

4. MEASUREMENT FUNCTIONS OF THE INSTRUMENT

The **SVAN 945** is a unique pocket instrument combining functions of a **sound level meter (SLM)**, with the Type 1 accuracy (according to IEC 651, IEC 804 and IEC 61672-1 standards), **1/1 OCTAVE** and **1/3 OCTAVE** real time analyser in which in parallel operate the digital pass-band filters. The values of the central frequencies of these filters are defined in the sequence conforming to the base two system. All 1/1 octave & 1/3 octave filters are Type 1 (according to IEC 1260 standard).

In the instrument the measurement of loudness is also available and the long term acoustics monitoring or pure tone detection is possible.

Thanks to the application of the state of the art in the digital signal processing in the instrument work in parallel **three independent sound level meters, so-called here profiles**, which perform the measurement of the acoustic signal with the selectable combination of **A, C** or **LIN (Z)** weighting filters (conforming to IEC 61672-1 standard) and **SLOW, FAST** or **IMPULSE** RMS detectors. **1/1 OCTAVE or 1/3 OCTAVE analyser can work simultaneously with the mentioned above profiles.**

The measurement of **SPL, LEQ, SEL, Lex8, Ltm3, Ltm5, PEAK, MAX, MIN, statistics (LN)** and **time history** are performed simultaneously in all profiles (cf. Appendix D for the definitions).

The measurement results can be presented on the screen of the instrument in the different ways depending on the selected function and the setting of the parameters. In the case of the sound level meter the following display modes (the ways of the measurement results presentation) are available:

- One Profile, **3 PROFILES, STATISTICS** and **PLOT**.
- In the case of **1/1 OCTAVE & 1/3 OCTAVE analysis** the possibility of the spectra presentation is also available (**SPECTRUM** mode).
- The **selection of the display mode** is made by pressing the **<ENTER>** push-button.
- The **switching between the profiles** is possible by pressing the **<ENTER>** and **<SHIFT>** push-buttons (**<ESC>**).
- The **switching between the results in the selected profile** is made by pressing the **<◀>**, **<▶>** push-buttons (in One Profile or **3 PROFILES**).
- The **changing of the statistics class, 1/1 octave or 1/3 octave filter** and the **value in the buffer** is done by pressing the **<◀>**, **<▶>** push-buttons (in **STATISTICS, SPECTRUM** and **PLOT**).
- The pressing of the **<◀>**, **<▶>** together with **<SHIFT>** push-button enables the user to **change the relation between the vertical and horizontal axis** for the **SPECTRUM** and **PLOT** presentations and to **change the statistics class** in One Profile or **3 PROFILES** presentation.
- The pressing of the **<INPUT>** and **<FILE>** push-button enables the user to see the spectra registered in the buffer's file of the instrument.

The acoustic measurement channel, consisted of the instrument, the preamplifier SV 11 and the microphone, is factory calibrated and prepared for the work in the standard environmental conditions. The calibration of the measurement channel has to be done when the absolute sound pressure level value is important. It is because the microphone sensitivity is a function of the temperature, ambient pressure and humidity. The calibration procedure is described in Chapter 4.1.

The main function of the instrument is the **measurement of sound level. 1/1 OCTAVE** or **1/3 OCTAVE** analysis, the measurement of loudness, etc. are the optional functions, which broaden the applications of the instrument. They can be supported by the producer or purchased later. The producer activates the optional functions bought with the instrument. The user should activate the functions purchased later. The way of this activation is presented in Chapter 4.3.

The detailed description of the usage of the instrument to:

- **The calibration of the measurement channel** is shown in **Chapter 4.1**.
- **The measurement of sound level** is given in **Chapter 4.2**.
- **1/1 OCTAVE analysis** is presented in **Chapter 4.4**.
- **1/3 OCTAVE analysis** is discussed in **Chapter 4.5**.

The additional functions of the instrument, namely: the available ways of the measurement results presentation (*DISPLAY* list), the settings (*SETUP* list), the storing of the measurement results (*FILE* list) and the printing of the reports (*REPORT* list), are described in Chapter 5.

4.1. CALIBRATION

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, when the absolute sound pressure level value is important, the calibration of the measurement channel has to be done. In order to select a calibration function the user has to enter the **FUNCTION** list by pressing the **<FUNC>** push-button (the **<DISPLAY>** in conjunction with the **<SHIFT>** one). This list contains two sub-lists: **FUNCTION** and **CALIBRATION**. Next, the user has to open the **CALIBRATION** sub-list (to select the **CALIBRATION** text using the **<◀>**, **<▶>** push-buttons and press the **<ENTER>** push-button when this text is displayed inversely).



The view of the screens with the **FUNCTION** list and after entering the **CALIBRATION** sub-list

Calibration procedure of the instrument

The calibration for the sound measurements can be done in the following way:

1. Attach the acoustic calibrator SV 30 (or equivalent 94 dB / 1000 Hz) to the instrument's microphone.



Notice: It is also possible to use the pistonphone, which generates the signal ca 124 dB or different type of acoustic calibrator dedicated for 1/2" microphones. **In any case, before starting the calibration measurement, the user has to set (by means of the **<◀>**, **<▶>** push-buttons) the level of the signal generated by the given calibrator (CAL. LEVEL position of CALIBRATION sub-list), which is usually stated in the calibration certificate of the unit (the value of the CAL. LEVEL set by the producer of SVAN 945 is equal to 94.0 dB).**

2. Switch on the calibrator and wait ca 30 seconds before starting the calibration measurement.
3. Start the calibration measurement by pressing the **<ST/SP>** push-button (the **<PAUSE>** in conjunction with the **<SHIFT>**). The measurement time is set to 5 seconds with 5 seconds delay. During the calibration measurement the **<ESC>** push-button does not operate but it is possible to stop the measurement using the **<ST/SP>** push-button.



The view of the screens during the calibration measurement

Waiting for the start of the measurements the **DELAY** is counted down on the screen and the **CALIBRATION** text is changing (from big letters to small and vice versa). During the measurements the **cal. measure** text is changing. After the end of the measurement its result is displayed on the screen in the bottom line.

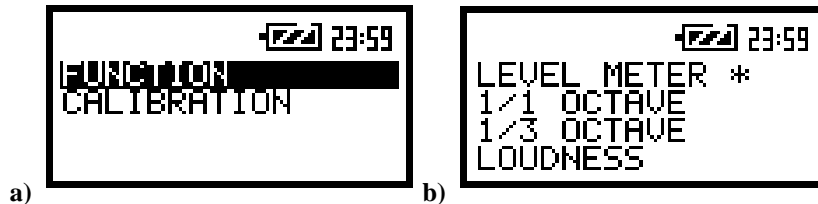
It is recommended to repeat the calibration measurement few times. The obtained results should be almost the same (with ± 0.1 dB difference). The reasons for the unstable results are as follows:

- the calibrator is not properly attached to the instrument,
- there are external disturbances,

4.2. SOUND LEVEL METER

The **SOUND LEVEL METER mode** provides the user with the functions of the **SLM** meeting the IEC 651, IEC 804 and IEC 61672-1 standards for the Type 1 accuracy. Using the measurement results logged in the huge buffer the instrument can also be used for the long-term acoustic monitoring.

In order to select the **SLM** mode the user has to enter the **FUNCTION** list by pressing the **<FUNC>** push-button (the **<DISPLAY>** in conjunction with the **<SHIFT>**). This list contains two sub-lists: **FUNCTION** and **CALIBRATION**. The user has to open next the **FUNCTION** sub-list (to select the text **FUNCTION** using the **<◀>**, **<▶>** push-buttons and press the **<ENTER>** push-button when this text is displayed inversely).



The view of the screens with the **FUNCTION** list opened (a) and after entering the **FUNCTION** sub-list (b)

The **SLM** mode is selected by placing the asterisk character in the line with the **LEVEL METER** text. The position of the asterisk can be changed using the **<◀>**, **<▶>** push-buttons. After placing the asterisks in the line with the **LEVEL METER** text the user has to press the **<ENTER>** push-button. After this the instrument confirms the selection of the function displaying for about 2 seconds the text:

**LEVEL METER
selected ! / SELECTED !**

and closes the **FUNCTION** sub-list.



Notice: It is not possible to change the mode during the measurements. The instrument displays in this case for about 3 seconds the text: **“measurement in progress / MEASUREMENT IN PROGRESS”**. In order to change the mode of the instrument the measurement must be finished!

The operation in **one measurement RANGE** from **24 dBA_{RMS}** to **135 dBA_{RMS}** (**138 dB_{PEAK}**) is the main distinguishing feature of the **SLM mode** of the instrument (for $\frac{1}{2}$ " condenser microphone with the sensitivity of 50 mV/Pa supplied with the unit).

The second distinguishing feature of the instrument is that **sound is always measured in three parallel “profiles” which are in fact three separate sound level meters working independently.**



Notice: **SOUND LEVEL METER is the main mode of the instrument.** In the **SLM mode** there is no access to **1/1 OCTAVE** or **1/3 OCTAVE** analysis.

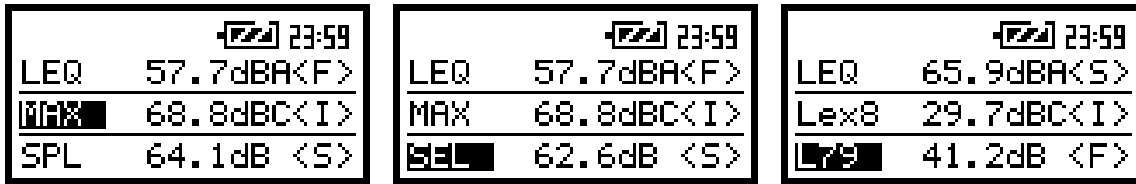
For each of the profiles the **RMS detector type** and the **weighting filter can be defined independently** (see the **INPUT** list).

The “main results” of the profiles are presented on the display in the form described below. For each profile the selected result is displayed on the left side followed by its value, units and the type of the detector. The **dBA**, **dBC** or **dB** units are related with the weighting filter selected for the given profile:

- the usage of **A** weighting filter is indicated by **dBA** units,
- the usage of **C** weighting filter is indicated by **dBC** units,
- the usage of **LIN** weighting filter is indicated by **dB** units.

On the right side of the display the **RMS detector type** (selected for the given profile) is presented:

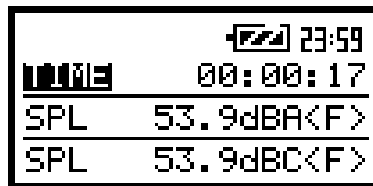
- the **SLOW** type RMS detector is indicated by the symbol <S>,
- the **FAST** type RMS detector is indicated by the symbol <F>,
- the **IMPULSE** type RMS detector is indicated by the symbol <I>.



The view of the instrument's screens in 3 PROFILES display mode

For each of the profiles (three independent measurement modules) the following results are measured in parallel (see Appendix D for the definitions):

- **PEAK**,
- **MAX**,
- **MIN**,
- **SPL** (the displayed **SPL** value is the biggest measured result for the selected RMS detector **over the last second** of the measurement),
- **LEQ**,
- **SEL**,
- **Lex8**,
- **Ltm3**,
- **Ltm5**,
- **LN** – selected by the user statistics class (where N is from 1 to 99),
- **Current measurement time** (this time is available in the result's field only in **3 PROFILES** display mode).



The view of the instrument's screen in 3 PROFILES display mode with the current measurement time



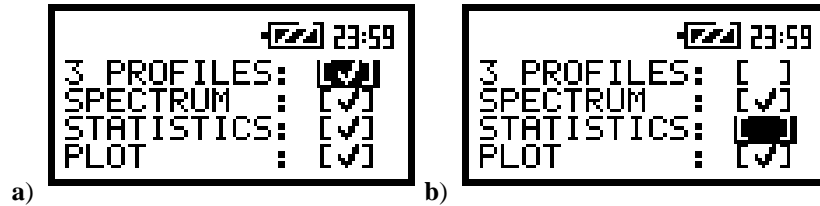
Notice: Switching between the profiles is possible by pressing the <ESC> push-button (<ENTER> together with <SHIFT>). Switching between the results for the selected profile is made by pressing only the <◀>, <▶> push-buttons. In order to change the N in statistical level the user has to press the <◀>, <▶> push-buttons together with the <SHIFT> one.

By pressing the <ENTER> push-button the user can switch the display mode (the way of the measurement results presentation) to:

- One Profile,
- **3 PROFILES**,
- **STATISTICS**,
- **PLOT**.

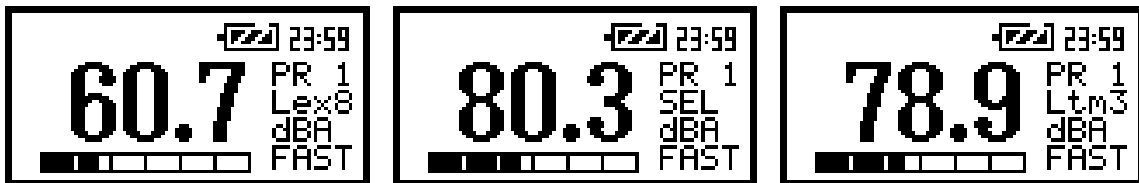


Notice: All, mentioned above, display modes (except One Profile) have to be activated in the **DISPLAY** sub-list of the **DISPLAY** list. This activation is indicated by the graphical symbol placed in the proper line of the **DISPLAY** sub-list. Below the view of the screens is presented with all active modes ([√]) and some of them switched off ([]). More details about the display modes are given in the description of the **DISPLAY** list in the Chapter 5.



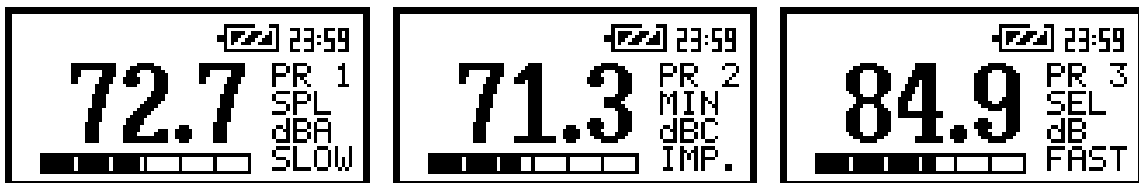
The view of the screens with the **DISPLAY** sub-list opened and active all ways of the measurement results presentation (a) and some of them switched off (b)

In one profile mode the selected result is presented in the middle of the screen in the easy visible format. The length of the horizontal bar placed under the digital value corresponds to the measured result. In this mode important parameters of the result, namely: the profile's number, the name of the displayed value, the weighting filter (given by the units) and the RMS detector's type are presented in four lines on the right side of the display.



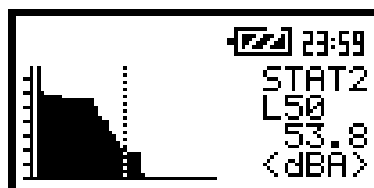
The view of the screens in one profile presentation

The change of the profile is achieved by pressing the **<ESC>** push-button (**<ENTER>** together with **<SHIFT>**). The switching between the results in the given profile is done by pressing the **<◀>**, **<▶>** push-buttons. The selection of the statistical level number needs in this presentation mode pressing the **<◀>**, **<▶>** push-buttons together with the **<SHIFT>** one.



The view of the screens in one profile presentation – the changing of the profiles

In the **STATISTICS** presentation all **LN** (from $N = 1$ up to $N = 99$) values for the selected profile are presented. The read-out of the interested **LN** value can be done using the cursor controlled by the **<◀>**, **<▶>** push-buttons. In this way of presentation the selected profile's number, the statistics class, its value and units are given on the right side of the display.



The view of the screen in **STATISTICS** way of presentation



Notice: The last selected statistics class (**LN** value) conforming to the cursor position in the **STATISTICS** mode of presentation, one for each profile, is also given in the other display modes (ways of the measurement results presentation).

In the **PLOT** presentation the results logged in the buffer's file of the instrument are also given on the display in the time history form. Each line corresponds to one measurement result (the results are registered with the step set in the **BUF. STEP** position of the **MEASURE SETUP** sub-list).

The read-out of the interested value can be done using the cursor controlled by the <◀>, <▶> push-buttons. The selected profile's number, time of the measurement and the measured result with its unit are presented on the right side of the display

In the **PLOT** it is possible to shift the horizontal axis in relation to the vertical one using the <◀>, <▶> push-buttons together with the <SHIFT> one.



The view of the screens in the PLOT presentation mode with the shifted axes



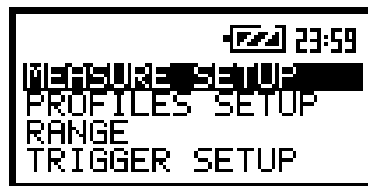
Notice: In the buffer many time histories can be stored, registered during the measurements. The user can select for the presentation the required time history in the **BUFFER VIEW** window available in the **DISPLAY** list (see Chapter 5 for details).

4.2.1. Measurement parameters setting

The important parameters for the measurement are programmed by means of the **INPUT** and **SETUP** lists.

Measurement parameters setting – INPUT list

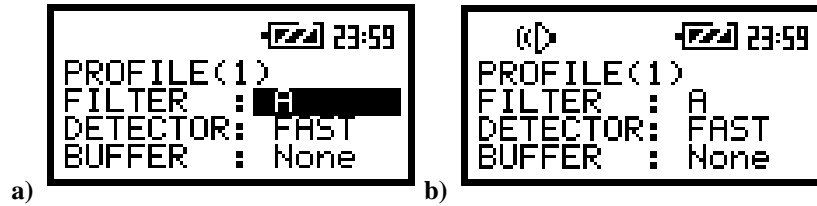
Setting of the profiles parameters can be done by means of the **INPUT** list after pressing the <INPUT> push-button. This list enables one the independent programming of the measurement parameters (**MEASURE SETUP** sub-list), the parameters of three profiles and 1/1 OCTAVE & 1/3 OCTAVE analysis (**PROFILES SETUP** sub-list), common for all profiles setting of the input range (**RANGE** position) and the trigger function (**TRIGGER SETUP** sub-list).



The view of the screen with the **INPUT** list opened



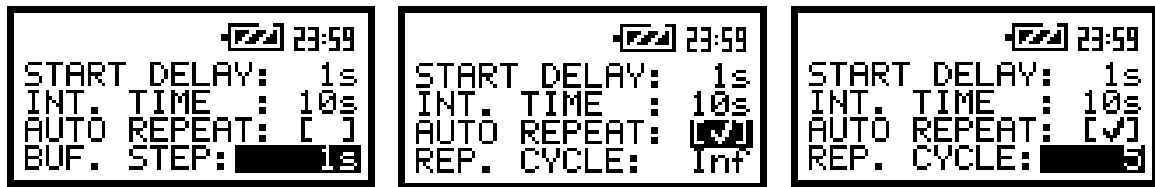
Notice: Any parameter in the **INPUT** list can be changed only when the instrument does not execute a measurement. The possibility of a change is signalled by displaying inversely a parameter's field. And in opposite, normally displayed field means that the parameter cannot be changed. The "Loudspeaker" icon indicates that the instrument is performing the measurements.



The view of the screen with the active (a) and not active (b) the PROFILE x sub-list

Selection of measurement parameters – MEASURE SETUP sub-list

The **MEASURE SETUP** sub-list consists of the parameters, which can be set, switched on or off, namely: the delay of the start of measurements (**START DELAY** position), the integration time (**INT. TIME** position), the repetition of the measurements (**AUTO REPEAT** position), the buffer's step (**BUF. STEP** position) and the number of the repetition of measurement cycles (**REP. CYCLE** position). The change of the displayed inversely parameter is performed by pressing the **<ENTER>** push-button. The **MEASURE SETUP** sub-list is closed after pressing in any time the **<ESC>** push-button or pressing the **<ENTER>** one, when the last parameter available for changing is displayed inversely.



The view of the screen with the MEASURE SETUP sub-list opened

Setting time delay before the start of measurements – START DELAY position

The **START DELAY** position defines the delay from the pressing the **<ST/SP>** push-button (the **<PAUSE>** together with the **<SHIFT>**) to the start of the measurements (the digital filters of the instrument analyse constantly the input signal even when the measurements are stopped). This delay can be set from **1 second** to **60 seconds** (with 1 second step by means of the **<◀>**, **<▶>** push-buttons and with 10 seconds step with the **<◀>**, **<▶>** push-buttons pressed together with the **<SHIFT>** one; the **<ENTER>** push-button must be pressed for the confirmation).



Notice: The minimum delay time is equal to 1 second. It protects from the registration by the instrument the effects of the push-button pressing. In the **CALIBRATION** mode the delay time is equal to 5 seconds.

Setting the integration time – INT. TIME position

The **INT. TIME** position defines the time period in which the signal is being averaged during the sound level measurements. The required parameter can be set by means of the **<◀>**, **<▶>** and confirmed by the **<ENTER>** push-button.

The integration time (**INT.TIME**) can be set (by pressing the **<▶>** or **<▶>** with **<SHIFT>** push-buttons):

- from **1 s** to **59 s** (with **1 second** or **10 seconds** step),
- from **1 m** (min) to **59 m** (with **1 minute** or **10 minutes** step) and
- from **1 h** to **24 h** (with **1 hour** or **10 hours** step).

Additionally, the predefined periods: **1 m**, **5 m**, **15 m**, **1 h**, **8 h** and **24 h**, which are enumerated in the standards, are also available (by pressing the <◀> push-button or <◀> with <SHIFT>).



Notice: The measurement can also be **temporary stopped** by pressing the <PAUSE> push-button. It inserts an arbitrary long **PAUSE**. The measurements can be continued after pressing the <ST/SP> push-button (the <PAUSE> together with the <SHIFT>). The subsequent pressing of the <PAUSE> push-button causes the cancellation of the last second of the measurement. This procedure can be repeated up to fifteen times (last 15 seconds of the measurement can be cancelled and erased from the memory).



Notice: In the case of switching on the **AUTO SAVE** and **AUTO REPEAT** functions the **minimum value of the integration time is equal to 5 seconds** (cf. Chapter 5).

Controlling of the repetition of measurements – AUTO REPEAT position

The **AUTO REPEAT** function can be used for performing continuously sound level measurements (when **AUTO REPEAT**: [√]) with the integration time greater or equal to 5 seconds.

The switched on **AUTO REPEAT** function ([√]) causes the following operations:

- The **REP. CYCLE** position is activated (see below).
- The new measurement is started automatically when the programmed integration time (**INT. TIME**) is reached.
- The measured **PEAK**, **MAX**, **MIN** or **RMS** results (over the **INT. TIME** periods), selected in the **BUFFER** position of the **PROFILE X** sub-list, are automatically stored in the buffer's file of the instrument!
- The **AUTO SAVE** function can be used to store all measurement results for each **INT. TIME** period greater or equal to 5 seconds.

The switched off **AUTO REPEAT** function ([]) causes the following operations:

- The **BUF. STEP** position is activated (see below).
- The measurement is finished automatically when the programmed integration time (**INT. TIME**) is reached.
- All measured **PEAK**, **MAX**, **MIN** or **RMS** calculated for the time set in the **BUF. STEP** position **over the INT. TIME** period, selected in the **BUFFER** position of the **PROFILE X** sub-list, are automatically stored in the buffer's file of the instrument!
- The **AUTO SAVE** function can be used to store automatically the measurement results.

Setting time between two writings to the buffer's file – BUF. STEP position

The **BUF. STEP** position defines the time period of the data logging in the buffer's file. It can be set from **10 ms** to **1 s** in 1, 2, 5 sequence. The required parameter can be set by means of the <◀>, <▶> push-buttons and accepted by the <ENTER> one.



Notice: The **BUF. STEP** position is active only for the single measurements (when the **AUTO REPEAT** function is switched off - []).

Setting number of repetition of measurement cycles – REP. CYCLE position

The **REP. CYCLE** position defines the number of cycles (with the measurement time defined in the **INT. TIME** position) which should be performed by the instrument. The required parameter can be set by

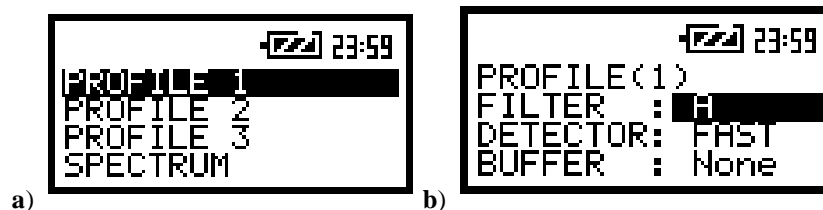
means of the <◀>, <▶> push-buttons and accepted by the <ENTER> one. The **Inf** value denotes the infinite repetition of the measurements (till the pressing of the <ST/SP> push-button).



Notice: The **REP. CYCLE** position is active only for the repetitive measurements (when the **AUTO REPEAT** function is switched on [N]).

Setting parameters in profiles and for octave analysis – PROFILES SETUP sub-list

The user enters the **PROFILES SETUP** sub-list after pressing the <ENTER> push-button on the displayed inversely **PROFILES SETUP** text. This sub-list consists of three **PROFILE x** and one **SPECTRUM** sub-lists. The next pressing of the same push-button opens the sub-list for a profile or spectrum (the spectrum is dedicated for **1/1 OCTAVE** & **1/3 OCTAVE** analysis).



The view of the sub-lists: **PROFILES SETUP** (a) and **PROFILE x** (b)

Setting parameters in a profile – PROFILE x sub-list

In the **PROFILE x** sub-list the following parameters can be programmed independently for each profile:

- **weighting filter**,
- **RMS detector type**,
- **profile's result logged in the buffer's file**.

Passing throughout the sub-list is possible by pressing the <ENTER> push-button.

Selection of the weighting filter in SLM – FILTER position

The following weighting filters are available in a profile of the instrument:

- **A** type 1 according to the IEC 651 and IEC 61672-1 standards,
- **C** type 1 according to the IEC 651 and IEC 61672-1 standards,
- **LIN** conforms to the requirements for the **Z** filter of type 1 according to the IEC 61672-1 standard.

The characteristics of the filters are given in the Appendix D. The selection of the required filter is made with the <◀>, <▶> push-buttons. The user can pass to the selection of the next parameter from the **PROFILE x** sub-list pressing the <ENTER> push-button. The return to the **PROFILES SETUP** sub-list is made after pressing the <ESC> push-button.

Selection of the RMS detector – DETECTOR position

In the instrument three RMS detectors are available: **IMPULSE**, **FAST** and **SLOW**. The selection of the required detector is made with the <◀>, <▶> push-buttons. The user can pass to the selection of the next parameter from the **PROFILE x** sub-list pressing the <ENTER> push-button. The return to the **PROFILES SETUP** sub-list is made after pressing the <ESC> push-button.

Selection of the SLM result to be saved in the buffer's file – BUFFER position

One measurement result from each profile can be saved in the buffer's file of the instrument. The following results can be saved: **PEAK**, **MAX**, **MIN** and **RMS**. The selection of the required result is made with the <◀>, <▶> push-buttons. The selection of the **None** text means that from this profile no result is to be saved in the buffer's file. The user causes the return to the **PROFILES SETUP** sub-list pressing the <ENTER> push-button in the **BUFFER** position. The return to the **PROFILES SETUP** sub-list is also possible after pressing the <ESC> push-button.



Notice: The change of the profiles parameters is not possible when the measurement is performed. The user has to finish the current measurement.



Notice: Setting **BUFFER:None** results in bypassing the storing of the given profile's results in the buffer's file. It creates more space in the buffer for other profiles (see Chapter 5 for details).



Notice: The buffer is updated in the time periods (steps) defined in the **BUF. STEP** position when **AUTO REPEAT** is switched off ([J]) or after each **INT. TIME** period when **AUTO REPEAT** is switched on ([√]). The way the measurement results are stored is described in Chapter 5.

The **SPECTRUM** sub-list of the **PROFILES SETUP** sub-list enables the user to set the parameters of 1/1 **OCTAVE** & 1/3 **OCTAVE** analyser.

Selection of the measurement range in SLM – RANGE position

After entering the **RANGE** position (the selection of the **RANGE** text from the **INPUT** list by means of the <◀>, <▶> push-buttons and pressing the <ENTER> push-button) the change of the input range is possible. For the **SLM** the instrument operates in **one, wide 125 dB** dynamic range and **no other ranges are available**. The return to the **INPUT** list is made after pressing the <ESC> or <ENTER> push-buttons.

This position is important for 1/1 **OCTAVE** and 1/3 **OCTAVE** analysis (see Chapter 4.4 and 4.5).



The view of the screen in the **RANGE** position of the SLM

Selection of mode and parameters of triggering – TRIGGER SETUP sub-list

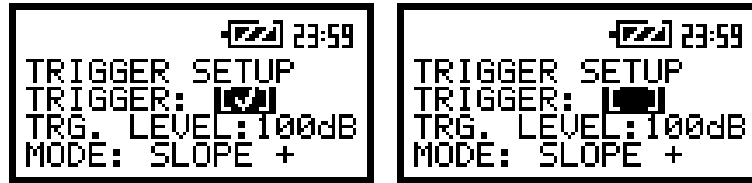
The **TRIGGER SETUP** sub-list consists of the positions, which can be set, switched on ([√]) or off ([J]). These positions are as follows:

- The triggering of the measurements (**TRIGGER** position).
- The level of the triggering (**TRG. LEVEL** position).
- The way of the triggering (**MODE** position).

The **TRIGGER SETUP** sub-list is closed after pressing in any time the <ESC> push-button or pressing the <ENTER> one when the option in the **MODE** line is displayed inversely.

Switching the triggering on and off- TRIGGER position

The triggering of the measurements (**TRIGGER** position) can be switched on ([✓]) or off ([]) using the <◀>, <▶> push-buttons. The user can pass to the selection of the next parameter from the **TRIGGER SETUP** sub-list pressing the <ENTER> push-button. The return to the **INPUT** list is made after pressing the <ESC> push-button.



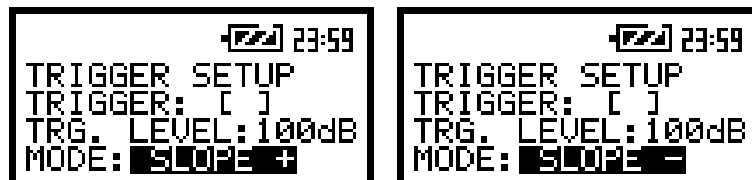
The view of the screens in the **TRIGGER SETUP** sub-list

Setting the level of triggering – TRG. LEVEL position

The level of the triggering (**TRG. LEVEL** position) can be set in 1 dB step (or 10 dB steps) from 24 dB to 136 dB range using the <◀>, <▶> push-buttons (or <◀>, <▶> with <SHIFT>). The user can pass to the selection of the next parameter from the **TRIGGER SETUP** sub-list pressing the <ENTER> push-button. The return to the **INPUT** list is made after pressing the <ESC> push-button.

Selection of the triggering mode- MODE position

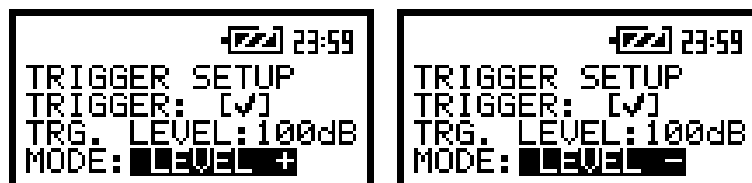
The way of the triggering (**MODE** position) can be determined by the slope of the triggering signal (**SLOPE +**, **SLOPE -**) or by the level of the signal (**LEVEL +** and **LEVEL -**). The change of the parameter in this line is performed after each pressing of the <◀>, <▶> push-buttons. The return to the **INPUT** list is made after pressing the <ESC> or <ENTER> push-buttons.



The view of the screens in the **TRIGGER SETUP** sub-list in the **MODE: SLOPE** option

In the case when the **SLOPE +** is selected, the measurement starts when the arising signal will pass the level determined in the **TRG. LEVEL** position.

In the case when the **SLOPE -** is selected, the measurement starts when the falling down signal will pass the level determined in the **TRG. LEVEL** position.



The view of the screens in the **TRIGGER SETUP** sub-list in the **MODE: LEVEL** option

In the case when the **LEVEL +** is selected, the measurement is registered only when the signal has the greater level then this determined in the **TRG. LEVEL** position.

In the case when the **LEVEL** - is selected, the measurement is registered only when the signal has the lower level then this determined in the **TRG. LEVEL** position.

The other parameters important for the sound measurements can be set by means of the **SETUP** list after pressing the **<SETUP>** push-button (the **<INPUT>** push-button together with the **<SHIFT>** one).



The view of the **SETUP** list

In the **SETUP** list the following elements are available:

- programmable clock (**TIMER** position),
- real time clock (**RTC** position),
- serial interface (**RS232** position),
- polarisation of the microphone (**MIC. POLAR.** position),
- mode of the **<SHIFT>** and **<PAUSE>** push-buttons (**SHIFT MODE** sub-list),
- return to the producer's (default) setup (**CLEAR SETUP** position),
- selection of the way of the integration for the **LEQ** calculation (**LEQ INTEGRATION** position).

The detailed description of the elements of the **SETUP** list is presented in Chapter 5. For the sound measurements two positions are important: the setting of the **LEQ INTEGRATION** parameter and the selection in the **MIC. POLAR.** position.

The **LEQ INTEGRATION** position enables the user to select the detector type for the calculations of the **LEQ** function. The required parameter can be set by means of the **<◀>**, **<▶>** push-buttons. The formulae used for the **LEQ** calculation are given in Appendix D. The return to the **SETUP** list is performed after pressing in any time the **<ESC>** or the **<ENTER>** push-buttons.



The view of the screens in the **SETUP** list (a) and with the possible options of **LEQ INTEGRATION** position (b), (c)

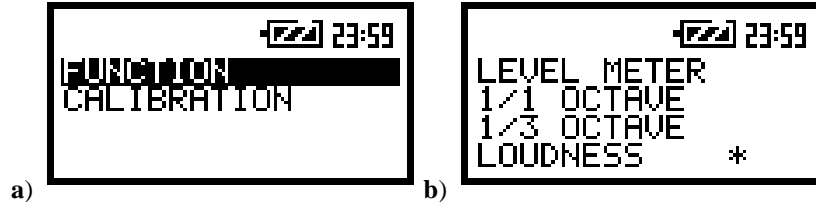
The **MIC. POLAR.** position enables the user to set the proper level of the voltage polarisation of the instrument's microphone (by means of the **<◀>**, **<▶>** push-buttons). Two levels (**200 V** and **0 V**) are selectable. The position is closed and the instrument returns to the **SETUP** list after pressing the **<ENTER>** or **<ESC>** push-button.



The view of the screens with the **MIC. POLAR.** position

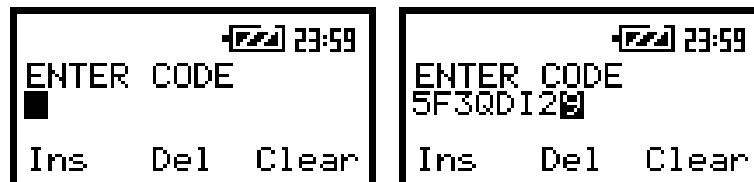
4.3. ACTIVATION OF OPTIONAL FUNCTIONS

The measurement of loudness and **1/1 OCTAVE** & **1/3 OCTAVE** analysis are the optional functions broadening the applications of the instrument. The function names are specified in the **FUNCTION** sub-list of the **FUNCTION** list.



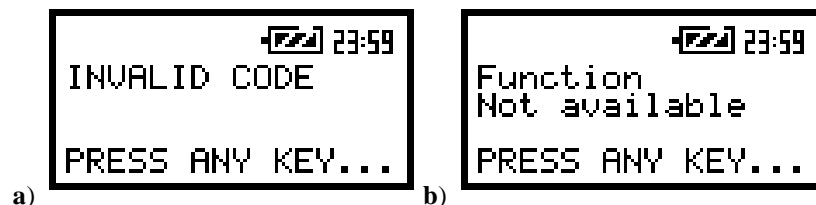
The view of the screens with the **FUNCTION** list opened (a) and the **FUNCTION** sub-list opened with the measurement of **LOUDNESS** selected (b)

A function is selected by placing the asterisk character in the line with the function's name. The position of the asterisk can be changed using the **<◀>**, **<▶>** push-buttons. After placing the asterisk in the line with the function's name the user has to press the **<ENTER>** push-button. The window for entering the access code to a function is opened in the first essay of its execution (after pressing the **<ENTER>** push-button) in the case when a function was not purchased together with the instrument.



The view of the screens during the entering of the access code to a function

The introduction of the access code is performed in the same way as the edition of the other text variables using the **<INPUT>** push-button (the **Insert** function), the **<DISPLAY>** push-button (the **Delete** function), the **<FILE>** push-button (the **Clear** function) and the **<◀>**, **<▶>** push-buttons in the conjunction with the **<SHIFT>** push-button (for the entering of characters). The verification is made after pressing the **<ENTER>** push-button. If the entered code was wrong the message is displayed and the instrument waits for the reaction of the user. After pressing the **<ENTER>** or the **<ESC>** push-button the information that the function is not available is displayed and the instrument once more waits for the reaction of the user.



The view of the screens after the unsuccessful verification of the access code (a) and with the text displayed after the negative verification (b)

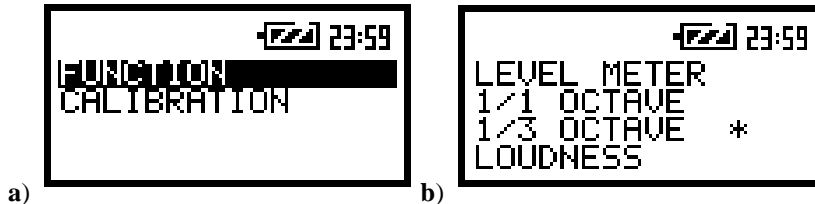
After pressing the **<ENTER>** or the **<ESC>** push-button the instrument returns to the **FUNCTION** sub-list displaying the list of the functions implemented in the unit (cf. the first Fig. in this chapter). After successful verification of the access code the windows described above are no more displayed. Once activated function is always available.



Notice: The number of the attempts for the access code entering is limited. After three unsuccessful essays the possibility is blocked.

4.4. 1/1 OCTAVE ANALYSER

In order to select the **1/1 OCTAVE** analysis mode the user has to enter the **FUNCTION** list by pressing the **<FUNC>** push-button (the **<DISPLAY>** in conjunction with the **<SHIFT>**). This list contains two sub-lists: **FUNCTION** and **CALIBRATION**. Next, the user has to open the **FUNCTION** sub-list (to select the **FUNCTION** text using the **<◀>**, **<▶>** push-buttons and press the **<ENTER>** push-button when this text is displayed inversely).



The view of the screens with the **FUNCTION** list opened (a) and **1/1 OCTAVE** analysis mode selected in **FUNCTION** sub-list (b)

The **1/1 OCTAVE** analysis mode is selected by placing the asterisk character in the line with **1/1 OCTAVE** text. The position of the asterisk can be changed using the **<◀>**, **<▶>** push-buttons. After placing the asterisk in the line with **1/1 OCTAVE** text the user has to press the **<ENTER>** push-button. After this the instrument confirms the selection of the function displaying for about 2 seconds the text:

**1/1 OCTAVE
selected ! / SELECTED !**

and closes the **FUNCTION** sub-list.



Notice: It is not possible to change the mode during the measurements. The instrument displays in this case for about 2 seconds the text: **“measurement in progress / MEASUREMENT IN PROGRESS”**. In order to change the mode the measurement must be finished!

The instrument's operation as **1/1 OCTAVE** analyser is similar to the **SLM** measurement mode with two important exceptions.

- In **1/1 OCTAVE** analysis the spectrum is available in parallel to the **SLM** operation. All 15 digital pass-band filters (with the centre frequencies from 16 kHz down to 1 Hz; in base two system) are working in the real time with the **weighting filters: HP, LIN, A or C** selected in the **SPECTRUM** sub-list of the **PROFILES SETUP** sub-list and the **linear RMS detector**. Additionally, the **TOTAL RMS** values for the full frequency range with the **A, C and LIN (Z)** weightings are displayed.



Notice: The **TOTAL RMS** results are measured with the weighting filters: **A, C and LIN** without taking into account the setting of the **SLM** profiles. The **spectra are always linearly averaged**. Thus, the **TOTAL** values from **1/1 OCTAVE** analysis can be different from those obtained for the **SLM** profiles (if the **LEQ INTEGRATION** was set as **EXPONENTIAL**).

- As **1/1 OCTAVE** analyser the instrument operates in three input ranges **95 dB, 110 dB and 125 dB**, which can be selected by means of the **RANGE** position (see below).

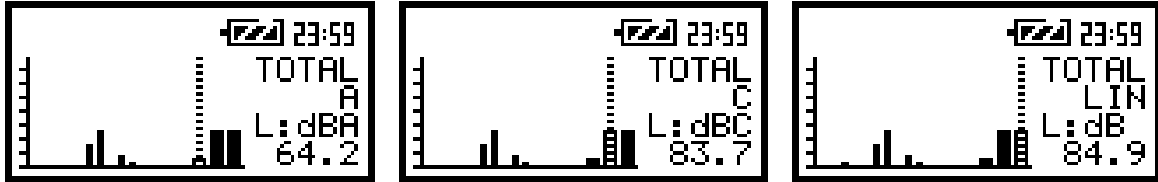
In order to change the mode of the measurement results presentation the user has to press the **<ENTER>** push-button. The following modes are available:

One Profile, 3 PROFILES, SPECTRUM, STATISTICS and PLOT.



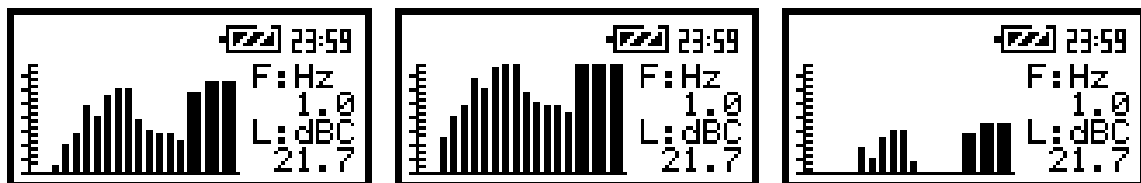
Notice: The user can select the number of the currently active modes of the measurement results **presentation** switching on ($[\sqrt{ }]$) or off ($[]$) the given mode in the **DISPLAY** sub-list of the **DISPLAY** list. Only one profile mode **cannot be switched off**. See Chapter 5 for the details about the display modes control.

One Profile, 3 PROFILES, STATISTICS and **PLOT** display modes are identical as for the **SLM**. The **SPECTRUM** mode displays **1/1 OCTAVE** analysis results (so-called spectrum) together with the **TOTAL RMS** values measured with **A**, **C** and **LIN** weighting filters. The read-out of the interested spectrum value can be done by means of the cursor controlled by the <◀>, <▶> push-buttons. On the right side of the screen the selected 1/1 octave filter centre frequency (or the selected **TOTAL**) is given, the units (**dBA**, **dBC** or **dB**; **L** denotes the level of the signal) and the numerical value are displayed.



The view of the screens in 1/1 OCTAVE analysis in the SPECTRUM display mode

In the **SPECTRUM** mode it is possible to shift the horizontal axis in relation to the vertical one of the presented results using the <◀>, <▶> push-buttons pressed in conjunction with the <SHIFT> one.



The view of the screens in 1/1 OCTAVE analysis with the shifted horizontal axis in relation to vertical one

In the **PLOT** mode the spectra saved in the buffer's file of the instrument are presented on the screen as the sequence of the single spectrum. The spectra are registered in the buffer's file with the same step as selected in the **SLM** profiles (see the description of the **BUF. STEP** position of the **MEASURE SETUP** sub-list).

In order to display the registered in the buffer's file spectra the user has to:

- press the <FILE> for the spectra stored later;
- press the <INPUT> for the spectra saved earlier.

In this mode it is also possible to shift the horizontal axis in relation to the vertical one of the presented results using the <◀>, <▶> push-buttons pressed in conjunction with the <SHIFT> one.



Notice: Many time histories can be saved in the buffer's file of the instrument during the measurements performed in different sessions. The presentation of these results is possible using the **BUFFER VIEW** window of the **DISPLAY** list (cf. Chapter 5).

Selection of the measurement range in 1/1 OCTAVE analysis – RANGE position

The selection of the input range is possible after entering the **RANGE** position (from the **INPUT** list by means of the <◀>, <▶> and <ENTER> push-buttons). In **1/1 OCTAVE** analyser the user can select (by means of the <◀>, <▶> and <ENTER> push-buttons) the input ranges specified in Appendix C. The return to the **INPUT** list is made after pressing the <ESC> or <ENTER> push-buttons.



The view of the screens with the RANGE position in 1/1 OCTAVE analyser



Notice: It is not possible to change the range during the measurement process. The instrument displays in this case for about 2 seconds the text: **“measurement in progress / MEASUREMENT IN PROGRESS”**. In order to change the range the measurement must be finished!



Notice: If an **OVERLOAD** occurs it is signalled by the icons **“Bars”** (all active) together with the icon **“Bell”** (cf. Chapter 3 for details).

Selection of 1/1 OCTAVE analysis parameters – SPECTRUM sub-list

Using the **SPECTRUM** sub-list of the **PROFILES SETUP** sub-list one can select in **1/1 OCTAVE** analysis the weighting filter and the result which has to be saved in the buffer’s file of the instrument.

Selection of the weighting filter in 1/1 OCTAVE analysis – FILTER position

The following weighting filters are available in **1/1 OCTAVE** analysis:

- **A** type 1 according to the IEC 651 and IEC 61672-1 standards,
- **C** type 1 according to the IEC 651 and IEC 61672-1 standards,
- **LIN** conforms to the requirements for the **Z** filter of type 1 according to the IEC 61672-1 standard,
- **HP** high-pass filter for **1/1 OCTAVE** analysis.

The characteristics of the filters are given in the Appendix D. The selection of the required filter is made with the **<◀>**, **<▶>** push-buttons. The user can pass to the selection of the next parameter from the **SPECTRUM** sub-list pressing the **<ENTER>** push-button. The return to the **PROFILES SETUP** sub-list is made after pressing the **<ESC>** push-button.

Selection of 1/1 OCTAVE analysis result to be saved in the buffer’s file – BUFFER position

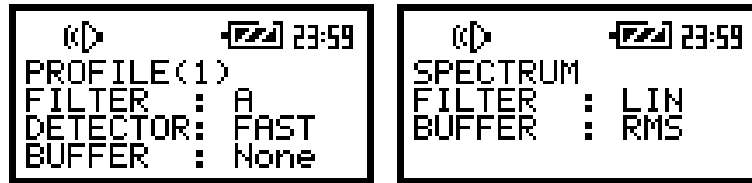
One measurement result from **1/1 OCTAVE** analysis can be saved in the buffer’s file of the instrument. The following results can be saved: **PEAK**, **MAX**, **MIN** and **RMS**. The selection of the required result is made with the **<◀>**, **<▶>** push-buttons. The selection of the **None** text means that no one **1/1 OCTAVE** analysis result is to be saved in the buffer’s file. The user causes the return to the **PROFILES SETUP** sub-list pressing the **<ENTER>** push-button in the **BUFFER** position. The return to the **PROFILES SETUP** sub-list is also possible after pressing the **<ESC>** push-button.



The view of the screens in the **SPECTRUM** sub-list



Notice: It is not possible to change the values of the parameters during the execution of the measurements. It is possible to open different lists and sub-lists but the positions in these lists are not displayed inversely and so - not accessible. The **“Loudspeaker”** icon indicates that the instrument is in the measurement process.



The view of the screens with not accessible parameters of the PROFILES SETUP lists

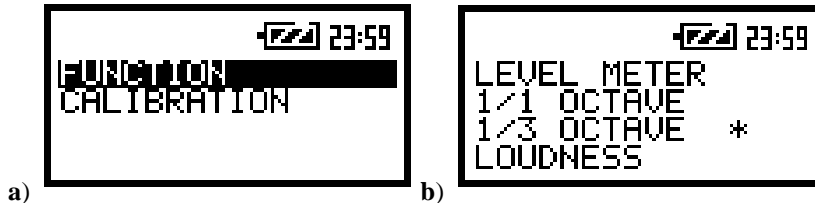


the SLM.

Notice: All other settings of the instrument are common for 1/1 OCTAVE analyser and

4.5. 1/3 OCTAVE ANALYSER

In order to select the **1/3 OCTAVE** analysis mode the user has to enter the **FUNCTION** list by pressing the **<FUNC>** push-button (the **<DISPLAY>** in conjunction with the **<SHIFT>**). This list contains two sub-lists: **FUNCTION** and **CALIBRATION**. The user has to open next the **FUNCTION** sub-list (to select the **FUNCTION** text using the **<◀>**, **<▶>** push-buttons and press the **<ENTER>** push-button when this text is displayed inversely).



The view of the screens with the **FUNCTION** list opened (a) and **1/3 OCTAVE** analysis mode selected in **FUNCTION** sub-list (b)

The **1/3 OCTAVE** analyser is selected by placing the asterisk character in the line with **1/3 OCTAVE** text. The position of the asterisk can be changed using the **<◀>**, **<▶>** push-buttons. After placing the asterisk in the line with **1/3 OCTAVE** text the user has to press the **<ENTER>** push-button. After this the instrument confirms the selection of the function displaying for about 2 seconds the text:

**1/3 OCTAVE
selected ! / SELECTED !**

and closes the **FUNCTION** sub-list.



Notice: It is not possible to change the mode during the measurements. The instrument displays in this case for about 3 seconds the text: **"measurement in progress / MEASUREMENT IN PROGRESS"**. In order to change the mode the measurement must be finished!

The instrument's operation as **1/3 OCTAVE** analyser is similar to the **SLM** with two important exceptions.

1. In **1/3 OCTAVE** analysis mode the spectrum is available in parallel to the **SLM** operation. All 45 digital pass-band filters (with the centre frequencies from 20 kHz down to 0.8 Hz; in base two system) are working in the real time with the weighting filters: **HP**, **LIN**, **A** or **C** selected in the **SPECTRUM** sub-list of the **PROFILES SETUP** sub-list and the linear RMS detector. Additionally, the **TOTAL RMS** values for the full frequency range with **A**, **C** and **LIN (Z)** weightings are displayed.



Notice: The **TOTAL RMS** results are measured with the weighting filters: **A**, **C** and **LIN** without taking into account the setting of the **SLM** profiles. The spectra are always linearly averaged. Thus, the **TOTAL** values from **1/3 OCTAVE** analysis can be different from those obtained for the **SLM** profiles (if the **LEQ INTEGRATION** was set as **EXPONENTIAL**).

2. As **1/3 OCTAVE** analyser the instrument operates in three input ranges **95 dB**, **110 dB** and **125 dB**, which can be selected by means of the **RANGE** position (see below).

In order to change the mode of the measurement results presentation the user has to press the **<ENTER>** push-button. The following modes are available:

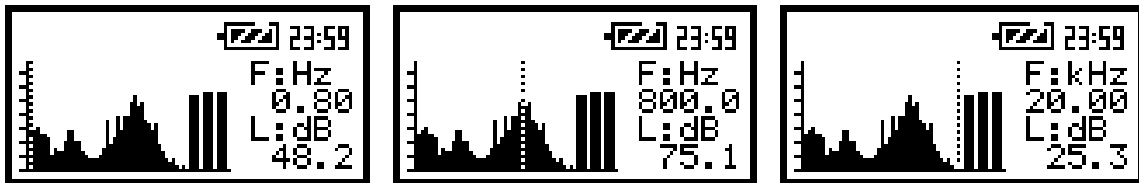
One Profile, 3 PROFILES, SPECTRUM, STATISTICS and **PLOT**.



Notice: The user can select the number of the currently active modes of the measurement results presentation switching on ($\sqrt{\quad}$) or off (\square) the given mode in the **DISPLAY** sub-list

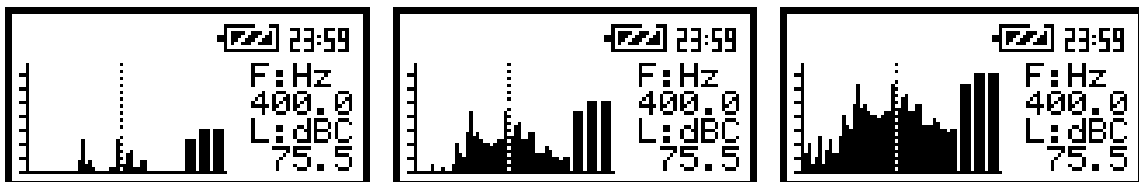
of the **DISPLAY** list. Only one profile mode **cannot be switched off**. See Chapter 5 for the details about the display modes control.

One Profile, 3 PROFILES, STATISTICS and **PLOT** display modes are identical as for the **SLM** mode. The **SPECTRUM** mode displays **1/3 OCTAVE** analysis result (so-called spectrum) together with the **TOTAL RMS** values measured with **A, C** and **LIN** weighted filters. The read-out of the interested spectrum value can be done by means of the cursor controlled by the <◀>, <▶> push-buttons. On the right side of the screen the selected 1/3 octave filter centre frequency (or the selected **TOTAL**) is given, the units (**dBA, dBC** or **dB**; **L** denotes the level of the signal) and the numerical value are displayed.



The view of the screens in 1/3 OCTAVE analysis in the **SPECTRUM** display mode

In the **SPECTRUM** mode it is possible to shift the horizontal axis in relation to the vertical one of the presented results using the <◀>, <▶> push-buttons pressed in conjunction with the <SHIFT> one.



The view of the screens in 1/3 OCTAVE analysis with the shifted horizontal axis in relation to vertical one

In the **PLOT** mode the spectra saved in the buffer's file of the instrument are presented on the screen as the sequence of the single spectrum. The spectra are registered in the buffer's file of the instrument with the same step as selected in the **SLM** profiles (see the description of the **BUF. STEP** position of the **MEASURE SETUP** sub-list).

In order to display the registered in the buffer's file spectra the user has to:

- press the <FILE> for the spectra stored later;
- press the <INPUT> for the spectra saved earlier.

In this mode it is also possible to shift the horizontal axis in relation to the vertical one of the presented results using the <◀>, <▶> push-buttons pressed in conjunction with the <SHIFT> one.




Notice: Many time histories can be saved in the buffer's file of the instrument during the measurements performed in different sessions. The presentation of these results is possible using the **BUFFER VIEW** window of the **DISPLAY** list (cf. Chapt.5).


Selection of the measurement range in 1/3 OCTAVE analysis – RANGE position

The selection of the input range is possible after entering the **RANGE** position (from the **INPUT** list by means of the <◀>, <▶> and <ENTER> push-buttons). In **1/3 OCTAVE** analyser the user can select (by means of the <◀>, <▶> and <ENTER> push-buttons) the input ranges specified in Appendix C. The return to the **INPUT** list is made after pressing the <ESC> or <ENTER> push-buttons.



The view of the screens with the RANGE position in 1/3 OCTAVE analysis mode

 **Notice:** It is not possible to change the range of the measurements. The instrument displays in this case for about 3 seconds the text: **“measurement in progress / MEASUREMENT IN PROGRESS”**. In order to change the range the measurement must be finished!

 **Notice:** If an **OVERLOAD** occurs it is signalled by the icons **“Bars”** (all active) together with the icon **“Bell”**.

Selection of 1/3 OCTAVE analysis parameters – SPECTRUM sub-list

Using the **SPECTRUM** sub-list of the **PROFILES SETUP** sub-list one can select in **1/3 OCTAVE** analysis the weighting filter and the result which has to be saved in the buffer’s file of the instrument.

Selection of the weighting filter in 1/3 OCTAVE analysis – FILTER position

The following weighting filters are available in **1/3 OCTAVE** analysis:

- **A** type 1 according to the IEC 651 and IEC 61672-1 standards,
- **C** type 1 according to the IEC 651 and IEC 61672-1 standards,
- **LIN** conforms to the requirements for the **Z** filter of type 1 according to the IEC 61672-1 standard,
- **HP** high-pass filter for **1/3 OCTAVE** analysis.

The characteristics of the filters are given in the Appendix D. The selection of the required filter is made with the **<◀>**, **<▶>** push-buttons. The user can pass to the selection of the next parameter from the **SPECTRUM** sub-list pressing the **<ENTER>** push-button. The return to the **PROFILES SETUP** sub-list is made after pressing the **<ESC>** push-button.

Selection of 1/3 OCTAVE analysis result to be saved in the buffer’s file – BUFFER position

One measurement result from **1/3 OCTAVE** analysis can be saved in the buffer’s file of the instrument. The following results can be saved: **PEAK**, **MAX**, **MIN** and **RMS**. The selection of the required result is made with the **<◀>**, **<▶>** push-buttons. The selection of the **None** text means that no one **1/3 OCTAVE** analysis result is to be saved in the buffer’s file. The user causes the return to the **PROFILES SETUP** sub-list pressing the **<ENTER>** push-button in the **BUFFER** position. The return to the **PROFILES SETUP** sub-list is also possible after pressing the **<ESC>** push-button.



The view of the screens in the SPECTRUM sub-list



Notice: It is not possible to change the values of the parameters during the execution of the measurements. It is possible to open different lists and sub-lists but the positions in these lists are not displayed inversely and so - not accessible. The "Loudspeaker" icon indicates that the instrument is in the measurement process.

```
(D) [Loudspeaker] 23:59
PROFILE(1)
FILTER : A
DETECTOR: FAST
BUFFER : None
```

```
(D) [Loudspeaker] 23:59
SPECTRUM
FILTER : LIN
BUFFER : RMS
```

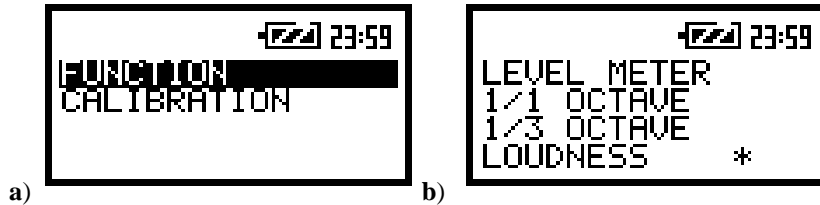
The view of the screens with not accessible parameters of the PROFILES SETUP lists



Notice: All other settings of the instrument are common for 1/3 OCTAVE analyser and the SLM.

4.6. LOUDNESS MEASUREMENT

In order to select the **LOUDNESS** measurement mode the user has to enter the *FUNCTION* list by pressing the <FUNC> push-button (the <DISPLAY> in conjunction with the <SHIFT>). This list contains two sub-lists: **FUNCTION** and **CALIBRATION**. The user has to open next the **FUNCTION** sub-list (to select the **FUNCTION** text using the <◀>, <▶> push-buttons and press the <ENTER> push-button when this text is displayed inversely).



The view of the screens with the *FUNCTION* list opened (a) and the **LOUDNESS** measurement selected in the *FUNCTION* sub-list (b)

The **LOUDNESS** measurement mode is selected by placing the asterisk character in the line with the **LOUDNESS** text. The position of the asterisk can be changed using the <◀>, <▶> push-buttons. After placing the asterisk in the line with the **LOUDNESS** text the user has to press the <ENTER> push-button. After this the instrument confirms the selection of the function displaying for about 2 seconds the text:

LOUDNESS
selected ! / SELECTED !

and closes the **FUNCTION** sub-list.



Notice: It is not possible to change the mode during the measurements. The instrument displays in this case for about 3 seconds the text: **“measurement in progress / MEASUREMENT IN PROGRESS”**. In order to change the mode the measurement must be finished!



Notice: The **LOUDNESS** function is optional and is yet under development.