, 80, 85, 90 (*10 dB)
31	ExchangeRate[2]	the 2nd profile exchange rate (only **DOSE METER**): 2, 3, 4, 5, 6
32	CriterionLevel[3]	the 3rd profile criterion level (only **DOSE METER**): 60, 65, 70, 75, 80, 81, 82, 83, 84, 85, 87, 90 (*10 dB)
33	ThresholdLevel[3]	the 3rd profile threshold level (only **DOSE METER**): 0, 60, 65, 70, 75, 80, 85, 90 (*10 dB)
34	ExchangeRate[3]	the 3rd profile exchange rate (only **DOSE METER**): 2, 3, 4, 5, 6
35	MainResBuff	Summary results. Contents defined as a sum of: 0 - none 1 - **Main Results** 2 - **Spectrum** 4 - **Spectrum MAX** 8 - **Spectrum MIN** 16 - **reserved** 32 - **Statistical levels** 64 - **Statistical analysis in profiles** 128 – **reserved**
36	StartSync	Synchronization the start of measurement with RTC 0 - switched off. 1 - synchronization to **1 min**. 15 - synchronization to **15 min**. 30 - synchronization to **30 min**. 60 - synchronization to **1 hour**.
37	CalMic10	reserved
38	FreeField	Free Field compensating filter for microphones: 0 - switched off, 1 - switched on
39	ProfileMask	Active profiles. Contents defined as a sum of: 1 - 1st profile 2 - 2nd profile 4 - 3rd profile
40	Pause[1]	Programmable pause no. 1.

41	PauseBegin[1]	The start time of the pause no. 1 in format 0xhhmm hh – hour mm – minute
42	PauseEnd[1]	The end time of the pause no. 1 in format 0xhhmm: hh – hour mm – minute
43	Pause[2]	Programmable pause no. 2.
44	PauseBegin[2]	The start time of the pause no. 2 in format 0xhhmm hh – hour mm – minute
45	PauseEnd[2]	The end time of the pause no. 2 in format 0xhhmm: hh – hour mm – minute
46	Pause[3]	Programmable pause no. 3.
47	PauseBegin[3]	The start time of the pause no. 3 in format 0xhhmm hh – hour mm – minute
48	PauseEnd[3]	The end time of the pause no. 3 in format 0xhhmm: hh – hour mm – minute
49	Pause[4]	Programmable pause no. 4.
50	PauseBegin[4]	The start time of the pause no. 4 in format 0xhhmm hh – hour mm – minute
51	PauseEnd[4]	The end time of the pause no. 4 in format 0xhhmm: hh – hour mm – minute
52	Pause[5]	Programmable pause no. 5.
53	PauseBegin[5]	The start time of the pause no. 5 in format 0xhhmm hh – hour mm – minute
54	PauseEnd[5]	The end time of the pause no. 5 in format 0xhhmm: hh – hour mm – minute
55	UL Th. Level[4]	the 4th profile threshold level for ULT calculation 70 ÷ 140 dB (*10)
56	PEAK Th. Level[4]	the 4th profile threshold level for PTC calculation 70 ÷ 140 dB (*10)
57	CriterionLevel[4]	the 4th profile criterion level (only **DOSE METER**): 60, 65, 70, 75, 80, 81, 82, 83, 84, 85, 87, 90 (*10 dB)
58	ThresholdLevel[4]	the 4th profile threshold level (only **DOSE METER**): 0, 60, 65, 70, 75, 80, 85, 90 (*10 dB)
59	ExchangeRate[4]	the 4th profile exchange rate (only **DOSE METER**): 2, 3, 4, 5, 6
…		

Table B.1.10. Wave-file recording parameters

Word number	Name	Comment
0	0xnn2D	[2D, nn=block's length]

1	TriggerMode	trigger mode: 0 - **OFF**, 1 - recording whole measurement 2 - recording on trigger **SLOPE+** 3 - recording on trigger **SLOPE–** 4 - recording on trigger **LEVEL+** 5 - recording on trigger **LEVEL–** 6 - recording on trigger **GRAD+** 7 - recording on trigger **MANUAL**
2	TriggerSource	source of the triggering signal: 0 - **Leq(1)** the **Leq** result from the first profile
3	TriggerLevel	level of triggering: 50 ÷ 136 dB (*10)
4	TriggerGrad	gradient of triggering: 1 dB/ms ÷ 100 dB/ms
5	TriggerPre	pretrigger time given in 10ms
6	TriggerPost	reserved
7	TriggerSampling	sampling frequency given in 10Hz
8	TriggerRecTime	recording time of single data block: 0 - recording to the end of measurement 1..28800 (sec)
9	TriggerStep	trigger period given in 0.1 ms. If zero Step is equal to logger time-step (cf. Tab. B.1.15)
10	TriggerFilter	filter type: 1 - **Z**, 2 - **A**, 3 - **C**
11	BitsPerSample	bits/sample: 16
12	Range	Full scale signal range in 0.01dB
13	Gain	Signal gain in dB
…		

Table B.1.12. Special settings for profiles

Word number	Name	Comment
0	0xnn05	[05, nn=block's length]
1	0x040F	[0x04=number of profiles, 0x0F=active profiles mask]
2	0xmm06	[06, mm=sub-block's length]
3	DetectorP[1]	detector type in the 1st profile: 0 - **IMP.**, 1 - **FAST**, 2 - **SLOW**

4	FilterP[1]	filter type in the 1st profile: 1 - **Z**, 2 - **A**, 3 - **C**
5	BufferP[1]	logger contents in the 1st profile defined as a sum of: 0 - none, 1 - Lxpeak[1] 2 - Lxvmax[2] 4 - Lxvmin[2] 8 - Lxveq[23] 16 - **LAV**
6	FilterPeakP[1]	filter type for Peak result calculation in the 1st profile: 1 - **Z**, 2 - **A**, 3 – **C**
7	LeqInt[1]	detector's type in the **Leq** function (1st profile): **0 - LINEAR,** 1 - **EXPONENTIAL**
8	0xmm06	[06, mm=sub-block's length]
9	DetectorP[2]	detector type in the 2nd profile: 0 - **IMP.**, 1 - **FAST**, 2 - **SLOW**
10	FilterP[2]	filter type in the 2nd profile: 1 - **Z**, 2 - **A**, 3 - **C**
11	BufferP[2]	logger contents in the 2nd profile defined as a sum of: 0 - none, 1 - Lxpeak[1] 2 - Lxvmax[2] 4 - Lxvmin[2] 8 - Lxveq[23] 16 - **LAV**
12	FilterPeakP[2]	filter type for Peak result calculation in the 2nd profile: 1 - **Z**, 2 - **A**, 3 - **C**
13	LeqInt[2]	detector's type in the **Leq** function (2nd profile): 0 - **LINEAR,** 1 – **EXPONENTIAL**
14	0xmm06	[06, mm=sub-block's length]
15	DetectorP[3]	detector type in the 3rd profile: 0 - **IMP.**, 1 - **FAST**, 2 - **SLOW**

16	FilterP[3]	filter type in the 3rd profile: 1 - **Z**, 2 - **A**, 3 - **C**
17	BufferP[3]	logger contents in the 3rd profile defined as a sum of: 0 - none, 1 - Lxpeak[1] 2 - Lxvmax[2] 4 - Lxvmin[2] 8 - Lxveq[23] 16 - **LAV**
18	FilterPeakP[3]	filter type for Peak result calculation in the 3rd profile: 1 - **Z**, 2 - **A**, 3 – **C**
19	LeqInt[3]	detector's type in the **Leq** function (3rd profile): **0 - LINEAR,** 1 - **EXPONENTIAL**
20	0xmm06	[06, mm=sub-block's length]
21	DetectorP[4]	detector type in the 4th profile: 0 - **IMP.**, 1 - **FAST**, 2 – **SLOW**
22	FilterP[4]	filter type in the 4th profile: 1 - **Z**, 2 - **A**, 3 - **C**
23	BufferP[4]	logger contents in the 4th profile defined as a sum of: 0 - none, 1 - Lxpeak[1] 2 - Lxvmax[2] 4 - Lxvmin[2] 8 - Lxveq[23] 16 - **LAV**
24	FilterPeakP[4]	filter type for Peak result calculation in the 4th profile: 1 - **Z**, 2 - **A**, 3 – **C**
25	LeqInt[4]	detector's type in the **Leq** function (4th profile): **0 - LINEAR,** 1 - **EXPONENTIAL**
…		

[1] x - depends of the filter type for Peak result calculation in selected profile: A, C, Z (cf. Tab. B.1.12)

[2] x - depends of the filter type in selected profile: A, C, Z (cf. Tab. B.1.12)
y - depends of the detector type in selected profile: I (imp.), F (fast), S (slow) (cf. Tab. B.1.12)

[3] y - only for exponential detector's type (cf. Tab. B.1.6)

Table B.1.13. Display settings of the main results

Word number	Name	Comment
0	0xnn48	[48, nn=header's length]
1	TIME	0 – TIME result not displayed, 1 - TIME result displayed
2	L_peak	0 – Lxpeak[1] result not displayed, 1 – Lxpeak[1] result displayed
3	L_max	0 – Lxymax[2] result not displayed, 1 – Lxymax[2] result displayed
4	L_min	0 – Lxymin[2] result not displayed, 1 – Lxymin[2] result displayed
5	L_	0 – Lxy[2] result not displayed, 1 – Lxy[2] result displayed
6	DOSE	0 – DOSE result not displayed, 1 - DOSE result displayed
7	D_8h	0 – D_8h result not displayed, 1 - D_8h result displayed
8	LAV	0 – LAV result not displayed, 1 - LAV result displayed
9	L_eq	0 – Lxyeq[23] result not displayed, 1 – Lxyeq[23] result displayed
10	L_E	0 – LxyE[23] result not displayed, 1 - LxyE[23] result displayed
11	SEL8	0 – SEL8 result not displayed, 1 - SEL8 result displayed
12	E	0 – E result not displayed, 1 – E result displayed
13	E_8h	0 – E_8h result not displayed, E_8h 1 - result displayed
14	Lden	Reserved
15	LEPd	0 – LEPd result not displayed, 1 - LEPd result displayed
16	PSEL	0 – PSEL result not displayed, 1 - PSEL result displayed
17	Ltm3	0 – Ltm3 result not displayed, 1 - Ltm3 result displayed
18	Ltm5	0 – Ltm5 result not displayed, 1 - Ltm5 result displayed
19	Ln	0 – Ln result not displayed, 1 - Ln result displayed
20	PTC	0 – PTC result not displayed, 1 - PTC result displayed
21	PTP	0 – PTP result not displayed, 1 - PTP result displayed
22	ULT	0 – ULT result not displayed, 1 - ULT result displayed
23	TWA	0 – TWA result not displayed, 1 - TWA result displayed
24	PrDOSE	0 – PrDOSE result not displayed, 1 - PrDOSE result displayed
25	PrTWA	0 – PrTWA result not displayed, 1 - PrTWA result displayed
26	LR15	Reserved
27	LR60	Reserved
28	LCA	0 – Lc-a result not displayed, 1 – Lc-a result displayed
29	OVL	0 – OVL result not displayed, 1 - OVL result displayed
30	NoMotion	0 – NoMotion result not displayed, 1 - NoMotion result displayed
…	…	…

[1] x - depends of the filter type for Peak result calculation in selected profile: A, C, Z (cf. Tab. B.1.12)
[2] x - depends of the filter type in selected profile: A, C, Z (cf. Tab. B.1.12)
y - depends of the detector type in selected profile: I (imp.), F (fast), S (slow) (cf. Tab. B.1.12)
[3] y - only for exponential detector's type (cf. Tab. B.1.6)

Table B.1.14. Header of the statistical analysis

Word number	Name	Comment
0	0xnn09	[09, nn=block's length]
1	0x040F	[0x04=number of profiles, 0x0F=active profiles mask]

2	0xmm0A	[0A, mm=sub-block's length]
3	NofClasses[1]	number of classes in the first profile (120)
4	BottomClass[1]	bottom class boundary (*10 dB) in the first profile
5	ClassWidth[1]	class width (*10 dB) in the first profile
6	0xmm0A	[0A, mm=sub-block's length]
7	NofClasses[2]	number of classes in the second profile (120)
8	BottomClass[2]	bottom class boundary (*10 dB) in the second profile
9	ClassWidth[2]	class width (*10 dB) in the second profile
10	0xmm0A	[0A, mm=sub-block's length]
11	NofClasses[3]	number of classes in the third profile (120)
12	BottomClass[3]	bottom class boundary (*10 dB) in the third profile
13	ClassWidth[3]	class width (*10 dB) in the third profile
14	0xmm0A	[0A, mm=sub-block's length]
15	NofClasses[4]	number of classes in the fourth profile (120)
16	BottomClass[4]	bottom class boundary (*10 dB) in the fourth profile
17	ClassWidth[4]	class width (*10 dB) in the fourth profile
…	…	…

Table B.1.15. Header of the file from the logger

Word number	Name	Comment
0	0xnn0F	[0F, nn=header's length]
1	BuffTSec	logger time step - full seconds part
2	BuffTMilisec	logger time step - milliseconds part
3	LowestFreq	the lowest **1/1 OCTAVE** or **1/3 OCTAVE** frequency (*100 Hz)
4	NOctTer	number of **1/1 OCTAVE** or **1/3 OCTAVE** results
5	NOctTerTot	number of **TOTAL** values
6..7	BuffLength	logger length (bytes)
8..9	RecsInBuff	number of records in the logger
10..11	RecsInObserv	number of records in the observation period equal to: number of records in the logger + number of records not saved
12..13	AudioRecords	number of audio records in the logger
…	…	…

Note: *The current logger time step in seconds can be obtained from the formulae:*
T = BuffTSec + BuffTMillisec / 1000

Table B.1.16. Contents of the file from the logger

Word number	Name	Comment
0..(BuffLength/2-1)		result#1, result#2, ... result#(BuffLength/2-1)

Table B.1.17. Main results (saved in Summary Results Record)

Word number	Name	Comment
0	0xnn07	[07, nn=block's length]
1	0x040F	[0x04=number of profiles, 0x0F=active profiles mask]
2	0xmm08	[08, mm=sub-block's length]
3..4	MeasureTime	time of the measurement
5	Result[1][1]	Lxpeak[1] value in the 1st profile (*100 dB)
6	Result[1][2]	LxyE[23] value in the 1st profile (*100 dB)
7	Result[1][3]	maximal value (Lxymax[2]) in the 1st profile (*100 dB)
8	Result[1][4]	minimal value (Lxymin[2]) in the 1st profile (*100 dB)
9	Result[1][5]	Lxy[2] value in the 1st profile (*100 dB)
10	Result[1][6]	Lxyeq[23] value in the 1st profile (*100 dB)
11	Result[1][7]	Lc-a (LCeq-LAeq) value (*100 dB)
12	Result[1][8]	**Ltm3** value in the 1st profile (*100 dB)
13	Result[1][9]	**Ltm5** value in the 1st profile (*100 dB)
14	Result[1][10]	**LAV** value in the 1st profile (*100 dB)
15	Result[1][11]	**TLAV** value in the 1st profile (*100 dB)
16	UnderRes[1]	under-range value in the 1st profile
17..18	ULTime[1]	**ULT** value in the 1st profile (sec.)
19..20	PTC[1]	**PTC** value in the 1st profile
21	UnitFlags	flags word for measurement cycle (definition in table B.1.6)
22	0xmm08	[08, mm=sub-block's length]
23..24	OVL	overlad time
25	Result[2][1]	Lxpeak[1] value in the 2nd profile (*100 dB)
26	Result[2][2]	LxyE[23] value in the 2nd profile (*100 dB)
27	Result[2][3]	maximal value (Lxymax[2]) in the 2nd profile (*100 dB)
28	Result[2][4]	minimal value (Lxymin[2]) in the 2nd profile (*100 dB)
29	Result[2][5]	Lxy[2] value in the 2nd profile (*100 dB)
30	Result[2][6]	Lxyeq[23] value in the 2nd profile (*100 dB)
31	Result[2][7]	reserved

32	Result[2][8]	**Ltm3** value in the 2nd profile (*100 dB)
33	Result[2][9]	**Ltm5** value in the 2nd profile (*100 dB)
34	Result[2][10]	**LAV** value in the 2nd profile (*100 dB)
35	Result[2][11]	**TLAV** value in the 2nd profile (*100 dB)
36	UnderRes[2]	under-range value in the 2nd profile
37..38	ULTime[2]	**ULT** value in the 2nd profile (sec.)
39..40	PTC[2]	**PTC** value in the 2nd profile
41	UnitFlags	flags word for measurement cycle (definition in table B.1.6)
42	0xmm08	[08, mm=sub-block's length]
43..44	NoMotion	No Motion Time (sec.)
45	Result[3][1]	Lxpeak[1] value in the 3rd profile (*100 dB)
46	Result[3][2]	LxyE[23] value in the 3rd profile (*100 dB)
47	Result[3][3]	maximal value (Lxymax[2]) in the 3rd profile (*100 dB)
48	Result[3][4]	minimal value (Lxymin[2]) in the 3rd profile (*100 dB)
49	Result[3][5]	Lxy[2] value in the 3rd profile (*100 dB)
50	Result[3][6]	Lxyeq[23] value in the 3rd profile (*100 dB)
51	Result[3][7]	reserved
52	Result[3][8]	**Ltm3** value in the 3rd profile (*100 dB)
53	Result[3][9]	**Ltm5** value in the 3rd profile (*100 dB)
54	Result[3][10]	**LAV** value in the 3rd profile (*100 dB)
55	Result[3][11]	**TLAV** value in the 3rd profile (*100 dB)
56	UnderRes[3]	under-range value in the 3rd profile
57..58	ULTime[3]	**ULT** value in the 3rd profile (sec.)
59..60	PTC[3]	**PTC** value in the 3rd profile
61	UnitFlags	flags word for measurement cycle (definition in table B.1.6)
62	0xmm08	[08, mm=sub-block's length]
63..64	reserved	Reserved
65	Result[3][1]	Lxpeak[1] value in the 4th profile (*100 dB)
66	Result[3][2]	LxyE[23] value in the 4th profile (*100 dB)
67	Result[3][3]	maximal value (Lxymax[2]) in the 4th profile (*100 dB)
68	Result[3][4]	minimal value (Lxymin[2]) in the 4th profile (*100 dB)
69	Result[3][5]	Lxy[2] value in the 4th profile (*100 dB)
70	Result[3][6]	Lxyeq[23] value in the 4th profile (*100 dB)
71	Result[3][7]	Reserved
72	Result[3][8]	**Ltm3** value in the 4th profile (*100 dB)

73	Result[3][9]	**Ltm5** value in the 4th profile (*100 dB)
74	Result[3][10]	**LAV** value in the 4th profile (*100 dB)
75	Result[3][11]	**TLAV** value in the 4th profile (*100 dB)
76	UnderRes[3]	under-range value in the 4th profile
77..78	ULTime[3]	**ULT** value in the 4th profile (sec.)
79..80	PTC[3]	**PTC** value in the 4th profile
81	UnitFlags	flags word for measurement cycle (definition in table B.1.6)
…	…	…

[1] x - depends of the filter type for Peak result calculation in selected profile: A, C, Z (cf. Tab. B.1.12)
[2] x - depends of the filter type in selected profile: A, C, Z (cf. Tab. B.1.12)
y - depends of the detector type in selected profile: I (imp.), F (fast), S (slow) (cf. Tab. B.1.12)
[3] y - only for exponential detector's type (cf. Tab. B.1.6)

Table B.1.18. Statistical levels (saved in Summary Results Record)

Word number	Name	Comment
0	0xnn17	[17, nn=block's length]
1	0x040F	[0x04=number of profiles, 0x0F=active profiles mask]
2	N_stat_level	number of statistical levels = N
3+i*(pp+1)	nn[i]	number of the **Lnn** statistics; i=0..N-1
3+i*(pp+1)+p	**Lnn**[i,p]	value of the **Lnn** statistics for profile p (p=1..pp) (*100 dB)
…	…	…

Table B.1.19. 1/1 OCTAVE analysis results (saved in Summary Results Record)

Word number	Name	Comment
0	0xnn0E, 0xnn26, 0xnn27	[block_id, nn=block_length] 0xnn**0E** - averaged spectrum results, 0xnn**26** - min. spectrum results, 0xnn**27** - max. spectrum results
1	0x0101	[used_profile, profile's mask]
2	LowestFreq	the lowest **1/1 OCTAVE** frequency (*100 Hz): 3150 (**AUDIO BAND**)
3	NOct	number of **1/1 OCTAVE** values: 9 (**AUDIO BAND**)
4	NOctTot	number of **TOTAL** values: 3
5÷20	Octave[i]	1/1 octave[i] value (*100 dB); i=1÷NOct+NoctTot (1÷13)
…	…	…

Table B.1.20. 1/3 OCTAVE analysis results (saved in Summary Results Record)

Word number	Name	Comment
0	0xnn10, 0xnn28, 0xnn29	[block_id, nn=block_length] 0xnn1**0** - averaged spectrum results, 0xnn**28** - min. spectrum results, 0xnn**29** - max. spectrum results
1	0x0101	[used_profile, profile's mask]
2	LowestFreq	the lowest **1/3 OCTAVE** frequency (*100 Hz): 2000 (**AUDIO BAND**)
3	NTer	number of **1/3 OCTAVE** values: 28 (**AUDIO BAND**)
4	NTerTot	number of **TOTAL** values: 3
5÷50	Tercje[i]	1/3 octave[i] value (*100 dB); i=1÷NTer+NTerTot (1÷34)
…	…	…

Table B.1.21. Results of the statistical analysis in profiles (saved in Summary Results Record)

Word number	Name	Comment
0	0x010B	[0B, prof_mask#1]
1	SubblockLength	2 * number of classes in the first profile + 2
2..3	Histogram[1][1]	the first counter in the first profile
4..5	Histogram[1][2]	the second counter in the first profile
.....	.....	.....
0	0x020B	[0B, prof_mask#2]
1	SubblockLength	2 * number of classes in the second profile + 2
2..3	Histogram[2][1]	the first counter in the second profile
4..5	Histogram[2][2]	the second counter in the second profile
.....	.....	.....
0	0x040B	[0B, prof_mask#3]
1	SubblockLength	2 * number of classes in the third profile + 2
2..3	Histogram[3][1]	the first counter in the third profile
4..5	Histogram[3][2]	the second counter in the third profile
.....	.....	.....
0	0x080B	[0B, prof_mask#4]
1	SubblockLength	2 * number of classes in the third profile + 2
2..3	Histogram[4][1]	the first counter in the third profile
4..5	Histogram[4][2]	the second counter in the third profile
.....	.....	.....

Table B.1.22. SETUP file

Word number	Name	Comment
0	0x0020	[20, 00=block's length in the second word]
1	BlockLength	length of the block
2..BlockLength-1	SetupTextData	saved setup values

Table B.1.23. File-end-marker

Word number	Name	Comment
0	0xFFFF	file end marker

Table B.1.24. Unit text info

Word number	Name	Comment
0	0xnn58	[58, nn=block's length]
1	"UN"	Unit name header
2..8	UnitName	Unit name
9	"SE"	Setup name header
10..14	SetupName	Setup name
15	"P1"	1st profile name header
16..20	ProfileName[1]	1st profile name
21	"P2"	2nd profile name header
22..26	ProfileName[2]	2nd profile name
27	"P3"	3rd profile name header
28..32	ProfileName[3]	3rd profile name
33	"P4"	4th profile name header
34..38	ProfileName[4]	4th profile name
.....	.....	.....

Table B.1.25. Header of the Summary Results Record (saved in Summary Results Record)

Word number	Name	Comment
0	0xnn59	[59, nn=header's length]
1..2	RecNumber	Summary Results Record number: 1..
…	…	…

B.2 STRUCTURE OF THE FILE CONTAINING RESULTS FROM LOGGER'S FILE

SvanPC file header - cf. Tab. B.1.1.

File header - cf. Tab. B.1.2.

Unit and software specification - cf. Tab. B.1.3.

Calibration settings - cf. Tab. B.1.4.

USER'S text - cf. Tab. B.1.5.

Unit text info - cf. Tab. B.1.24.

Parameters and global settings - cf. Tab. B.1.6.

Wave-file recording parameters - cf. Tab. B.1.10.

Special settings for profiles - cf. Tab. B.1.12.

Display settings of the main results - cf. Tab. B.1.13.

Header of the statistical analysis - cf. Tab. B.1.14.

Header of the file from the logger - cf. Tab. B.1.15.

Contents of the file from the logger - cf. Tab. B.1.16. and the description in B.2.1.

B.2.1 The contents of the files in the logger

The records with the results and the records with the state of the markers as well as the records with the breaks in the results registration are saved in the files in the logger. All results are written in dB*100.

B.2.1.1 Record with the results

The contents of the record with the results depends on the selected measurement function and the value set in the **LOGGER** position of the **PROFILE x** and **SPECTRUM** sub-lists. The following elements can be present (in the given sequence):

- flag record

< flags > :

- b0: 1- the overload detected, 0 - the overload not detected
- b1: 1- the excessive self-vibration detected, 0 - the excessive self-vibration not detected
- b2: 1- the No Motion detected, 0 - the No Motion not detected

- results of the measurement from the first profile if the corresponding **LOGGER** position was active (BufferP [1] in Tab. B.1.12); up to five words are written:

<result1> - Lxpeak[1] result, depending on the value of BufferP[1] (cf. Tab. B.1.12)
<result2> - Lxymax[2] result, depending on the value of BufferP[1] (cf. Tab. B.1.12)
<result3> - Lxymin[2] result, depending on the value of BufferP[1] (cf. Tab. B.1.12)
<result4> - Lxyeq[23] result, depending on the value of BufferP[1] (cf. Tab. B.1.12)
<result5> - **LAV** result, depending on the value of BufferP[1] (cf. Tab. B.1.12)

- results of the measurement from the second profile if the corresponding **LOGGER** position was active (BufferP [2] in Tab. B.1.12); up to five words are written:

<result1> - Lxpeak[1] result, depending on the value of BufferP[2] (cf. Tab. B.1.12)
<result2> - Lxymax[2] result, depending on the value of BufferP[2] (cf. Tab. B.1.12)
<result3> - Lxymin[2] result, depending on the value of BufferP[2] (cf. Tab. B.1.12)
<result4> - Lxyeq[23] result, depending on the value of BufferP[2] (cf. Tab. B.1.12)
<result5> - **LAV** result, depending on the value of BufferP[2] (cf. Tab. B.1.12)

- results of the measurement from the third profile if the corresponding **LOGGER** position was active (BufferP [3] in Tab. B.1.12); up to five words are written:

<result1> - Lxpeak[1] result, depending on the value of BufferP[3] (cf. Tab. B.1.12)
<result2> - Lxymax[2] result, depending on the value of BufferP[3] (cf. Tab. B.1.12)
<result3> - Lxymin[2] result, depending on the value of BufferP[3] (cf. Tab. B.1.12)
<result4> - Lxyeq[23] result, depending on the value of BufferP[3] (cf. Tab. B.1.12)
<result5> - **LAV** result, depending on the value of BufferP[3] (cf. Tab. B.1.12)

- results of the measurement from the third profile if the corresponding **LOGGER** position was active (BufferP [4] in Tab. B.1.12); up to five words are written:

<result1> - Lxpeak[1] result, depending on the value of BufferP[4] (cf. Tab. B.1.12)
<result2> - Lxymax[2] result, depending on the value of BufferP[4] (cf. Tab. B.1.12)
<result3> - Lxymin[2] result, depending on the value of BufferP[4] (cf. Tab. B.1.12)
<result4> - Lxyeq[23] result, depending on the value of BufferP[4] (cf. Tab. B.1.12)
<result5> - **LAV** result, depending on the value of BufferP[4] (cf. Tab. B.1.12)

1	x - depends of the filter type for Peak result calculation in selected profile: A, C, Z (cf. Tab. B.1.12)
2	x - depends of the filter type in selected profile: A, C, Z (cf. Tab. B.1.12) y - depends of the detector type in selected profile: I (imp.), F (fast), S (slow) (cf. Tab. B.1.12)
3	y - only for exponential detector's type (cf. Tab. B.1.6)

- results of **1/1 OCTAVE** analysis or **1/3 OCTAVE** analysis if **1/1 OCTAVE** analysis or **1/3 OCTAVE** analysis was selected as the measurement function and the **LOGGER** was active (SpectrumBuff in Tab. B.1.6);
  the sequence of words is written:

<Octave Leq[1]> <Octave Leq[2]> ... <Octave Leq[NOct+NOctTot]>

where:
Octave Leq[i] - the result of **1/1 OCTAVE** or **1/3 OCTAVE** Leq analysis (*100 dB); i = 1..NOct+NOctTot

B.2.1.2 Record with the state of the markers

The record with the state of the markers consists of one word:

<0x8nnn>

in which 12 bits nnn denote the state of the markers:

b11 = state of #12 marker

b10 = state of #11 marker

...

b1 = state of #2 marker

b0 = state of #1 marker

B.2.1.3 Record with the breaks in the results registration

The record with the breaks in the results registration consists of four words:

<0xB0ii> <0xB1jj> <0xB2kk> <0xB3nn>

in which ii, jj, kk, nn bytes denote 4-bytes counter of left or skipped records: nnkkjjii (ii is the least significant byte, nn – the most significant byte).

B.2.1.4 Record with the breaks account PAUSE in the results registration

The record with the breaks in the results registration consists of four words:

<0xA0ii> <0xA1jj> <0xA2kk> <0xA3nn>

in which ii, jj, kk, nn bytes denote 4-bytes counter duration of PAUSE in milliseconds:

nnkkjjii (ii is the least significant byte, nn - the most significant byte).

B.2.1.5 Record with the wave file name

The record with the wave file name consists of six words:

<0xC2aa>

<0xccbb>

<0xeedd>

<0xggff>

<0xiihh>

<0xCAaa>

in which:

aa - size of records,

bb cc dd ee ff gg hh ii - 8-bytes name of wave file name

B.2.1.6 Record with Summary Results

The format of the data frame is as follows:

HS	L (optional)	D	L (optional)	HE

where:

HS starting header (1 word)

L length of the block (field is optional and occurs only when b7..b0 in header are set to zero)

D Summary Data:
- Header of the Summary Results Record (cf. Tab. B.1.25)
- Main results (cf. Tab. B.1.17)
- Statistical levels (optional, cf. Tab. B.1.18)
- 1/1 OCTAVE analysis results (optional, cf. Tab. B.1.19)
- 1/3 OCTAVE analysis results (optional, cf. Tab. B.1.20)
- The results of the statistical analysis in profiles(optional, cf. Tab. B.1.21)

HE ending header (1 word), which differs from the HS only on b11 bit (thanks to it, it is possible to analyse the recorded file starting from its end)

The HEADER format is as follows:

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

where:

b15 - 1
b14 - 1
b13 - 0
b12 - 0,
b11 - header type:

0 - HS

1 - HE

b10 - 0

b9 - 1

b8 - 1

b15÷b8 – HS (0xC3), HE (0xCB)
b7÷b0 – length of the block (if zero length of the block is saved in additional word L)

B.2.1.8 ***Record with name of the comment file***

The format of the data frame is as follows:

HS	D	HE

where:

HS starting header (1 word)
D The full name of the comment file (e.g. “REC62.WAV”).
HE ending header (1 word), which differs from the HS only on b11 bit (thanks to it, it is possible to analyse the recorded file starting from its end)

The HEADER format is as follows:

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

where:

b15 - 1
b14 - 1
b13 - 0
b12 - 0,
b11 - header type:

0 - HS

1 - HE

b10 - 1

b9 - 0

b8 - 0

b15÷b8 – HS (0xC4), HE (0xCC)
b7÷b0 – length of the block

B.3 Structure of the SETUP file

SvanPC file header - cf. Tab. B.1.1.

File header - cf. Tab. B.1.2.

Unit and software specification - cf. Tab. B.1.3.

SETUP DATA - cf. Tab. B.1.22.

File-end-marker - cf. Tab. B.1.23.

B.4 Date and time

Following function written in C explain how the date and time are coded:

```
void ExtractDateTime(int date, unsigned int time, int dt[])
{
      dt[0] = time % 30;                  /* sec */
      dt[1] = (time/30) % 60;             /* min */
      dt[2] = time/1800;                  /* hour */

      dt[3] = date & 0x001F;              /* day */
      dt[4] = (date>>5) & 0x000F;         /* month */
      dt[5] = (date>>9) & 0x007F + 2000;  /* year */
}
```

APPENDIX C TECHNICAL SPECIFICATIONS

C.1 SPECIFICATION OF SV 104BIS AS DOSIMETER

C.1.1 Specification of SV 104BIS as dosimeter in standard configuration

Statement of performance

SV 104BIS dosimeter with all listed below accessories meets requirements of IEC 61672-1:2013 for Class 2 Group X instruments and IEC 61252 ed1.2 (2017) for personal sound exposure meters of one accuracy grade.

Configuration of the complete SLM and with its normal mode of operation:

SV 104BIS	dosimeter/analyser including ST 104CIS microphone (1/2", nominal sensitivity 1 mV/Pa, polarization 0 V) and SA 122BIS windscreen
Recommended calibrator	
SV 34B	Class 2 acoustic calibrator 114 dB@1000 Hz or equivalent (not included in the standard set)

Accessories included in SV 104BIS instrument set

ST 104CIS	½ MEMS microphone
SA 122BIS	windscreen

Measured quantities

The measured quantities for *DOSE METER* mode are: **Time, Lpeak, Lmax, Lmin,** SPL (**L**)**, DOSE, D_8h, PrDOSE, Lav, Leq,** SEL (**LE**)**, SEL8, E, E_8h, LEPd, PSEL, Ltm3, Ltm5,** Leq statistics (**Ln**)**, PTC, PTP, ULT, TWA, PrTWA, Lc-a.** Definitions for measured quantities are given in Appendix D.

Conformance testing

This chapter contains the information needed to conduct conformance testing according to the specified standards.

Mounting for acoustical tests	The microphone must be mounted on the instrument.
Electrical substitute for the microphone	To obtain a BNC Class electrical input, the microphone must be replaced by an electrical microphone impedance adapter SC 104AT **before turning the instrument on**. Total microphone substitute impedance is 125 Ω.

Note: *The recommended time interval for periodic test of noise exposure meter for checking its acoustic and electrical working characteristics is one year.*

Note: *For the conformance electrical tests the* ***Microphone Compensation*** *must be disabled (see Chapter 4.15).*

Note: *For the conformance acoustical tests with the microphone the* ***Microphone Compensation*** *must be enabled (see Chapter 4.15).*

For the comparison coupler evaluation, the ***Free Field*** *compensation must be disabled.*

For the free filed evaluation, the ***Free Filed*** *compensation must be enabled.*

Linear Operating Ranges

The starting point at which tests of level linearity shall begin is 114.0 dB for the frequencies specifies below.

Linear operating range for the sinusoidal signal and microphone sensitivity 1 mV/Pa

Single measuring range – see table below.

Table C.1. Linear operating ranges for Leq

[dB]	$L_{AS/F}$		$L_{CS/F}$		$L_{ZS/F}$		L_{AeqT}		L_{CeqT}		L_{AE} (t_{int} = 2 s)		L_{Cpeak}	
	from	to	from	to	from	to	from	to	from	to	from	to	from	to
31.5 Hz	53	98.6	55	135	65	138	53	98.6	55	135	53	101.6	70	138
500 Hz	53	134.8	55	138	65	138	53	134.8	55	138	53	137.8	70	141
1 kHz	53	138	55	138	65	138	53	138	55	138	53	141	70	141
4 kHz	53	139	55	137.2	65	138	53	139	55	137.2	53	142	70	140.2
8 kHz	53	136.9	55	135	65	138	53	136.9	55	135	53	139.9	70	139

Note: *For the signals with the crest factor* ***n >1.41*** *upper measuring range of the RMS (****LEQ*** *and* ***SPL****) is reduced. The valid upper limit can be calculated according to the below given formula:*

$A_n = 140 - 20\,log(n/\sqrt{2})$, *where* ***A*** *is the upper limit for the sinusoidal signal*

Example: *For the crest factor* ***n = 10*** *the upper limit is* A_{10} = ***123 dB***

Measurement frequency range of the acoustic pressure (-3 dB): 20 Hz – 10000 Hz

Basic measurement error of the acoustic pressure	< 1 dB (measured for the reference conditions, see below).
Noise exposure values displayed range	0.01Pa²h ÷ 99.99 Pa²h
Noise exposure values displayed resolution	0.01 Pa²h

Note: *Instrument can measure wider Sound Exposure (****E****) range than displayed. Based on the measured* ***Leq (dB)*** *value and exposure time* ***T (h), E = $p_0^2 T(10^{0.1 x Laqe,T})$***

Example: For the ***L_{Aeq} = 124 dB*** *and* ***T= 1h*** *exposure value* ***E = 1004 Pa²h***

Weighting filters

Z meeting requirements of IEC 61672-1:2013 for the Class 1 "**Z**" filter

A meeting requirement of IEC 61672-1:2013 for the Class 1 "**A**" filter

C meeting requirements of IEC 61672-1:2013 for the Class 1 "**C**" filter

Self-generated noise (electrical)

"A" weighting	< 43 dB
"C" weighting	< 45 dB
"Z" weighting	< 55 dB

Self-generated noise (acoustical compensated)

"A" weighting	< 48 dB
"C" weighting	< 50 dB
"Z" weighting	< 60 dB

RMS detector

Digital	"True RMS" with Peak detection,
Resolution	0.1 dB
Range	327.7 dB
Crest Factor	unlimited (for signals in 8 kHz bandwidth).

Overload detector

The instrument has the built-in overload detectors. Both A/D converter and input amplifier overload conditions are detected. The overload in the measurement channel (in its analogue part) and the overload of the analogue / digital converter are both detected. The "overload" indication appears when the input signal amplitude is 0.5 dB above the declared "Peak measurement range".

Underrange detector

The instrument has the built-in under-range detector. The "underrange" indication appears when the RMS value for the elapsed time is below the lower linear operating range.

Time weighting characteristics (Exponential averaging)

Slow	"**S**" according to IEC 61672-1:2013 Class 2, Equivalent Time Constant 1000 ms
Fast	"**F**" according to IEC 61672-1:2013 Class 2, Equivalent Time Constant 125 ms
Impulse	"**I**" according to IEC 61672-1:2013 Class 2, Equivalent Time Constant 35 ms, Hold Time 1500 ms

Reference conditions as per IEC 61252

Class of the acoustic field	Free field
Reference acoustic pressure	114.0 dB (related to 20 μPa)
Reference integration time	1 min
Reference noise exposure level	1.67 Pa^2h
Reference frequency	1000 Hz
Reference temperature	+20°C
Reference relative humidity	65 %
Reference static pressure	1013 hPa
Reference incidence direction	perpendicular to the microphone diaphragm

Calibration

Acoustical **-** with the **SV 34B** sound calibrator (or equivalent):

- Calibration level for the pressure field — 114.0 dB (equal to the calibrator pressure level - see calibration chart of the used calibrator)
- Calibration level for the Free Field — 113.82 dB (equal to the calibration level for the pressure field minus Free Field correction of ST 104CIS at 1000 Hz - see Table C.3)

Note: *The above levels correspond to 114 dB of calibrator's sound pressure. If the calibrator has a different sound pressure than 114 dB, the calibration levels must be accordingly adjusted.*

Maximum peak voltage 3 V Peak-Peak

Maximum peak voltage of input sinusoidal signal, which can be led to the electrical input without destruction to the meter.

Warm-up time: 1 minute (for 0.1 dB accuracy)

Typical stabilization time after change the temperature in environmental conditions by 20°C is 1 hour.

Nominal delay 1 second

Delay between operating of the "Reset-Button" and beginning of a new measurement.

Time shift after completion of a measurement, before a measurement is shown: < 1 second.

Note: *When the instrument is moved from a warm environment with high humidity, to a colder environment, care should be taken to avoid condensation inside the instruments. In such case, much longer stabilization periods may be necessary.*

Environmental, electrostatic and radio frequency criteria

Effect of humidity < 0.5 dB (for 30%<RH<90% at 40°C and 1000 Hz)

Effect of magnetic field meets requirements of IEC 61252 p.12.5 (below electrical noise level for 80 A/m @ 50/60 Hz)

The maximum susceptibility (the least immunity) is achieved when in the Dosimeter the **Z** filter and time weighting **F** are selected, and the dosimeter measurements are considered.

The maximum susceptibility is achieved when the dosimeter is placed in plane of the magnetic field test coil, so the vertical axis of dosimeter is in parallel with wiring of the test frame (Fig. C.1).

In addition, with microphone cable, the maximum susceptibility is achieved when the dosimeter and cable is placed along field and the cable is coil as solenoid.

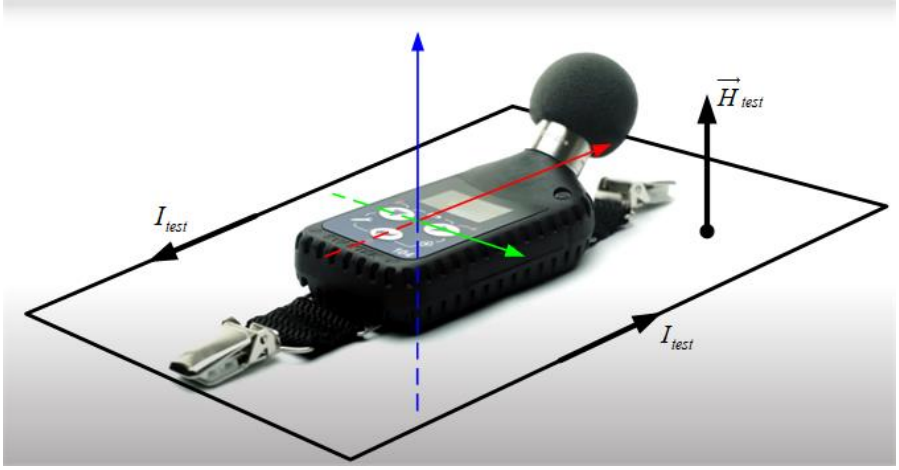


Figure C.1 SV 104BIS placed in magnetic field test coil in the direction of maximum response

Effect of radio frequency fields meets requirements of IEC 801-3:1984

Dosimeter use is allowed in the presence of an electromagnetic field whose source does not exceed the level of:

a) 10 V/m in the frequency range from 80 MHz to 1000 MHz,

b) 3 V/m in the frequency range from 1000 MHz to 6000 MHz.

Limitations of use: according to IEC 801-3 or IEC 1000-4-3 or EN 61000-4-3

Effect of electrostatic discharge meets requirements of IEC 801-2:1984

Dosimeter can be used without interrupting the continuity of operation, without changing the operating mode and configuration, without corruption or loss of the stored data, in presence of electrostatic discharge, the source of which does not exceed the level of:

a) +/- 4 kV for contact discharge,

b) +/- 8 kV for air discharge.

Limitations of use: according to IEC 801-2 or IEC 1000-4-2 or EN 61000-4-2

Effect of ambient pressure compensated within the range 65 ÷ 108 kPa

Effect of temperature range < 1.0 dB (from -10°C to +50°C)

Effect of vibration

For mechanical vibration with an acceleration of 1 m/s² vertically to the membrane of the microphone for the frequencies 31,5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 630 Hz, 800 Hz and 1000 Hz **increases the low level of the linear operation range to 70 dB for the frequency weighting "A".**

For mechanical vibration with an acceleration of 1 m/s² parallel to the membrane of the microphone for the frequencies 31,5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 630 Hz, 800 Hz and 1000 Hz **increases the low level of the linear operation range to 80 dB for the frequency weighting "A".**

Operating temperature range	from -10°C to +50°C
Storage temperature range	from -20°C to +50°C
Charging temperature range	from 0°C to +40°C

Microphone

ST 104CIS	MEMS type (½" housing)
Nominal sensitivity	1 mV/Pa (corresponding to app. -60 dBV/Pa re 1 V/Pa)
Impedance	350 Ohm
Static pressure coefficient	0.02 dB/kPa

Note: *Maximum sound pressure level that can affect the microphone without destroying the microphone: 160 dB.*

ST 104CIS and SV 104BIS frequency characteristics

The instrument should be mounted so that the microphone diaphragm is perpendicular to the direction of the sound wave.

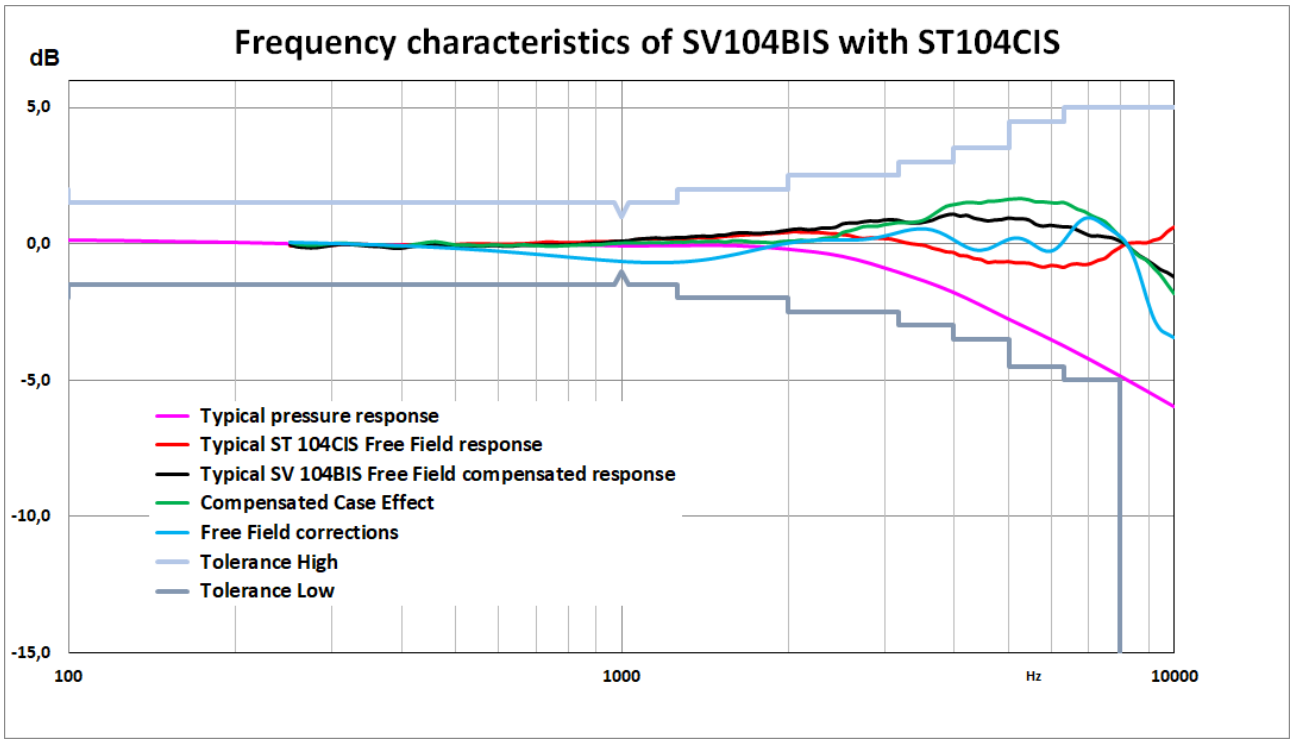


Figure C.2 SV 104BIS frequency characteristics

Table C.2. ST 104CIS Free Field corrections using the Bruel & Kjaer 4226

Corrections [dB]	Frequency [Hz]								
	31.5	63	125	250	500	1000	2000	4000	8000
Typical pressure response	-0.70	-0.10	0.00	0.00	0.00	0.10	0.20	-1.20	-3.90
Free Field corrections	0	0	0	-0.07	0.00	0.00	0.21	0.98	3.69
Uncertainty (IEC 62585)	--	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.35

Table C.3. ST 104CIS Free Field corrections using the G.R.A.S. 51AB comparison coupler and the reference 1/2“ B&K 4192 microphone

Corrections [dB]	Frequency [Hz]									
	31.5	63	125	250	500	1000	2000	4000	8000	10000
Typical pressure response	-0.67	0.01	0.11	0.00	-0.05	-0.08	-0.20	-1.78	-4.83	-5.98
Free Field corrections	0	0	0	-0.07	0.05	0.18	0.61	1.56	4.62	6.61
Uncertainty (IEC 62585)	--	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.35	0.35

Table C.4. ST 104CIS and SV 104BIS typical frequency characteristics

Frequency [Hz]	ST 104CIS Free Field response [dB]	SV 104BIS compensated Free Field response [dB]	Compensated case effect [dB]	Uncertainty (IEC 62585:2012) [dB]
251	-0.07	-0.02	0.05	0.25
259	-0.07	-0.10	-0.03	0.25
266	-0.07	-0.17	-0.10	0.25
274	-0.05	-0.15	-0.10	0.25
282	-0.07	-0.15	-0.08	0.25
290	-0.07	-0.10	-0.03	0.25
299	-0.07	-0.04	0.03	0.25
307	-0.02	0.02	0.05	0.25
316	0.00	0.06	0.06	0.25
325	0.00	0.01	0.00	0.25
335	-0.02	-0.09	-0.07	0.25
345	-0.01	-0.10	-0.08	0.25
355	-0.03	-0.07	-0.05	0.25
365	-0.05	-0.07	-0.02	0.25
376	-0.06	-0.08	-0.02	0.25
387	-0.06	-0.14	-0.07	0.25
398	-0.06	-0.24	-0.18	0.25
410	-0.03	-0.24	-0.21	0.25
422	-0.03	-0.07	-0.03	0.25
434	-0.02	0.12	0.14	0.25
447	-0.07	0.06	0.12	0.25
460	-0.07	-0.06	0.01	0.25
473	-0.07	-0.07	0.00	0.25
487	-0.04	0.01	0.05	0.25
501	0.00	0.00	0.00	0.25

Frequency [Hz]	ST 104CIS Free Field response [dB]	SV 104BIS compensated Free Field response [dB]	Compensated case effect [dB]	Uncertainty (IEC 62585:2012) [dB]
516	0.00	-0.13	-0.13	0.25
531	0.02	-0.16	-0.17	0.25
546	0.02	-0.01	-0.02	0.25
562	-0.02	0.03	0.05	0.25
579	-0.01	-0.08	-0.07	0.25
596	0.00	-0.15	-0.15	0.25
613	0.02	-0.06	-0.08	0.25
631	-0.01	-0.01	-0.01	0.25
649	-0.02	-0.08	-0.06	0.25
668	-0.02	-0.10	-0.08	0.25
688	0.02	0.00	-0.02	0.25
708	0.07	0.02	-0.05	0.25
729	0.08	-0.03	-0.11	0.25
750	0.07	-0.06	-0.12	0.25
772	0.11	-0.05	-0.16	0.25
794	0.01	-0.04	-0.06	0.25
818	0.01	0.02	0.01	0.25
841	0.02	-0.01	-0.03	0.25
866	0.09	-0.01	-0.11	0.25
891	0.13	0.04	-0.09	0.25
917	0.12	0.06	-0.05	0.25
944	0.05	0.10	0.05	0.25
972	0.04	0.02	-0.01	0.25
1000	0.10	0.15	0.05	0.25
1029	0.18	0.17	0.00	0.25
1059	0.10	0.11	0.01	0.25
1090	0.10	0.19	0.10	0.25
1122	0.28	0.26	-0.01	0.25
1155	0.25	0.26	0.00	0.25
1189	0.17	0.26	0.09	0.25
1223	0.18	0.18	-0.01	0.25
1259	0.05	0.11	0.06	0.25
1296	0.25	0.33	0.08	0.25
1334	0.29	0.36	0.07	0.25
1372	0.18	0.22	0.04	0.25
1413	0.21	0.35	0.15	0.25
1454	0.24	0.21	-0.03	0.25
1496	0.21	0.34	0.13	0.25
1540	0.25	0.31	0.06	0.25
1585	0.35	0.46	0.11	0.25
1631	0.37	0.36	-0.01	0.25
1679	0.29	0.49	0.20	0.25
1728	0.33	0.48	0.15	0.25
1778	0.32	0.32	-0.01	0.25
1830	0.42	0.36	-0.05	0.25
1884	0.37	0.33	-0.04	0.25
1939	0.48	0.62	0.14	0.25
1995	0.41	0.52	0.10	0.25
2054	0.37	0.57	0.20	0.25

Frequency [Hz]	ST 104CIS Free Field response [dB]	SV 104BIS compensated Free Field response [dB]	Compensated case effect [dB]	Uncertainty (IEC 62585:2012) [dB]
2113	0.51	0.54	0.04	0.25
2175	0.55	0.53	-0.02	0.25
2239	0.35	0.66	0.31	0.25
2304	0.39	0.37	-0.02	0.25
2371	0.33	0.63	0.30	0.25
2441	0.46	0.80	0.35	0.25
2512	0.41	0.51	0.10	0.25
2585	0.31	0.80	0.50	0.25
2661	0.20	0.98	0.78	0.25
2738	0.20	0.79	0.60	0.25
2818	0.09	0.79	0.70	0.25
2901	0.23	0.77	0.54	0.25
2985	0.42	0.95	0.53	0.25
3073	0.12	0.92	0.80	0.25
3162	0.14	1.03	0.89	0.25
3255	0.01	0.88	0.87	0.25
3350	-0.08	0.65	0.73	0.25
3447	0.07	0.59	0.52	0.25
3548	-0.11	0.74	0.85	0.25
3652	-0.03	1.02	1.05	0.25
3758	-0.17	1.11	1.28	0.25
3868	-0.55	0.96	1.51	0.25
3981	-0.22	1.15	1.37	0.25
4097	-0.50	1.11	1.61	0.35
4217	-0.14	1.21	1.35	0.35
4340	-0.76	0.74	1.50	0.35
4467	-0.63	1.09	1.72	0.35
4597	-0.70	0.64	1.35	0.35
4732	-0.65	0.86	1.51	0.35
4870	-0.70	0.95	1.65	0.35
5012	-0.62	0.90	1.52	0.35
5158	-0.70	1.17	1.86	0.35
5309	-0.62	0.94	1.56	0.35
5464	-0.87	0.72	1.60	0.35
5623	-0.74	0.95	1.69	0.35
5788	-0.65	0.66	1.31	0.35
5957	-1.10	0.36	1.46	0.35
6131	-0.95	0.62	1.57	0.35
6310	-0.60	0.88	1.48	0.35
6494	-0.78	0.80	1.58	0.35
6683	-0.92	0.52	1.43	0.35
6879	-0.60	0.32	0.92	0.35
7079	-0.81	0.06	0.87	0.35
7286	-0.77	0.30	1.07	0.35
7499	-0.53	0.31	0.84	0.35
7718	-0.33	0.54	0.88	0.35
7943	-0.21	0.12	0.34	0.35
8175	0.27	-0.10	-0.36	0.35
8414	0.03	-0.21	-0.24	0.35

Frequency [Hz]	ST 104CIS Free Field response [dB]	SV 104BIS compensated Free Field response [dB]	Compensated case effect [dB]	Uncertainty (IEC 62585:2012) [dB]
8660	0.25	-0.28	-0.52	0.35
8913	-0.12	-0.66	-0.54	0.35
9173	-0.17	-0.87	-0.70	0.35
9441	0.20	-0.87	-1.07	0.35
9716	0.53	-1.05	-1.58	0.35
10000	0.63	-1.21	-1.84	0.35

Table C.5. SV 104BIS combined Free Field corrections (ST 104CIS + Compensated Case Effect) using the Bruel & Kjaer 4226

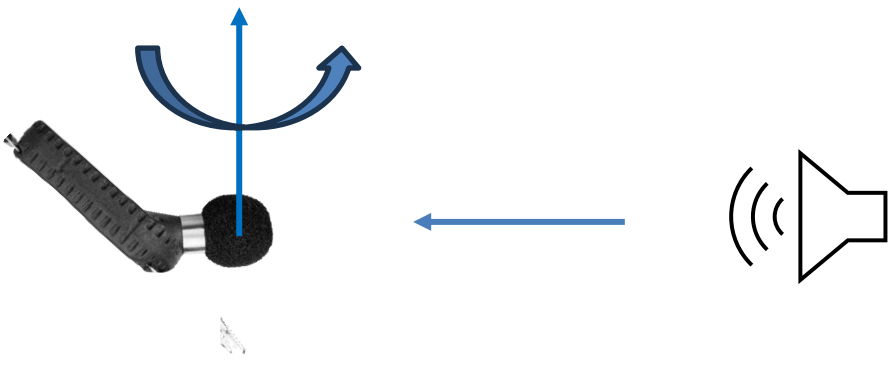
Corrections [dB]	Frequency [Hz]								
	31.5	63	125	250	500	1000	2000	4000	8000
Compensated Case Effect	0.00	0.00	0.00	0.05	0.00	0.05	0.10	1.37	0.34
Free Field corrections	0	0	0	-0.02	0.00	0.05	0.32	2.35	4.02
Uncertainty (IEC 62585)	--	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.35

Table C.6. SV 104BIS combined Free Field corrections (ST 104CIS + Compensated Case Effect) using the G.R.A.S. 51AB comparison coupler and the reference 1/2“ B&K 4192 microphone

Corrections [dB]	Frequency [Hz]									
	31.5	63	125	250	500	1000	2000	4000	8000	10000
Compensated Case Effect	0.00	0.00	0.00	0.05	0.00	0.05	0.10	1.37	0.34	-1.84
Free Field corrections	0	0	0	-0.02	0.05	0.23	0.71	2.93	4.95	4.77
Uncertainty (IEC 62585)	--	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.35	0.35

Directional characteristics of SV 104BIS

Directional response for the symmetrical axis of the SV 104BIS dosimeter with the **ST 104CIS** microphone and the **SA 122BIS** windscreen at specified frequencies (Table C.5):



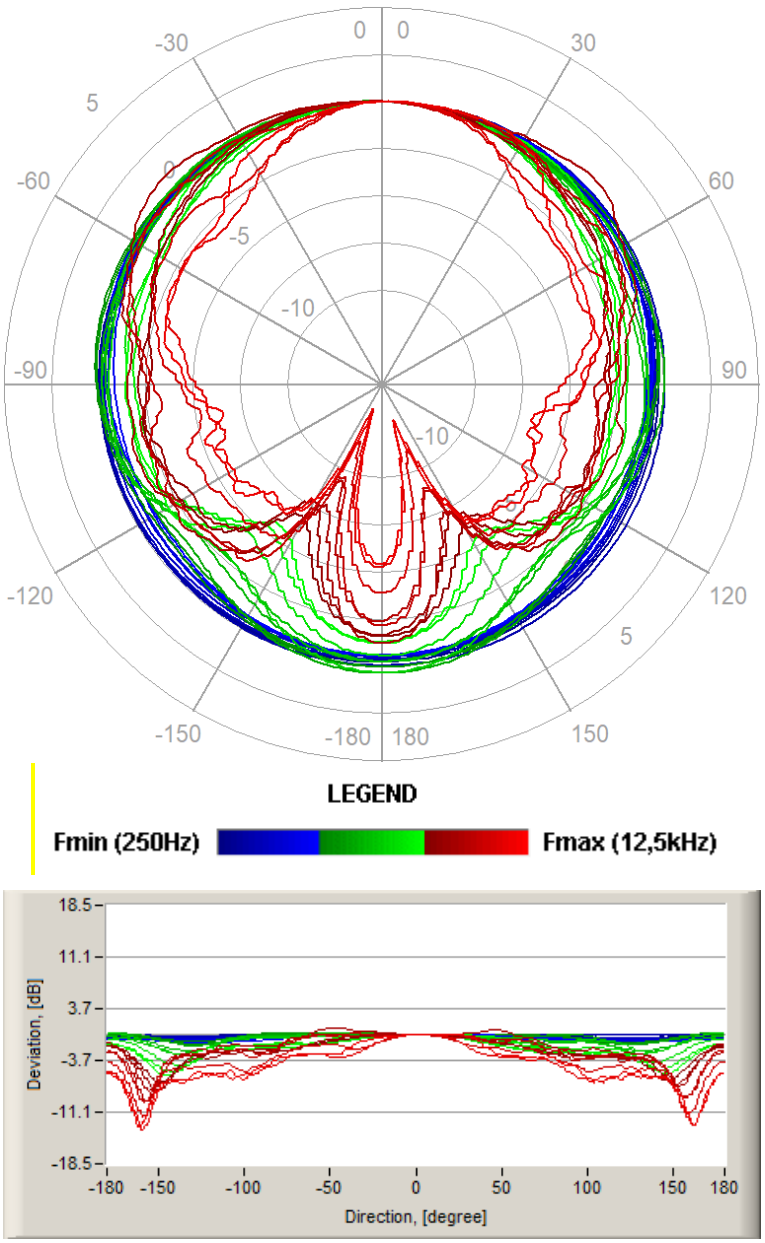
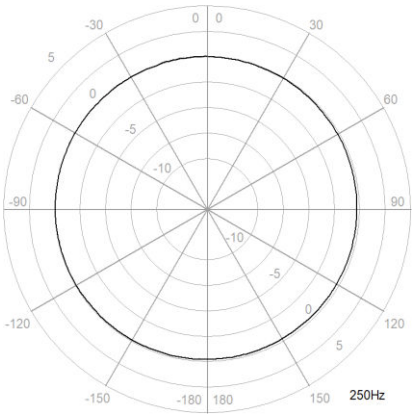
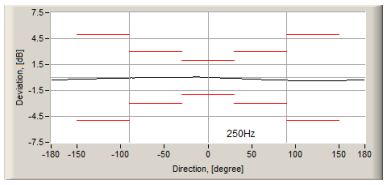


Figure C.3 Total directional characteristics (symmetrical axis)

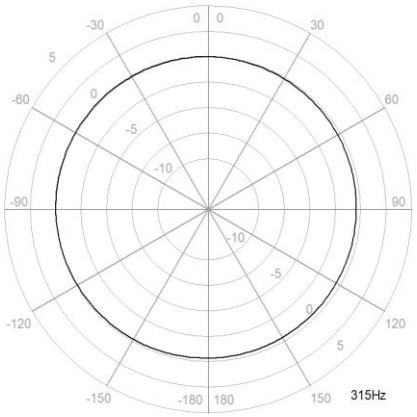
The round charts show the directional characteristic, and the charts below shows the errors for particular angles (note: limits are for class 1).

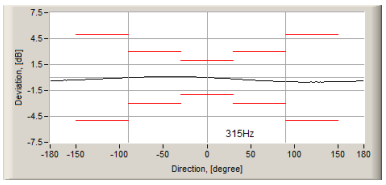
250 Hz



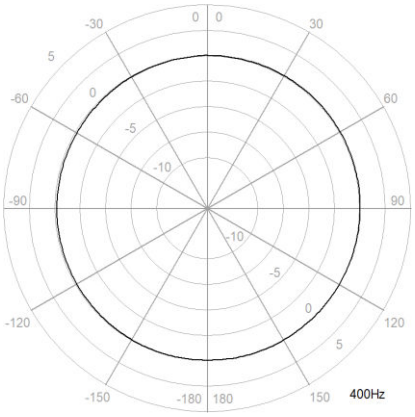


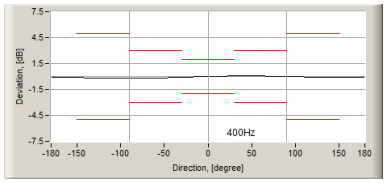
315 Hz



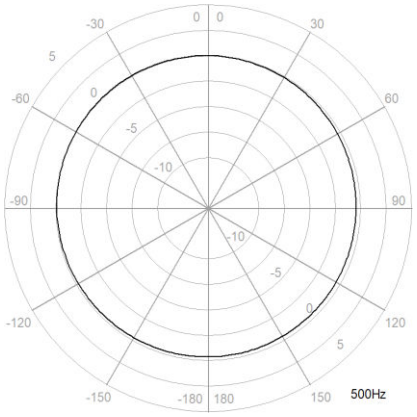


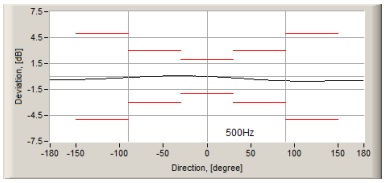
400 Hz



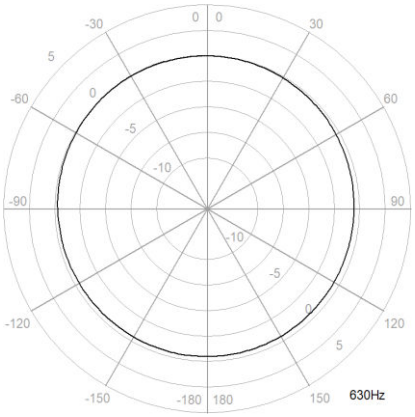


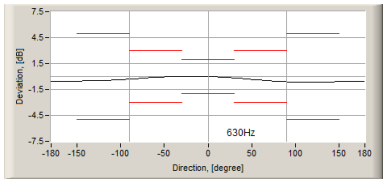
500 Hz



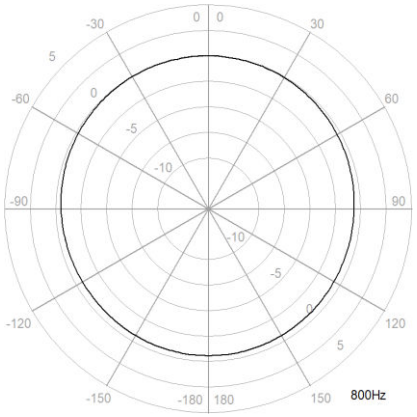


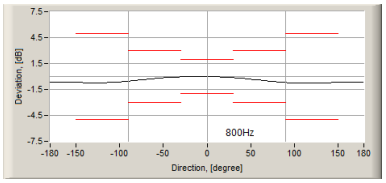
630 Hz



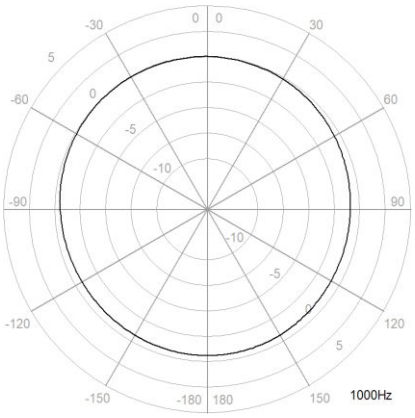


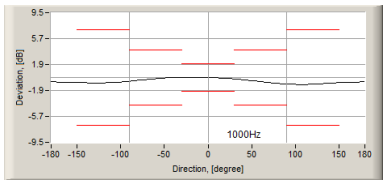
800 Hz



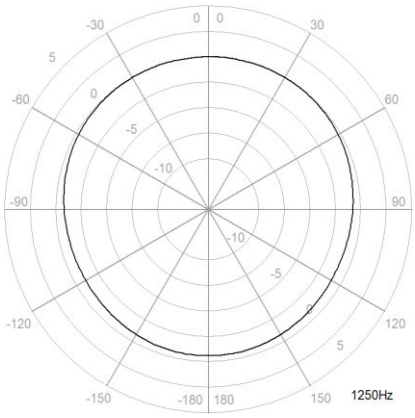


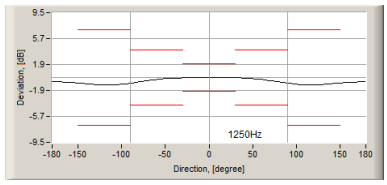
1000 Hz



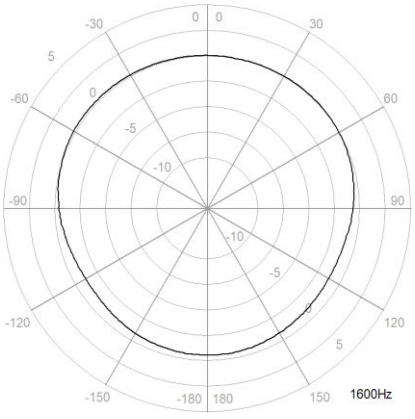


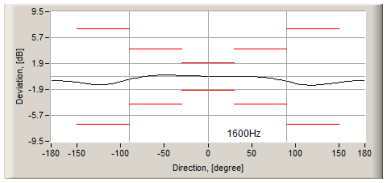
1250 Hz



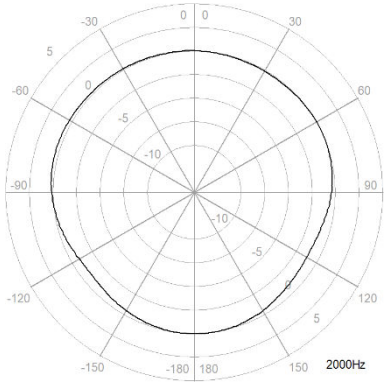


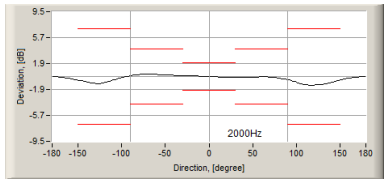
1600 Hz



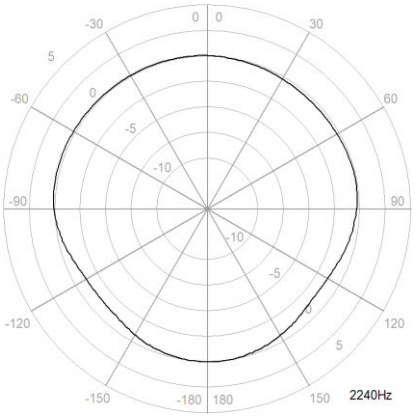


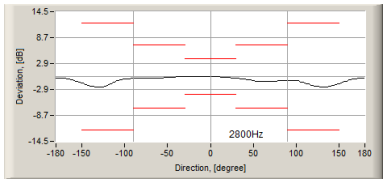
2000 Hz



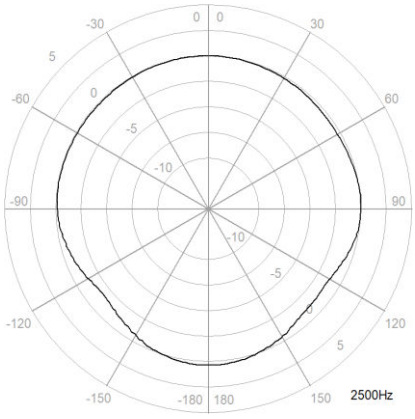


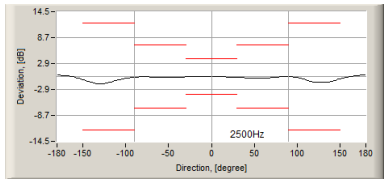
2240 Hz



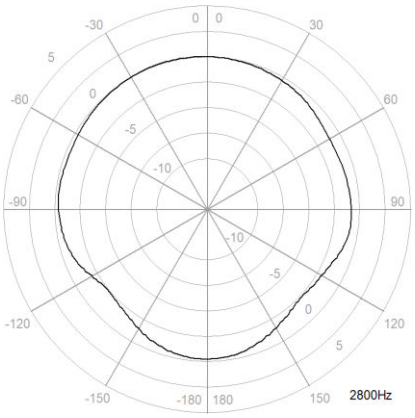


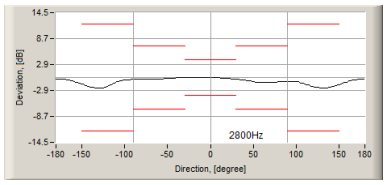
2500 Hz



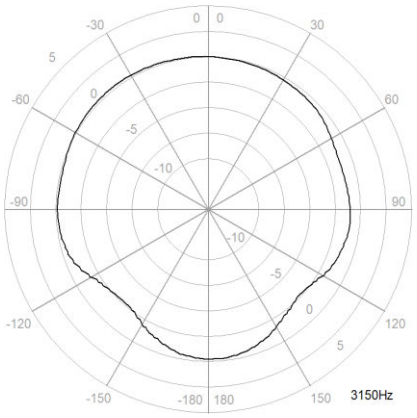


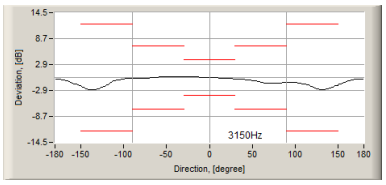
2800 Hz



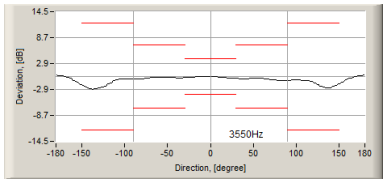


3150 Hz

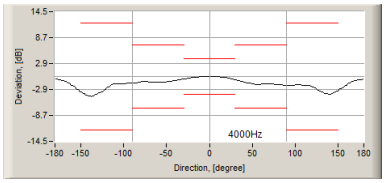




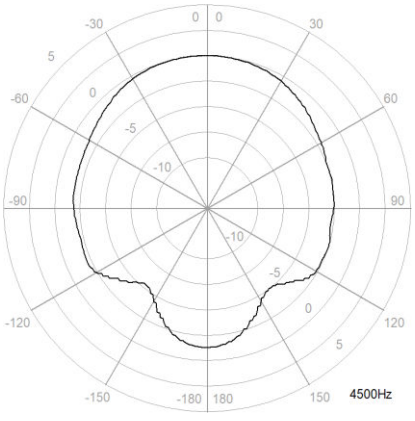
3550 Hz

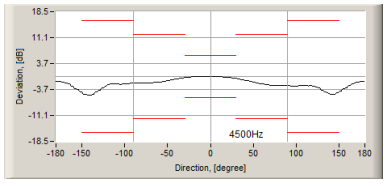


4000 Hz

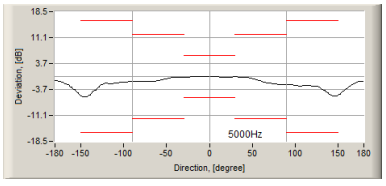


4500 Hz

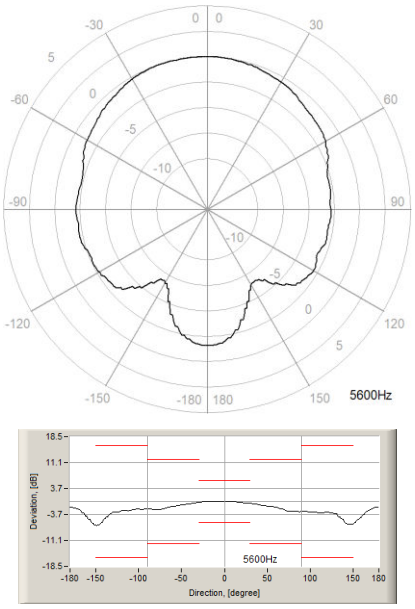




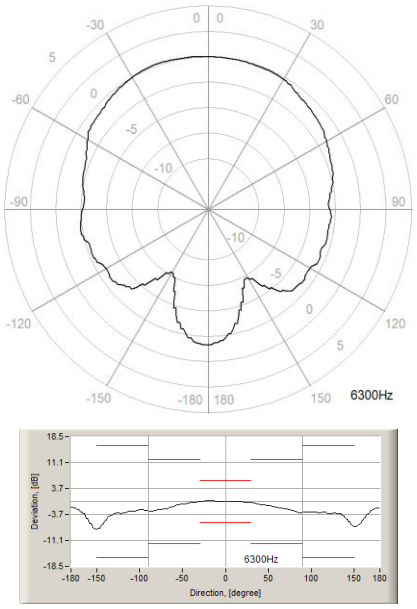
5000 Hz



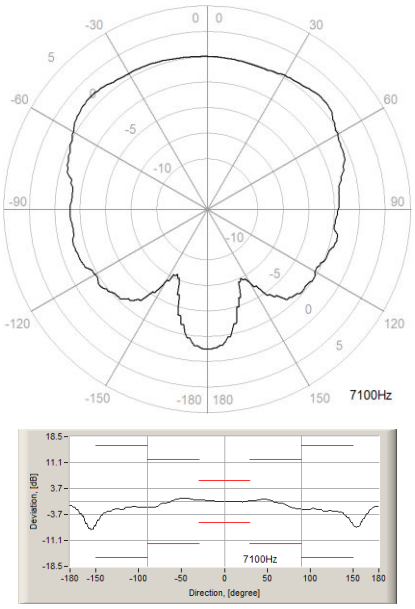
5600 Hz



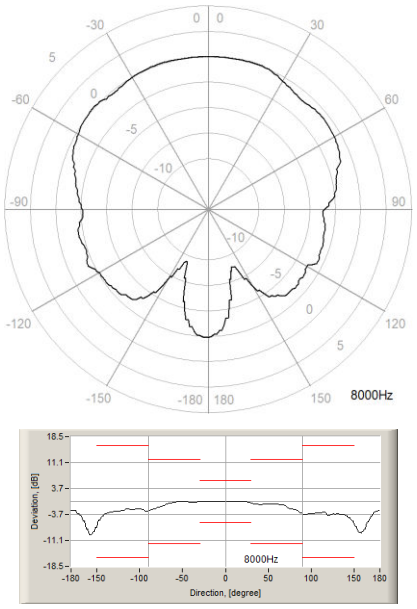
6300 Hz



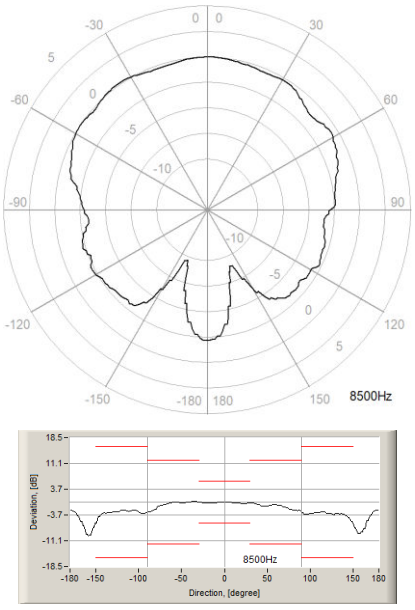
7100 Hz



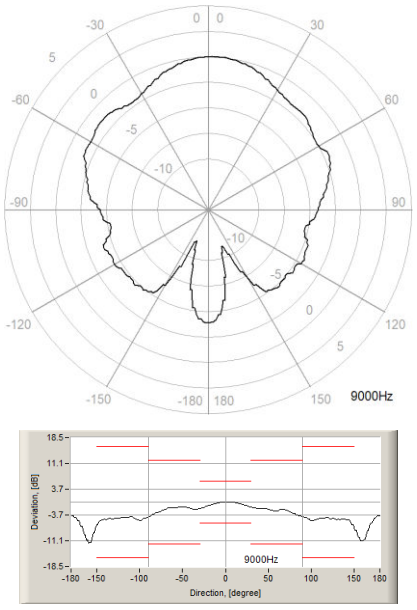
8000 Hz



8500 Hz



9000 Hz



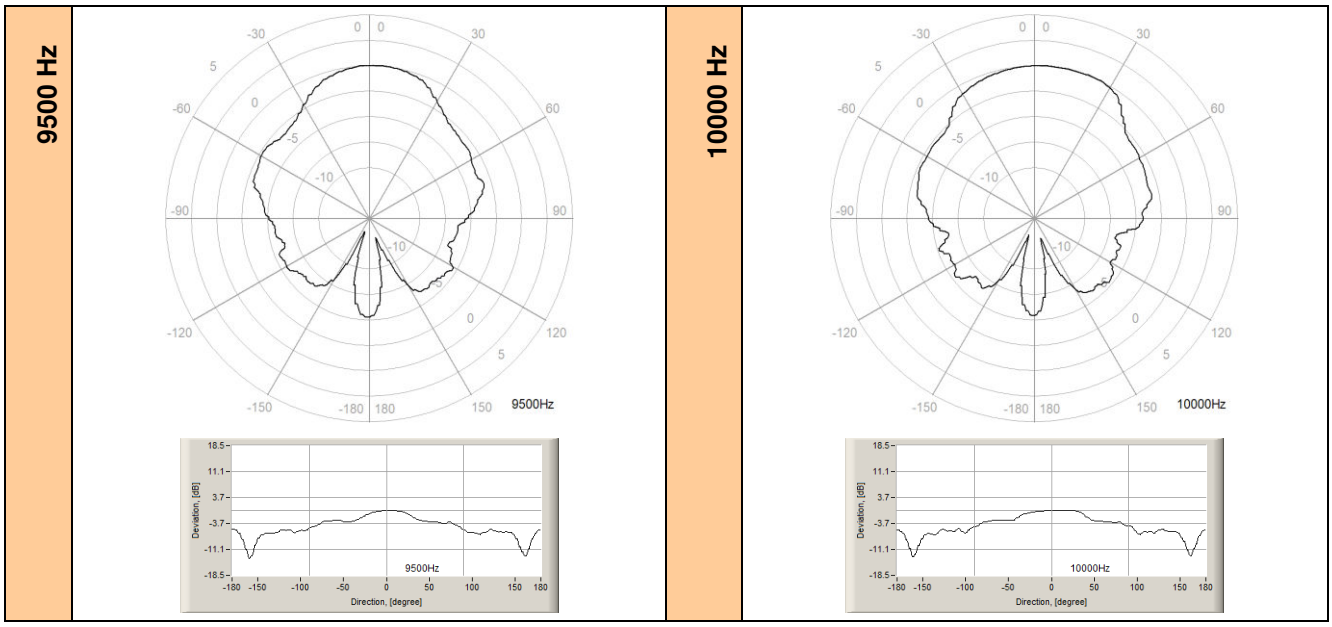


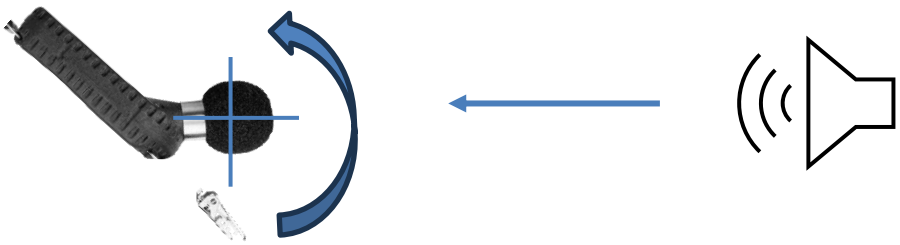
Table C.7. Directional response for SV 104BIS with microphone ST 104CIS and SA 122BIS windscreen (symmetrical axis)

Angle [˚]									
f [Hz]	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
250	0.0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3
315	-0.1	-0.1	-0.2	-0.2	-0.3	-0.4	-0.4	-0.5	-0.5
400	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0
500	0.0	-0.1	-0.2	-0.2	-0.3	-0.4	-0.4	-0.5	-0.5
630	0.0	-0.1	-0.2	-0.3	-0.3	-0.4	-0.5	-0.6	-0.6
800	0.0	-0.1	-0.1	-0.2	-0.3	-0.4	-0.5	-0.6	-0.7
1000	-0.1	-0.1	-0.2	-0.3	-0.5	-0.6	-0.8	-0.9	-1.0
1250	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.5	-0.7	-0.8
1600	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.4	-0.7
2000	-0.1	-0.1	-0.2	-0.2	-0.1	-0.1	-0.1	-0.2	-0.5
2240	-0.1	-0.2	-0.3	-0.4	-0.4	-0.4	-0.3	-0.2	-0.4
2500	0.0	-0.1	-0.2	-0.3	-0.4	-0.4	-0.4	-0.2	-0.1
2800	-0.1	-0.2	-0.4	-0.6	-0.9	-1.2	-1.2	-1.1	-1.0
3150	-0.1	-0.2	-0.3	-0.4	-0.6	-1.1	-1.3	-1.3	-1.2
3550	-0.1	-0.3	-0.5	-0.5	-0.5	-0.4	-0.7	-0.9	-1.0
4000	-0.1	-0.3	-0.8	-1.3	-1.7	-1.8	-1.7	-1.8	-2.0
4500	-0.1	-0.3	-0.6	-1.1	-1.7	-2.2	-2.5	-2.5	-2.7
5000	-0.1	-0.2	-0.2	-0.2	-0.7	-1.4	-1.9	-2.2	-2.4
5600	-0.1	-0.3	-0.6	-1.0	-1.3	-1.7	-2.6	-2.8	-2.9
6300	0.0	-0.1	-0.3	-0.8	-1.2	-1.7	-2.2	-2.8	-3.2
7100	0.0	-0.1	0.2	0.5	0.7	0.5	-0.8	-1.9	-2.2
8000	0.0	0.1	-0.5	-0.9	-0.9	-0.7	-1.5	-2.2	-3.7
8500	-0.2	-0.4	-0.4	-0.8	-1.3	-1.0	-1.4	-2.3	-3.1
9000	-0.1	-0.6	-1.6	-1.8	-2.1	-2.5	-2.4	-3.4	-4.4
9500	0.0	-0.5	-1.8	-2.8	-3.2	-3.5	-3.7	-4.2	-5.6
10000	0.0	0.0	-0.3	-1.8	-2.9	-3.2	-3.4	-3.4	-4.4

Angle [°]									
f [Hz]	90-100	100-110	110-120	120-130	130-140	140-150	150-160	160-170	170-180
250	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
315	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.4
400	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
500	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.4
630	-0.6	-0.7	-0.7	-0.7	-0.6	-0.6	-0.6	-0.6	-0.6
800	-0.8	-0.8	-0.8	-0.8	-0.7	-0.7	-0.7	-0.7	-0.6
1000	-1.0	-1.0	-1.0	-1.0	-0.9	-0.8	-0.7	-0.7	-0.7
1250	-1.0	-1.1	-1.1	-1.1	-1.0	-0.9	-0.8	-0.7	-0.7
1600	-1.0	-1.2	-1.3	-1.3	-1.2	-1.0	-0.8	-0.7	-0.6
2000	-0.9	-1.2	-1.3	-1.2	-1.1	-0.9	-0.4	-0.2	-0.1
2240	-0.7	-1.0	-1.4	-1.5	-1.4	-1.0	-0.6	-0.3	-0.1
2500	-0.2	-0.9	-1.3	-1.4	-1.3	-1.1	-0.4	0.2	0.3
2800	-1.0	-1.4	-2.1	-2.4	-2.4	-2.0	-1.4	-0.8	-0.4
3150	-1.1	-1.5	-2.1	-2.7	-2.7	-2.4	-1.5	-0.8	-0.4
3550	-0.9	-0.9	-1.5	-2.3	-2.5	-2.4	-1.5	-0.4	0.3
4000	-2.0	-2.0	-2.3	-3.4	-3.9	-3.9	-2.8	-1.5	-0.8
4500	-2.8	-2.7	-2.7	-3.9	-5.0	-5.1	-4.1	-2.6	-1.6
5000	-2.6	-2.8	-2.7	-3.6	-5.3	-5.5	-5.1	-3.0	-1.6
5600	-3.0	-3.2	-3.4	-3.6	-6.2	-6.6	-6.1	-3.6	-2.0
6300	-3.1	-3.3	-3.5	-3.6	-5.2	-7.3	-7.3	-4.7	-2.3
7100	-2.4	-2.4	-2.9	-2.8	-4.2	-6.8	-7.5	-5.0	-1.9
8000	-3.7	-3.4	-3.8	-3.8	-4.2	-6.4	-9.0	-7.8	-3.6
8500	-3.5	-3.3	-3.3	-3.6	-3.7	-6.4	-9.1	-7.6	-3.7
9000	-5.3	-5.3	-4.8	-5.1	-5.0	-8.1	-11.2	-10.6	-5.3
9500	-6.3	-6.9	-6.4	-5.9	-6.3	-8.1	-12.7	-13.0	-7.2
10000	-6.8	-6.9	-6.4	-5.9	-6.0	-7.1	-12.4	-12.9	-7.2
Angle [°]									
f [Hz]	180-190	190-200	200-210	210-220	220-230	230-240	240-250	250-260	260-270
250	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1
315	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	-0.1	-0.1	-0.1
400	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
500	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2
630	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.4	-0.4
800	-0.6	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.6
1000	-0.7	-0.7	-0.8	-0.8	-0.8	-0.8	-0.8	-0.7	-0.6
1250	-0.7	-0.7	-0.8	-0.9	-1.0	-1.1	-1.1	-1.1	-1.0
1600	-0.6	-0.7	-0.8	-1.0	-1.2	-1.2	-1.2	-1.0	-0.7
2000	-0.1	-0.3	-0.6	-0.8	-1.0	-1.0	-0.8	-0.4	-0.2
2240	-0.2	-0.4	-0.8	-1.2	-1.3	-1.3	-1.2	-0.8	-0.3
2500	0.3	-0.2	-0.8	-1.4	-1.7	-1.7	-1.3	-0.8	-0.4
2800	-0.5	-0.9	-1.5	-2.2	-2.4	-2.4	-1.8	-1.0	-0.6
3150	-0.6	-1.2	-2.1	-2.7	-2.7	-2.5	-1.6	-0.6	-0.3
3550	0.3	-0.8	-2.0	-2.8	-2.8	-2.5	-1.7	-0.7	-0.6
4000	-1.1	-2.0	-3.4	-4.4	-4.5	-3.6	-2.3	-1.6	-1.6
4500	-1.8	-3.0	-4.7	-5.4	-5.3	-3.8	-2.3	-2.2	-2.1
5000	-1.8	-3.4	-5.5	-5.8	-5.3	-3.0	-2.0	-1.8	-1.6
5600	-2.4	-4.6	-6.8	-6.8	-4.9	-3.1	-2.7	-2.4	-2.3
6300	-2.6	-5.5	-7.9	-7.6	-5.3	-3.5	-3.4	-2.8	-2.7
7100	-2.8	-7.0	-8.0	-5.3	-3.3	-2.4	-2.2	-1.7	-1.7
8000	-4.0	-8.9	-9.5	-5.3	-3.4	-2.9	-2.5	-2.3	-2.7
8500	-4.7	-9.2	-9.8	-4.9	-3.2	-2.8	-2.7	-2.9	-3.3

9000	-6.1	-11.8	-11.6	-5.6	-5.0	-4.7	-4.5	-5.3	-5.3
9500	-7.3	-13.6	-13.0	-7.9	-6.6	-6.2	-6.3	-6.4	-5.7
10000	-8.3	-13.3	-12.5	-7.1	-7.0	-6.0	-6.0	-6.4	-6.2
Angle [°]									
f [Hz]	270-280	280-290	290-300	300-310	310-320	320-330	330-340	340-350	350-360
250	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
315	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
400	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	0.0
500	-0.1	-0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.0
630	-0.3	-0.2	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0
800	-0.5	-0.4	-0.3	-0.2	-0.1	-0.1	0.0	0.0	0.0
1000	-0.5	-0.4	-0.3	-0.1	-0.1	0.0	0.1	0.1	0.0
1250	-0.8	-0.6	-0.4	-0.3	-0.1	-0.1	0.0	0.0	0.0
1600	-0.4	-0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1
2000	0.3	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.0
2240	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
2500	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
2800	-0.4	-0.4	-0.4	-0.3	-0.2	-0.1	0.1	0.1	0.0
3150	-0.2	-0.2	-0.1	0.2	0.3	0.3	0.2	0.1	0.1
3550	-0.5	-0.5	-0.2	-0.2	-0.3	-0.3	-0.3	-0.1	0.0
4000	-1.5	-1.2	-1.3	-1.3	-1.2	-0.8	-0.5	-0.2	0.0
4500	-1.8	-1.8	-1.8	-1.5	-1.1	-0.6	-0.3	-0.1	0.0
5000	-1.5	-1.4	-1.4	-1.1	-0.5	-0.2	-0.1	-0.1	0.0
5600	-2.3	-2.3	-1.9	-1.3	-0.9	-0.5	-0.2	0.0	0.0
6300	-2.8	-2.4	-2.0	-1.1	-0.7	-0.3	0.2	0.2	0.1
7100	-1.7	-1.4	-0.4	0.9	1.0	0.6	0.4	0.3	0.1
8000	-2.5	-1.7	-0.6	-0.1	-0.3	-0.3	0.1	0.1	0.0
8500	-2.7	-1.6	-0.6	-0.2	-0.2	0.1	-0.3	-0.3	-0.1
9000	-4.1	-2.9	-1.9	-1.7	-1.9	-2.1	-1.7	-0.8	-0.2
9500	-4.9	-4.0	-3.0	-3.1	-3.3	-3.0	-1.8	-0.7	-0.1
10000	-4.5	-3.3	-2.8	-2.8	-2.8	-1.8	-0.9	-0.3	-0.1

Directional response for the orthogonal asymmetrical axis of the SV 104BIS dosimeter with the **ST 104CIS** microphone and the **SA 122BIS** windscreen at specified frequencies (Table C.6):



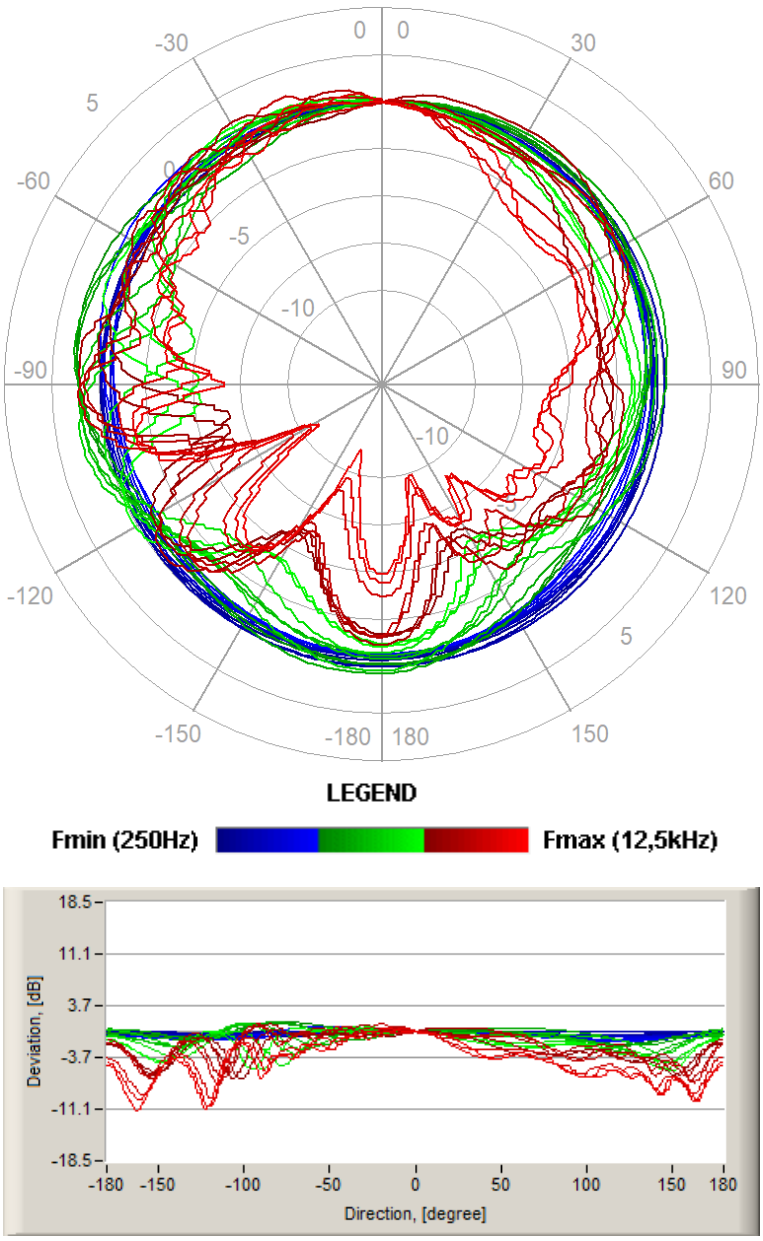
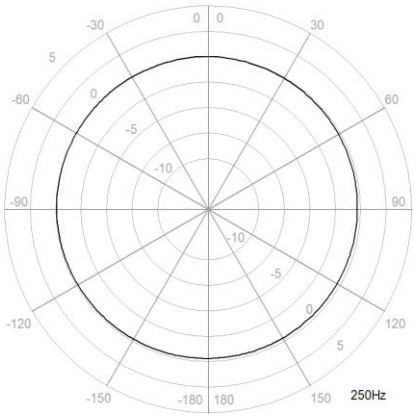
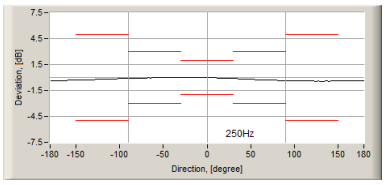


Figure C.4 Total directional characteristics (asymmetrical axis)

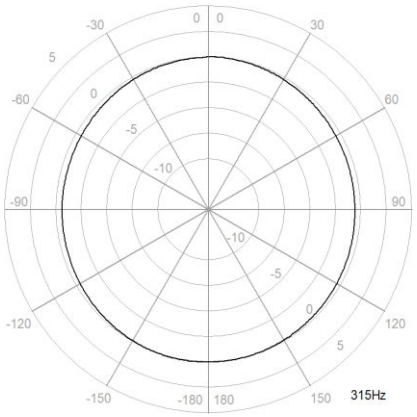
The round charts show the directional characteristic, and the charts below shows the errors for particular angles (note: limits are for class 1).

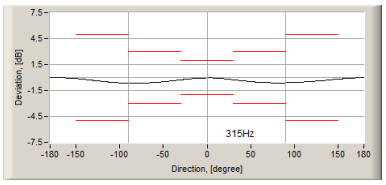
250 Hz



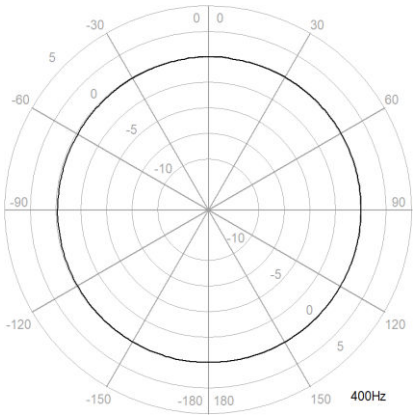


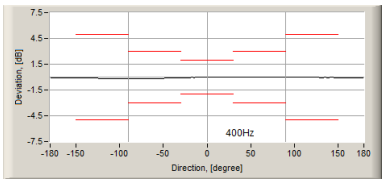
315 Hz



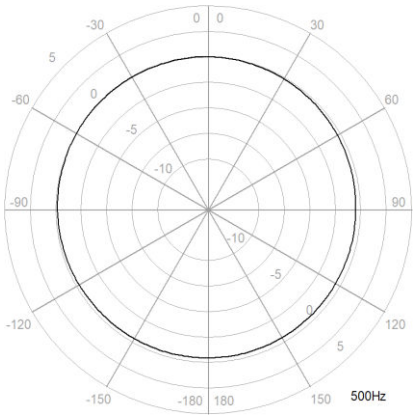


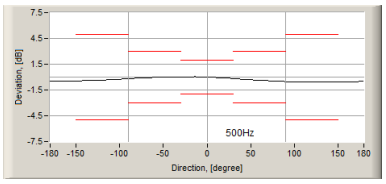
400 Hz



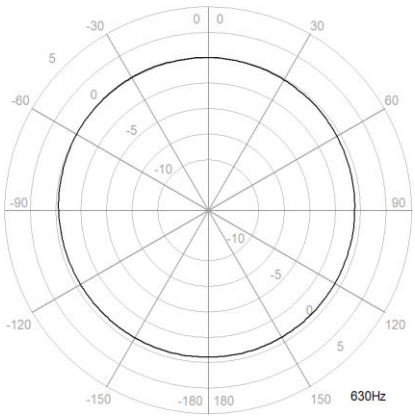


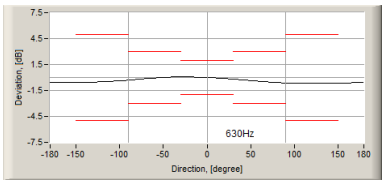
500 Hz



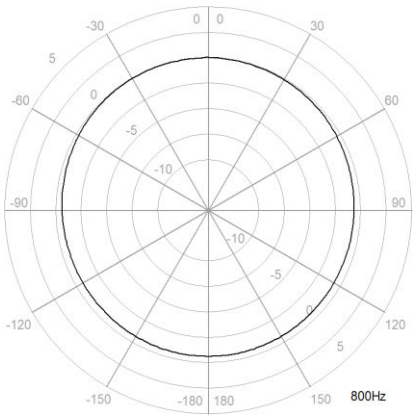


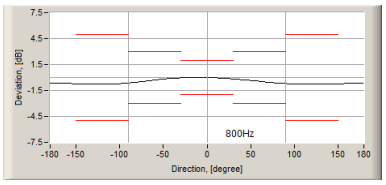
630 Hz



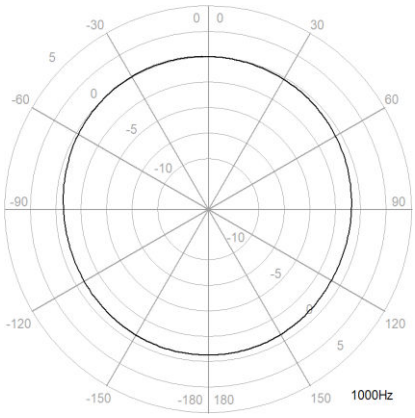


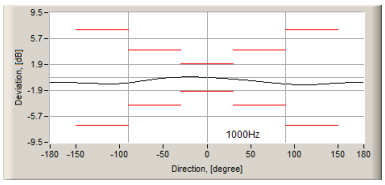
800 Hz



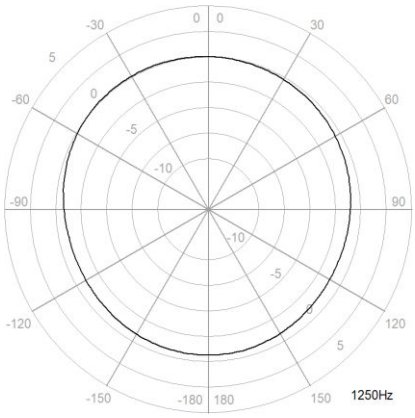


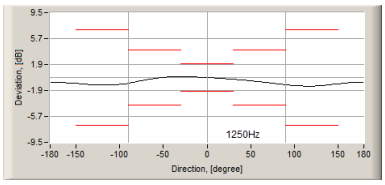
1000 Hz



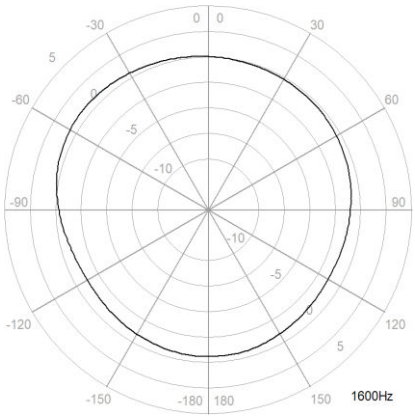


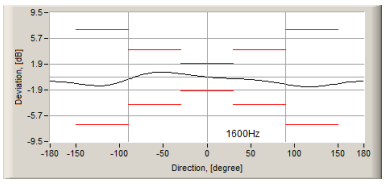
1250 Hz



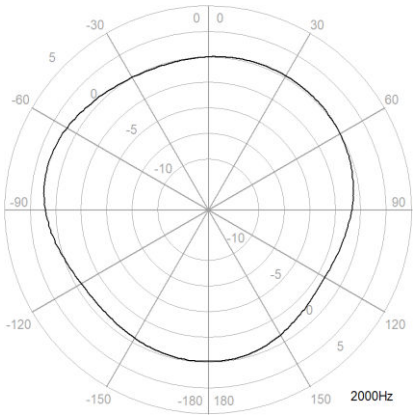


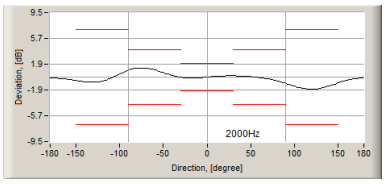
1600 Hz



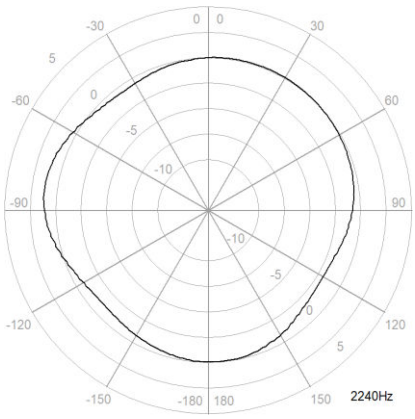


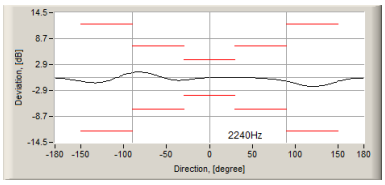
2000 Hz



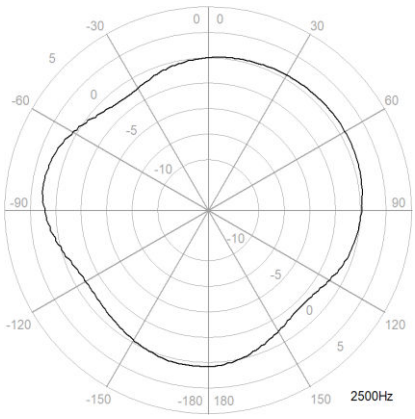


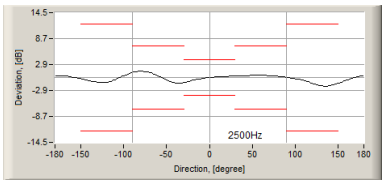
2240 Hz



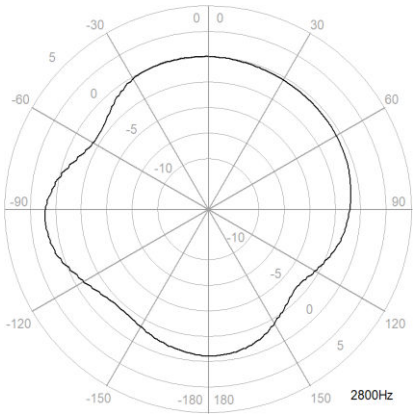


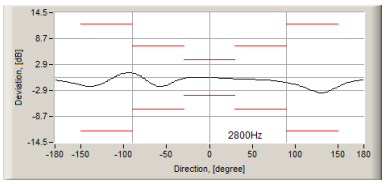
2500 Hz



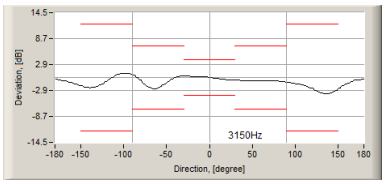


2800 Hz

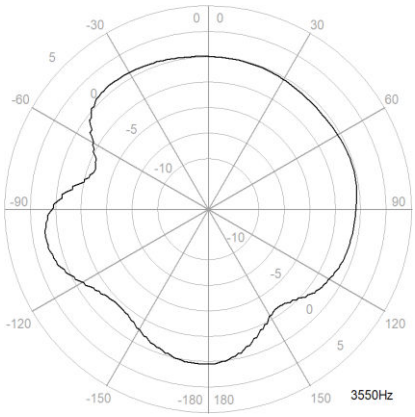


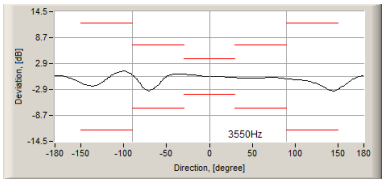


3150 Hz

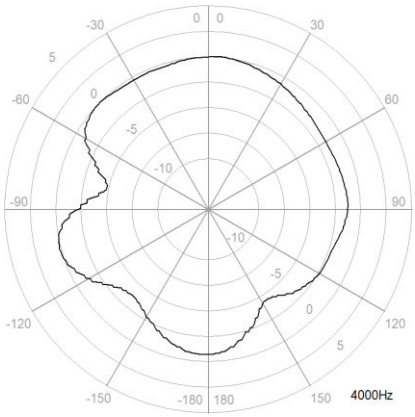


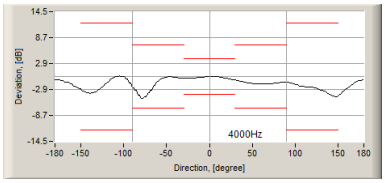
3550 Hz



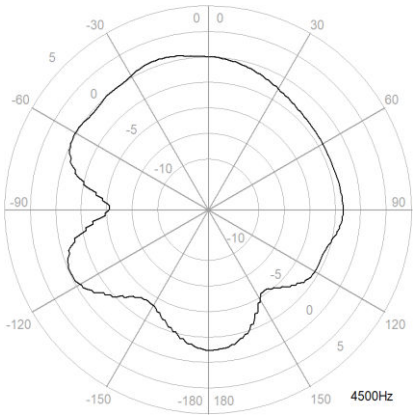


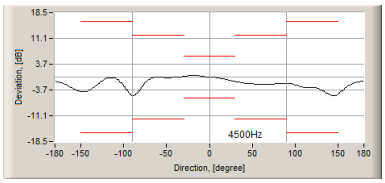
4000 Hz



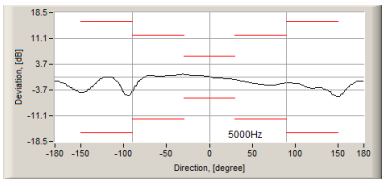


4500 Hz

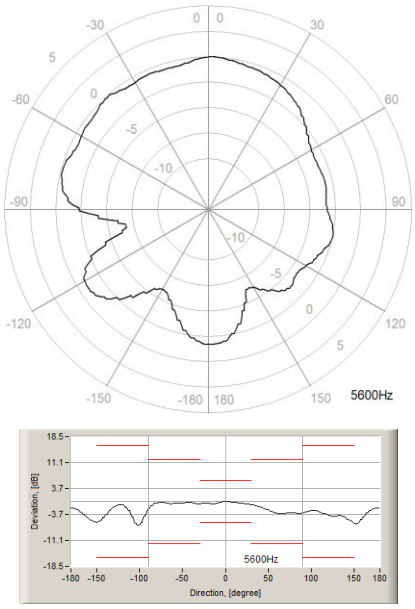




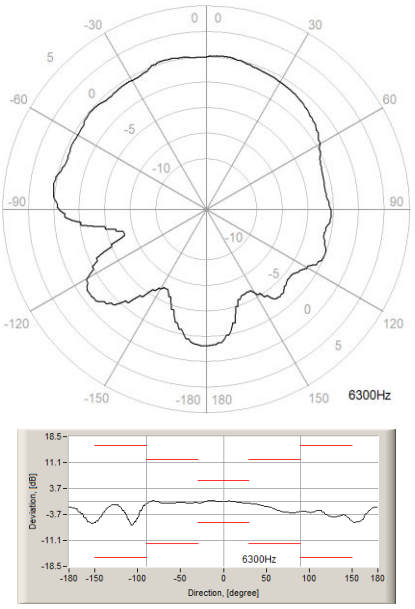
5000 Hz



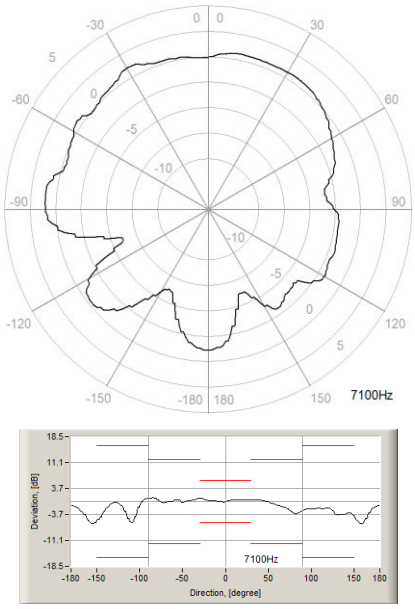
5600 Hz



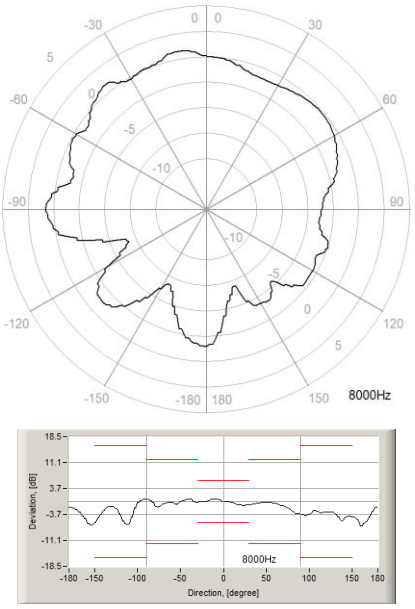
6300 Hz



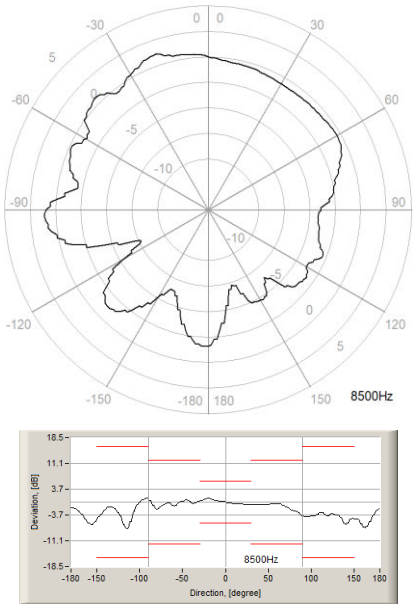
7100 Hz



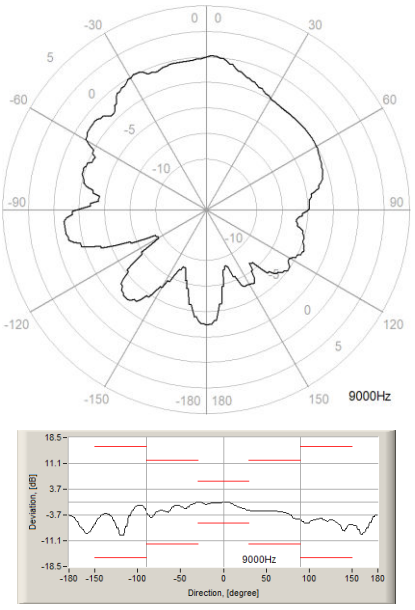
8000 Hz



8500 Hz



9000 Hz



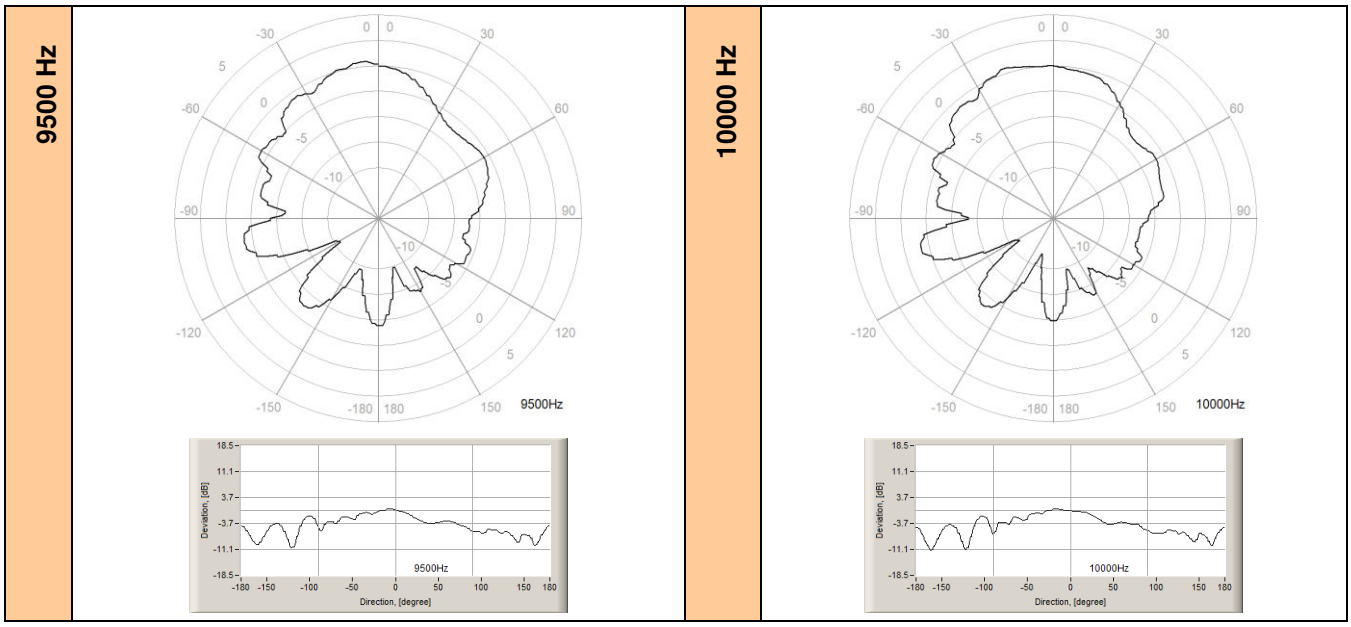


Table C.8. Directional response for SV 104BIS with microphone ST 104CIS and SA 122BIS windscreen (asymmetrical axis)

Angle [°]									
f [Hz]	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
630	0.0	-0.1	-0.1	-0.2	-0.2	-0.3	-0.3	-0.3	-0.4
800	-0.1	-0.2	-0.3	-0.4	-0.5	-0.6	-0.6	-0.6	-0.6
1000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1250	-0.1	-0.1	-0.2	-0.2	-0.3	-0.4	-0.4	-0.5	-0.5
1600	-0.1	-0.1	-0.2	-0.3	-0.4	-0.4	-0.5	-0.6	-0.6
2000	0.0	-0.1	-0.2	-0.2	-0.4	-0.5	-0.6	-0.6	-0.7
2240	-0.1	-0.1	-0.2	-0.4	-0.5	-0.6	-0.7	-0.8	-0.9
2500	-0.1	-0.2	-0.3	-0.4	-0.5	-0.6	-0.8	-0.9	-1.1
2800	-0.1	-0.2	-0.2	-0.3	-0.4	-0.5	-0.7	-0.8	-1.0
3150	0.1	0.2	0.2	0.2	0.1	-0.1	-0.3	-0.6	-1.0
3550	0.1	0.1	0.1	0.1	-0.1	-0.2	-0.3	-0.5	-0.9
4000	0.2	0.3	0.4	0.4	0.5	0.5	0.5	0.4	0.2
4500	-0.1	-0.2	-0.3	-0.4	-0.5	-0.5	-0.6	-0.8	-1.1
5000	-0.3	-0.5	-0.6	-0.7	-0.7	-0.7	-0.7	-0.8	-1.1
5600	-0.1	-0.1	-0.3	-0.4	-0.5	-0.4	-0.3	-0.3	-0.5
6300	-0.1	-0.5	-0.9	-1.3	-1.6	-1.7	-1.7	-1.6	-1.4
7100	-0.2	-0.8	-1.3	-1.7	-2.0	-2.1	-2.1	-2.1	-1.9
8000	-0.3	-0.4	-0.8	-1.2	-1.8	-2.1	-2.4	-2.4	-2.0
8500	-0.3	-0.5	-0.9	-1.6	-2.6	-3.4	-3.4	-3.3	-3.4
9000	0.1	-0.3	-0.6	-0.9	-1.4	-2.3	-3.0	-3.2	-3.2
9500	0.6	0.6	0.6	0.6	0.4	-1.1	-1.9	-3.5	-3.5
10000	-0.3	-1.0	-1.1	-0.8	-0.5	-0.6	-1.5	-2.9	-3.7
Angle [°]									
f [Hz]	90-100	100-110	110-120	120-130	130-140	140-150	150-160	160-170	170-180
630	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
800	-0.6	-0.6	-0.5	-0.4	-0.4	-0.3	-0.2	-0.1	0.0
1000	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
1250	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.5	-0.5
1600	-0.7	-0.7	-0.7	-0.7	-0.7	-0.6	-0.6	-0.6	-0.6
2000	-0.8	-0.8	-0.8	-0.8	-0.8	-0.7	-0.7	-0.7	-0.7
2240	-1.0	-1.1	-1.1	-1.0	-1.0	-0.9	-0.8	-0.8	-0.7

2500	-1.2	-1.3	-1.3	-1.3	-1.2	-1.1	-0.9	-0.8	-0.7
2800	-1.3	-1.4	-1.4	-1.4	-1.3	-1.1	-0.9	-0.8	-0.7
3150	-1.4	-1.7	-1.8	-1.8	-1.6	-1.2	-0.8	-0.4	-0.2
3550	-1.4	-1.8	-2.0	-2.0	-1.8	-1.4	-0.8	-0.4	-0.2
4000	-0.3	-0.7	-1.4	-1.8	-1.9	-1.8	-1.2	-0.5	0.4
4500	-1.6	-2.2	-3.0	-3.5	-3.4	-2.9	-2.0	-1.0	-0.7
5000	-1.4	-1.8	-2.6	-3.4	-3.7	-3.5	-2.3	-1.2	-0.6
5600	-0.7	-0.8	-1.4	-2.1	-3.2	-3.2	-2.7	-1.3	0.2
6300	-1.9	-2.3	-2.4	-3.0	-4.2	-4.5	-4.1	-2.4	-1.1
7100	-2.2	-2.9	-2.9	-3.7	-5.1	-5.4	-4.7	-2.3	-1.5
8000	-1.8	-2.5	-3.2	-3.2	-4.2	-5.5	-5.5	-2.8	-1.3
8500	-3.2	-3.0	-3.9	-4.3	-4.7	-6.2	-6.4	-4.5	-2.0
9000	-3.2	-3.2	-3.6	-4.5	-4.4	-5.7	-6.0	-5.0	-2.1
9500	-2.2	-2.1	-2.1	-4.0	-3.8	-4.7	-6.2	-5.6	-2.0
10000	-3.9	-3.4	-3.3	-3.6	-5.5	-4.7	-7.0	-6.9	-3.6
Angle [°]									
f [Hz]	180-190	190-200	200-210	210-220	220-230	230-240	240-250	250-260	260-270
630	-0.4	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.1
800	0.0	-0.1	-0.1	-0.2	-0.3	-0.5	-0.6	-0.6	-0.6
1000	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2
1250	-0.5	-0.5	-0.5	-0.4	-0.4	-0.4	-0.3	-0.3	-0.2
1600	-0.6	-0.6	-0.6	-0.6	-0.5	-0.5	-0.5	-0.4	-0.4
2000	-0.7	-0.7	-0.7	-0.8	-0.8	-0.8	-0.8	-0.8	-0.7
2240	-0.7	-0.7	-0.8	-0.8	-0.9	-0.9	-0.9	-0.9	-0.9
2500	-0.7	-0.8	-0.9	-1.0	-1.1	-1.1	-1.1	-1.1	-1.0
2800	-0.7	-0.8	-1.0	-1.1	-1.3	-1.3	-1.3	-1.1	-0.7
3150	-0.2	-0.3	-0.6	-0.7	-0.8	-0.7	-0.5	0.5	1.0
3550	-0.3	-0.5	-0.9	-1.1	-1.2	-1.2	-0.7	0.6	1.2
4000	0.4	0.3	-0.3	-0.7	-1.1	-1.1	-1.1	0.3	1.1
4500	-0.9	-1.2	-1.7	-2.0	-2.0	-1.6	-0.6	1.0	1.1
5000	-0.7	-1.2	-1.9	-2.3	-2.3	-1.6	0.5	1.0	1.0
5600	0.2	-0.6	-1.4	-2.1	-2.1	-1.6	0.8	1.2	1.2
6300	-1.0	-1.9	-3.0	-3.7	-3.7	-3.0	-1.2	0.1	-2.5
7100	-2.1	-3.2	-4.2	-4.3	-3.4	-1.9	-0.3	-2.8	-5.3
8000	-1.9	-3.4	-4.4	-4.3	-3.1	-0.9	-1.1	-4.2	-5.4
8500	-2.9	-5.0	-5.9	-5.9	-3.6	-1.1	-4.4	-6.8	-6.1
9000	-2.5	-5.2	-6.3	-5.6	-3.0	-1.8	-6.0	-6.6	-3.7
9500	-2.7	-5.2	-6.3	-5.0	-1.5	-1.9	-6.1	-6.1	1.0
10000	-2.6	-5.7	-6.8	-5.3	-2.5	-4.4	-6.8	-4.4	0.8
Angle [°]									
f [Hz]	270-280	280-290	290-300	300-310	310-320	320-330	330-340	340-350	350-360
630	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
800	-0.7	-0.7	-0.6	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1
1000	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	0.0
1250	-0.2	-0.1	-0.1	0.0	0.0	0.0	0.0	0.1	0.0
1600	-0.3	-0.2	-0.1	0.0	0.1	0.1	0.1	0.1	0.0
2000	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0	0.0	0.0
2240	-0.8	-0.6	-0.4	-0.2	-0.1	0.1	0.1	0.1	0.1
2500	-0.8	-0.5	-0.3	-0.1	0.1	0.1	0.1	0.1	0.0
2800	-0.2	0.5	0.7	0.7	0.7	0.6	0.4	0.3	0.1
3150	1.3	1.4	1.3	1.0	0.5	0.2	-0.1	-0.2	-0.1
3550	1.2	1.2	0.8	0.2	-0.6	-0.7	-0.6	-0.3	-0.1
4000	1.4	1.4	1.0	-0.6	-1.2	-1.3	-1.0	-0.5	-0.2
4500	0.8	-1.2	-2.0	-2.0	-1.6	-0.8	-0.1	0.1	0.0

5000	-0.6	-2.3	-2.5	-2.2	-0.9	0.3	0.3	0.2	0.1
5600	-2.0	-3.2	-3.2	-1.6	0.6	0.6	0.5	0.3	0.1
6300	-4.8	-4.8	-3.0	-0.8	-0.2	-0.3	-0.3	-0.3	-0.1
7100	-5.3	-2.5	-0.3	-0.3	-0.3	0.2	0.5	0.5	0.2
8000	-3.4	0.6	0.5	0.4	0.5	0.8	0.8	0.4	0.4
8500	-1.7	-0.4	-0.7	-0.5	-0.5	-0.6	-0.6	-0.6	-0.5
9000	-0.4	-0.5	-0.5	-0.4	-0.5	-0.4	-0.4	0.2	0.1
9500	1.1	0.5	0.4	0.6	0.4	1.0	1.0	0.3	-0.1
10000	-1.4	-1.6	-0.6	-0.8	0.8	0.8	0.1	0.8	0.7

C.2 SPECIFICATION OF THE SV 104BIS AS 1/1 AND 1/3 OCTAVE ANALYSER

The SV 104BIS instrument operating as **1/1 OCTAVE or 1/3 OCTAVE** sound analyser meets the IEC 61260-1:2014 standard for the pass band filters.

Note: *Simultaneously to the frequency analysis SV 104BIS operates as a Dosimeter!*

Signal input

Connector	6 pin SVANTEK
Maximum input voltage	SV 104BIS meets the requirements of the EN/IEC 61010-1 category I measurement circuit. The input voltage shall not exceed the limits between 0 V and +3 V.
Impedance	2 x 39kΩ / 44nF.

Linear operating ranges

For the sinusoidal signal and microphone sensitivity 1 mV/Pa.

See Table C.1 on page 89 for details.

Note: *For the signals with the crest factor* ***n >1.41*** *upper measuring range of the RMS (****LEQ*** *and* ***SPL****) is reduced. The valid upper limit can be calculated according to the below given formula:*

$A_n = 137 - 20 \log\left(n/\sqrt{2}\right)$, *where* ***A*** *is the upper limit for the sinusoidal signal*

Example: *For the crest factor* ***n = 10*** *the upper limit is* $A_{10} = 120$ ***dB***

Measuring frequency range with the Z filter (-3 dB): 20 Hz ÷ 10.0 kHz

Maximum peak voltage of input sinusoidal signal, which can be led to the Dose Meter without destruction of the meter: 3 V Peak-Peak

RMS detector

Digital	"True RMS" with Peak detection
Resolution	0.1 dB
Range	327.7 dB
Crest Factor	unlimited (for signals in 10 kHz band)

Reference conditions as per IEC 61260-1:2014

Reference frequency	1000 Hz
Reference level	114 dB
Reference temperature	from +20°C to +26°C
Reference relative humidity	from 35% to 65%

Calibration (electrical)

Calibration level	114.0 dB (ref. 1μV_{RMS})
Basic accuracy	< ± 0.1 dB (for the temperature T = +23°C ± 5°C for the sinusoidal signal 114 dB_{RMS} in the bandwidth 20 Hz ÷ 10 kHz with the **Z** input filter

Voltage measurement error in the full temperature range

< ± 0.1 dB when the temperature is from -10°C to +40°C for the sinusoidal signal.

Overload detector

The instrument has the built-in overload detectors. The overload in the measurement channel (in its analogue part) and the overload of the analogue / digital converter are both detected. The "overload" indication is when the input signal amplitude **is 0.5 dB above** the declared "Peak measurement range"

Anti-aliasing filter

Built-in electric anti-aliasing filter ensuring correct sampling of the measured signal.

Pass band (-3 dB)	11.3 kHz
Stop band	14.4 kHz
Attenuation in the stop band	> 50 dB
Sampling frequency	24 kHz
Analogue to digital converter	sigma-delta 24 bit
Internal oscillator accuracy	0.01% (for f = 1 kHz and T = +23°C)

Digital filters

Weighting filters

Z meeting requirements of IEC 61672-1:2013 for the Class 2 "**Z**" filter
A meeting requirements of IEC 61672-1:2013 for the Class 2 "**A**" filter
C meeting requirements of IEC 61672-1:2013 for the Class 2 "**C**" filter

See part for the A and C filters characteristics.

Noise levels (measured with the **SC 104BT** and source impedance **50 Ω**, **Microphone** compensation switched-off)

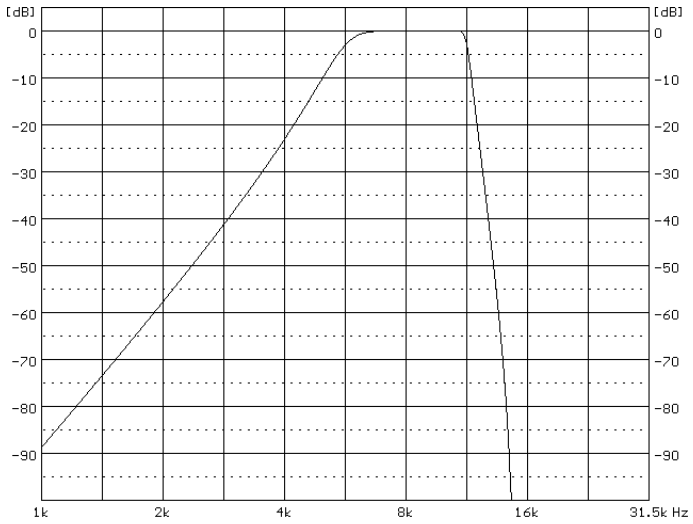
"**Z**" weighting	< 316 μV_{RMS}, (50 dB)
"**A**" weighting	< 126 μV_{RMS}, (42 dB)
"**C**" weighting	< 112 μV_{RMS}, (41 dB)

Noise levels during test according IEC 61252 p.12.5 (measured in presence of magnetic field 80A/m @ 50Hz, "the worst device orientation", with the **SC 104BT** and source impedance **50 Ω**, **Microphone** compensation switched-off)

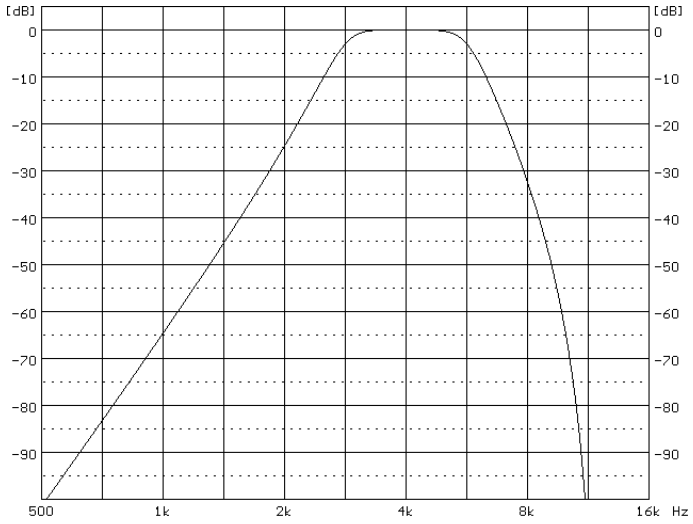
"**Z**" weighting	< 251 μV_{RMS}, (48.0 dB)
"**A**" weighting	< 114 μV_{RMS}, (41.2 dB)
"**C**" weighting	< 104 μV_{RMS}, (40.4 dB)

1/1 octave filters

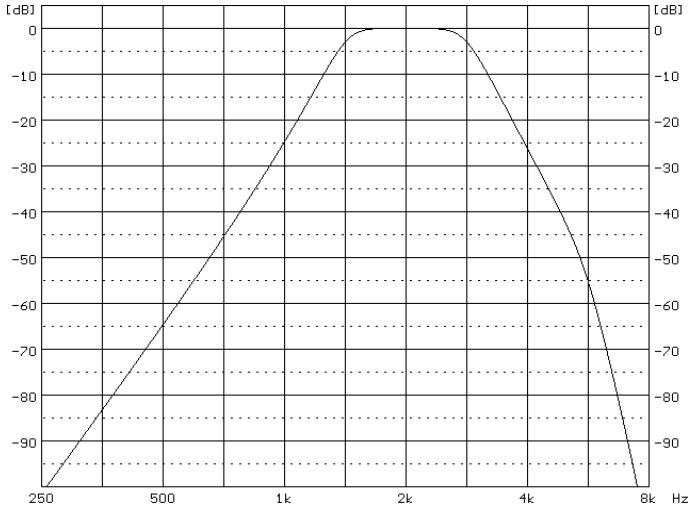
9 filters with centre frequencies from 31.5 Hz to 8 kHz (base 10), meeting IEC 61260-1:2014 for Class 1.



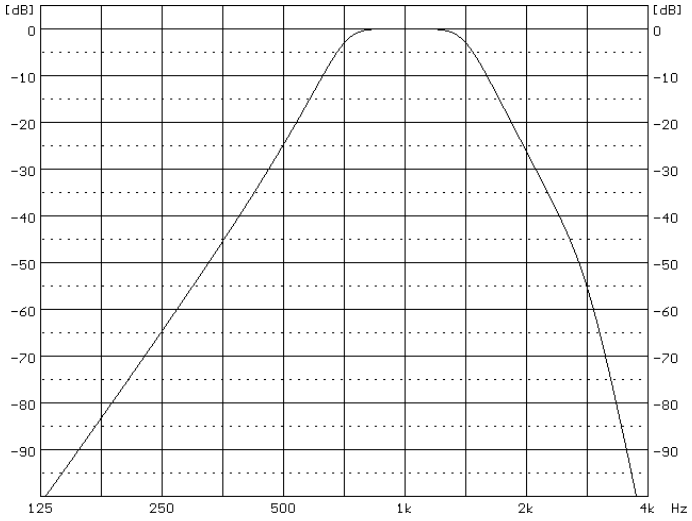
8.0 kHz 1/1 octave filter



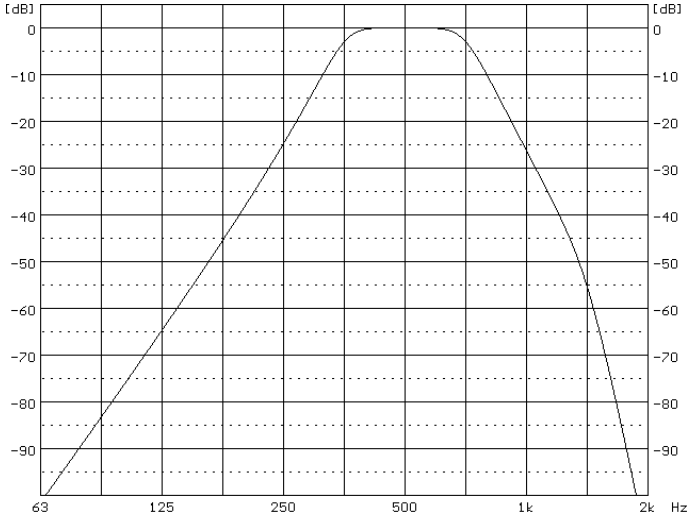
4.0 kHz 1/1 octave filter



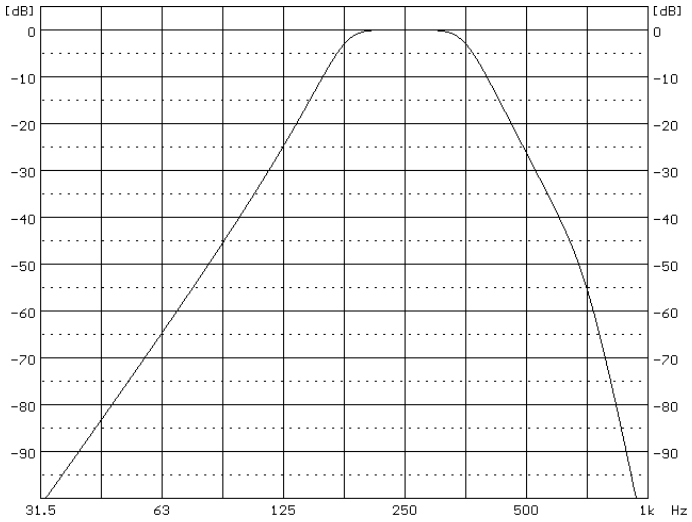
2.0 kHz 1/1 octave filter



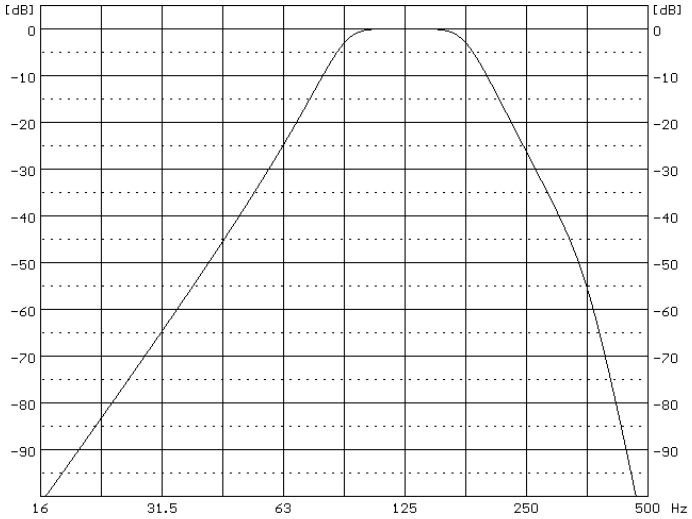
1.0 kHz 1/1 octave filter



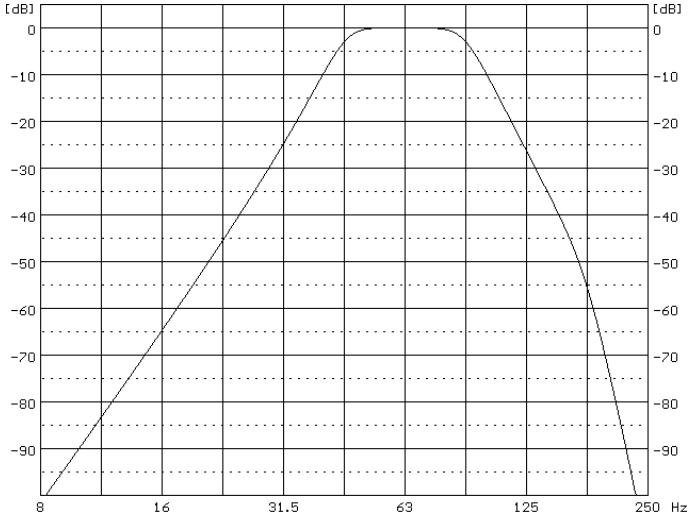
500 Hz 1/1 octave filter



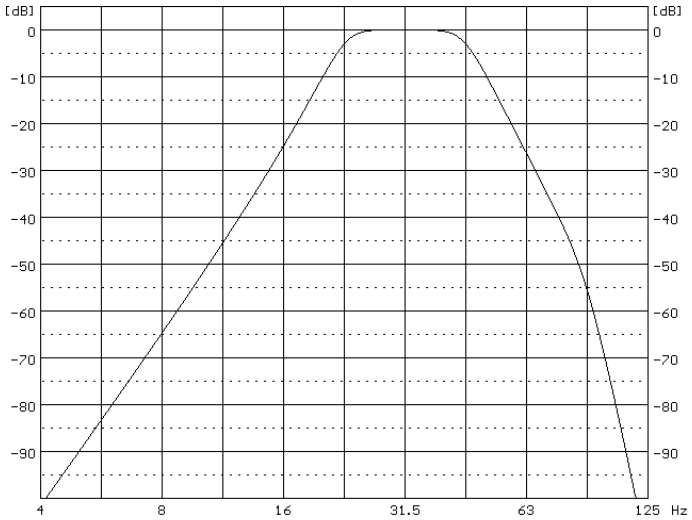
250 Hz 1/1 octave filter



125 Hz 1/1 octave filter



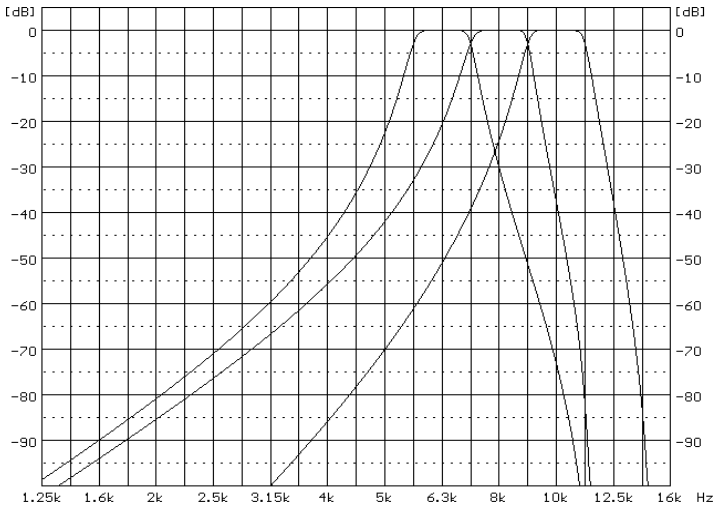
63.0 Hz 1/1 octave filter



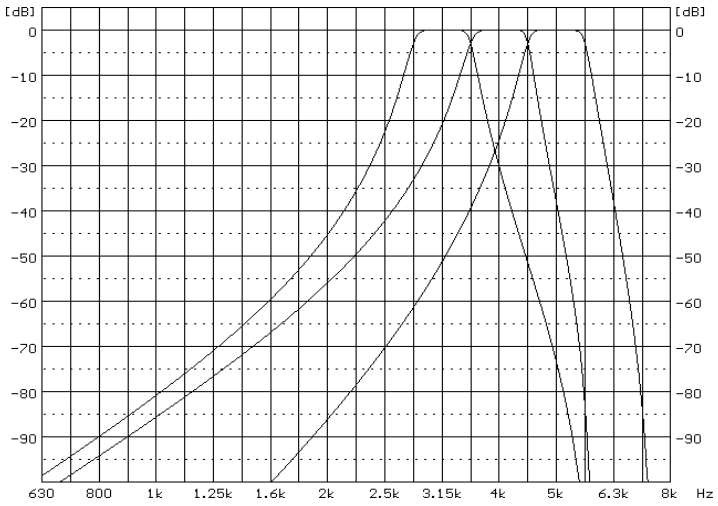
31.5 Hz 1/1 octave filter

1/3 octave filters

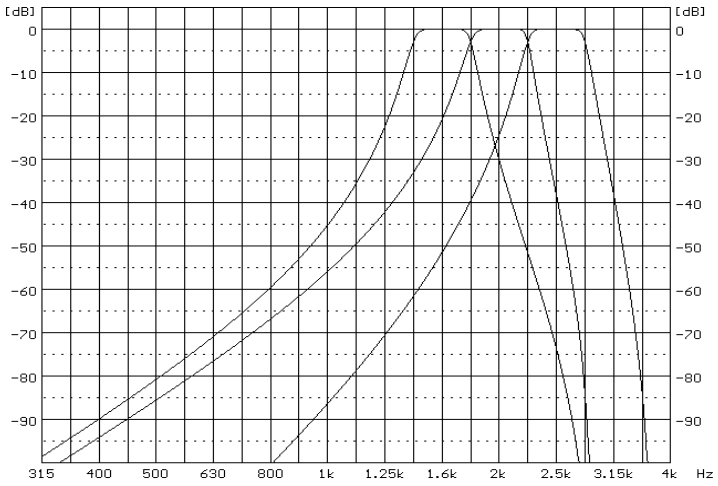
28 filters with centre frequencies from 20 Hz to 10 kHz (base 10), meeting IEC 61260-1:2014 for Class 1.



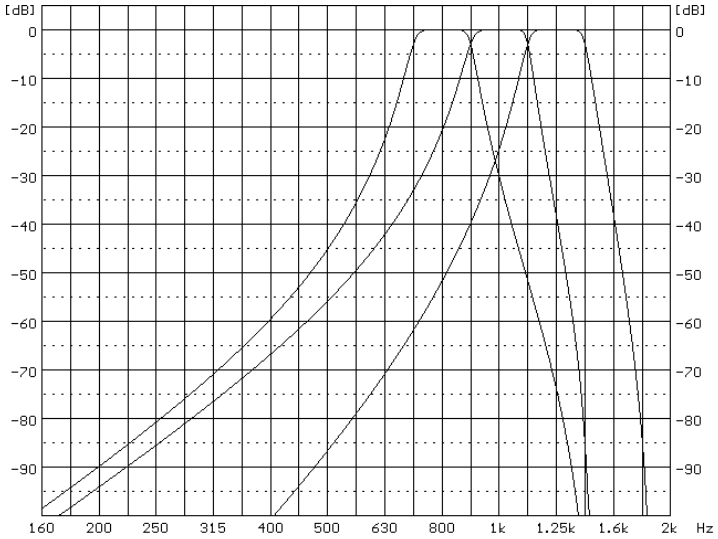
1/3 octave filters for 8.0 kHz 1/1 octave filter



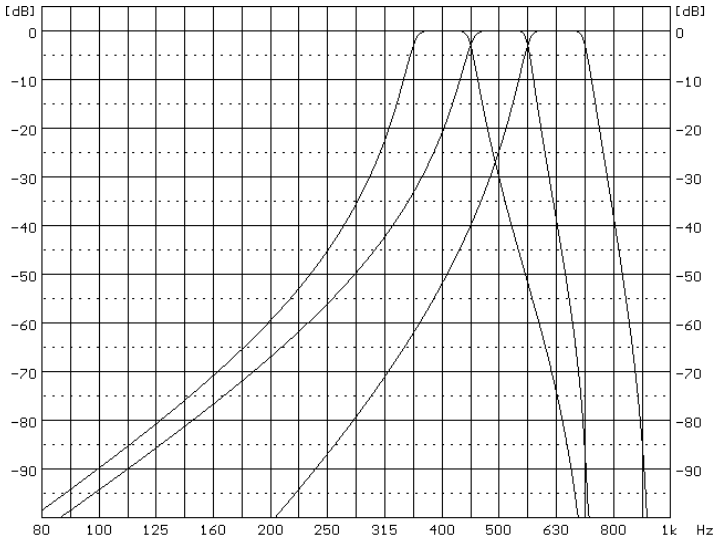
1/3 octave filters for 4.0 kHz 1/1 octave filter



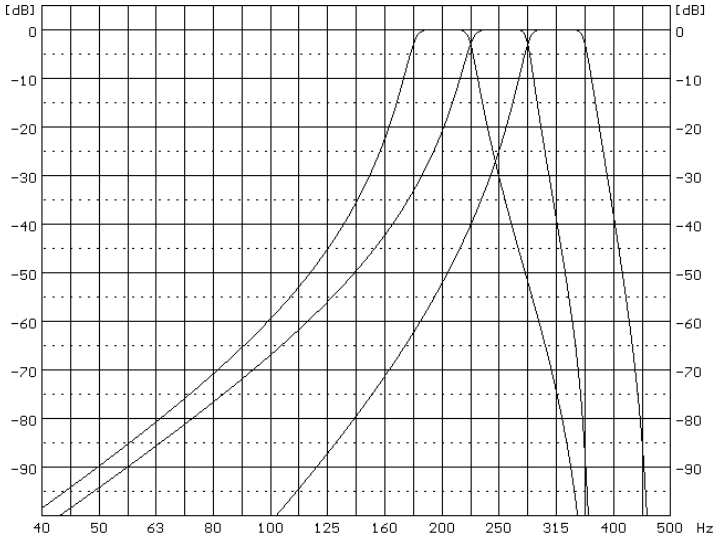
1/3 octave filters for 2.0 kHz 1/1 octave filter



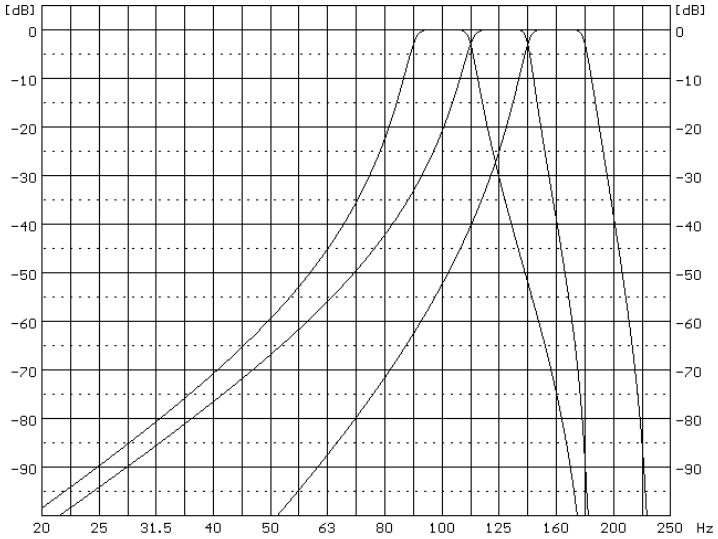
1/3 octave filters for 1.00 kHz 1/1 octave filter



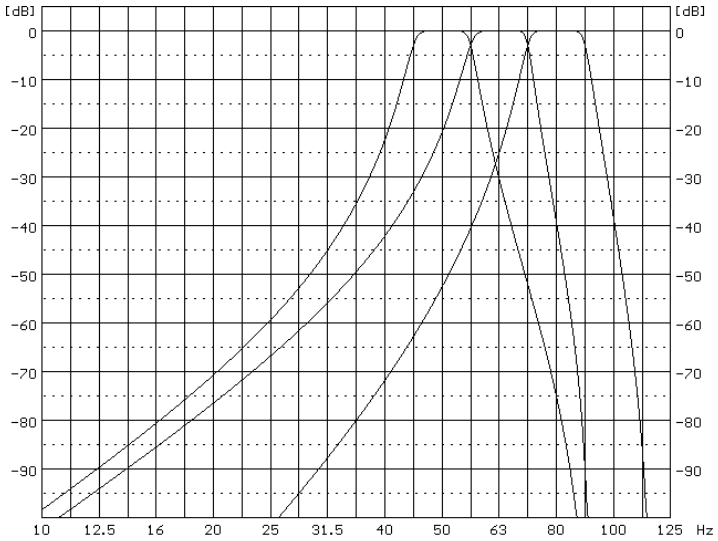
1/3 octave filters for 500 Hz 1/1 octave filter



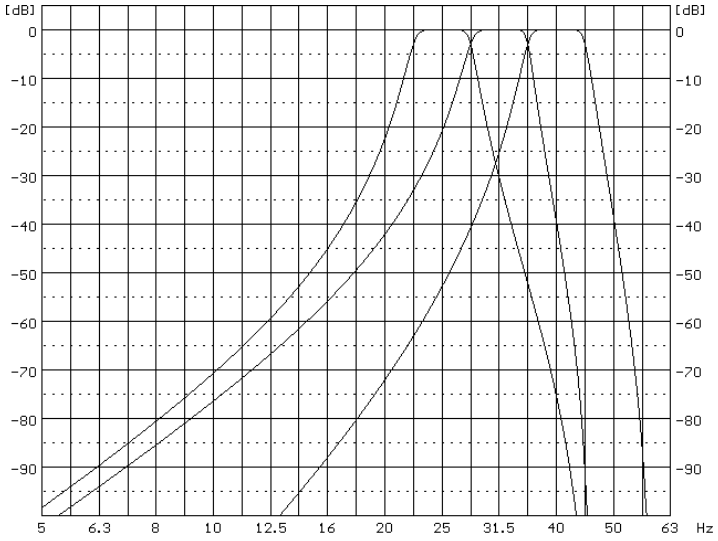
1/3 octave filters for 250 Hz 1/1 octave filter



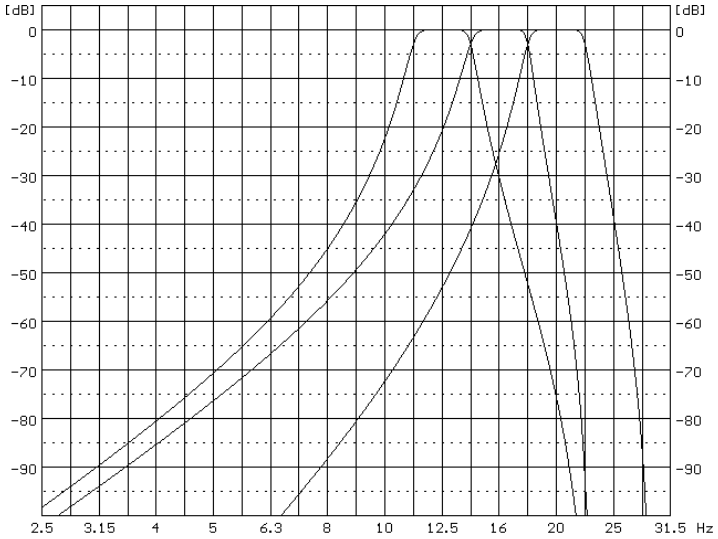
1/3 octave filters for 125 Hz 1/1 octave filter



1/3 octave filters for 63.0 Hz 1/1 octave filter



1/3 octave filters for 31.5 Hz 1/1 octave filter

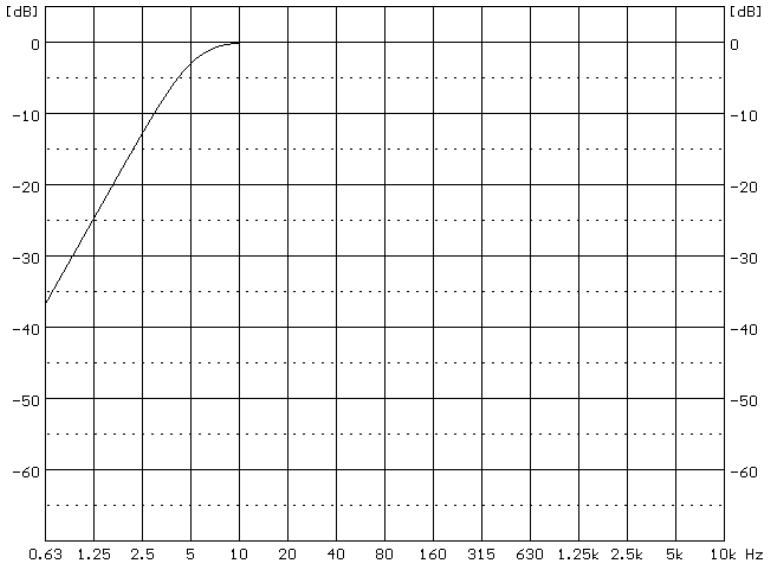


1/3 octave filters for 16.0 Hz 1/1 octave filter

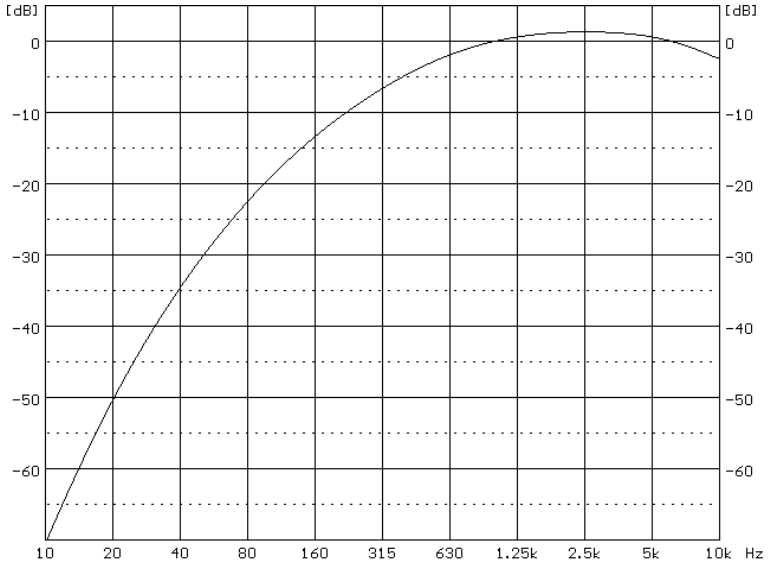
C.3 FREQUENCY CHARACTERISTICS OF THE IMPLEMENTED DIGITAL FILTERS

Digital weighting filters implemented in dose and octave mode

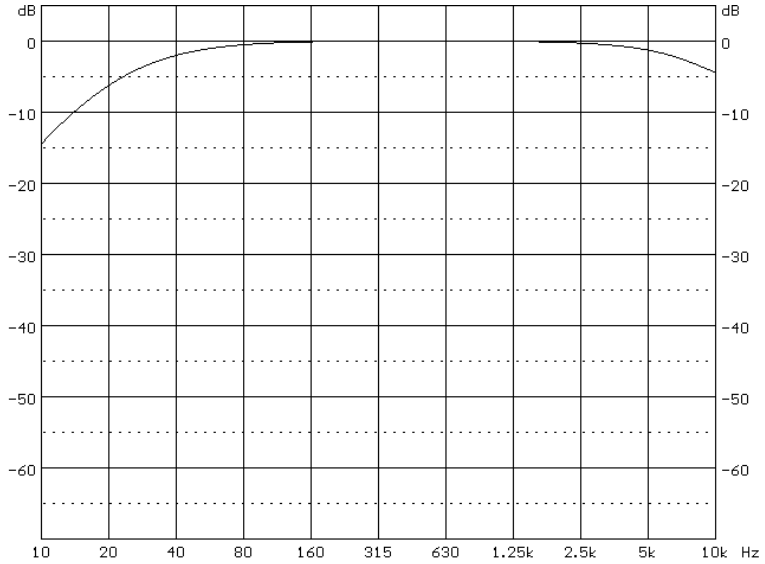
Z Filter: Class 2 according to the IEC 61672-1:2013 standard.



A Filter: Class 2 according to the IEC 61672-1:2013 standard.



C Filter Class 2 according to the IEC 61672-1:2013 standard.



The weighting filters, which are available in sound modes (**Z**, **A**, and **C**) are selected in thru SUPERVISOR software under the settings window.

C.4 GENERAL SPECIFICATION OF THE SV 104BIS

Signal input

The input of the measured signal (mounting head):

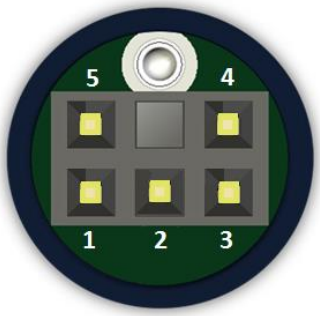


Figure C.10 ST 104CIS microphone connector (mounting head outer view)

Table C.9. Pin out of the microphone connector

Pin Number	Function
1	"SIGNAL" Input channel 1
2	2.8V/5mA supply DC voltage
3	"SIGNAL" Input channel 2
4	TEDS
5	GND
Chassis	Ground

Power supply

The instrument is dedicated for the operation from the internal rechargeable battery only.

- Instrument is dedicated for the operation from the internal rechargeable battery.
- Power consumption 14 mA[3] under measurement run from 3.7V internal cells.
- Typical operating time from internal single Li-ion rechargeable batteries is about **45 hours**.
- The recommended charging dock station is: **SB 104B-1, SB 104B-5**.
- Power consumption from the external ⎓6V source is approx. 190 mA (250mA max) at + 20°C under battery charging,
- Internal rechargeable battery is protected against overcurrent and overvoltage conditions. Safety Maximum Charging Current for Li-ion cells used in SV 104BIS is 725 mA and Maximum Charging Voltage is 4.4 VDC.

Note: *For the temperatures below 10°C operating time can decrease.*

Note: *The equipment shall only be charged in non-hazardous area by manufacturer's chargers on a fireproof surface.*

[3] display off, octave/one-third analysis off

Communication Interface and external Power Connector

The SV 104BIS electrical interface enables remote control of the instrument and data transfer up to attainable with 3 MHz clock.

"Client" communication port

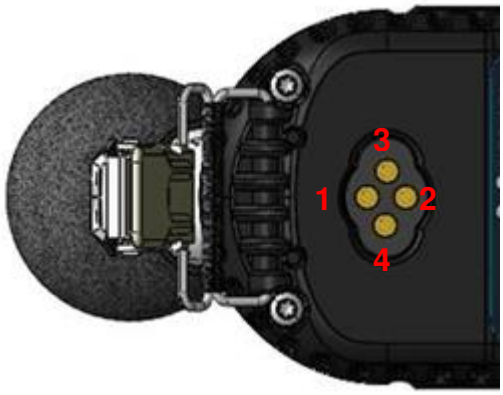


Figure C.11 Power and Communication Port (external bottom view)

Table C.10. Pin-out of the electrical interface

Pin number	Function
1	Power supply: ⎓**6V** ±1.3V **NOTE: Um=8V**
2	Ground
3	Receiver
4	Transmitter

Real Time Clock	built-in, accuracy better than 1 minute/month
Weight with the battery	~140 g (SV 104BIS with mounting clips and ST 104CIS and SA 122BIS)
Dimensions	90x50x31 mm (base: no microphone, no mounting accessories).

Safety

The product described above is compliant with following standards: EN/IEC 61010-1:2010

Note: *The measurement circuit is safety category I according to EN/IEC 61010-1:2010 standard. This measurement equipment should not be used for measurements in categories II, III, IV. The input voltage should be within the 30 V Peak – Peak.*

Category I equipment: *dedicated to measurements performed on circuits not directly connected to mains, such as circuits not derived from mains or protected mains-derived circuits, including low-voltage circuits from power supplies.*

Note: *SV 104BIS acoustic measurement is contactless.*

The device marked with symbol ⚠, meaning:

ATTENTION, CONSULT ACCOMPANYING DOCUMENTS

Environmental Ingress Protection:	**IP65** per EN 60529:1991/A2:2013 (IEC 60529:1989/Amd2: 2013). Dust-tight. Protected against water jets. Suitable for outdoor use.

Environmental parameters

Dedicated for indoor and outdoor use:

Operating temperature range	-10°C ÷ +50°C
Storing temperature range	-20°C ÷ +50°C
Charging temperature range	0°C ÷ +35°C
Humidity	≤ 90% RH in 40°C (uncondensed vapour)
Atmospheric pressure	80 kPa ÷ 110 kPa
Atmosphere	air with normal oxygen content, typically 21% v/v

WIRELESS BLUETOOTH 5.2 CONNECTIVITY

This dosimeter supports wireless connection via Bluetooth® 5.2 (Low energy). This connectivity is compatible with mobile and PC devices that support Bluetooth® 5.2.

- TX power: up to 8 dBm
- Receiver sensitivity: -90 dBm
- Range: typically, ≤50m line-of-sight and depending on local RF conditions.

The instrument contains a wireless transmission module, BGM121 from Silicon Laboratories. Copies of the modules regional approvals certificates may be obtained from Svantek or Silicon Laboratories.

- Declaration ID: D033250, Controller Subsystem Qualified Design ID: 88831

FCC and ISEDC

This product contains an FCC and Industry Canada certified Bluetooth® Low energy wireless transmission module:

- **FCC IDENTIFIER:** QOQBGM12LMA
- **Industry Canada IC:** 5123A-BGM12LMA
- Producer: Silicon Laboratories Inc.
- Model: BGM121V Bluetooth smart module
- Modular Type: Single Modular

FCC Statements:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter meets both portable and mobile limits as demonstrated in the RF Exposure Analysis and SAR

test report. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

ISEDC Statements:

This radio transmitter has been approved by Industry Canada to operate with its embedded antenna. Other antenna types are strictly prohibited for use with this device. This device complies with Industry Canada's license-exempt RSS standards. Operation is subject to the following two conditions:

(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Exception from routine SAR evaluation limits are given in RSS-102 Issue5. BGM121N meets the given requirements when the minimum separation distance to human body is less than equal to 15 mm. RF exposure or SAR evaluation is not required when the separation distance is 15 mm or more. BGM121A module has been tested for worst case RF exposure. As demonstrated in the SAR test report, BGM121A and BGM123A can be mounted in touch with human body without further SAR evaluation.

Compliance with EU Directives

CE mark indicates compliance with:

- **RED**, Radio Equipment Directive 2014/53/EU
- **RoHS2**, Restriction of Hazardous Substances in Electrical and Electronic Equipment 2011/65/EU
- **WEEE**, Waste of Electrical and Electronic Equipment 2012/19/EU

APPENDIX D DEFINITIONS AND FORMULAE OF MEASURED VALUES

D.1 BASIC TERMS AND DEFINITIONS

T — Current time period of the measurement in seconds.

T_1 — Last second of the measurement.

T_e — Exposure time in seconds (time period during which a person is exposed to the action of noise). This parameter can be set in the **Exposure Time** setup (**Measurement** menu). The available values are from 1 minute to 12 hours with 1-minute step.

T_{8h} — Time period equal to 8 hours (28 800 seconds).

τ — Exponential time constant in seconds for the giving time-weighting. Three time constants are available: **Slow** (1000 ms), **Fast** (125 ms), **Impulse** (35 ms, but on falling values a longer time constant of 1500 ms is applied).

W — Frequency-weighting filter: **A**, **C, B** or **Z**.

$p_W(t)$ — Instantaneous frequency-weighted sound pressure with the weighting filter **W**. Sound pressure is expressed in pascals (Pa).

$p_{W\tau}(t)$ — Instantaneous frequency and time-weighted sound pressure with the weighting filter **W** and time constant τ calculated from the equation:

$$p_{W\tau}(t) = \sqrt{\frac{1}{\tau}\int_{-\infty}^{t} p_W^2(\xi)\, e^{-(t-\xi)/\tau}\, d\xi}$$

where: ξ – variable of integration.

$r(t)$ — Instantaneous sound pressure depends on the <**RMS Integration**> parameter:

$$r(t) = \begin{cases} p_W(t) & \text{RMS Integration = Lin} \\ p_{W\tau}(t) & \text{RMS Integration = Exp} \end{cases}$$

p_0 — Reference value (20 μPa).

$\log(x)$ — Logarithm of x to the base 10.

Q — Exchange rate in decibels is equal to 2, 3, 4, 5 or 6. The value of Q influences the calculations of dose meter results, namely **DOSE**, **D_8h** and **LAV**. The exposure rate equal to 3 complies with ISO R 1999 “Assessment of Occupational Noise Exposure for Hearing Conservation Purposes”, while Q equal to 5 complies with the American “Occupational Safety and Health Act” – OSHA.

q

Value of q is used in the calculations of **DOSE**, **D_8h** and **LAV** is taken from the formula

$$q = \begin{cases} \dfrac{Q}{\log 2} & \text{for } Q \neq 3 \\ 10 & \text{for } Q = 3 \end{cases}$$

L_T

Threshold sound level set in the **Threshold Level** via the SUPERVISOR software. The available values are as follows: **None**, **60dB** up to **90dB** in 5 dB steps.

L_C

Criterion sound level set in the **Criterion Level** set via the SUPERVISOR software. The available values are from **60dB** up to **90dB** in 5 dB steps.

L(t)

Sound level (a function of time) measured with the selected time constant (**IMPULSE**, **FAST** or **SLOW**) and the weighting filter (equal to **A**, **C** or **Z**)

$$L(t) = 20 \log \frac{p_W(t)}{p_0}$$

$L_d(t)$

Sound level (a function of time) depends on the selected threshold level.

In case the **None** option is selected

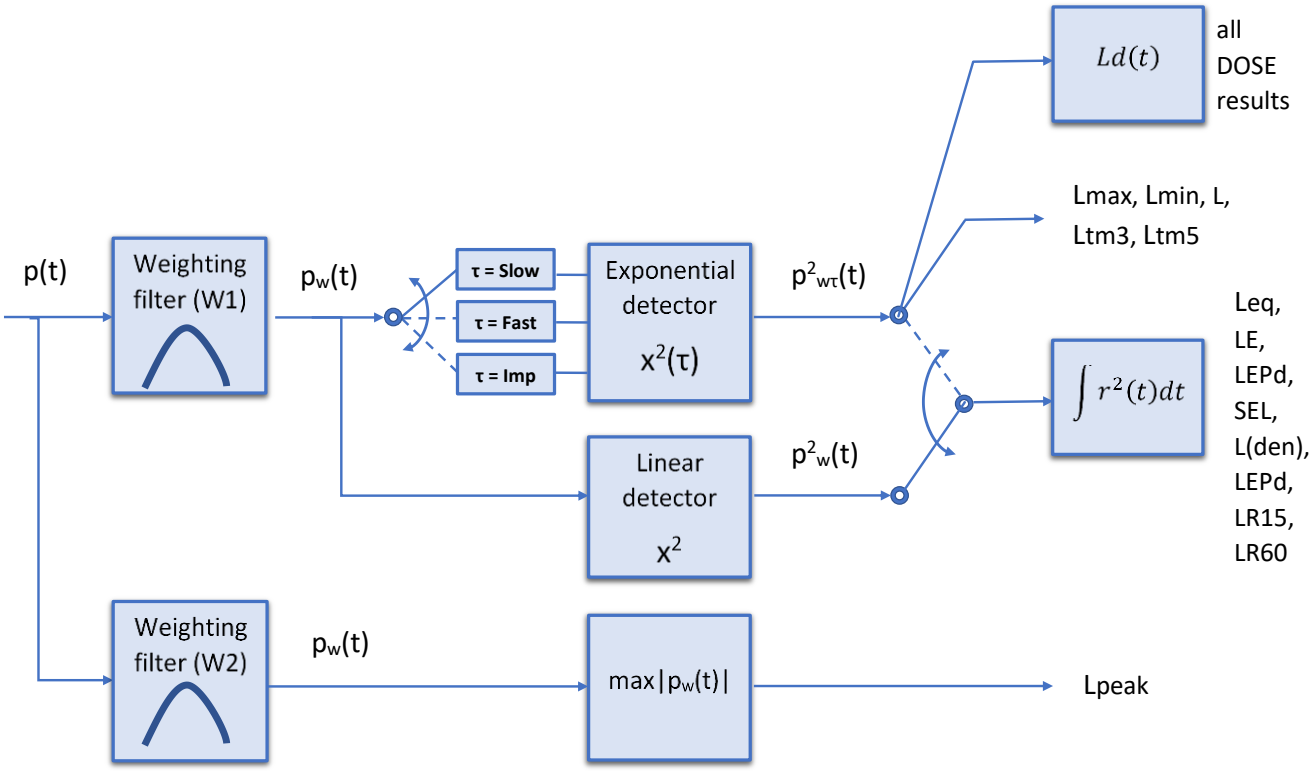
$$L_d(t) = L(t)$$

In other cases (when the **Threshold Level** set via the SUPERVISOR software is not set to none and equal to **60 dB** … or up to **90 dB**)

$$L_d(t) = \begin{cases} L(t) & \text{for } L(t) \geq L_T \\ -\infty & \text{for } L(t) < L_T \end{cases}$$

D.2 DEFINITIONS AND FORMULAS OF THE SLM FUNCTION RESULTS

The instrument calculates the sound measurement results in four profiles. The calculation flow diagram for the profile is presented below:



OVL — Percentage of the overloaded input signal, which occurred during the current time period of the measurement (**T**)

L(A/C/Z)peak — Peak sound level expressed in dB, for frequency weightings A, C, Z, symbols are **LApeak**, **LCpeak** and **LZpeak**. Peak sound level is calculated for the given **T**.

$$\mathbf{Peak = 10 \log \left(max_T \frac{p_w^2(t)}{p_0^2} \right)}$$

L(A/C/Z)(S/F/I) max — The highest time weighted sound level (**Max**) expressed in dB, within a stated time interval, for frequency weightings A, C, Z and time weightings F, S, I symbols are **LAFmax**, **LASmax**, **LCFmax**, **LCSmax** etc.

$$\mathbf{Max = 10 \log \left(max_T \frac{p_{w\tau}^2(t)}{p_0^2} \right)}$$

L(A/C/Z)(S/F/I) min

The lowest time weighted sound level (**Min**) expressed in dB, within a stated time interval, for frequency weightings A, C, Z and time weightings F, S, I symbols are **LAFmin**, **LASmin**, **LCFmin**, **LCSmin** etc.

$$\mathbf{Min = 10 \log \left(\min_T \frac{p^2_{W\tau}(t)}{p_0^2} \right)}$$

L(A/C/Z)(S/F/I)

Time weighted sound level expressed at observation time, expressed in dB, for frequency weightings A, C, Z and time weightings F, S, I symbols are **LAF**, **LAS**, **LCF**, **LCS** etc.

$$\mathbf{L = 10 \log \left(1/\tau \frac{p^2_{W\tau}(t)}{p_0^2} \right)}$$

L(A/C/Z)eq

Time averaged equivalent continuous sound level (**Leq**) expressed in dB, for frequency weightings A, C, Z symbols are **LAeq**, **LCeq** and **LZeq**. In principle time weighting is not involved in a determination of time averaged sound level. Time-averaged sound level is calculated for current time period of the measurement (**T**).

$$\mathbf{Leq = 10 \log \left(\frac{1}{T} \int_0^T (r(t)/p_0)^2 dt \right)}$$

L(A/C/Z)E

Sound Exposure Level (**SEL**) expressed in dB, for frequency weightings A, C, Z symbols are **LAE**, **LCE** and **LZE**. **SEL** is essentially the subset of the **Leq** result. Its value is equal to the **Leq** result referred to the integration time equal to one second (so, for the Integration time equal to 1 s, **SEL** is always equal to **Leq**).

$$\mathbf{SEL = 10 \log \left(\int_0^T (r(t)/p_0)^2 dt \right) = Leq + 10 \log \frac{T}{1s}}$$

LEPd

Daily Personal Noise Exposure is the noise exposure level for a nominal 8-hour working day. The **LEPd** result is calculated on the base of the **LEQ**

$$\mathbf{LEPd = Leq + 10 \log \frac{T_e}{T_{8h}}}$$

LTM3 and **LTM5** The **LTM3** and **LTM5** results (Takt-Maximal Levels) are calculated according to the German standard TA Lärm.

Ln

Statistical level is the certain boundary level surpassed by the temporary noise level values in not more than **nn %** of the observation period

Example: Let us assume that **L35** is equal to 76.8 dB. It means that during the measurements the noise level 76.8 dB was exceeded in not more than 35% of the observation period.

D.3 DEFINITIONS AND FORMULAS OF THE ADDITIONAL DOSIMETER FUNCTION RESULTS

DOSE

Quantity of noise received by the worker, expressed as the percentage of the whole day acceptable value.

$$DOSE = \frac{100\%}{T_{8h}} \int_0^T 10^{\frac{L_d(t)-L_c}{q}} dt$$

D_8h

Quantity of noise received by the worker during 8 hours.

$$D\_8h = \frac{100\%}{T} \int_0^T 10^{\frac{L_d(t)-L_c}{q}} dt = \frac{T_{8h}}{T} \cdot DOSE$$

PrDOSE

Quantity of noise received by the worker during exposure time.

$$Pr\,DOSE = \frac{100\%}{T} \int_0^T 10^{\frac{L_d(t)-L_c}{q}} dt = \frac{T_e}{T} \cdot DOSE$$

LAV

Average level of the acoustic pressure for the given time period of the measurement.

$$LAV = q \cdot \log\left(\frac{1}{T} \int_0^T 10^{\frac{L_d(t)}{q}} dt \right)$$

SEL8

SEL result corresponding to the integration time equal to 8 hours. The **SEL8** result is calculated on the base of the **LEQ**.

$$SEL8 = LEQ + 10 \cdot \log \frac{T_{8h}[s]}{1[s]}$$

PSEL

Individual Sound Exposure Level to the noise is equal to the standing sound level in a measurement period. The **PSEL** result is calculated on the base of the **LEQ**.

$$PSEL = LEQ + 10 \cdot \log \frac{T}{T_{8h}}$$

E

Amount of the acoustical energy received by the worker.

$$E = \frac{T[s]}{3600} p_o^2 \cdot 10^{\frac{LEQ}{10}}$$

E_8h

The **E_8h** result (Exposition in 8 hours) represents the amount of the acoustical energy received by the worker during 8 hours. The E_8h result is expressed in the linear units [Pa^2h].

$$E\_8h = 8[h] \cdot p_o^2 \cdot 10^{\frac{LEQ}{10}}$$

PTC

Peak Threshold Counter – the number of the overpasses of the Threshold Level by Lpeak result. This result is incremented in 100 ms intervals.

PTP

PTC result expressed in percent.

$$PTP = \frac{100 \cdot PTC}{10T_c}$$

ULT

Upper Limit Time: the time that the SPL exceeded the "ULT Threshold Level" set during configuration.

TWA

Time Weighted Average is the average A-weighted sound level for a nominal 8-hour workday with Time Weighting S and Exchange Rate 5. **TWA** is usually measured with A-weighting and Slow response detector type. **TWA** is calculated from the measured LAV (taking Threshold Level into account) and a Reference time of 8 h. Mainly used in the USA for assessing the noise exposure for a worker during a workday.

- Sound levels at or above the **THRESHOLD LEVEL** are averaged into the calculations relating to noise exposure. **TWA** is calculated with no threshold level, or with threshold level (typically 80dB or 90dB)
- In case the time period is below 8 hours, the **TWA** is less than the **LAV** In case the time period is more than 8 hours, the **TWA** is greater than the **LAV**

PrTWA

Projected Time Weighted Average is calculated from the measured **LAV** (taking **THRESHOLD LEVEL** into account) and the exposure time.

Lc-a

The C-A measurement is an Leq that enhances the low-frequency components of the sound signal. It is the result of subtracting an A-weighted LAeq from a simultaneously collected C-weighted Leq

Lc-a = LCeq - LAeq

D.4 STATISTICAL LEVELS – LN DEFINITION

The noise level **L(t)** is the continuous random variable. The probability that the temporary noise level **L(t)** belongs to the interval $\langle L_k, L_k + \Delta L \rangle$ is called the class density and it can be expressed by the equation:

$$P_k\left[L_k \le L(t) \le L_k + \Delta L\right] = \sum_{i=1}^{n} \Delta t_i \Big/ P$$

where: Δt_i - time intervals, in which the noise level $L(t) \in \langle L_k, L_k + \Delta L \rangle$ occurs,

ΔL - so-called class interval or distribution class of the series,

P - total observation period.

In case when the class interval approaches infinity, the probability of **L(t)** tends to the probability of L_k. In practice, ΔL value is strictly determined, and it depends mainly on the dynamics of the measurements performed in the instrument. There are 100 classes in the instrument and the width of each class is 1 dB. The histogram is the set of the class density values calculated for all classes.

The statistical distribution function, which determines the probability (expressed in %) of the noise occurrence on the level equal or less than $L_k + \Delta L$ is given by the formulae:

$$P\left[L(t) \le L_j\right] = \sum_{k=1}^{j} P_k(L)$$

The cumulative density function, expressed by the equation:

$$P\left[L(t) > L_j\right] = 1 - P\left[L(t) \le L_j\right]$$

is directly used to determine so-called statistical levels **Ln** or position parameters of the distribution.

The **Ln** is the certain boundary level surpassed by the temporary noise level values in not more than **n%** of the observation period.

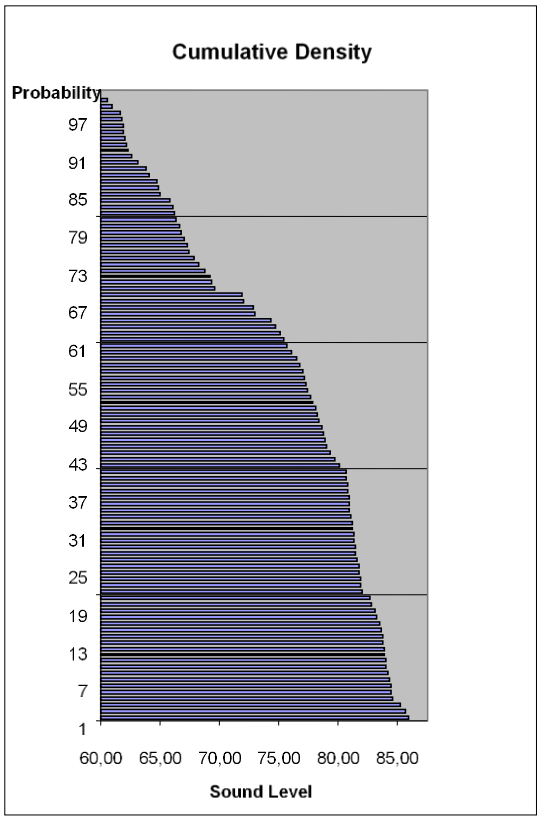
Example:

Let us assume that **L35** is equal to 76.8 dB. It means that during the measurements the noise level 76.8 dB was exceeded in not more than 35% of the observation period.

The cumulative density function for the exemplary data is presented in Figure on the right side. In order to determine the **Ln** level, one has to draw the horizontal cursor and find out the crossing point between the cumulative density function and the cursor. In the instrument the user can determine 10 statistical levels - from **L01** to **L99** (1% step of observation period).

The display in the instrument presents only first statistical level N1 (set to: L01 up to L99).

The statistical level **Ln** value, the profile's number the statistics are taken from, the RMS detector (**Lin.**, or **Exp.**: **Fast**, **Slow** or **Imp**.), the filter's name (**A**, **C** or **Z**) and real time are displayed in the top-right side of the display in one-result view mode.



Exemplary cumulative density