

APPENDIX D. DEFINITIONS AND FILTER CHARACTERISTICS

D.1. DEFINITIONS AND FORMULAE

The SPL function

The **SPL** function (**S**ound **P**ressure **L**evel) - gives an equivalent of the **Sound Level Meter** according to the **IEC 651 Standard** (meeting the requirements for the **Type "1"** instrument). The value of the functions is calculated from the formula:

$$\text{SPL} = \max_{1 \leq n \leq 200} \{20 \log(p_n / p_0)\}$$

where:

$n = 1, \dots, 200$;

p_n - the RMS value of the measured sound pressure for 5 ms time interval;

p_0 - the value to which the measurement is related, equal to 20 μPa .

The LEQ function

The **LEQ** function enables the user to calculate the RMS value of sound pressure in the given time period. The instrument operates as the standard **Integrating Sound Level Meter** and conforms to the **IEC 804 Standard** (meeting the requirements for the **Type "1"** instrument). The value of the **LEQ** function is calculated, when the **LINEAR** option is selected in the **LEQ INTEGRATION** position of the **SETUP** list, according to the formula:

$$\text{LEQ} = L_{\text{weq},T} = 10 \log \frac{1}{T} \int_0^T (p_w(t)/p_0)^2 dt$$

where:

T - total measurement time, equal to the value set in the **INT. TIME** position of the **MEASURE SETUP** sublist;

$p_w(t)$ - the value of the measured sound pressure with the **W** weighting filter (it means **A**, **C** or **LIN**);

p_0 - the value to which the measurement is related, equal to 20 μPa .

The value of the **LEQ** function is calculated, when the **EXPONENTIAL** option is selected in the **LEQ INTEGRATION** position of the **SETUP** list, according to the formula:

$$\text{LEQ} = L_{\text{wdeq},T} = 10 \log \frac{1}{T} \int_0^T (p_{wd}(t)/p_0)^2 dt$$

where:

T - total measurement time, equal to the value set in the **INT. TIME** position of the **MEASURE SETUP** sublist;

$p_{wd}(t)$ - the value of the measured sound pressure with the **W** weighting filter (it means **A**, **C** or **LIN**) and the **D** detector (it means **IMPULSE**, **FAST** or **SLOW**);

p_0 - the value to which the measurement is related, equal to 20 μPa .

The MAX result

The **MAX** result means the maximal value on the detector output for the integration time period depending on the **AUTO REPEAT** function of the **MEASURE SETUP** sublist. When the function is switched on (**[√]**) the integration time period is equal to the value set in the **INT. TIME** position of the **MEASURE SETUP** sublist. When the **AUTO REPEAT** function is switched off (**[]**) the integration time

period is equal to the value set in the **BUF. STEP** position of the same sublist. The **MAX** result for the time period of 1 second is equal to the value of the **SPL** function. The **MAX** result is calculated according to the formula:

$$\mathbf{MAX} = \max_{1 \leq n \leq N} \{20 \log(\mathbf{p}_n / \mathbf{p}_0)\}$$

where:

N = 200 **T** [s],

T - total measurement time in seconds equal to the value set in the **INT. TIME** position;

p_n - the RMS value of the measured sound pressure for 5 ms time interval;

p₀ - the value to which the measurement is related, equal to 20 μPa.

The MIN result

The **MIN** result is calculated according to the formula:

$$\mathbf{MIN} = \min_{1 \leq n \leq N} \{20 \log(\mathbf{p}_n / \mathbf{p}_0)\}$$

where:

N = 200 **T** [s],

T - total measurement time in seconds equal to the value set in the **INT. TIME** position;

p_n - the RMS value of the measured sound pressure for 5 ms time interval;

p₀ - the value to which the measurement is related, equal to 20 μPa.

The SEL result

The **SEL** result (Sound Exposure Level) is essentially the subset of the **LEQ** function. Its value is equal to the **LEQ result referred to the integration time equal to one second** (so, for the **INT. TIME=1 s**, **SEL** is always equal to **LEQ**). The result is calculated from the formula:

$$\mathbf{SEL} = 10 \log \frac{1}{t_0} \int_0^T (\mathbf{p}(t) / \mathbf{p}_0)^2 dt$$

where:

T - total measurement time, equal to the value set in the **INT. TIME** position;

t₀ - time to which the measurement is related, equal to 1 s;

p(t) - the value of the measured sound pressure;

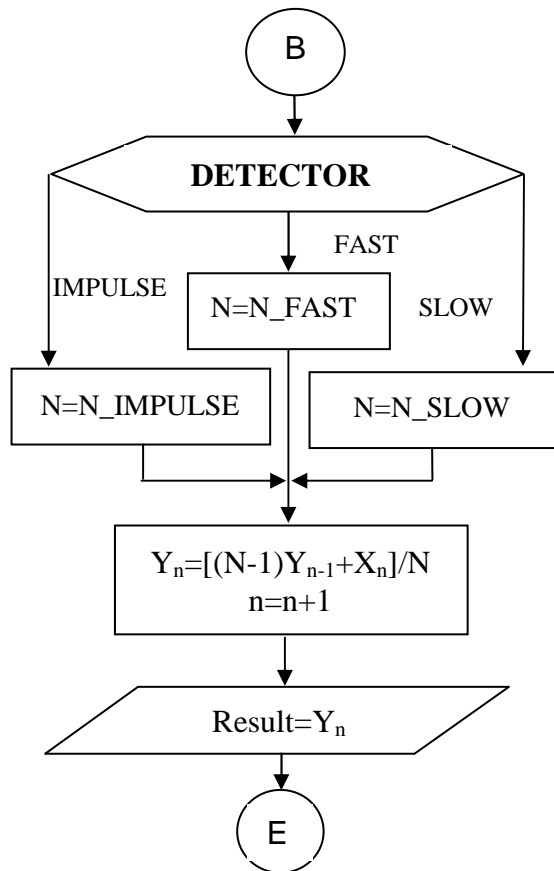
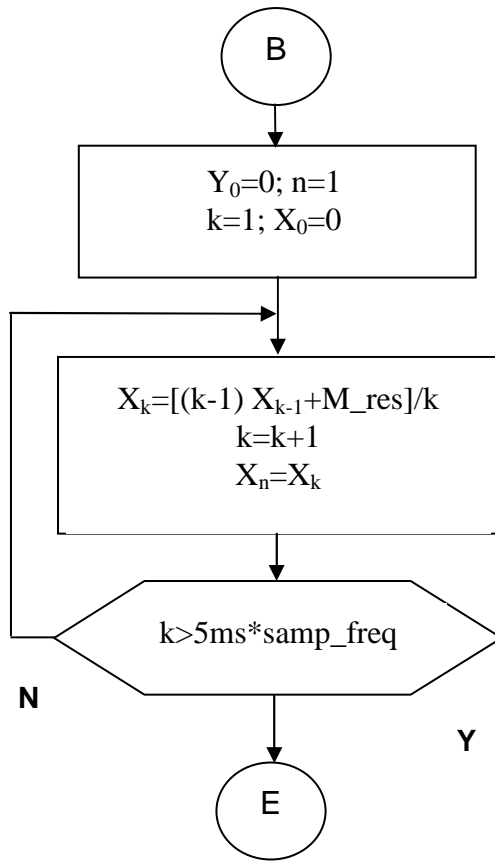
p₀ - the value to which the measurement is related, equal to 20 μPa.

The Ltm3 and Ltm5 results

The **Ltm3** and **Ltm5** results (Takt-Maximal Levels) are calculated according to the German standard TA Larm.

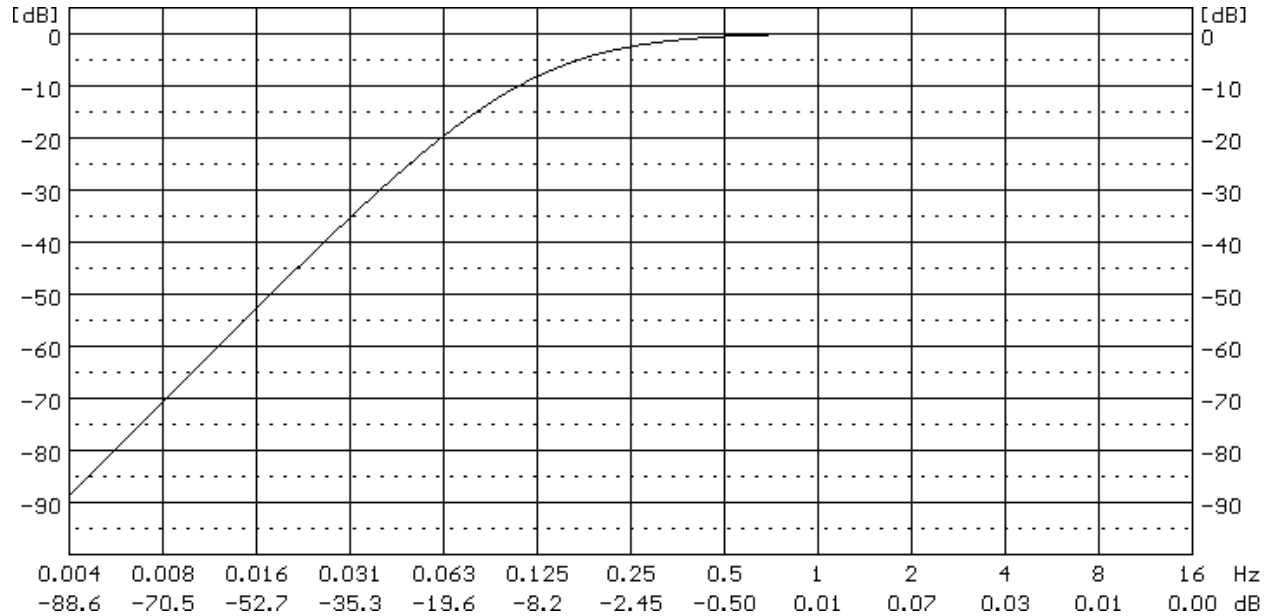
The RMS result

The **RMS** result, saved in the buffer's file, is calculated according to the formula of the **LEQ** function for the integration time depending on the **AUTO REPEAT** function. When the function is switched on ([√]) the integration time period is equal to the value set in the **INT. TIME** position of the **MEASURE SETUP** sublist. When the **AUTO REPEAT** function is switched off ([]) the integration time period is equal to the value set in the **BUF. STEP** position of the same sublist.



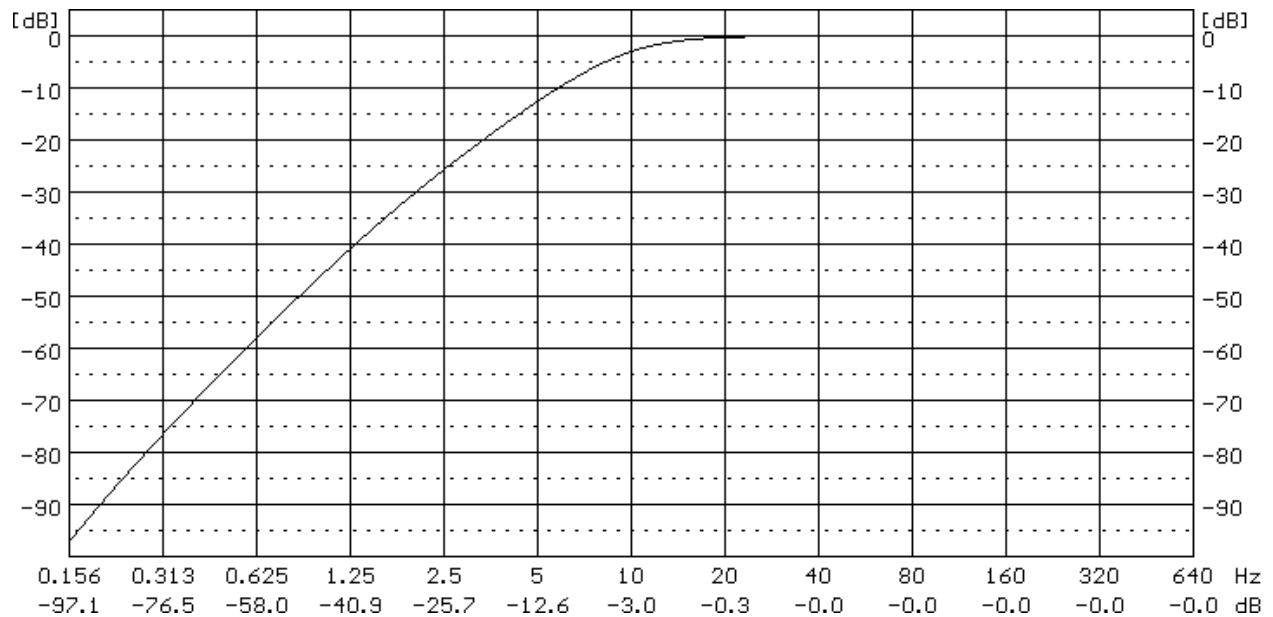
D.2. CHARACTERISTICS OF DIGITAL FILTERS IMPLEMENTED IN SVAN 945

HP: cut-off frequency: 0,770 Hz / -0,1 dB (0,225 Hz / -3,0 dB).



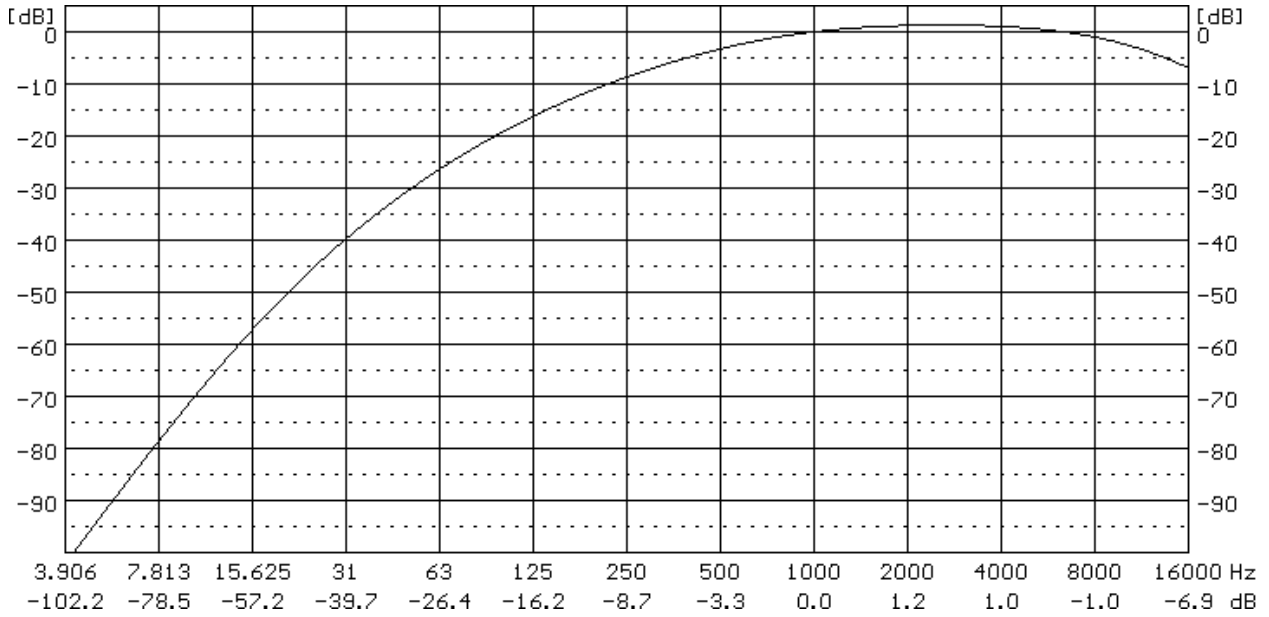
Characteristics of the HP filter implemented in the SVAN 945 instrument

LIN: cut-off frequency: 27.0 Hz / -0.1 dB (10.0 Hz / -3.0 dB).



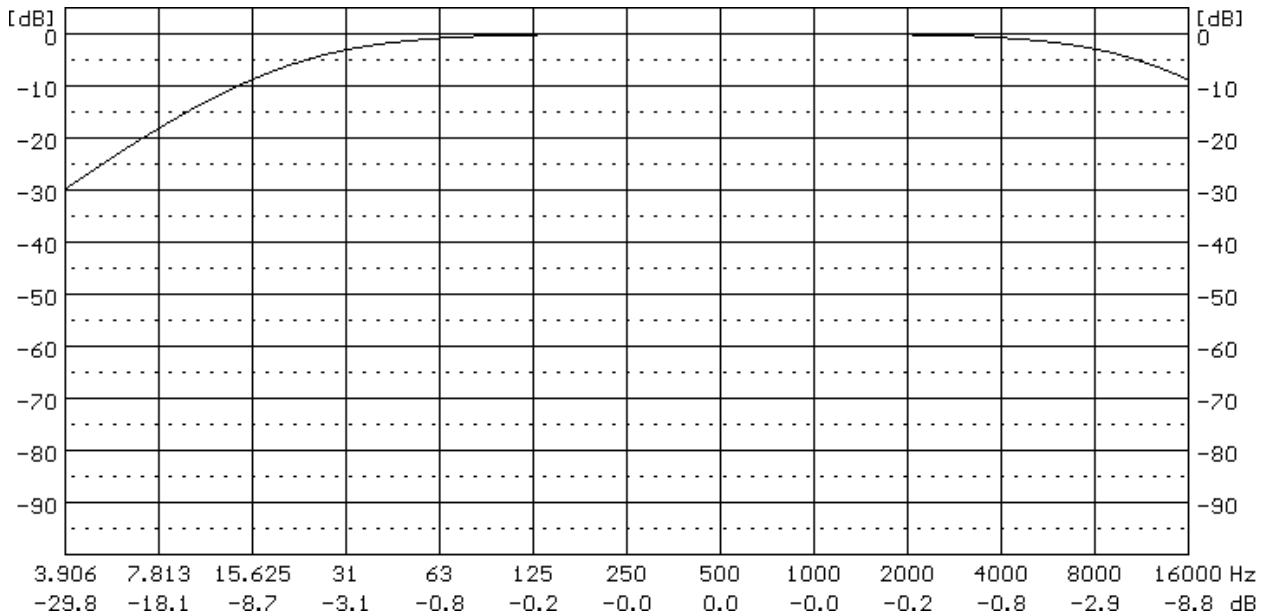
Characteristics of the LIN filter implemented in the SVAN 945 instrument

A type 1 according to IEC 651 standard.



Characteristics of the A filter implemented in the SVAN 945 instrument

C type 1 according to IEC 651 standard.



Characteristics of the C filter implemented in the SVAN 945 instrument