RT 60 MESURMENT OF THE REVERBERATION TIME

The RT 60 analysis mode is an optional function of the **SVAN 94x** instrument series, which provide reverberation time of the 1/3 octave bands (from 31.5 Hz to 10 kHz) and three total RMS levels (**A**, **C** and **LIN** weighted). Whole measurement process and calculations implemented in the **SVAN 94x** instrument fulfil the **ISO 3382** standard.

The reverberation time of the room can be obtained via the **SVAN 94x** instrument series by two measurements methods: **IMPULSE** (Impulse Response Method) or **DECAY** (Interrupted Noise Method). The selection of the method depends on type of the sound source utilized by the user. The **IMPULSE** method is designed for measurement utilizing the impulse sound source (like pistol shot, petard explosion), whereas the **DECAY** method is intended for measurements when room is excited by broad or narrow band sound noise source (usually pink noise). For more details about the measurement and calculation process see Appendix H.

The reverberation time analysis applied in the instrument consists of two parts:

1. The measurement part in which the acoustic response of the room is registered.
2. The calculation part in which the reverberation time (**EDT**, **RT 20** and **RT 30**) is calculated for the measured room response.

Notice: *It is recommended to familiarize with the* ***Appendix H*** *before proceeding. This chapter describes only the navigation of the instruments, whereas* ***Appendix H*** *depicts the definitions and description of the reverberation time measurement.*

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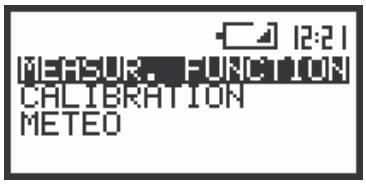
1. Selecting RT 60 mode

In order to select the **RT 60** analysis mode the user has to enter the ***FUNCTION*** list by pressing the **<MENU>** push-button, selecting by means of the **<▲>**, **<▼>** push-buttons the **FUNCTION** text and pressing the **<ENTER>**. Then, the user has to open the **MEASUR. FUNCTION** sub-list (to select the **MEASUR. FUNCTION** text using the **<▲>**, **<▼>** push-buttons and press the **<ENTER>** push-button when this text is highlighted).

a) 

b) 

c) 

The view of the SVAN 945A displays in the main list with the FUNCTION text selected (a), the *FUNCTION* list *(path: MENU / FUNCTION / MEASUR. FUNCTION)* **opened with the MEASUR. FUNCTION text selected (b), RT 60 analysis mode selected in MEASUR. FUNCTION sub-list (c)**

To select the **RT 60** mode place the asterisk [*] in the line with the **RT 60** text. The position of the character can be changed by the **<▲>**, **<▼>** push-buttons. After placing the asterisk in the line with the **RT 60** text the user has to press the **<ENTER>** push-button, which closes the **MEASUR. FUNCTION** sub-list and confirms the selection. After pressing the **<ESC>** push-button the sub-list is also closed but **all changes are ignored.**

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

When the **RT 60** mode is selected to return to the data visualization display press the **<ESC>** push-button until one of the below views appear on the display:

a) 

b) 

The views of the displays present data visualization screen when no measurement was taken. Figure (a) when the DECAY method is selected and (b) when IMPULSE method is selected

Each of the above screens indicates that the **RT 60** mode is selected. Depends on the actually selected method (*path: MENU / INPUT / MEASURE SETUP*) screen (a) - **DECAY** or (b) - **IMPULSE** appears (the default is the **DECAY** method).

The instruments: **SVAN 947A** and **SVAN 949A** are switched automatically to the **SOUND METER** mode (*path: MENU / FUNCTION / MODE*).

2. Selecting the method of RT 60 mode

In order to select the method of the **RT 60** mode the user has to enter the ***INPUT*** list by pressing the **<MENU>** push-button, selecting by means of the **<▲>**, **<▼>** push-buttons the **INPUT** text and pressing the **<ENTER>**. Then enter the **MEASURE SETUP** in the same way.

a) 

b) 

c) 

The view of the displays in the main list with the INPUT text selected (a), the *INPUT* list *(path: MENU / INPUT)* **with the MEASURE SETUP text selected (b), the MEASURE SETUP sub-list** *(path: MENU / INPUT / MEASURE SETUP)* **(c)**

In the **MEASURE SETUP** sub-list the user selects the **RT 60** method by pressing **< ◄ >**, **< ► >** push-buttons.

a) 

b) 

The view of the displays in the MEASURE SETUP sub-list *(path: MENU / INPUT / MEASURE SETUP)***: (a) – when the DECAY method is selected, (b) – when the IMPULSE method is selected**

After selecting the desired method the user has to confirm the choice by means of the **<ENTER>** push-button, what closes the **MEASURE SETUP** sub-list. The **<ESC>** push-buttons also closes the **MEASURE SETUP** sub-list, but **all changes are ignored**. The default setting is the **DECAY** method.

3. Setting time resolution, recording time and measurement range

The data recording options of the **RT 60** function are located in the **MEASURE SETUP** sub-list *(path: MENU / INPUT / MEASURE SETUP)*. By these options user can set the total measurement time (**RESPONSE T.**) and the time step of the data recording (**TIME STEP**). The view of the display with the **MEASURE SETUP** sub-list and the way to enter it is presented in the previous section. By pressing the **< ▲ >**, **< ▼ >** push-buttons the user can highlight the **RESPONSE T.** and the **TIME STEP** text and then, by pressing **< ◄ >**, **< ► >** push-buttons, change to desired value each of the parameters.

- **RESPONSE T.** (response time) – This value set the measurement data (sound pressure level decay curve) recording time. The data acquiring starts in the moment of the trigger condition appearance. The response time can be set in the range **1** ÷ **30 s** with **1 s** step (default **7 s**).
- **TIME STEP** – This value set the time step of data registering (sound pressure level) in the buffer. The parameter can be set to the value **2**, **5**, **10**, **20**, **50**, **100 ms** (default **10 ms**).

The **RANGE** sub-list in the ***INPUT*** list gives the possibility to select between two ranges named as: **105 dB** and **130 dB**. By selecting the proper range the user obtains the best accuracy of the measurements. To select range the user needs to enter the **RANGE** sub-list *(path: MENU / INPUT / MEASURE SETUP)* and by pressing the **< ◄ >**, **< ► >** push-buttons set desired value of this parameter. Then confirm the selections by pressing the **<ENTER>** push-button. The **<ESC>** push-button also exits this sub-list but all changes are ignored. The default range setting is **130 dB**.

a) 

b) 

c) 

The view of the displays in the *INPUT* list *(path: MENU / INPUT*) **with the RANGE sub-list highlighted (a), the RANGE sub-list when the range is set to 105 dB (b), the RANGE sub-list when the range is set to 130 dB (c)**

4. Trigger configuration of RT 60 mode

a. DECAY method

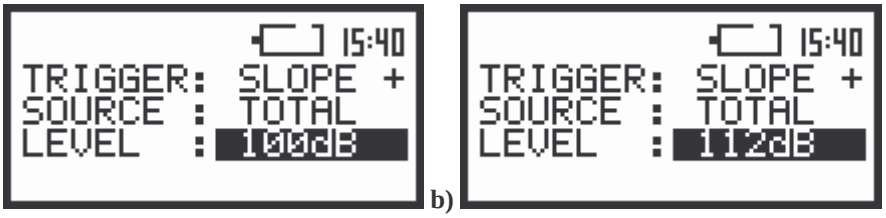
The **TRIGGER SETUP** sub-list for the **DECAY** method (for more details about method selections see section 2) is **only for indicating purpose** (the user cannot select anything) that the measurement

will start when the total sound level value decreases by **10 dB** *(path: MENU / INPUT / TRIGGER SETUP)*. To close the sub-list press **<ENTER>** or **<ESC>** push-buttons.

The view of the display in the TRIGGER SETUP sub-list *(path: MENU / INPUT / TRIGGER SETUP*) **for the DECAY method**

b. IMPULSE method

In the **IMPULSE** method (for more details about the selecting method see section 2) the trigger condition appears when the **TOTAL** sound pressure level exceeds the defined by the user threshold **LEVEL** value. The **TRIGGER SETUP** sub-list *(path: MENU / INPUT / TRIGGER SETUP)* for the **IMPULSE** method allows the user only to set the **LEVEL** value by pressing the **<◄>**, **<►>** push-buttons. By holding the **<SHIFT>** and pressing the **<◄>**, **<►>** push-buttons the change of the level value is accelerated. To close sub-list and confirm press the **<ENTER>** push-button or press the **<ESC>** push-button to close and ignore changes. The parameter can be set in the range **24** ÷ **136 dB** with **1 dB** step (**100 dB** default value).



The view of the displays in the TRIGGER SETUP sub-list *(path: MENU / INPUT / TRIGGER SETUP*) **with the highlighted LEVEL parameter (a) – 100 dB (default) and (b) – example 112 dB**

Notice: *For more details about the trigger conditions appearance see* ***Appendix H****.*

5. Setting the auxiliary parameters of RT 60 mode

The user can influence on the results of the reverberation time calculation by setting the sound pressure level decay curve averaging (**SMOOTHING**) and requesting additional margin value to the background noise level (**NOISE MAR.**). In order to select the **RT 60 OPTIONS** the user has to enter the ***SETUP*** list by pressing the **<MENU>** push-button, selecting by means of the **<▲>**, **<▼>** push-buttons the **SETUP** text and pressing the **<ENTER>** and then enter the **RT 60 OPTIONS** in the same way.

The views of the display in the main list with the SETUP text selected (a), the *SETUP* list *(path: MENU / SETUP)* **with the RT 60 OPTIONS text highlighted (b), the RT 60 OPTIONS sub-list** *(path: MENU / SETUP / RT 60 OPTIONS)* **(c)**

By pressing the **<▲>**, **<▼>** push-buttons the user switches the highlighting between the **SMOOTHING** and the **NOISE MAR.** text and then by pressing the **<◀>**, **<▶>** push-buttons the user changes to desired value each of the parameters.

- **SMOOTHING** – This parameter set the number of samples which are taken to averaging process of the sound pressure level decay curve. **Notice: this parameter influences the reverberation time results.** The parameter can be set in the range **0** ÷ **15** with **1** sample step (default **3** samples).
- **NOISE MAR.** (noise margin) – This parameter set the value which demands the additional margin value to the calculated noise level (for more detail see Appendix H). This parameter can be set in the range **0 ÷ 20 dB** with **0.1 dB** step (default **10 dB**).

Notice: *The noise merging is required to be set to 10 dB (or greater value) if the measurement have to fulfilled the* ***ISO 3382*** *standard requirements.*

6. Setting the results display mode

Each of the results display levels can be suited to user needs. The options of the levels visualization are located in the **RT 60 RESULTS** sub-list *(path: MENU / SETUP / RT 60 RESULTS)* and additional options for level **3** in the **DISPLAY MODES** sub-list *(path: MENU / DISPLAY / DISPLAY MODES).* For more details about the visualization levels see section 10.

By utilizing the **RT 60 RESULTS** sub-list the user selects which reverberation time results (**EDT**, **RT 20** or **RT 30**) to which 1/3 octave bands will be presented in the visualization levels. In order to select the **RT 60 RESULTS** sub-list the user has to enter the ***SETUP*** list by pressing the **<MENU>** push-button, selecting by means of the **<▲>**, **<▼>** push-buttons the **SETUP** text and pressing the **<ENTER>** and then enter the **RT 60 RESULTS** in the same way.

a) 

b) 

c) 

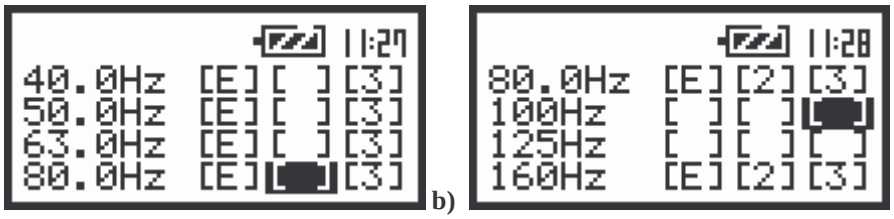
The view of the displays in the main list with the SETUP text selected (a), the *SETUP* list *(path: MENU / SETUP)* **with the RT 60 RESULTS text highlighted (b), the RT 60 RESULTS sub-list** *(path: MENU / SETUP / RT 60 RESULTS)* **(c)**

By marking (**[E], [2]**, **[3]**) or unmarking (**[ ], [ ]**, **[ ]**) the options, the user can set to each 1/3 octave band which of the reverberation time results will be presented in the visualization levels:

- **[E]** (EDT) - the **EDT** reverberation time is marked,
- **[2]** (RT 20) - the **RT 20** reverberation time is marked,
- **[3]** (RT 30) - the **RT 30** reverberation time is marked.

By pressing the **<▲>**, **<▼>**, **<◀>**, **<▶>** push-buttons the user can highlight the one of three options **[E], [2]**, **[3]** to each 1/3 octave band. For faster scroll between the rows press the **<SHIFT>** push-button and while holding it, press the **<▲>**, **<▼>** push-buttons. To mark or unmark the desired options, first highlight it and then, while holding the **<SHIFT>** push-button, press one of the **<◀>**, **<▶>** push-buttons to mark or unmark.

Notice: *For more details about obtaining the* ***EDT***, ***RT 20*** *and* ***RT 30*** *reverberation time see* ***Appendix H****.*



a) b)

The views of the display in the RT 60 RESULTS sub-list. The (a) figure presents the case when for 40, 50, 63 and 80 Hz 1/3 octave bands the EDT and RT 30 reverberation time are marked. The (b) figure illustrates situation when for 80 Hz and 160 Hz 1/3 octave bands the EDT, RT 20 and RT 30 reverberation time are marked

By **DISPLAY MODES** sub-list the user can select which data (the sound pressure level versus time decay curve) are plotted in visualization level **3** (more details about visualization levels in section 10). The user can chose between: raw data, smooth data or integrated data (impulse method only).

a. DECAY method

In order to select the **DISPLAY MODES** the user has to enter the ***DISPLAY*** list by pressing the **<MENU>** push-button, selecting by means of the **<▲>**, **<▼>** push-buttons the **DISPLAY** text and pressing the **<ENTER>** and then enter the **DISPLAY MODES** in the same way.

a) b) c)

The view of the displays in the main list with the DISPLAY text selected (a), the *DISPLAY* list *(path: MENU / DISPLAY)* **with the DISPLAY MODES text highlighted (b), the DISPLAY MODES sub-list** *(path: MENU / DISPLAY / DISPLAY MODES)* **(c)**

By pressing the **<▲>**, **<▼>** push-buttons the user can select between the **RAW DATA** and **SMOOTH DATA** by placing the asterisk [*] in the proper line and then press the **<ENTER>** push-button to close the sub-list and confirm the selection. The **<ESC>** push-buttons also closes the **DISPLAY MODES** sub-list, **but the selection is ignored**. The smooth data is the default setting.

b. IMPULSE method

In order to select the **DISPLAY MODES** the user has to enter the ***DISPLAY*** list *(path: MENU / DISPLAY / DISPLAY MODES)* like it is explained in the section 6a for the decay method.

a) b) c)

The view of the displays in the main list with the DISPLAY text selected (a), the *DISPLAY* list *(path: MENU / DISPLAY)* **with the DISPLAY MODES text highlighted (b), the DISPLAY MODES sub-list** *(path: MENU / DISPLAY / DISPLAY MODES)* **(c)**

By pressing the **<▲>**, **<▼>** push-buttons the user can select between the **RAW DATA**, **SMOOTH DATA** and **INT. DATA** by placing the asterisk [*] in the proper line and then press the **<ENTER>** push-button to close the sub-list and confirm selection. The **<ESC>** push-buttons also closes the **DISPLAY MODES** sub-list, **but the selection is ignored**. The integrated data is the default setting.

Notice: *For more details about* ***RAW DATA****,* ***SMOOTH DATA*** *and* ***INTEGRATED DATA*** *see* ***Appendix H****.*

7. The RT 60 results averaging function

The **RT 60** mode allows the user to average the reverberation time results from several measurements. To enable averaging the user needs to enter the ***SETUP*** list by pressing the **<MENU>** push-button, selecting by means of the **<▲>**, **<▼>** push-buttons the **SETUP** text and pressing the **<ENTER>** and then enter the **RT 60 AVERAGING** in the same way.

a) 

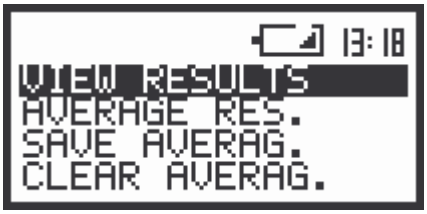
b) 

c) 

The view of the displays in the main list with the SETUP text selected (a), the *SETUP* list *(path: MENU / SETUP)* **with the RT 60 AVERAGING text highlighted (b), the RT 60 AVERAGING sub-list** *(path: MENU / SETUP / RT 60 AVERAGING)* **(c)**

By pressing the **<▲>**, **<▼>** push-buttons the user can highlight the **AVERAG.** and **AVER. CLEAR** options and then by pressing the **<◀>**, **<▶>** push-buttons set **On** text in line with **AVERAG.** word and press the **<ENTER>** push-buttons to confirm. The **<ESC>** push-button returns to the previous menu but **all selections are ignored**.

- **AVERAG.:** (averaging) – This option switches **On** and **Off** the averaging process of the reverberation time results. When this option is **On** the additional visualization level **0** appears on the display after each measurement:



The view of the display in the visualization level 0

If this option is **Off** then after taking the measurement the visualization level **1** appears on the display (for more details about the visualization see section 10). The default setting is **On**.

- **AVER. CLEAR:** (averaging clear) – This function reset the averaging process. The whole averaged results are lost if not saved. By pressing the **<◀>**, **<▶>** push-buttons the **Yes** or **No** text can be set in line. If selection is **YES** the reset will be done after closing the sub-list by pressing the **<ENTER>** push-button (the **<ESC>** push button closes list without clearing averaged results).
- **AVER. NO.:** (average number) – This line is only for indicating purpose. It shows how many measurements were taken to the averaging process calculation.

8. Taking measurements by DECAY method

Reverberation time measurement process (**DECAY** method) in steps:

Ø First the user has to select the **RT 60** mode (more details in section 1) with the **DECAY** method (more details in section 2).

Ø Optionally, the user can configure the options to this method or performs the measurement with the default settings.

Default settings:

- **RESPONSE T. = 7 s** – section 3
- **TIME STEP = 10 ms** – section 3
- **RANGE – 130 dB** – section 3
- **SMOOTHING = 3 samples** – section 5
- **NOISE MAR. = 10 dB** – section 5
- **AVERAG.: - On** – section 7

Notice: *The default measurement time of the decay curve registering (**RESPONSE T.**) is 7 seconds. It can be insufficient in some applications. It is recommended to set this value to be at least two times longer then expected reverberation time. For details see section 3 and **Appendix H**.*

Ø Place the sound power source in the measured room (for the sound power source location - see the reverberation time measurement ISO standard).

Ø Place the microphone in one of the selected measurement points (for the measurement points location see the reverberation time measurement ISO standard).

Ø Switch on the sound power source.

Notice: *It is necessary to switch on the sound source before starting the measurement because of the trigger requirements (for more details see **Appendix H**). If there is need to start the instrument before switching on the sound source it is recommended to use the **DELAY** option (path: MENU / INPUT / MEASURE SETUP / DELAY) to handle this needs.*

Ø Start the measurement process in the **SVAN 94x** instrument by pressing the **<START/STOP>** push-button. The display indicating that the instrument is waiting for the trigger condition fulfilment appears on the instrument.

The view of the display when the instrument is waiting for the trigger conditions fulfilment

Notice: *For more details about the trigger conditions fulfilment see **Appendix H**.*

Ø Switch off the sound power source (the source should work enough long to obtain the acoustic field stabilization). After the trigger condition fulfilment the instrument starts to collect data.

Notice: *During the data collections in the investigated room all other sources of sound should be suppressed to not affect the measurements.*

Ø After the data recording process ends, the instrument starts the calculation of the reverberation time results.

a) 

b) 

The views of the display when the instrument: (a) is collecting data, (b) is calculating the reverberation time

To break the data recording process press the **<START/STOP>** push-button, whereas to break the calculation process press the **<ESC>** push-button.

Ø When the averaging process is enabled the visualization screen of level **0** appears on the display. The user can view the results (**VIEW RESULTS**), if they are acceptable, include them to the averaging process by the **AVERAG RES.** function in level **0**. Then proceed with the next measurements which could be averaged with the previous results (for more details about averaging process see section 10 level **0**). To save averaged results enter the **SAVE AVERAG.** sub-list (level **0**). To save last (actual) measurement results enter the **SAVE** sub-list (*path: MENU / FILE / SAVE*) or utilize the **AUTO SAVE** options *(path: MENU / FILE / SAVE OPTIONS)*.

Ø If the averaging process is disabled the visualization screen of level **1** appears on the display (for details about results visualization see section 11). To save results enter the **SAVE** sub-list (*path: MENU / FILE / SAVE*) or utilize the **AUTO SAVE** options *(path: MENU / FILE / SAVE OPTIONS)*.

9. Taking measurements by IMPULSE methods

Reverberation time measurement process (**IMPULSE** method) in steps:

Ø First the user has to select the **RT 60** mode (more details in section 1) with the **IMPULSE** method (more details in section 2).

Ø Optionally, the user can configure the options to this method or perform measurements with the default setup.

Default settings:

- **RESPONSE T. = 7 s** – section 3
- **TIME STEP = 10 ms** – section 3
- **RANGE – 130 dB** – section 3
- **SMOOTHING = 3 samples** – section 5
- **NOISE MAR. = 10 dB** – section 5
- **AVERAG.: - On** – section 7
- **TRIGGER LEVEL = 100 dB** – section 4b

Notice: *The default measurement time of the decay curve registering (**RESPONSE T.**) is 7 seconds. It can be insufficient in some application. It is recommended to set this value to be at least two times longer then expected reverberation time. For details see section 3 and **Appendix H**.*

Notice: *The proper value of the sound level trigger threshold should be set well above the background noise and significantly below the maximum sound level emitted by the impulse source.*

Ø Place the microphone in one of the selected measurement points (for the measurement points location see reverberation time measurement ISO standard).

Ø Start the measurement process in the **SVAN 94x** instrument by pressing the **<START/STOP>** push-button. The display indicating that the instrument is waiting for the trigger condition fulfilment appears on the instrument.

The view of the display when the instrument is waiting for the trigger conditions fulfilment

Notice: *For more details about the trigger conditions fulfilment see* ***Appendix H****.*

Ø Fire the impulse sound power source. If the trigger condition are fulfilled the instrument starts to collect data.

Notice: *During the data collections in the investigated room all other sources of sound should be suppressed to not affect the measurements.*

Ø After the data recording process ends, the instrument starts the calculation of the reverberation time results.

a)

b)

The views of the display when the instrument: (a) is collecting data, (b) is calculating the reverberation time

To break the data recording process press the **<START/STOP>** push-button, whereas to break the calculation process press the **<ESC>** push-button.

Ø When the averaging process is enabled the visualization screen of level **0** appears on the display. The user can view the results (**VIEW RESULTS**), if they are acceptable, include them to the averaging process by the **AVERAG RES.** function in level **0**. Then proceed with the next measurements which could be averaged with the previous results (for more details about averaging process see section 10 level **0**). To save averaged results enter the **SAVE AVERAG.** sub-list (level **0**). To save last (actual) measurement results enter the **SAVE** sub-list (*path: MENU / FILE / SAVE*) or utilize the **AUTO SAVE** options *(path: MENU / FILE / SAVE OPTIONS)*.

Ø If the averaging process is disabled the visualization screen of level **1** appears on the display (for details about results visualization see section 11). To save results enter the **SAVE** sub-list (*path: MENU / FILE / SAVE*) or utilize the **AUTO SAVE** options *(path: MENU / FILE / SAVE OPTIONS)*.

10. Visualization of the RT 60 measurements results

The reverberation time measurement results can be viewed on the instrument display by advanced system of the visualization screens. The results presentation is divided into three levels (1/3 octave bands plot, text and decay curve plot).

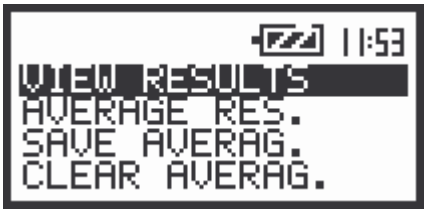
Notice: *The third visualization level (level **3**) give possibility to calculate the user defined (**RT USER**) reverberation time. More details in the next part of this section.*

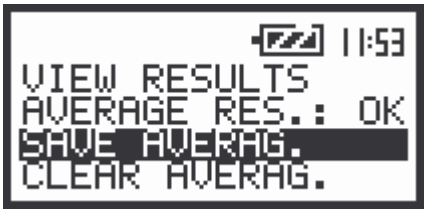
The navigation of the visualization system levels (screens) is presented in the Table G.1:

In the presented table each of the rows represents one level of the results visualization screen. The navigation and detailed capabilities of each of the level is presented below:

Ø LEVEL 0 (optional)

The level **0** is an optional level and this dialog display appears only when the **averaging function** is enabled (for more details about averaging see sections 7 and 10) and this display appears after each measurement end.

a) 

b) 

The views of the display (when averaging function is enabled) after the measurement end; (a) screen presents the default situation whereas (b) after setting the last result to averaging process

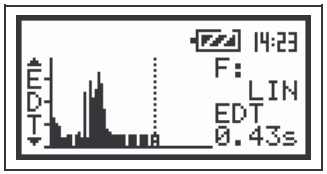
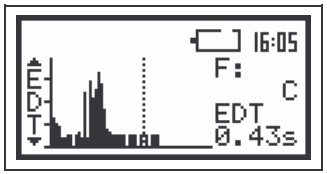
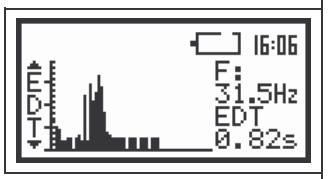
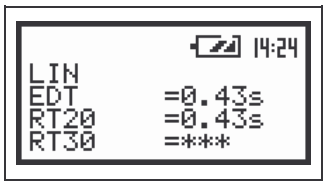
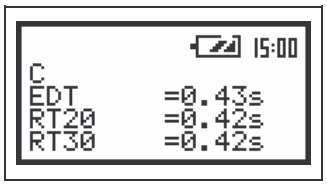
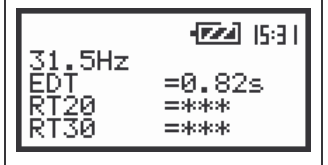
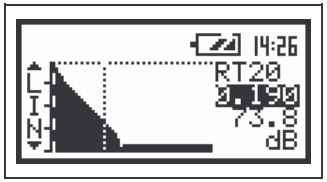
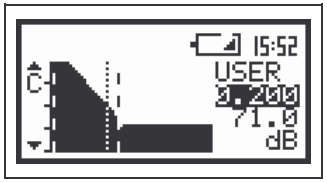
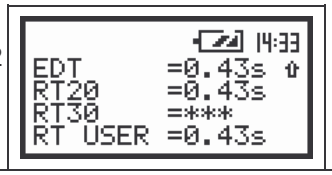
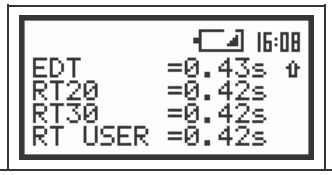
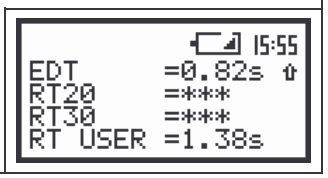
By pressing the **<▲>**, **<▼>** push-buttons the user highlights the desired options and by means of the **<ENTER>** push-buttons enters or activates each of the options detailed below.

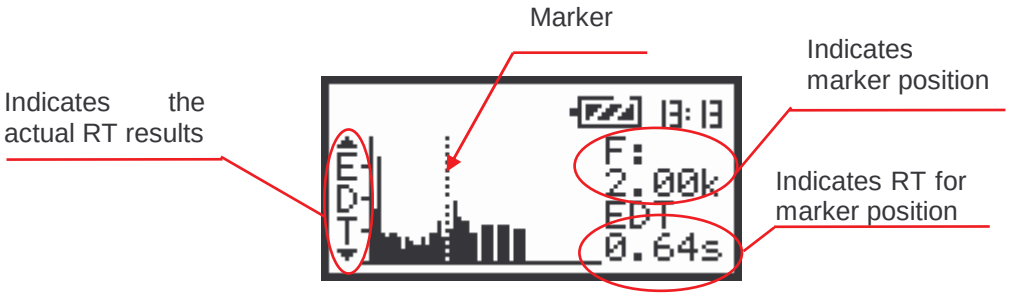
- **VIEW RESULTS** – By pressing the **<ENTER>** push button when this text is highlighted the user enters to level **1** of the visualization system to the graphical view (bar graph) of reverberation time results (for more details of level **1** see next point of this section).
- **AVERAGE RES.** (Average results) – By pressing the **<ENTER>** push-button on this text the user activates the selection of the actual reverberation time result (last measurement) to be included to averaging process. The actual results are averaged with the results previously averaged or the results prepared to average with the upcoming results (the results which would be obtained in the next measurements).
- **SAVE AVERAG.** (Save averaged result) – By pressing the **<ENTER>** push-button the user can save averaged result (only the values after the last averaging process). This option is available (the text can be highlighted) only when the averaging process was performed (what is indicated by appearing the **OK** text in the end of the line **AVERAGE RES.:** - see picture (b) above).
- **CLEAR AVERAG.** (Clear averaging process) – By pressing the **<ENTER>** push-buttons on this text and confirming the clearing in appearing dialog box, the user starts the new averaging process (all data obtained in averaging process will be lost if they were not saved by the **SAVE AVERAG.** function).

Ø LEVEL 1

The level **1** view appears on the display after the measurement end when the averaging process is disabled, or when the user enters to this level from level **0**. The default view of this display is presented in the table “DEFAULT SCREEN” column “level **1**” row. The legend is shown below.

Tab. G.1. The navigation of the visualization system levels

LEVEL	COMMENTS	DEFAULT SCREEN	NEXT SCREEN	MIDDLE SCREEN	LAST SCREEN
0	Averaging dialog screen, which appears after measurement end (if averaging process is enabled)		---	---	---
		<ENTER> ↓ ↑ **<ESC>**			
1	This screen appears after measurement end if averaging process is disabled			By pressing **<◄ >**, **< ►>** push-buttons you move marker between 1/3 octave bands or total levels	
		<ENTER> ↓ ↑ **<ESC>**	**<ENTER>** ↓ ↑ **<ESC>**	**<ENTER>** ↓ ↑ **<ESC>**	**<ENTER>** ↓ ↑ **<ESC>**
2	This screen presents three value of RT for selected 1/3 octave band or total level			By pressing **<▼>**, **<▲>** push-buttons you move marker between 1/3 octave bands or total levels	
		<ENTER> ↓ ↑ **<ESC>**	**<ENTER>** ↓ ↑ **<ESC>**	**<ENTER>** ↓ ↑ **<ESC>**	**<ENTER>** ↓ ↑ **<ESC>**
3	This screen presents decay curve and allows setting marker for the user RT calculation			By pressing **<▼>**, **<▲>** push-buttons you move marker between 1/3 octave bands or total levels	
		<ENTER> ↓	**<ENTER>** ↓	**<ENTER>** ↓	**<ENTER>** ↓
2'	It is the same as level 2 but with user RT value indicated			By pressing **<▼>**, **<▲>** push-buttons you move marker between 1/3 octave bands or total levels	

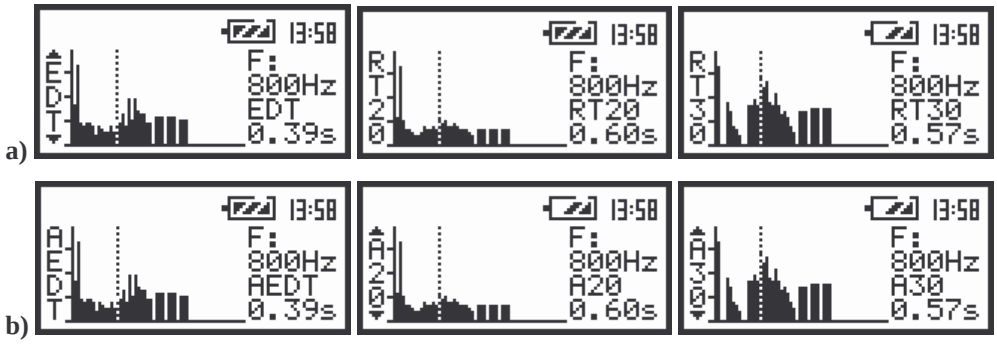


The view of the display in level 1 with the legend

Notice: *If in the RT indicator field appear "*******" that means that for this 1/3 octave band with the selected parameters (**NOISE MAR.**) the required measurement conditions were not fulfilled to obtain the results (for more details see section 3 and **Appendix H**).*

The navigation keys:

- **<ENTER>** push-button – Enter upper level **2**, where on the display three (**EDT**, **RT 20** and **RT 30**) **RT 60** results are presented for the actual marker position in level **1**.
- **<ESC>** push-button – Return to lower level **0** (if the averaging process is enabled).
- **<▲>**, **<▼>** push-buttons – switch the data presented on the bar graph. Explicitly between the reverberation time results obtained by the different definitions of the **RT 60**: **EDT**, **RT 20** and **RT 30** (for more detail about that see **Appendix H**). If the averaging process is enabled the averaged data of the **RT 60** function are also available to view **AEDT** (averaged **EDT**), **A 20** (averaged **RT 20**) and **A 30** (averaged **RT 30**). The all possibilities are presented below:

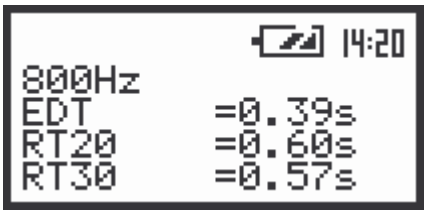


The views of the display in level 1: (a) actual measurement results (b) averaged results

- **<◄>**, **<►>** push-buttons – Move the marker in the left and right direction on the bar graph. The actual position of the marker and the reverberation time at its position are indicated in the right region of the display (see figure above – the indicating positions).

Ø LEVEL 2

The display of level **2** visualization system presents the three reverberation time results (**EDT**, **RT 20**, **RT 30**) for the 1/3 octave band (or total level) pointed by the marker on the level **1**.



The views of the display in level 2

The navigation keys:

- **<ENTER>** push-button – Enter upper level **3**, where on the display the decay curve for actual 1/3 octave band (or total level) is presented.
- **<ESC>** push-button – Return to lower level **1**. The marker position at level **1** will be set to the actually presented 1/3 octave band (or total level) in level **2**.
- **<▲>**, **<▼>** push-buttons – scroll up and down the presented 1/3 octave bands (or total level) reverberation time results (for more details see the table).

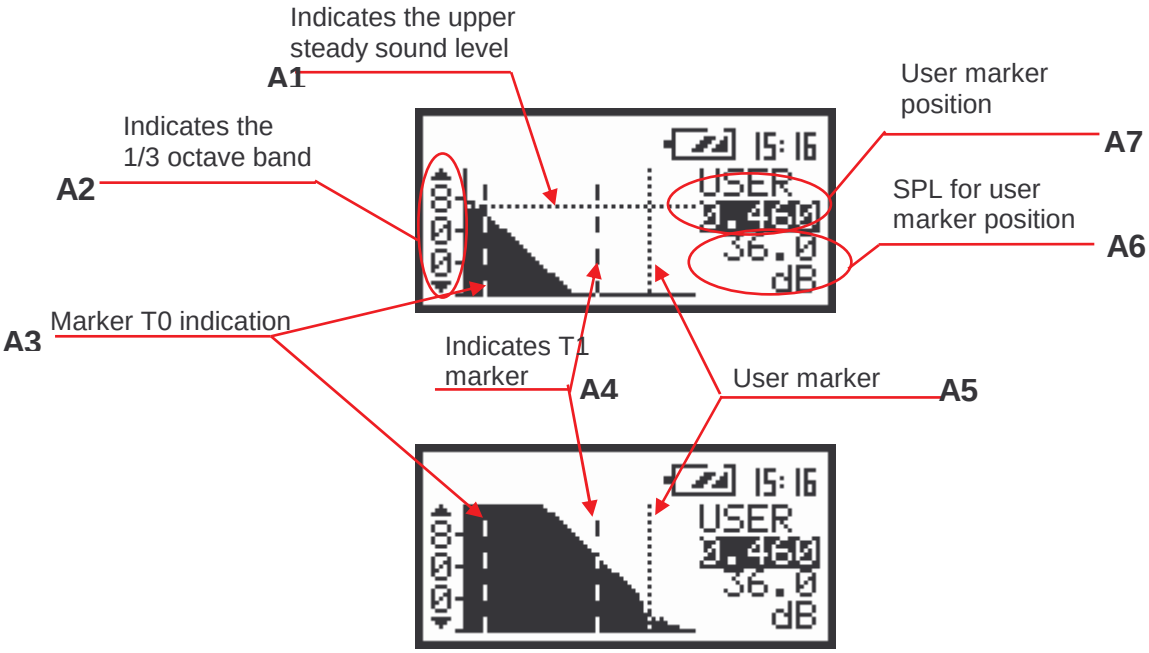
Ø LEVEL 3

The level **3** is the highest level of the results visualization system. At this level the display presents the plot in which the decay curve of the sound pressure level versus time is illustrated. The graph is plotted for actual 1/3 octave band or (total level) which was indicated in the previous level **2**. This level allows calculating the user reverberation time by placing the marker **A5** on the decay curve. The display view and the description of it are shown in the picture below.

The legend for the figure below:

- **A1** – This horizontal doted line indicates the calculated steady sound level value. In the crossing point of this line with the decay curve, the marker T0 (**A3**) is placed. This marker is used as a starting point to all three (and the **RT USER**) reverberation time calculations (for more details see **Appendix H**).
- **A2** – Text placed in this field indicates which 1/3 octave band (or total level) decay curve is plotted on the display.
- **A3** – This line indicates the T0 marker position. This marker is used as a starting point to all three (and the **RT USER** also) reverberation time calculations (for more details see **Appendix H**).
- **A4** – This line indicates the T1 marker position. On the display this marker position is labelled (indicator **A7**) as **EDT**, **RT 20** or **RT 30** according to which the most restricted definition of the RT condition is fulfilled (for more details see **Appendix H**).
- **A5** – This vertical doted line indicates the user marker position. By placing this marker the user can calculate the own reverberation time indicated as the **RT USER** (for more details see **Appendix H**).
- **A6** – This field shows the **SPL** (sound pressure level) in the actual marker (**A5**) position.
- **A7** – This field denotes the actual user marker position and shows label of the marker (when the user marker actual position is the same as T0 marker or T1 marker the upper line indicates that).

Notice: *The data to plot the graph of the decay curve can be selected between* ***RAW DATA***, ***SMOOTH DATA*** *or* ***INT. DATA*** *(for more details see section 6).*



The view of the display in level 3, both displays were made for the same data and marker position. The difference between them is in y-axis position (the (b) graph is (a) graph scrolled down)

The navigation keys:

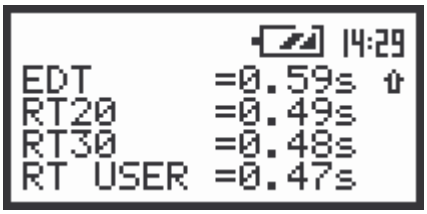
- **<ESC>** push-button – Return to the lower level **2** keeping the actual 1/3 octave band (or total levels) position.
- **<▲>**, **<▼>** push-buttons – Switch the data presented on the graph between 1/3 octave bands (or total levels), the **A2** indicates actually plotted data.
- **<SHIFT> + <▲>** push-buttons – Scroll the decay curve graph in up vertical directions.
- **<SHIFT> + <▼>** push-buttons – Scroll the decay curve graph in down vertical directions.
- **<◀>**, **<▶>** push-buttons – Move the marker in horizontal directions (left / right) and also scroll the decay curve plot in the horizontal direction if the user tries to move the marker outside the visible area of the display. By holding the **<SHIFT>** push-button the move of the marker is accelerated.
- **<ENTER>** push-button – Enter to the level **2'** and calculate the user reverberation time for actual marker position.

Procedure of obtaining RT USER (user reverberation time) in steps:

- Select the 1/3 octave band or one of the total levels, for user reverberation time calculation process.
- Set position of the marker for reverberation time calculation.

Notice: *The marker has to be located on the right side of the T0 marker (**A3**) but not in the noise background region (for more details about the reverberation time calculation see Appendix H).*

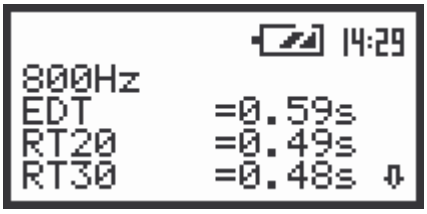
- When the marker position is located press the **<ENTER>** push-button to confirm.
- The view of level **2'** with the calculated user reverberation time (**RT USER** at the bottom) will appear on the display. The view of the display is presented below.

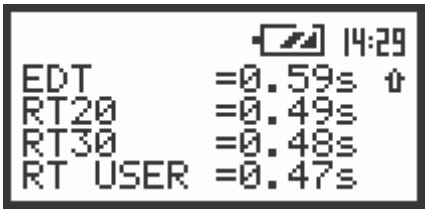


The view of the display after user reverberation time (RT USER) calculation – level 2'

Ø LEVEL 2'

The level **2'** is in principle the same as the mentioned above level **2** but it is extended of the user reverberation time value presented at the bottom of the display. Therefore the all key navigation and functionality is the same as in level **2**. The only difference which appears is the possibility of scrolling the display in vertical direction which allows viewing all four reverberation time results (**EDT**, **RT 20**, **RT 30** and **RT USER**). To scroll up the display press the **<◄>** push-button or use the combination of the **<SHIFT> + <▲>** push-buttons. To scroll down the display press the **<►>** push-button or use the combination of the **<SHIFT> + <▼>** push-buttons.

a) 

b) 

The view of the display in level 2': (a) top region of the display is presented; (b) bottom region of the display is presented