DIGITAL SOUND ANALYZER

DSA-50

Instruction Manual

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C O N T E N T S

1. FEATURES OF THE INSTRUMENT

Digital sound analyzer model DSA-50 is the instrument combining the features of integrating sound level meter as well as 1/1- and 1/3-octave band frequency analyzer.

The majority of quantities characterizing occupational, environmental and other kinds of acoustic noise can be measured by this Class 1 digital-signal-processing instrument.

DSA-50 is designed to be capable to perform long-lasting measurements without need of battery recharging. Internal battery allows for at least 24h continuous operation of the instrument provided microphone heating is turned off. External battery or mains adaptor may be also used.

The instrument is equipped with USB 1.1 interface to enable bi-directional communication with PC.

Fig. 1.1. DSA-50 digital sound analyzer – general view.

1.1. Accessories

Basic accessories:

- Model 5014 external power supply (Mascot).
- Instruction Manual.
- Declaration of Conformity.
- Warranty Card.
- Certificate of Verification.
- OP 60/2 microphone windscreen.
- Carrying case.
- 1.8 m USB interface cable.
- DSA-50 computer software for instrument remote operation (PC under MS Windows 98SE/ME/2000/XP required).
- DSA Monitor computer software for data display, readout and analysis (PC under MS Windows 98SE/ME/2000/XP required).

Additional accessories:

- Built-in microphone heating system.
- Watertight carrying case.
- KA-50 sound calibrator.
- CV-06 external supply source together with 8614 power supply (Mascot).
- Weatherproof accessories set for microphone.
- Microphone extension cable PD5Lx (x stands for cable length, max. 6 m).
- Microphone extension cable PD7Lx (x stands for cable length, max. 6 m).
- Supporting stand for microphone: SM2 (2 m height) and SM4 (4 m height).
- Supporting stand for the instrument: SMR (1.5 m height).

1.2. Weatherproof accessories set for microphone

This set enables to convert WK-21 microphone into WK-21WP weatherproof microphone. It consists of:

- weatherproof version of microphone protecting grid, model SM,
- rain cover, model OK,
- windscreen with anti-bird spikes, model TOP,
- microphone holder.

To assemble weatherproof microphone proceed as follows:

- Fasten the part (2) of microphone holder to microphone extension cable PD7Lx and next connect this cable to microphone-preamplifier assembly (1) (see Fig. 1.2).
- Put part (3) of microphone holder on microphone-preamplifier assembly (1) and then screw it to part (2) of microphone holder fastened earlier to extension cable (see Fig. 1.2).
- Remove standard protecting grid (4) from WK-21 (see Fig. 1.3).
  WARNING! During this and next action particular care should be observed as the microphone diaphragm is exposed after protection grid removing and may be easily damaged!
- Screw SM weatherproof protecting grid (5) to the microphone (see Fig. 1.4).
- Put OK rain cover (6) on the microphone (see Fig. 1.4).
- Put TOP windscreen with anti-bird spikes (7) on the microphone assembled as above (see Fig. 1.5) until the windscreen reaches microphone holder.
- Fig. 1.6 shows completely assembled weatherproof microphone WK-21WP.

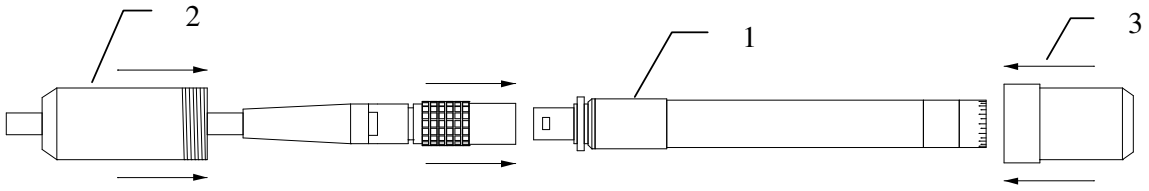


Fig. 1.2. Assembling of weatherproof accessories – step 1.

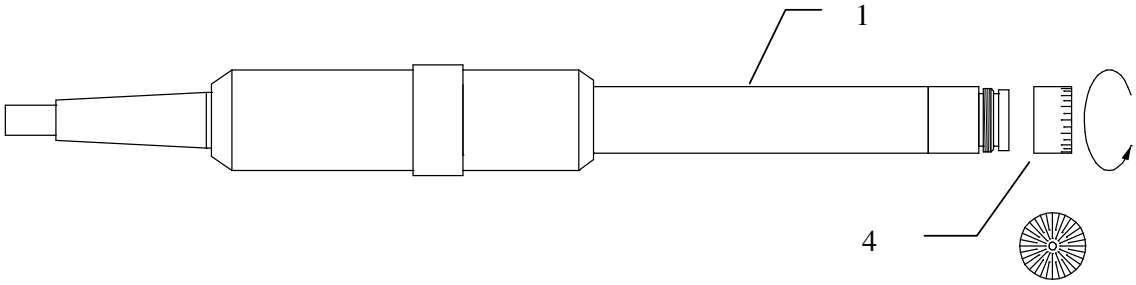


Fig. 1.3. Assembling of weatherproof accessories – step 2.

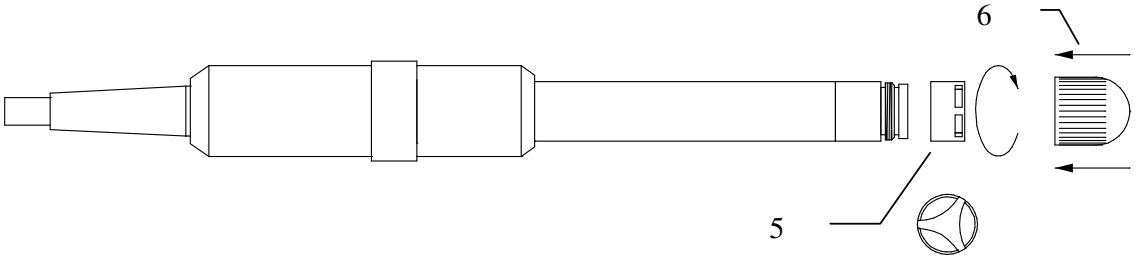


Fig. 1.4. Assembling of weatherproof accessories – step 3.

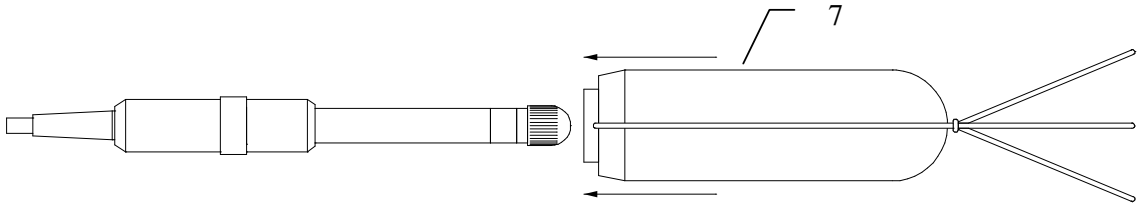


Fig. 1.5. Assembling of weatherproof accessories – step 4.

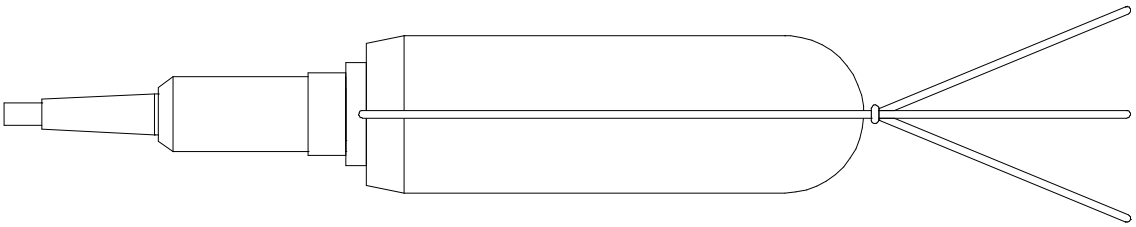


Fig. 1.6. Completely assembled weatherproof microphone WK-21WP.

1.3. System configuration

Basic configuration:

- DSA-50 digital sound analyzer (manufacturer: SONOPAN).
- PW21LG ½" microphone preamplifier (manufacturer: SONOPAN).

- WK-21 ½" measurement microphone (manufacturer: SONOPAN).

Other accessories specified in chapter 1.1 are optional.

1.4. Measured quantities

Many quantities used to characterize acoustic noise can be measured simultaneously using DSA-50 digital sound analyzer. The set of measured quantities depends on instrument operating mode. Measurement duration and battery condition information is displayed at every operating mode.

1.4.1. Sound level meter (SLM) mode

For two frequency weightings, selected among from three ones: A, C and Z available in the instrument, following quantities can be measured simultaneously (in symbols listed below X stands for selected frequency weighting):

- L_{XF} current RMS, F-time-weighted sound level,
- L_{XFmn} minimum RMS, F-time-weighted sound level,
- L_{XFmx} maximum RMS, F-time-weighted sound level,
- L_{XS} current RMS, S-time-weighted sound level,
- L_{XSmn} minimum RMS, S-time-weighted sound level,
- L_{XSmx} maximum RMS, S-time-weighted sound level,
- L_{XI} current RMS, I-time-weighted sound level,
- L_{XImn} minimum RMS, I-time-weighted sound level,
- L_{XImx} maximum RMS, I-time-weighted sound level,
- L_{XPk} current peak sound level,
- L_{XMPk} maximum peak sound level,
- L_{Xeq} time-average (equivalent continuous) sound level,
- L_{Xeq1s} time-average sound level for last one second.

If A frequency weighting is one of two selected weightings, then following quantities are measured additionally for this weighting:

- L_{AE} sound exposure level,
- $L_{AEX,T}$ noise exposure level referred to specified exposure time T.

1.4.2. 1/1-octave analyzer mode

1/1-octave analyzer contains nine digital octave-band filters having exact centre frequencies specified for binary octave ratio. Nominal centre frequencies are 31.5Hz, 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz and 8kHz. Specifications of filters conform to Class 1 requirements of EN 61260:1995 and EN 61260:1995/A1:2001.

Following quantities can be measured simultaneously for each filter centre frequency (and also for wide-band response), when one frequency weighting is selected among from three available weightings (A, C and Z):

- L_F current RMS, F-time-weighted sound level,
- L_S current RMS, S-time-weighted sound level,
- L_{eq} time-average sound level.

If A frequency weighting is selected, then following quantities are measured additionally:

- L_{ASmx} maximum RMS, A-frequency-weighted, S-time-weighted sound level,
- L_{Aeq} time-average A-frequency-weighted sound level,
- L_{CMPk} maximum peak C sound level.

1.4.3. 1/3-octave analyzer mode

1/3-octave analyzer contains twenty nine digital 1/3-octave band filters having exact centre frequencies specified for binary octave ratio. Nominal centre frequencies are 25Hz, 31.5Hz, 40Hz, 50Hz, 63Hz, 80Hz, 100Hz, 125Hz, 160Hz, 200Hz, 250Hz, 315Hz, 400Hz, 500Hz, 630Hz, 800Hz,

1kHz, 1.25kHz, 1.6kHz, 2kHz, 2.5kHz, 3.15kHz, 4kHz, 5kHz, 6.3kHz, 8kHz, 10kHz, 12.5kHz and 16kHz. Specifications of filters conform to Class 1 requirements of EN 61260:1995 and EN 61260:1995/A1:2001.

Following quantities can be measured simultaneously for each filter centre frequency (and also for wide-band response), when one frequency weighting is selected among from three available weightings (A, C and Z) and when one time weighting is selected among from two available weightings (F and S):

- L current RMS sound level,
- L_{eq} time-average sound level.

1.4.4. Infra G filter mode

Following quantities can be measured simultaneously:

- L_{GS} current RMS, G-frequency-weighted S-time-weighted sound level,
- L_{GSmn} minimum RMS, G-frequency-weighted S-time-weighted sound level,
- L_{GSmx} maximum RMS, G-frequency-weighted S-time-weighted sound level,
- L_{IPk} current peak sound level in infrasound band,
- L_{IMPk} maximum peak sound level in infrasound band,
- L_{Geq} G-frequency-weighted time-average sound level.

1.5. Specifications

DSA-50 digital sound analyzer conforms to requirements of following standards:

🕮 **EN 61672-1:2002**	Electroacoustics – Sound level meters – Part 1: Specifications.
🕮 **EN 61260:1995/A1:2001**	Electroacoustics – Octave-band and fractional-octave-band filters.
🕮 **ISO 7196:1995**	Acoustics – Frequency-weighting characteristic for infrasound measurements.

DSA-50 conforms to electromagnetic compatibility (EMC) requirements specified in EN 61672-1:2002 for X group instruments.

Specifications common for all operating modes:

- Accuracy class: 1
- Readout resolution: 0.1dB
- Maximum sound pressure level can be applied without causing damage to the instrument: 150dB (3% THD)
- Maximum electrical voltage can be applied at instrument electrical input facility without causing damage to the instrument: $22V_{p-p}$
- Capacitance of electrical input facility: 18pF
- Reference conditions:
  - type of sound field: free field
  - reference frequency: 1000Hz
  - reference sound pressure level: 94dB
  - reference level range:
    - for SLM mode: 55 – 135dB
    - for 1/1- and 1/3-octave analyzer mode: 65 – 135dB
    - for infra G filter mode: 65 – 145dB
  - sampling frequency:
    - for SLM, 1/1- octave and 1/3-octave mode: 52.1kHz
    - for infra G filter mode: 17.4kHz

- Microphone reference direction — microphone symmetry axis
- microphone reference point — microphone diaphragm centre
- reference orientation — sound wave arriving from reference direction
- reference temperature — +23°C
- reference humidity — 50% RH
- reference static pressure — 101.325kPa

- Permissible error for sinusoidal reference signal (progressive sound wave incident perpendicularly to microphone diaphragm, 94dB, 1000Hz) — ≤ ±0.7dB
- Operating temperature range — -10 ÷ +50°C
- Storage temperature range — -10 ÷ +50 °C
- Operating humidity range — ≤ 90% RH (no condensation)
- Operating static pressure range — 65 ÷ 108kPa
- Electromagnetic emission — within the limits specified in EN 61672-1:2002 (maximum emission when operating with external power supply)

- Warm-up time:
  - after turn-on — 1 minute
  - after environmental conditions change — 15 minutes
- Measurement duration — 99h 59m 58s (set with 1s resolution) or infinite
- Serial communication interface — USB 1.1
- Dimensions (without microphone) — 237 x 84 x 50 mm
- Power supply
  - internal battery — NiMH 6V 2.1Ah
  - external power supply — Mascot 5014 (9V, 350mA)
- Minimum operating voltage of internal battery — 5.5V
- Continuous operating time (battery fully charged, microphone heating turned off) — 24h
- Weight — 600g
- Nominal corrections for effects of reflection from instrument case (free field, 0° incidence) — See table below

f [Hz]	250	315	400	500	630	800	1000	1250	1600	2000	2240
dL [dB]	0,23	-0,22	0,41	-0,08	-0,30	-0,29	-0,30	0,30	-0,17	-0,44	-0,11
U [dB]	≤ 0,03							≤ 0,05			
f [Hz]	2500	2800	3150	3550	4000	4500	5000	5600	6300	7100	8000
dL [dB]	-0,09	0,12	-0,17	-0,51	0,04	0,00	-0,44	-0,29	0,19	0,16	0,51
U [dB]	≤ 0,05										
f [Hz]	8500	9000	9500	10000	10600	11200	11800	12500	13200	14000	15000
dL [dB]	-0,33	0,25	-0,33	-0,52	0,08	-0,18	-0,05	0,19	-0,12	-0,43	-0,53
U [dB]	≤ 0,05						≤ 0,09				
f [Hz]	16000	17000	18000	19000	20000						
dL [dB]	0,03	0,63	0,60	-0,97	-1,50						
U [dB]	≤ 0,09										

- Differences between WK-21 microphone free field frequency response at 0° incidence and electrostatic

actuator response; expanded (k=2) uncertainty of the determination of these differences — See table below and Fig. 1.7

f [Hz]	250	315	400	500	630	800	1000	1250	1600	2000	2240
dL [dB]	0,00	0,02	0,03	0,04	0,05	0,08	0,11	0,18	0,26	0,36	0,43
U [dB]	≤ 0,29										
f [Hz]	2500	2800	3150	3550	4000	4500	5000	5600	6300	7100	8000
dL [dB]	0,52	0,62	0,74	0,93	1,13	1,42	1,70	2,08	2,50	2,89	3,30
U [dB]	≤ 0,29								≤ 0,39		
f [Hz]	8500	9000	9500	10000	10600	11200	11800	12500	13200	14000	15000
dL [dB]	3,49	3,69	3,90	4,18	4,49	4,82	5,19	5,72	6,34	6,83	7,31
U [dB]	≤ 0,39							≤ 0,48			
f [Hz]	16000	17000	18000	19000	20000						
dL [dB]	7,67	8,09	8,47	8,77	9,12						
U [dB]	≤ 0,48										

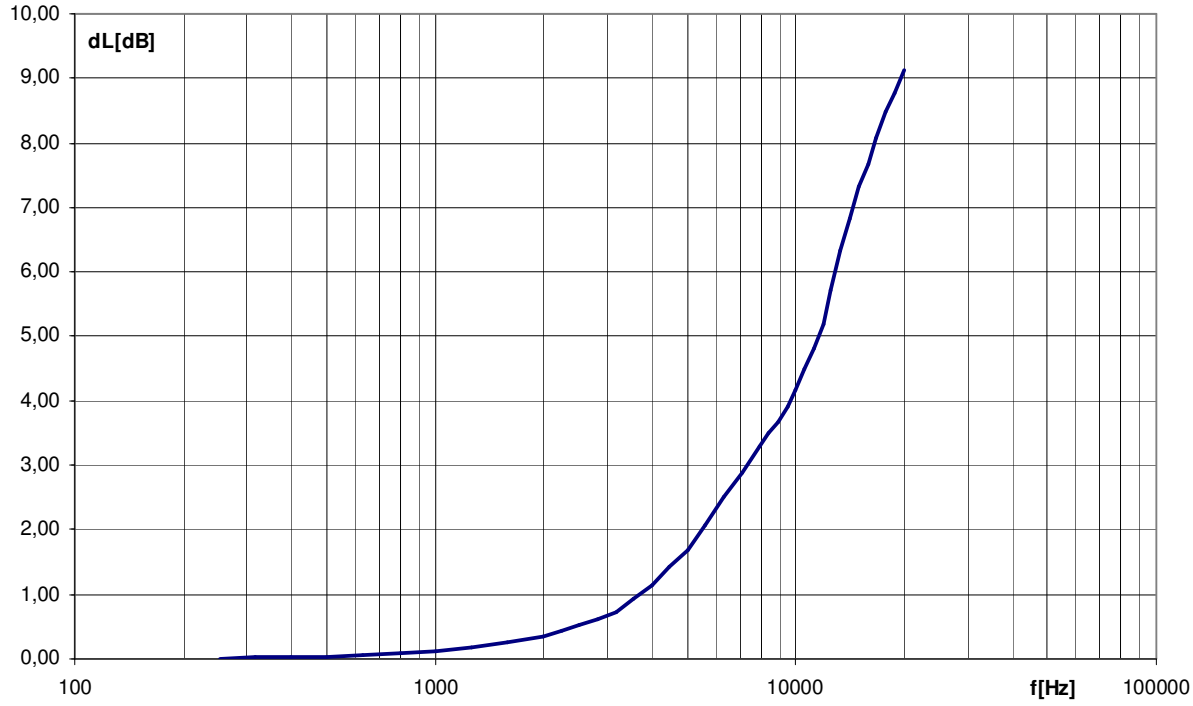


Fig. 1.7. Free-field correction for WK-21 microphone (0° incidence).

Table below and Fig. 1.8 show typical free-field frequency response of WK-21 microphone (relative to its sensitivity at 250Hz) together with maximum permissible deviations as specified in EN 61094-4:1995.

f [Hz]	250	315	400	500	630	800	1000	1250	1600	2000	2240
dL [dB]	0,00	-0,07	-0,02	0,00	0,02	-0,05	0,02	-0,01	-0,08	0,04	-0,02
U [dB]	≤ 0,21										
f [Hz]	2500	2800	3150	3550	4000	4500	5000	5600	6300	7100	8000
dL [dB]	0,07	0,06	-0,15	0,06	-0,13	0,11	-0,05	-0,05	0,20	0,31	0,38
U [dB]	≤ 0,21								≤ 0,34		

f [Hz]	8500	9000	9500	10000	10600	11200	11800	12500	13200	14000	15000
dL [dB]	-0,46	0,03	-0,50	-0,66	-0,23	-0,42	-0,83	-0,33	-0,20	-0,21	0,08
U [dB]	≤ 0,34							≤ 0,44			

f [Hz]	16000	17000	18000	19000	20000
dL [dB]	0,02	-0,09	-0,08	-0,21	-0,46
U [dB]	≤ 0,44				

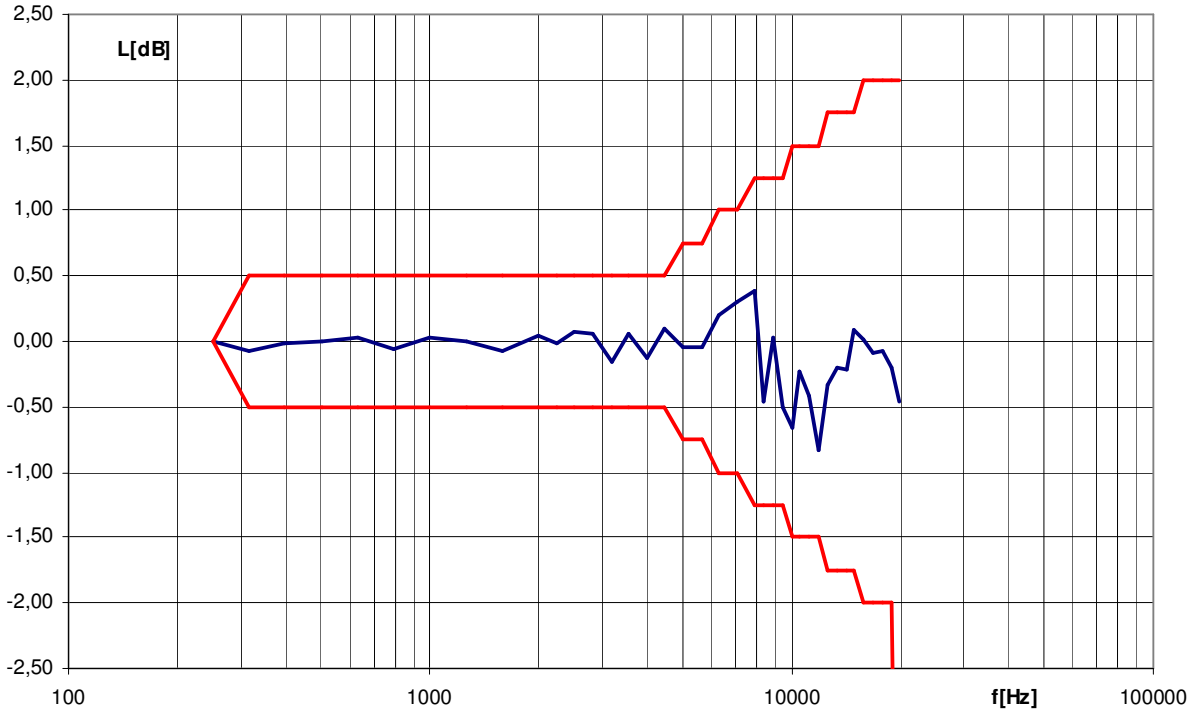


Fig. 1.8. Typical free-field frequency response of WK-21 microphone.

1.5.1. Specifications for SLM mode

- Frequency weightings — A, C, Z
- AC electrical output (sine, 1000 Hz)
  - weighted frequency response — A, Z
  - FSD output voltage for level range — $14V_{p-p}$
  - maximum output voltage — $22V_{p-p}$
  - output impedance — 1kΩ
  - load impedance — ≥10kΩ
- Time weightings — SLOW, FAST, IMPULSE
- Starting level for level linearity testing — reference sound pressure level at reference level range
- Maximum unweighted sound pressure level not activating overload indication — See table below

Level range	Peak level (sine)	RMS level (sine)
15 – 95dB	118dB	95dB
35 – 115dB	128dB	115dB
55 – 135dB	138dB	135dB

- Total range for L_A sound level and L_{Aeq} time-average sound level 18 – 135dBA
- Total range for L_{CPk} peak sound level 40 – 138dBC
- Extents of measurement range at specified signal frequency, level range and frequency weighting:
  - for sound level (L) and time-average sound level (L_{eq})

31.5Hz			
Level range	A	C	Z
15 – 95dB	18 – 58.2dB	25 – 95.2dB	29 – 95dB
35 – 115dB	35 – 78.3dB	35 – 115.2dB	35 – 115dB
55 – 135dB	55 – 95.6dB	55 – 132.5dB	55 – 135dB
1kHz			
Level range	A	C	Z
15 – 95dB	18 – 95dB	25 – 95dB	29 – 95dB
35 – 115dB	35 – 115dB	35 – 115dB	35 – 115dB
55 – 135dB	55 – 135dB	55 – 135dB	55 – 135dB
4kHz			
Level range	A	C	Z
15 – 95dB	18 – 95dB	25 – 93.2dB	29 – 95dB
35– 115dB	35 – 115dB	35 – 113.2dB	35 – 115dB
55 – 135dB	55 – 135dB	55 – 133.2dB	55 – 135dB
8kHz			
Level range	A	C	Z
15 – 95dB	18 – 95dB	25 – 93.1dB	29 – 95dB
35 – 115dB	35 – 115dB	35 – 113.1dB	35 – 115dB
55 – 135dB	55 – 135dB	55 – 133.2dB	55 – 135dB
12.5kHz			
Level range	A	C	Z
15 – 95dB	18 – 95dB	25 – 92.8dB	29 – 95dB
35 – 115dB	35 – 115dB	35 – 112.8dB	35 – 115dB
55 – 135dB	55 – 131.4dB	55 – 129.1dB	55 – 135dB

  - for peak level (L_{Pk})

Level range	A	C	Z
15 – 95dB	46 – 98dB	40 – 97dB	61 – 98dB
35 – 115dB	60 – 118dB	50 – 117dB	70 – 118dB
55 – 135dB	73 – 138dB	65 – 137dB	82 – 138dB

WARNING! The extents of measurement range for peak level at A and Z frequency weightings are determined for continuous 1000Hz sine signal; measurement error extended by expanded measurement uncertainty is less than 1.1 dB.

- Self-generated noise
  - measured with electrical input facility installed:
    - at A frequency weighting ≤13dB
    - at C frequency weighting ≤19dB
    - at Z frequency weighting ≤25dB

- measured with WK-21 microphone installed:
  - at A frequency weighting ≤19dB
  - at C frequency weighting ≤24dB
  - at Z frequency weighting ≤27dB

1.5.2. 1/1-octave analyzer mode

- Frequency weightings A, C, Z
- AC electrical output (sine, 1000 Hz)
  - weighted frequency response A, Z
  - FSD output voltage for level range $14V_{p-p}$
  - maximum output voltage $22V_{p-p}$
  - output impedance 1kΩ
  - load impedance ≥10kΩ
- Time weightings SLOW, FAST
- Extents of measurement range at specified level range and frequency weighting, for time-weighted sound level L and time-average sound level L_{eq} (analyzer):

Level range	A	C	Z
5 – 75dB	See table below		
25 – 95dB	25 – 95dB	25– 95dB	25 – 95dB
45 – 115dB	45 – 115dB	45– 115dB	45 – 115dB
65 – 135dB	65 – 135dB	65 – 135dB	65 – 135dB

- Extents of measurement range at specified octave bands and at most-sensitive level range (5 – 75dB), for time-weighted sound level L and time-average sound level L_{eq} (analyzer):

Frequency	A	C	Z
31.5Hz	5 – 38.4dB	23 – 72.1dB	29 – 75dB
63Hz	5 – 49.4dB	22 – 74.3dB	26 – 75dB
125Hz	6 – 58.9dB	19 – 74.9dB	20 – 75dB
250Hz	6 – 66.4dB	19 – 75dB	16 – 75dB
500Hz	10 – 71.8dB	19 – 75dB	12 – 75dB
1kHz	10 – 75dB	19 – 75dB	12 – 75dB
2kHz	10 – 75dB	19 – 74.9dB	10 – 75dB
4kHz	9 – 75dB	19 – 74.2dB	12 – 75dB
8kHz	9 – 75dB	19 – 72.1dB	13 – 75dB

- Extent of measurement range for L_{ASmx} maximum sound level and L_{Aeq} time-average sound level (criterion values 17 – 135dB
- Extents of measurement range for L_{CPk} peak sound level (criterion values)

Level range	C
5 – 75dB	45 – 77dB
25 – 95dB	40 – 97dB
45 – 115dB	55 – 117dB
65 – 135dB	75 – 137dB

- Self-generated noise
  - measured with electrical input facility installed

Frequency	A	C	Z
31.5Hz	not measurable	≤9.0dB	≤14.0dB
63Hz	not measurable	≤8.0dB	≤9.0dB
125Hz	not measurable	≤6.0dB	≤6.0dB
250Hz	not measurable	≤4.0dB	≤4.0dB
500Hz	not measurable	≤3.0dB	≤3.0dB
1kHz	≤2.0dB	≤2.0dB	≤2.0dB
2kHz	≤3.0dB	≤2.0dB	≤2.0dB
4kHz	≤4.0dB	≤2.0dB	≤3.0dB
8kHz	≤4.0dB	≤2.0dB	≤5.0dB
power sum of all octave bands	≤7.0dB	≤11.0dB	≤14.0dB

- measured with WK-21 microphone installed

Frequency	A	C	Z
31,5Hz	not measurable	≤19.0dB	≤22.0dB
63Hz	not measurable	≤17.0dB	≤19.0dB
125Hz	not measurable	≤15.0dB	≤16.0dB
250Hz	≤5.0dB	≤13.0dB	≤13.0dB
500Hz	≤8.0dB	≤11.0dB	≤12.0dB
1kHz	≤11.0dB	≤11.0dB	≤11.0dB
2kHz	≤13.0dB	≤11.0dB	≤12.0dB
4kHz	≤14.0dB	≤12.0dB	≤13.0dB
8kHz	≤13.0dB	≤11.0dB	≤14.0dB
power sum of all octave bands	≤16.0dB	≤20.0dB	≤22.0dB

1.5.3. 1/3-octave analyzer mode

- Frequency weightings — A, C, Z
- AC electrical output (sine, 1000 Hz)
  - weighted frequency response — A, Z
  - FSD output voltage for level range — $14V_{p-p}$
  - maximum output voltage — $22V_{p-p}$
  - output impedance — 1kΩ
  - load impedance — ≥10kΩ
- Time weightings — SLOW, FAST
- Extents of measurement range at specified level range and frequency weighting, for time-weighted sound level L and time-average sound level L_{eq}

Level range	A	C	Z
5 – 75dB	See table below		
25 – 95dB	25 – 95dB	25 – 95dB	25 – 95dB
45 – 115dB	45 – 115dB	45 – 115dB	45 – 115dB
65 – 135dB	65 – 135dB	65 – 135dB	65 – 135dB

- Extents of measurement range at specified octave bands and at most-sensitive level range (5 – 75 dB), for time-weighted sound level L and time-average sound level L_{eq}

Frequency	A	C	Z
25Hz	9 – 60.3dB	21 – 75dB	29 – 75dB
31.5Hz	9 – 65.6dB	21 – 75dB	28 – 75dB
40Hz	9 – 70.4dB	23 – 75dB	24 – 75dB
50Hz	9 – 74.8dB	23 – 75dB	23 – 75dB
63Hz	9 – 75dB	23 – 75dB	21 – 75dB
80Hz	9 – 75dB	23 – 75dB	21 – 75dB
100Hz	9 – 75dB	21 – 75dB	19 – 75dB
125Hz	9 – 75dB	20 – 75dB	18 – 75dB
160Hz	9 – 75dB	18 – 75dB	17 – 75dB
200Hz	9 – 75dB	17 – 75dB	17 – 75dB
250Hz	10 – 75dB	16 – 75dB	15 – 75dB
315Hz	10 – 75dB	15 – 75dB	15 – 75dB
400Hz	10 – 75dB	14 – 75dB	15 – 75dB
500Hz	12– 75dB	13 – 75dB	14 – 75dB
630Hz	11 – 75dB	12 – 75dB	13 – 75dB
800Hz	11– 75dB	12 – 75dB	13 – 75dB
1kHz	11 – 75dB	12 – 75dB	13 – 75dB
1.25kHz	11 – 75dB	12 – 75dB	12 – 75dB
1.6kHz	11 – 75dB	11 – 75dB	12 – 75dB
2kHz	11 – 75dB	11 – 75dB	12 – 75dB
2.5kHz	11 – 75dB	10 – 75dB	12 – 75dB
3.15kHz	11 – 75dB	10 – 75dB	12 – 75dB
4kHz	11 – 75dB	10 – 75dB	12 – 75dB
5kHz	11 – 75dB	10 – 75dB	12 – 75dB
6.3kHz	10 – 75dB	9 – 75dB	12 – 75dB
8kHz	9 – 75dB	9 – 75dB	12 – 75dB
10kHz	8 – 75dB	9 – 75dB	12 – 75dB
12.5kHz	6 – 75dB	7 – 75dB	12 – 75dB
16kHz	5 – 75dB	6 – 75dB	12 – 75dB

- Self-generated noise
  - measured with electrical input facility installed

Frequency	A	C	Z
25Hz	not measurable	≤4.0dB	≤8.0dB
31.5Hz	not measurable	≤4.0dB	≤7.0dB
40Hz	not measurable	≤4.0dB	≤6.0dB
50Hz	not measurable	≤4.0dB	≤5.0dB
63Hz	not measurable	≤3.0dB	≤4.0dB
80Hz	not measurable	≤3.0dB	≤3.0dB
100Hz	not measurable	≤2.0dB	≤2.0dB
125Hz	not measurable	≤2.0dB	≤2.0dB
160Hz	not measurable	≤0.5dB	≤1.0dB
200Hz	not measurable	≤0.5dB	≤0.5dB
250Hz	not measurable	≤0.5dB	≤0.5dB
315Hz	not measurable	not measurable	not measurable
400Hz	not measurable	not measurable	not measurable
500Hz	not measurable	not measurable	not measurable

630Hz	not measurable	not measurable	not measurable
800Hz	not measurable	not measurable	not measurable
1kHz	not measurable	not measurable	not measurable
1.25kHz	not measurable	not measurable	not measurable
1.6kHz	not measurable	not measurable	not measurable
2kHz	not measurable	not measurable	not measurable
2.5kHz	not measurable	not measurable	not measurable
3.15kHz	not measurable	not measurable	not measurable
4kHz	not measurable	not measurable	not measurable
5kHz	not measurable	not measurable	not measurable
6.3kHz	not measurable	not measurable	not measurable
8kHz	not measurable	not measurable	≤0.5dB
10kHz	not measurable	not measurable	≤1.0dB
12.5kHz	not measurable	not measurable	≤2.0dB
16kHz	not measurable	not measurable	≤2.0dB
power sum for all 1/3-octave bands	≤8.0dB	≤9.0dB	≤11.0dB

- measured with WK-21 microphone installed

Frequency	A	C	Z
25Hz	not measurable	≤17.0dB	≤22.0dB
31.5Hz	not measurable	≤11.0dB	≤16.0dB
40Hz	not measurable	≤11.0dB	≤15.0dB
50Hz	not measurable	≤11.0dB	≤13.0dB
63Hz	not measurable	≤12.0dB	≤13.0dB
80Hz	not measurable	≤12.0dB	≤13.0dB
100Hz	not measurable	≤11.0dB	≤12.0dB
125Hz	not measurable	≤11.0dB	≤11.0dB
160Hz	not measurable	≤10.0dB	≤10.0dB
200Hz	not measurable	≤9.0dB	≤9.0dB
250Hz	not measurable	≤9.0dB	≤9.0dB
315Hz	≤1.0dB	≤8.0dB	≤8.0dB
400Hz	≤2.0dB	≤7.0dB	≤7.0dB
500Hz	≤3.0dB	≤7.0dB	≤7.0dB
630Hz	≤4.0dB	≤7.0dB	≤6.0dB
800Hz	≤5.0dB	≤6.0dB	≤6.0dB
1kHz	≤6.0dB	≤6.0dB	≤6.0dB
1.25kHz	≤7.0dB	≤6.0dB	≤6.0dB
1.6kHz	≤7.0dB	≤7.0dB	≤7.0dB
2kHz	≤8.0dB	≤7.0dB	≤7.0dB
2.5kHz	≤9.0dB	≤7.0dB	≤8.0dB
3.15kHz	≤9.0dB	≤7.0dB	≤8.0dB
4kHz	≤9.0dB	≤8.0dB	≤8.0dB
5kHz	≤9.0dB	≤8.0dB	≤9.0dB
6.3kHz	≤10.0dB	≤8.0dB	≤9.0dB
8kHz	≤8.0dB	≤6.0dB	≤9.0dB

10kHz	≤7.0dB	≤5.0dB	≤9.0dB
12.5kHz	≤5.0dB	≤3.0dB	≤9.0dB
16kHz	≤2.0dB	not measurable	≤8.0dB
power sum for all 1/3-octave bands	≤14.0dB	≤17.0dB	≤22.0dB

1.5.4. Infra G filter mode

- Frequency weightings — G, I
- AC electrical output (sine, 1000 Hz)
  - weighted frequency response — Z
  - FSD output voltage for level range — $14V_{p-p}$
  - maximum output voltage — $22V_{p-p}$
  - output impedance — 1kΩ
  - load impedance — ≥10kΩ
- Time weightings — SLOW
- Total range for L_G sound level and L_{Geq} time-average sound level — TBD
- Total range for L_{IPk} peak sound level — TBD
- Extents of measurement range at specified level range and frequency weighting, for time-weighted sound level L and time-average sound level L_{eq}

Level range	G
25 – 105dB	TBD
45 – 125dB	TBD
65 – 145dB	TBD

- Extents of measurement range for L_{Pk} peak sound level

Level range	G
25 – 105dB	TBD
45 – 125dB	TBD
65 – 145dB	TBD

WARNING! The extents of measurement range for peak level are determined for continuous 10Hz sine signal; measurement error extended by expanded measurement uncertainty is less than 1.1 dB.

- Self-generated noise
  - measured with electrical input facility installed
    - at G frequency weighting — ≤TBD
  - measured with WK-21 microphone installed:
    - at G frequency weighting — ≤TBD

1.6. Influence of operating environment

- Influence of static pressure — -0.01dB/kPa (at1kHz)
- Influence of temperature — ≤ ±0.5dB
- Influence of humidity — ≤ ±0.1dB (without condensation)

- Influence of vibration — see Appendix C
- Influence of electromagnetic field — conformable to EN 61672-1:2002 specifications (maximum when microphone extension cable is parallel to field direction)
- Influence of electrostatic field — conformable to EN 61672-1:2002
- Influence of 80 A/m a.c. power-frequency magnetic field:
  - SLM mode (15 – 95dB level range)
    - at A frequency weighting — not detectable
    - at C frequency weighting — ≤ 30.0dB
    - at Z frequency weighting — ≤ 32.0dB
  - 1/1-octave analyzer mode (5 – 75dB level range, f = 63Hz)
    - at A frequency weighting — not detectable
    - at C frequency weighting — ≤ 30.0dB
    - at Z frequency weighting — ≤ 31.0dB
  - 1/3-octave analyzer mode (5 – 75dB level range, f = 50Hz)
    - at A frequency weighting — not detectable
    - at C frequency weighting — ≤ 30.0dB
    - at Z frequency weighting — ≤ 31.0dB
  - Infra G filter mode (25 – 105dB level range) — TBD

1.7. Influence of instrument accessories

Installation of additional equipment does not deteriorate accuracy class of the instrument, however some influence of this equipment on entire instrument performance can be detected.

- Influence of microphone extension cable — its connection to the instrument causes nonlinear distortion increasing with frequency at high input signal levels – see table below.

		f [kHz]	1	2	4	5	6.3	8	10	12.5	16	20	25
Input level	PD5LD6	135dB	0.07%	0.07%	0.08%	0.08%	0.08%	0.09%	0.09%	0.15%	0.98%	1.9%	1.7%
		130dB	0.06%										
		125dB	0.03%										
	PD7LD6	135dB	0.07%	0.07%	0.07%	0.07%	0.07%	0.07%	0.07%	-	-	-	-
		130dB	0.04%										
		125dB	0.03%										

- Influence of windscreen (at 0° incidence) — See table below and Fig. 1.9.

f [Hz]	250	315	400	500	630	800	1000	1250	1600	2000	2240
dL [dB]	0.06	0.07	0.08	0.16	0.11	0.24	0.22	0.32	0.40	0.64	0.41
U [dB]	≤ 0.03									≤ 0.05	
f [Hz]	2500	2800	3150	3550	4000	4500	5000	5600	6300	7100	8000
dL [dB]	0.56	0.58	0.42	0.43	0.10	0.06	-0.23	-0.41	-0.48	-0.52	-0.61
U [dB]	≤ 0.05										
f [Hz]	8500	9000	9500	10000	10600	11200	11800	12500	13200	14000	15000
dL [dB]	-0.67	-0.70	-0.82	-1.04	-1.12	-1.21	-1.48	-1.38	-1.44	-1.63	-1.51
U [dB]	≤ 0.05			≤ 0.07							

f [Hz]	16000	17000	18000	19000	20000
dL [dB]	-1.86	-1.85	-2.22	-2.54	-2.66
U [dB]	≤ 0.07		≤ 0.10		

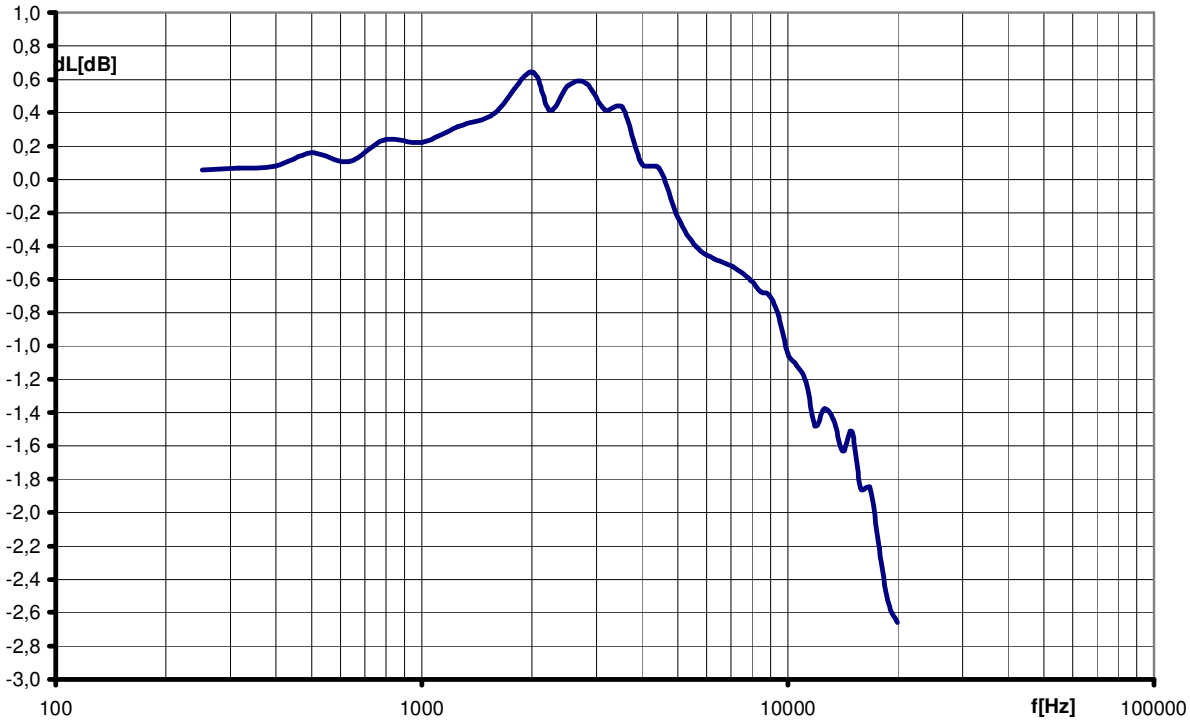


Fig. 1.9. Influence of OP60/2 windscreen.

- Influence of weatherproof screen (for 0° incidence) See table below and Fig. 1.10.

f [Hz]	250	315	400	500	630	800	1000	1250	1600	2000	2240
dL [dB]	-0.02	0.02	0.05	0.08	0.09	0.11	0.18	0.02	-0.02	0.00	0.30
U [dB]	≤ 0.10										
f [Hz]	2500	2800	3150	3550	4000	4500	5000	5600	6300	7100	8000
dL [dB]	0.30	-0.01	-0.20	-0.04	0.00	-0.34	0.09	-0.24	-0.38	-0.07	-1.06
U [dB]	≤ 0.10										≤ 0.20
f [Hz]	8500	9000	9500	10000	10600	11200	11800	12500	13200	14000	15000
dL [dB]	-0.34	0.37	-0.77	-0.27	0.34	0.18	0.61	0.39	0.73	1.03	0.91
U [dB]	≤ 0.20				≤ 0.38						≤ 0.47
f [Hz]	16000	17000	18000	19000	20000						
dL [dB]	1.55	2.16	1.76	2.02	1.25						
U [dB]	≤ 0.47										

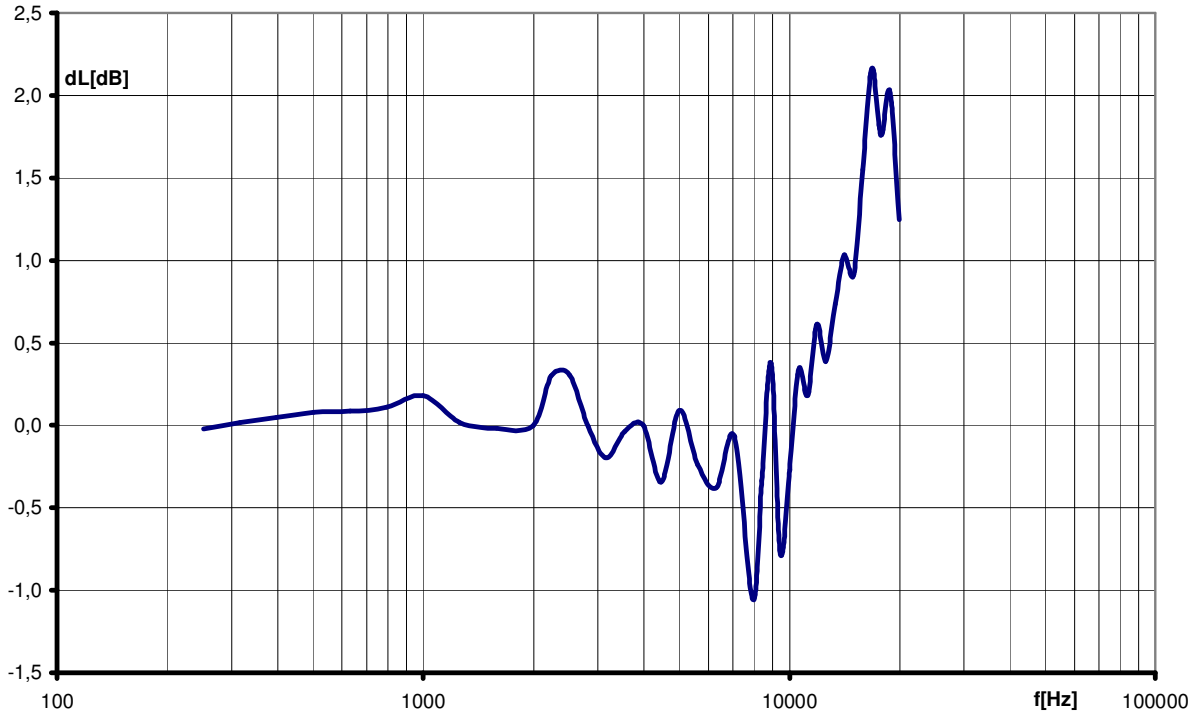


Fig. 1.10. Influence of weatherproof screen.

2. CONTROLLING OF THE INSTRUMENT

DSA-50 digital sound analyzer can be controlled either by instrument keyboard or by PC via USB interface.

2.1. Control keys

Instrument keyboard contains following keys:

- power switch,
- function keys: **MEMORY**, **FILTER**, **CLEAR**, **SETUP**, **TIME**, **RESULTS**,
- RUN/PAUSE key,
- cursor keys,
- ENTER key.

2.2. Input and output connectors of the instrument

The layout of input and output connectors of the instrument is shown on Fig. 2.1 and Fig. 2.2.

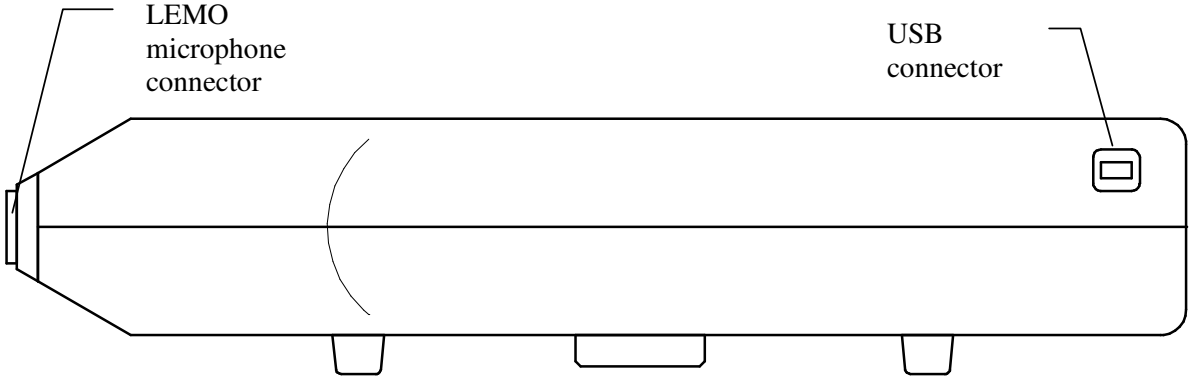


Fig. 2.1. Layout of instrument connectors – left-side view.

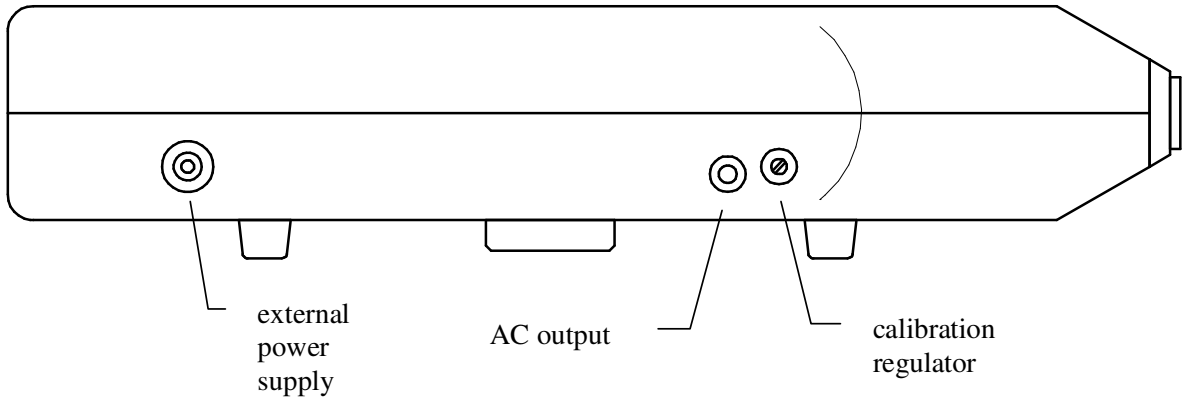


Fig. 2.2. Layout of instrument connectors – right-side view.

The instrument is equipped with following input and output connectors:

- LEMO EGG.1B.307.CLL microphone connector for microphone preamplifier

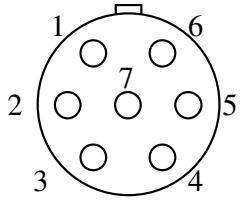


Fig. 2.3. Microphone connector – external view.

Pin no.	Function
1	heater
2	GND
3	polarization voltage (+200V)
4	signal input
5	heater
6	+12V supply
7	-12Vsupply
shield	GND

- GS2-2 analogue AC electrical signal output connector

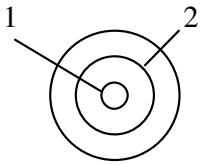


Fig. 2.4. AC analogue electrical signal output connector – external view.

Pin no.	Function
1	signal output
2	GND

- MJ-14 external power supply connector with 2.1 mm diameter central pin

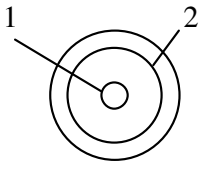


Fig. 2.5. External power supply connector – external view.

Pin no.	Function
1	supply positive terminal
2	supply negative terminal

- B-type USB interface connector for data exchange with PC

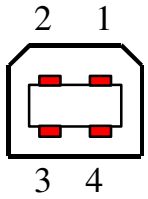


Fig. 2.6. B-type USB interface connector – external view.

Pin no.	Function
1	+5V
2	DM
3	DP
4	GND
shield	GND

2.3. Default instrument settings

Default settings of DSA-50 after instrument turn-on are specified below:

- Operating mode — Sound level meter (SLM) mode
- Level range — 55–135dB
- Frequency weightings — A and C
- Microphone heater — Off
- Measurement history recording — Off
- Integration time — 99h 59m 59s (infinite)
- Noise exposure duration — 8h 00m

The instrument setup can be recorded in measurement memory as follows:

- Turn the instrument on.
- Set proper operating mode, then select level range, frequency weighting, time weighting (only at 1/3-octave analyzer mode) and microphone heater state (ON or OFF).
- Save measurement result.

To use setup previously recorded, after turning instrument on, open MEMORY menu and load the content of previously filled memory cell.

2.4. Preparation of the instrument to operation

Screw WK-21 measurement microphone on microphone preamplifier. Take off microphone protecting cap. Connect this assembly to LEMO microphone connector. If microphone extension cable is to be used, insert it between microphone preamplifier and microphone connector. Place windscreen on the microphone, if necessary.

External power supply is optional. External AC mains adaptor or external battery, or internal battery can be used to power the instrument.

Turn the instrument on. Default instrument setup is specified in chapter 2.3.

Now it is recommended to perform acoustic calibration of the instrument as described in chapter 5.3.

After measurements completion, turn the instrument off and place protecting cap on the microphone.

3. OPERATION

To operate DSA-50 analyzer, select proper menu among from following: **SETUP**, **RESULTS**, **TIME**, **FILTER**, **MEMORY** and **CLEAR** using function keys. To select proper option of selected menu use arrow keys controlling the cursors. In some menus cursors are used to select proper value directly. Active keys are shown on instrument display.

Every setting influencing the measurement, may be modified only when the instrument is set in PAUSE state. In RUN state the information on active keys is not displayed.

Particular attention should be paid to results displaying manner in SLM mode. As the room to present measurement results on display screen is far insufficient to show results obtained for all measured quantities, it is necessary to select results to be currently displayed.

Detailed description of the method of selection of results to be displayed can be found in chapter 3.3.1.

In reduced capabilities version of DSA-50 analyzer following measurement options are unavailable:

- 1/1-octave analyzer (FILTER → 1/1 octave),
- 1/3-octave analyzer (FILTER → 1/3 octave),
- built-in microphone heater (SETUP → MIC HEATER),
- infra G filter (FILTER → infra G).

If any of unavailable options is selected, then error message is displayed on the screen.

Fig. 3.1. Error message displayed when unavailable option is selected.

3.1. Instrument data plate

After turning the instrument on, initial information is displayed on the screen. This information contains instrument name, firmware version and manufacturer data (name, website, phone).

Fig. 3.2. Instrument data plate.

3.2. SETUP menu

To recall this menu press **SETUP** key.

To change level range press ▲ or ▼ arrow key. Level range setting depends on instrument operating mode. Measurement results are not affected by level range change.

To change frequency weighting press ◀ arrow key. In SLM mode two of three available frequency weightings are selected. In 1/1- or 1/3-octave analyzer mode one of three available frequency weightings is selected.

WARNING! Results of last measurement are cleared by frequency weighting change!

Analogue signal, available at instrument AC signal output is frequency-weighted as shown below:

- SLM mode:

Frequency weighting selected	Frequency weighting of output signal
A/C or A/Z	A
Z/C or Z/Z	Z

- 1/1- or 1/3-octave analyzer mode:

Frequency weighting selected	Frequency weighting of output signal
A	A
C or Z	Z

- Infra G filter mode:

Frequency weighting selected	Frequency weighting of output signal
G	Z

To change RMS time weighting in 1/3-octave analyzer mode, press ◐ arrow key. F and S time weightings are available. In SLM mode RMS results are determined at S, F and I time weightings simultaneously. In 1/1-octave analyzer mode results are determined at S and F time weightings simultaneously. In infra G filter mode, all measurements are determined at S time weighting.

WARNING! Results of last measurement are cleared by time weighting change!

To turn microphone heater on or off in all operating modes press ↵ key.

If the instrument is in RUN state, present instrument settings can be only watched – its change is disabled and information on active keys is not displayed.

Fig. 3.3. SETUP menu at SLM mode.

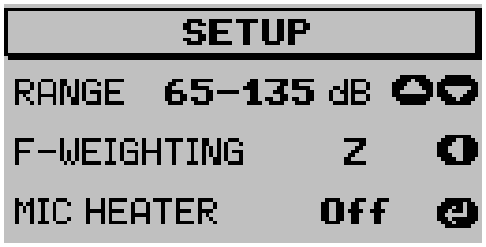


Fig. 3.4. SETUP menu at 1/1-octave analyzer mode.

Fig. 3.5. SETUP menu at 1/3-octave analyzer mode.

Fig. 3.6. SETUP menu at infra G filter mode.

3.3. RESULTS menu

In DSA-50 analyzer several sets of results are available. The number of these sets depends on instrument operating mode being in use. To select active set use ▲ or ▼ arrow key.

Following data are displayed at each operating mode: measurement duration time, overload indicator (not visible if no overload has been occurred), RUN/PAUSE state indicator, microphone heater state indicator (On/Off) and battery gauge.

Two modes of overload conditions are indicated:

- ▲▲ – overload has occurred during last second,
- ▲ – overload has occurred after measurement starting but not during last second.

Under-range indication is also displayed. If displayed result is below level range lower limit, then ↓ is displayed left of result number. Additionally, if signal level is not measurable or is not measured yet, then the icon `--.-` is displayed instead of result number.

WARNING! It may happen the instrument in 1/1- or 1/3-octave analyzer mode to indicate signal level in every frequency band as not measurable, whereas a number is displayed as power sum for entire frequency range (Σ OCT or Σ TER respectively). It may be explained as follows: signal levels in particular frequency bands are too low to cause numeric readout, but power sum of these levels is sufficient to cause it.

Measurement state is indicated by following icons:

- ▶▶▶ – RUN state (measurement in progress),
- ▮▮▮ – PAUSE state (measurement stopped),
- [3] – waiting for instrument readiness to operation; the number displayed stands for number of seconds remained to the end of waiting period .

Additionally in SLM mode, proper inscription: RUN, PAUSE, WAIT is displayed.

Microphone heater state is indicated similarly as overload: its indicator is not visible when heater is turned off and the icon HTR is displayed when heater is turned on.

Battery gauge can be displayed as follows:

- ▮▮▮▮ – full charge,
- ▮▮▮ – 75% charge,
- ▮▮ – 50% charge,
- ▮ – 25% charge,
- BAT – fully discharged.

If battery is fully discharged and no external power supply is connected to the instrument, then in some time the instrument is turned off. It is necessary for protecting the battery against extremely deep discharge and for disabling the measurements to be performed under too low supply voltage, when declared measurement accuracy may not be achieved.

3.3.1. SLM mode

As many quantities are measured simultaneously in this mode, it is possible to modify predefined sets of displayed results. To enter result set modification mode press ↵ key when any predefined set is displayed. When set modification mode is entered, the result selection cursor enabling the change of displayed quantity appears at one of display lines (see Fig. 3.7). Press ◄ or ► key to select any of available quantities. It is also possible to turn off the display in selected line, for instance to improve readability or when only one quantity display is of present interest. Press ▲ or ▼ key to select display line to be modified. Press ↵ key when in set modification mode to disable this mode.

Analogue signal level indicator is displayed near lower border of display screen. Its deflection is proportional to F-time-weighted sound pressure level at frequency weighting specified below:

Frequency weighting selected	Quantity displayed by analogue level indicator
A/C	L_{AF}
A/Z	L_{AF}
Z/C	L_{ZF}
Z/Z	L_{ZF}

Analogue level indicator makes the selection of optimum level range easier.

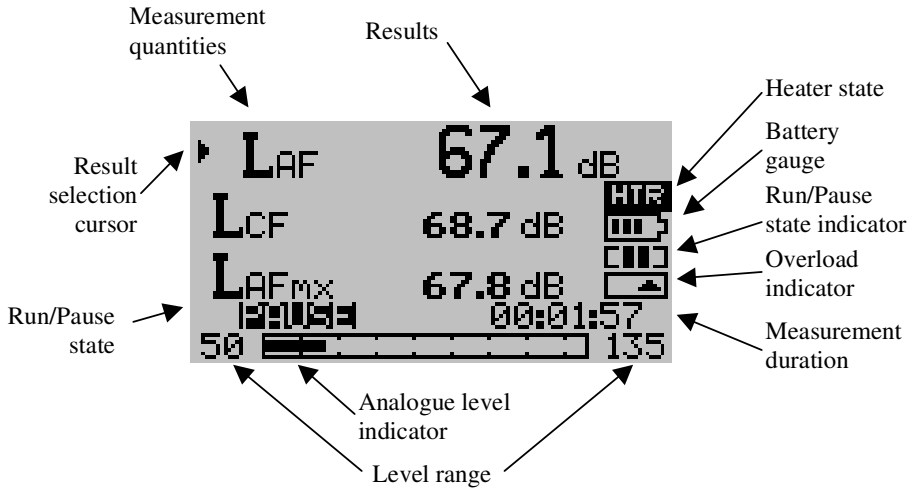


Fig. 3.7. RESULTS menu for SLM mode, results set no. 1.

Another predefined sets of results (results set no. 4 is available only if frequency weighting setting A/C or A/Z is selected) are shown below:

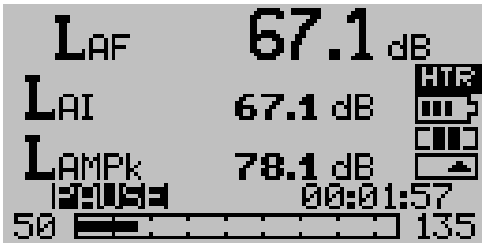


Fig. 3.8. RESULTS menu for SLM mode, results set no. 2.

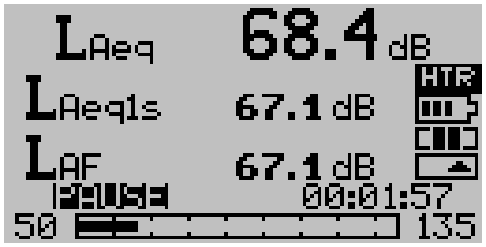


Fig. 3.9. RESULTS menu for SLM mode, results set no. 3.

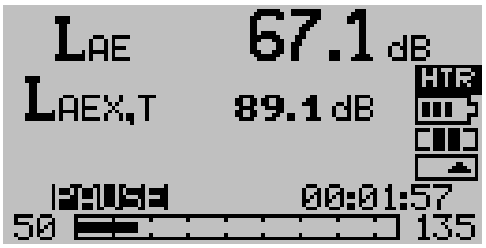


Fig. 3.10. RESULTS menu for SLM mode, results set no. 4.

3.3.1.1. Quick erasing of last one-second result

If the meter is in PAUSE mode and result set modification mode is turned off, pressing ◐ key deletes last second of the measure. This process can be repeated up to 10 seconds back or until

reaching the start of the measurement. After removing required amount of one-seconds results, the measurement can be continued at a specific point by pressing RUN/PAUSE button.

This is especially useful if the measurement is carried out without recording time history and user wants to remove "on the fly" acoustic event interfering measurement process.

3.3.2. 1/1-octave analyzer

If predefined results set no. 1, 2 or 3 is displayed, then use ◄ and ► key to move cursor to select bar representing signal level in one of frequency bands. Result for selected band is displayed numerically near lower display border. Most right bar, somewhat wider, marked as Σ OCT represents measured signal power sum from all octave bands.

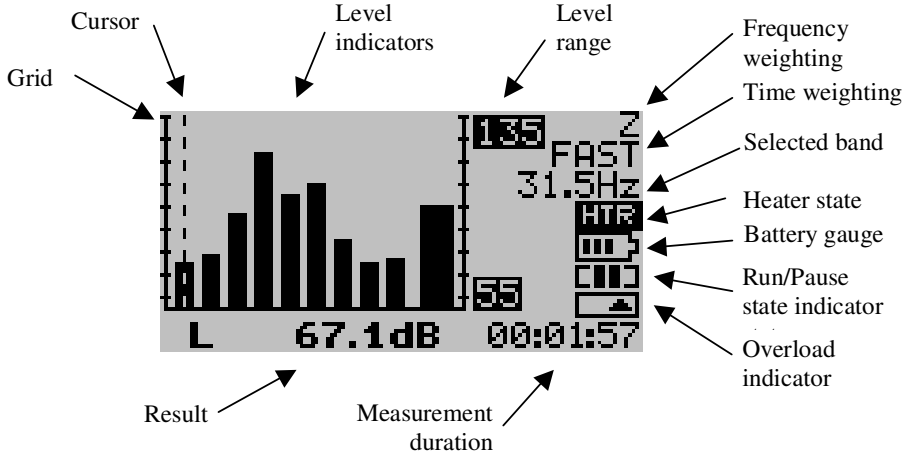


Fig. 3.11. RESULTS menu for 1/1-octave analyzer mode, results set no. 1.

Another predefined sets of results are shown on the figures below:

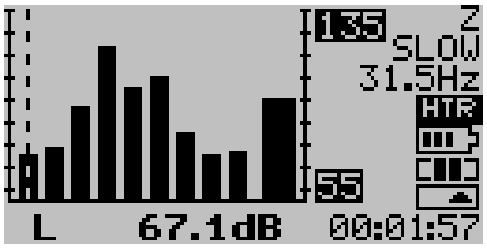


Fig. 3.12. RESULTS menu for 1/1-octave analyzer mode, results set no. 2.

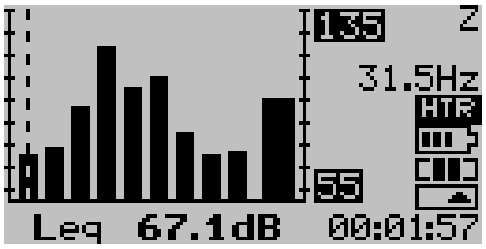


Fig. 3.13. RESULTS menu for 1/1-octave analyzer mode, results set no. 3.

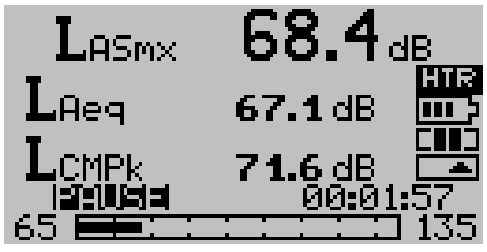


Fig. 3.14. RESULTS menu for 1/1-octave analyzer mode, results set no. 4.

If A frequency weighting is set, then results set no. 4, containing assessment parameters used for occupational noise measurements, is available.

On the screen corresponding to results set no. 4 the layout of icons indicating measurement state, microphone heater state, battery gauge etc. is identical as for SLM mode (see Fig. 3.7). Analogue signal level indicator is displayed near lower border of display screen. Its deflection is

proportional to A-frequency-weighted S-time-weighted sound level (L_{AS}). Analogue level indicator makes the selection of optimum level range easier.

3.3.3. 1/3-octave analyzer mode

Use ◄ and ► key to move cursor to select bar representing signal level in one of frequency bands. Result for selected band is displayed numerically near lower display border. Most right bar, somewhat wider, marked as Σ TER represents measured signal power sum from all 1/3-octave bands.

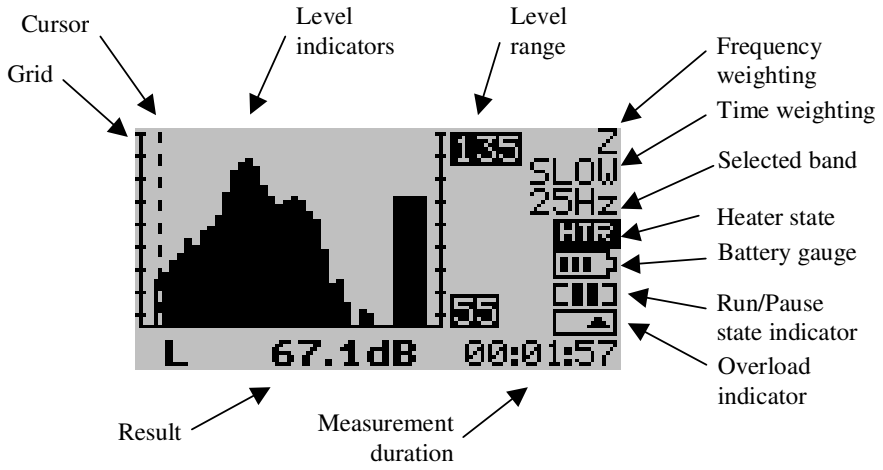


Fig. 3.15. RESULTS menu for 1/3-octave analyzer mode, results set no. 1.

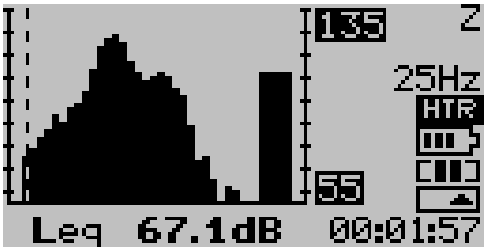


Fig. 3.16. RESULTS menu for 1/3-octave analyzer mode, results set no. 2.

3.3.4. Infra G filter mode

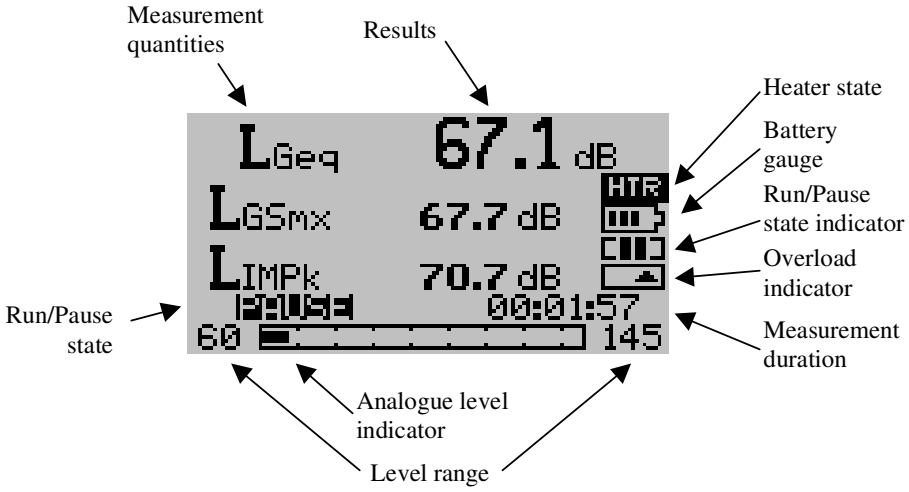


Fig. 3.17. RESULTS menu for infra G filter mode, results set no. 1.

Analogue signal level indicator is displayed near lower border of display screen. Its deflection is proportional to G-frequency-weighted S-time-weighted sound level (L_{GS}). Analogue level indicator makes the selection of optimum level range easier.

Another predefined sets of results are shown on the figures below:

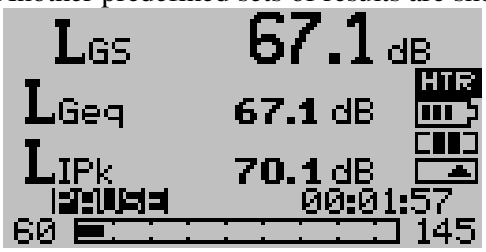


Fig. 3.18. RESULTS menu for infra G filter mode, results set no. 2.

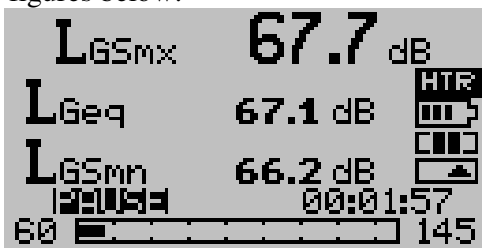


Fig. 3.19. RESULTS menu for infra G filter mode, results set no. 3.

3.4. SETUP TIME menu

To activate this menu press TIME key. It enables to preset measurement duration, noise exposure time (necessary to calculate noise exposure level $L_{AEX,T}$ for preset reference time), date and time for real-time clock built in the instrument.

Measurement duration (a.k.a.: integration time) is the time interval after which running measurement is automatically stopped. This time interval is reached when elapsed time indication (displayed on RESULTS menu screen) is equal to preset measurement duration.

WARNING! When measurement duration is set at 99h 59m 59s (99:59:59), automatic stopping of measurement is disabled and measurement duration is infinite. Elapsed time indication (displayed on RESULTS menu screen) is then set to zero at indication 100:00:00.

The exposure time may be set before measurement begin or after measurement completion. $L_{AEX,T}$ is re-calculated automatically after exposure time change.

Recently preset values are displayed on the screen. Press ▲ or ▼ key to select position to be edited. When selection is done press ▶ key to enter edit mode.

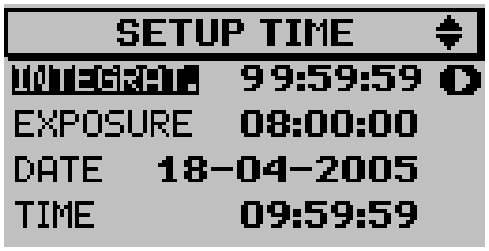


Fig. 3.20. SETUP TIME menu.

Fig. 3.21. SETUP TIME menu – measurement duration (integration time) setting.

Fig. 3.22. SETUP TIME menu – exposure time setting,

To edit selected menu position use arrow keys. Press ◄ or ► key to select place where digit is to be changed, then use ▲ and ▼ key to set desired value. After editing completion press ↵ key to confirm setting. The instrument returns then to SETUP TIME menu.

To abandon edit mode press any function key (SETUP, TIME, RESULTS, MEMORY, FILTER or CLEAR). Changed number then will not be stored

Fig. 3.23. SETUP TIME menu – date setting.

Fig. 3.24. SETUP TIME menu – time setting.

3.5. FILTER menu

This menu makes possible to select filter to be used during instrument operation – it is practically equivalent to operating mode selection. Filters specified below are available (operating mode corresponding to given filter is specified in parentheses).

- **none** (SLM mode),
- **1/1 octave** (1/1-octave analyzer mode),
- **1/3 octave** (1/3-octave analyzer mode),
- **infra G** (infra G filter mode).

Use ▲ and ▼ key to select filter, then press ↵ key to confirm selection.

WARNING! Results of last measurement are cleared after operating mode change!

Fig. 3.25. FILTER menu.

3.6. MEMORY menu

DSA-50 analyzer at every operating mode enables saving and loading of single measurement result and also recording of measurement history.

To select desired option press ▲ or ▼ key. To enter selected option and open proper submenu press ► key. Present status of measurement history recording (On or Off) is also displayed.

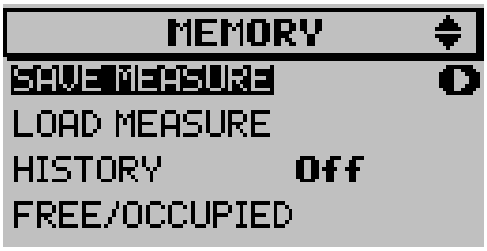


Fig. 3.26. MEMORY menu.

3.6.1. Save measure

Storing of measurement result is possible only when measurement process is stopped. All results of present measurement together with instrument settings are stored, so the measurement may be continued after loading the measurement result. It is possible to record measurement results at every instrument operating mode.

Press ▲ or ▼ key to select memory cell the measurement result is to be saved. After opening SAVE MEASURE submenu the number of first free cell is displayed. If no free cell is available then cell no. 1 is suggest. The status of selected cell (Free or Occupied) is displayed near lower left corner of the screen. If it is free then inscription FREE is displayed. If there some data are saved then date and time of saved measure are displayed.

To confirm storing measure results in selected memory cell press ↵ key, to cancel press ◄ key.

Maximum 99 measurement results can be saved.

Fig. 3.27. MEMORY menu, storing measure in free cell.

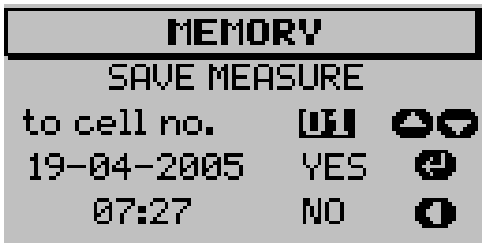


Fig. 3.28. MEMORY menu, storing measure in occupied cell.

3.6.2. Load measure

Loading of saved result is possible only when measurement process is stopped. Stored results are displayed, the instrument change its settings to loaded from memory cell and it is possible to continue this measurement. Measurement history recording remains in Off state, regardless it was On or Off during storing.

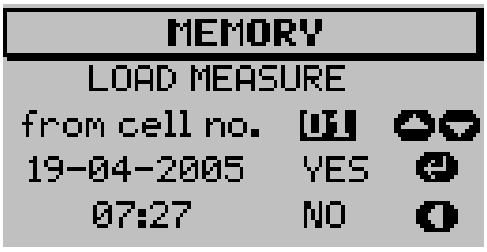


Fig. 3.29. MEMORY menu, loading measure from memory.

To select memory cell, from which data should be loaded use ▲ and ▼ keys. The date and time of stored measure is displayed near lower left corner of the screen. To load content of selected cell press ↵ key or press ◄ to cancel.
If no data are stored in instrument memory then the message: **NO DATA IN MEMORY!** is displayed.

3.6.3. Measurement history

The time history of measurement is recorded independently of measurement results. It is possible to record values of selected quantities in predefined time intervals (as it is done during noise monitoring). Recording of measurement history can be performed at each of instrument operating mode. Time interval between subsequent recordings can be selected among from following: 1s, 5s, 10s, 15s, 30s and 60s. Default time interval is 5s.

The recorded values are these measured since last recording. The recording time depends on instrument operating mode, time interval between subsequent recordings and number of quantities to be recorded. It is displayed near lower left corner of the screen.

The number of present history is displayed near upper right corner of the screen. Maximum forty measurement histories can be recorded.

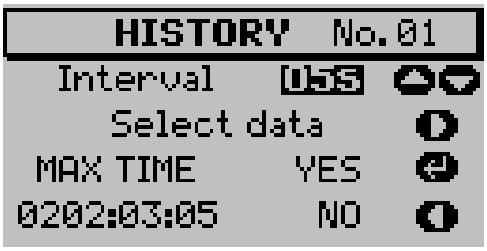


Fig. 3.30. MEMORY menu, measurement history.

To change time interval between subsequent measurements press ▲ or ▼ key. To turn measurement history recording on press ↵ key. To stop history recording press ◄ key. When history recording is turned on the data recording begins after running the measurement. To select quantities to be recorded press ► key. The number and sort of quantities can be recorded depends on instrument operating mode.

3.6.3.1. SLM mode

This operating mode enables to record values of 1 to 6 quantities. All quantities are determined for time interval elapsed since last recording. As for first recording after measurement run, the time interval is taken since measurement run moment. The quantities can be recorded (the same set of quantities for both frequency weightings selected, X in subscript stands for frequency weighting) are as follows:

- L_{XFmn} minimum F-time-weighted RMS level,
- L_{XFmx} maximum F-time-weighted RMS level,
- L_{XSmn} minimum S-time-weighted RMS level,
- L_{XSmx} maximum S-time-weighted RMS level,
- L_{XImn} minimum I-time-weighted RMS level,
- L_{XImx} maximum I-time-weighted RMS level,
- L_{XMPk} maximum peak level,
- L_{Xeq} time-average sound level.

To select number of quantity to be recorded press ▲ or ▼ key. To select quantity corresponding to selected number press ◄ or ► key. To confirm selection press ↵ key. When horizontal dashes are displayed instead of quantity symbol it means no quantity is assigned to given number.

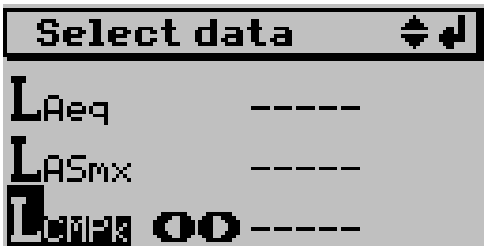


Fig. 3.31. MEMORY menu, measurement history, selecting data in SLM mode.

Maximum recording duration is shown in table below (hh:mm:ss):

No. of quantities	Maximum recording duration, when recording every:					
	1s	5s	10s	15s	30s	60s
1	97:56:56	489:44:40	979:29:20	1469:14:00	2938:28:00	5876:56:00
2	58:46:09	293:50:45	587:41:30	881:32:15	1763:04:30	3526:09:00
3	41:58:41	209:53:25	419:46:50	629:40:15	1259:20:30	2518:41:00
4	32:38:58	163:14:50	326:29:40	489:44:30	979:29:00	1958:58:00
5	26:42:48	133:34:00	267:08:00	400:42:00	801:24:00	1602:48:00
6	22:36:12	113:01:00	226:02:00	339:03:00	678:06:00	1356:12:00

3.6.3.2. 1/1-octave analyzer mode

This operating mode enables to record values of 1 to 3 quantities. All quantities are determined for time interval elapsed since last recording. As for first recording after measurement run, the time interval is taken since measurement run moment. The quantities can be recorded for all filters (X in subscript stands for frequency weighting) are as follows:

- L_{XFmx} maximum F-time-weighted RMS level,
- L_{XSmx} maximum S-time-weighted RMS level,
- L_{Xeq} time-average sound level.

To select number of quantity to be recorded press ▲ or ▼ key. To select quantity corresponding to selected number press ◄ or ► key. To confirm selection press ↵ key. When horizontal dashes are displayed instead of quantity symbol it means no quantity is assigned to given number.

Fig. 3.32. MEMORY menu, measurement history, selecting data in 1/1-octave mode.

Maximum recording duration is shown in table below (hh:mm:ss):

No. of quantities	Maximum recording duration, when recording every:					
	1s	5s	10s	15s	30s	60s
1	15:27:56	77:19:40	154:39:20	231:59:00	463:58:00	927:56:00
2	7:56:30	39:42:30	79:25:00	119:07:30	238:15:00	476:30:00
3	5:20:33	26:42:45	53:25:30	80:08:15	160:16:30	320:33:00

3.6.3.3. 1/3-octave analyzer mode

This operating mode enables to record values of 1 to 2 quantities. All quantities are determined for time interval elapsed since last recording. As for first recording after measurement run, the time interval is taken since measurement run moment. The quantities can be recorded for all filters are as follows:

- L_{XYmx} maximum RMS level (X stands for frequency weighting selected, Y for time weighting selected)
- L_{eq} time-average sound level.

To select number of quantity to be recorded press ▲ or ▼ key. To select quantity corresponding to selected number press ◄ or ► key. To confirm selection press ↵ key. When horizontal dashes are displayed instead of quantity symbol it means no quantity is assigned to given number.

Fig. 3.33. MEMORY menu, measurement history, selecting data in 1/3-octave mode.

Maximum recording duration is shown in table below (hh:mm:ss):

No. of quantities	Maximum recording duration, when recording every:					
	1s	5s	10s	15s	30s	60s
1	4:58:49	24:54:05	49:48:10	74:42:15	149:24:30	298:49:00
2	2:30:41	12:33:25	25:06:50	37:40:15	75:20:30	150:41:00

3.6.3.4. Infra G filter mode

This operating mode enables to record values of 1 to 4 quantities. All quantities are determined for time interval elapsed since last recording. As for first recording after measurement run, the time interval is taken since measurement run moment. The quantities can be recorded are as follows:

- L_{GSmn} minimum RMS, G-frequency-weighted S-time-weighted sound level,
- L_{GSmx} maximum RMS, G-frequency-weighted S-time-weighted sound level,
- L_{IMPk} maximum peak sound level in infrasound band,
- L_{Geq} G-frequency-weighted time-average sound level.

To select number of quantity to be recorded press ▲ or ▼ key. To select quantity corresponding to selected number press ◄ or ► key. To confirm selection press ↵ key. When horizontal dashes are displayed instead of quantity symbol it means no quantity is assigned to given number.

Fig. 3.34. MEMORY menu, measurement history, selecting data in infra G filter mode.

Maximum recording duration is shown in table below (hh:mm:ss):

No. of quantities	Maximum recording duration, when recording every:					
	1s	5s	10s	15s	30s	60s
1	97:56:56	489:44:40	979:29:20	1469:14:00	2938:28:00	5876:56:00
2	58:46:09	293:50:45	587:41:30	881:32:15	1763:04:30	3526:09:00
3	41:58:41	209:53:25	419:46:50	629:40:15	1259:20:30	2518:41:00
4	32:38:58	163:14:50	326:29:40	489:44:30	979:29:00	1958:58:00

3.6.4. FREE/OCCUPIED menu

This menu displays information on number of occupied memory cells and whether measurement history is recorded in memory. These data are available also when the measurement is running.

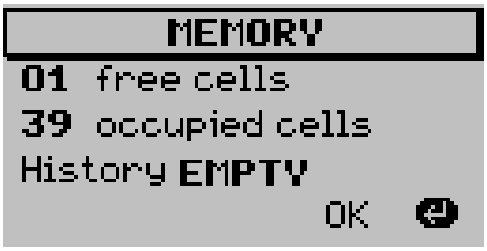


Fig. 3.35. MEMORY menu, free/occupied information.

3.7. CLEAR menu

This menu enables to clear entire memory or its part and also to delete results of last measurement (not stored in memory).

When memory contains no data the message **NO DATA IN MEMORY!** is displayed.

To select option press ▲ or ▼ key. To enter selected option and display proper submenu press ▶ key. The option LAST MEASURE is here an exception, as last measurement result is deleted directly by pressing ↵ key. After deleting of last measurement result RESULTS menu is displayed (with results set recently selected).

WARNING! Memory clearing cannot be reversed!

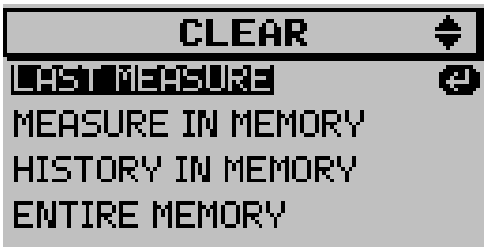


Fig. 3.36. CLEAR menu.

3.7.1. Measure in memory

To select number of cell to be cleared press ▲ or ▼ key. Measurement date and time are displayed near left border of the screen. When desired cell is selected press ↵ key to clear selected cell or ▶ key to clear all cells; press ◀ to cancel.

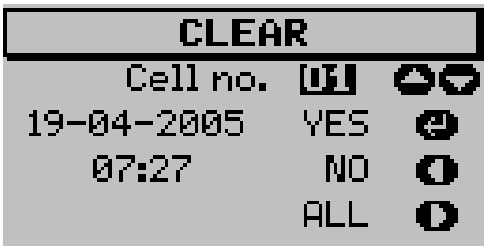


Fig. 3.37. CLEAR menu, deleting measure in memory.

3.7.2. Measurement history

To delete last history recorded press ↵ key. To clear entire history memory press → key; press ← to cancel.

Fig. 3.38. CLEAR menu, deleting measurement history in memory.

3.7.3. Entire memory

The message requiring to confirm clearing of all data is displayed. To confirm clearing press ↵ key. To cancel clearing press ← key.

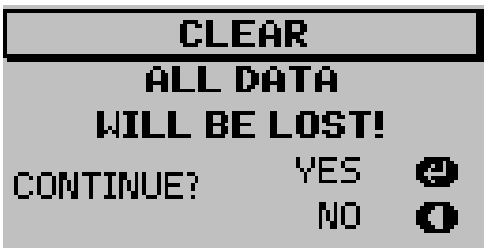


Fig. 3.39. CLEAR menu, clearing of entire memory.

4. COMMUNICATION WITH COMPUTER

DSA-50 should be connected with battery-powered PC class computer USB interface using original interface cable, supplied together with the instrument.

CD supplied with the instrument contains following data:

- installation package of Windows based PC software,
- USB D2XX device driver,
- instruction manual for the software in PDF format,
- instruction for device driver installation in PDF format,
- Adobe Reader to view PDF documents.

The software makes possible downloading data from DSA-50, manipulate, analyze, store on PC's hard disk, and export to other programs. Also, remote control of the instrument is possible.

Data transmission protocol is available on request.

5. RECOMENDATIONS FOR INSTRUMENT USE

During instrument use following recommendations should be strictly observed:

- do not remove microphone protection grid if not necessary,
- perform all connection changes (connecting or disconnecting of preamplifier, microphone or extension cable) only when the instrument is turned off; making these changes when the instrument is turned on, or turning the instrument on when microphone is not connected to its preamplifier can lead to instrument damage,
- when removing or installing microphone protecting cap use slight rotation right (as during screw driving) to avoid unwanted removing of microphone protecting grid,
- protect the microphone against mechanical shocks, dust, moisture and strong gusts of wind (use windscreen!),
- do not apply excessive force to connect or disconnect LEMO connectors as these are equipped with facilities to avoid improper connection; the way to disconnect microphone preamplifier equipped with LEMO plug is shown on Fig. 5.1.

Fig. 5.1. Disconnecting of microphone preamplifier equipped with LEMO connector.

5.1. Recommendations for correct performing of measurements

Fasten the instrument (or its microphone) to its supporting stand and ensure you are located at a distance (from the instrument or its microphone) assuring to avoid sound field disturbance.

Select level range ensuring to avoid overload or underrange during measurement.

If existing ambient temperature and humidity can lead to vapour condensation on the microphone, use built-in microphone heater. The heater can be turned on or off using SETUP menu (see chapter 3.2).

5.2. Internal battery

The instrument is normally operated with internal battery supply.

To charge the battery, connect external power supply to the instrument. Battery gauge is displayed in RESULTS menu at each instrument operating mode. Typical time to charge fully discharged battery is 12 hours. If possible, fully discharge battery (up to automatic turn-off of the instrument) before charging. Avoid charging of partially discharged battery.

It is possible to operate the instrument continuously using external power supply.

WARNING! If the instrument is not in use for time longer than two months, then it is necessary to recharge battery in order to avoid its self-discharge.

WARNING! The battery charging proceeds regardless the instrument is turned off or on!

5.3. Calibration of the instrument

Correct measurement can be performed only when calibrated instrument is used. Recommended sound calibrator for DSA-50 analyzer is SONOPAN KA-50 sound calibrator. This device produces calibrated sound signal of 94 dB nominal sound pressure level and 1000 Hz nominal frequency.

Another sound calibrator of class 1 or better, producing signal of nominal sound pressure level and frequency equivalent to KA-50 sound calibrator, can be also used for calibration.

Calibration of the instrument is performed at reference level range (55÷135dB for SLM mode).

To perform calibration of the instrument correctly:

- calculate reference level:
  $L_{ref} = L_{cal} + \Delta L_{ff}$,
  where:
  L_{cal} acoustic calibrator sound pressure level, read from its calibration certificate,
  ΔL_{ff} free field correction, for ½" microphone equal to –0.15dB,
- round calculated reference level to 0.1dB (resolution of SLM),
- couple calibrator with the microphone,
- turn the calibrator on,
- run the measurement and check if displayed sound pressure level is equal to calculated reference level.
- if instrument indication deviates from value mentioned above, then correct indication by turning calibration potentiometer located on instrument right-side panel (see Fig. 2.2) using supplied small screwdriver.

WARNING! During calibration the instrument together with sound calibrator shall not be exposed to noise higher than nominal sound pressure level of sound calibrator in use or ground vibration.

5.4. Warranty

SONOPAN grants the warranty on following stipulations:

- no remains of changes, corrections, crossing-out etc. are found on Warranty Card,
- the instrument shall be used according to manufacturer Instruction Manual,
- the warranty becomes void if instrument repairs or modifications are undertaken by unauthorized persons.

SONOPAN warrants this instrument:

- to be fulfilling the specifications given in Instruction Manual,
- to be working correctly for 12 months from purchase date in 24 months from date the instrument was produced.

Not covered by this warranty:

- damages resulting from instrument transportation (provided no clear neglects of manufacturer have been stated),
- mechanical damages through the fault of the purchaser,
- internal damages through the fault of the purchaser.

The purchaser is entitled to warranty claim only when instrument dealer does not meet his obligations resulting from this warranty.

5.4.1. Complaint instructions for the purchaser:

- contact SONOPAN and specify the cause of complaint, Warranty Card number, date and place of purchase and date the instrument was produced,
- after complaint receipt is confirmed send the instrument with Warranty Card included to SONOPAN by freight company,
- if SONOPAN service find instrument damage to be not covered by warranty or warranty conditions to be not fulfilled, then the purchaser is obliged to cover service and transport costs as specified in the bill made out by SONOPAN,
- the costs specified above are covered by SONOPAN if the complaint is accepted.

5.5. Maintenance and repair

DSA-50 digital sound analyzer requires no special maintenance treatments. **All repairs of the instrument are performed by the manufacturer**.

6. CE MARKING AND CONFORMANCE TO EU COUNCIL DIRECTIVES

The product described in this instruction conforms to following EU Council Directives:

2004/108/EC Electromagnetic compatibility

CE The conformance to above-mentioned requirements is confirmed by CE mark.

This product cannot be thrown away with household waste. Deposit the product in an authorized electrical and electronic waste collection area for recycling. Contact local Municipal Bureau or nearest waste disposal company to get more detailed information.

Appendix A. Filter characteristics

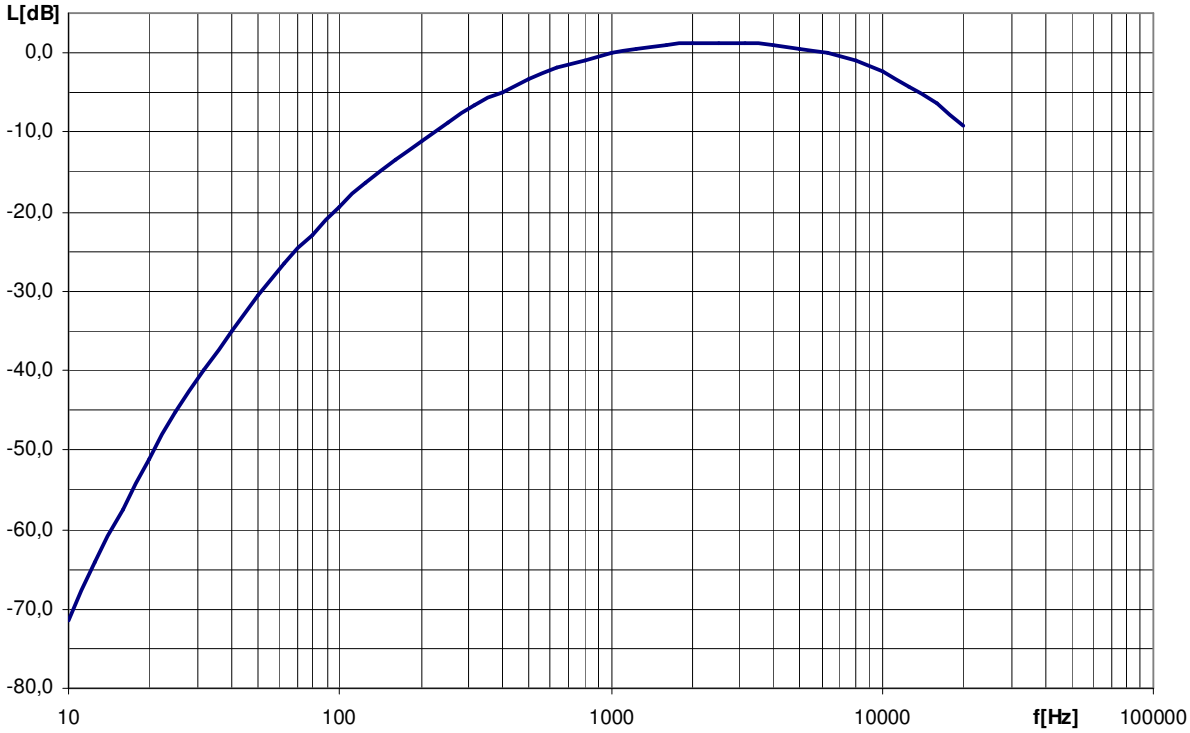


Fig. A.1. The characteristics of A filter, conformable to EN 61672-1:2002 class 1 requirements.

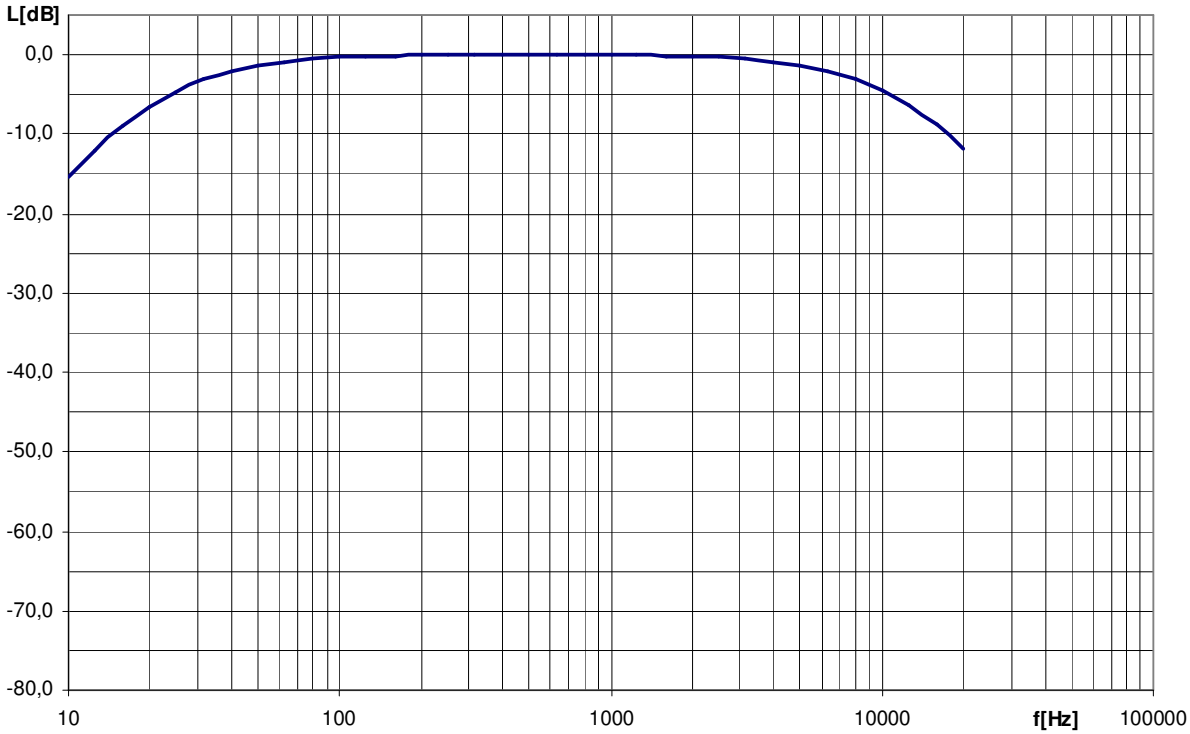


Fig. A.2. The characteristics of C filter, conformable to EN 61672-1:2002 class 1 requirements.

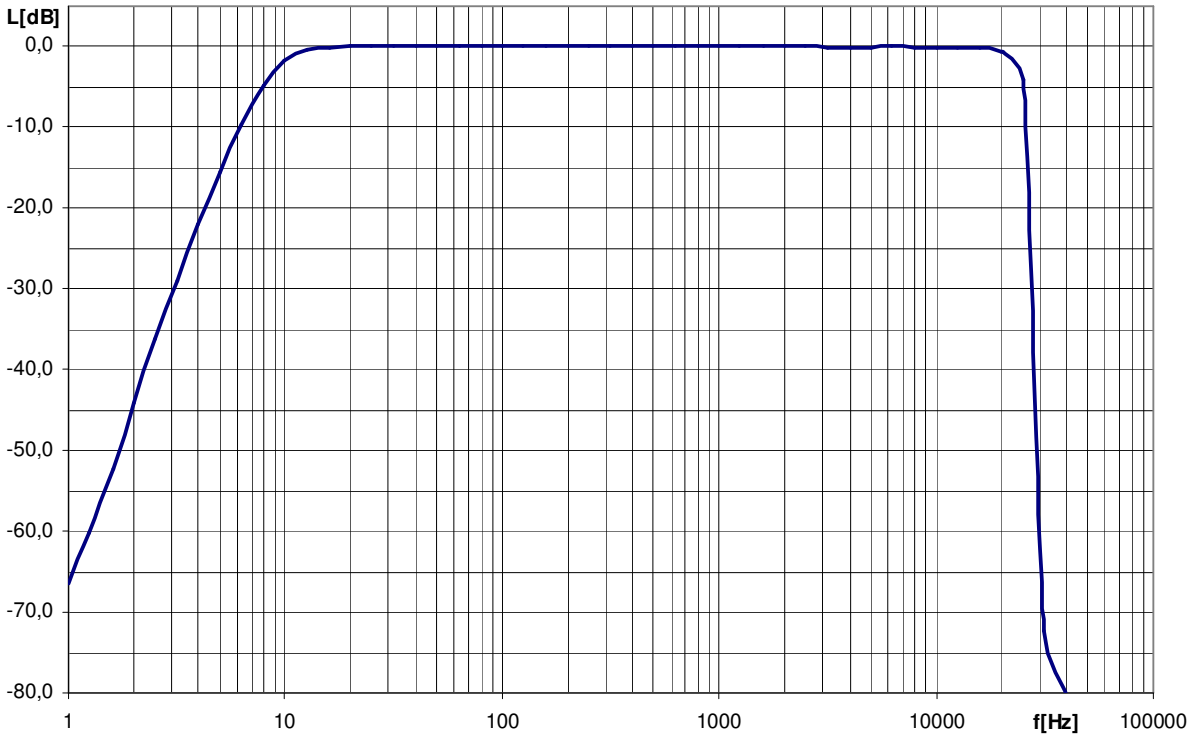


Fig. A.3. The characteristics of Z filter, conformable to EN 61672-1:2002 class 1 requirements (-3dB at f_1 = 8,7Hz and f_2 = 24,93kHz).

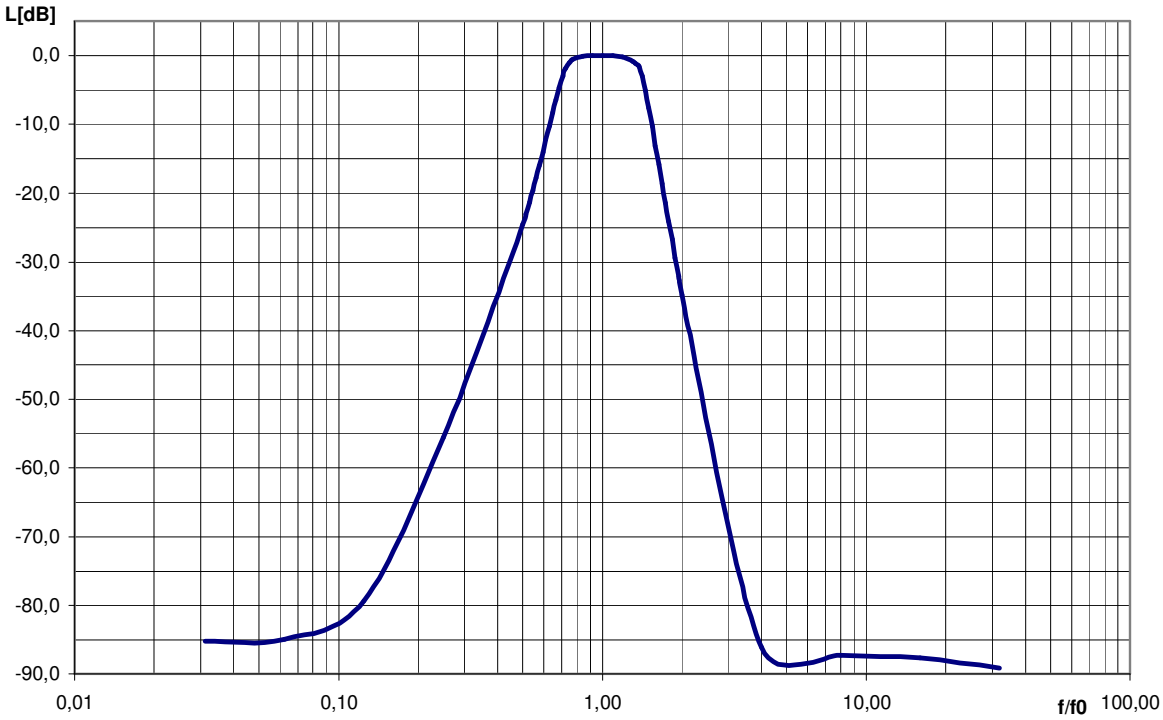


Fig. A.4. The characteristics of octave bandpass filter, conformable to EN 61260:1995/A1:2001 class 1 requirements.

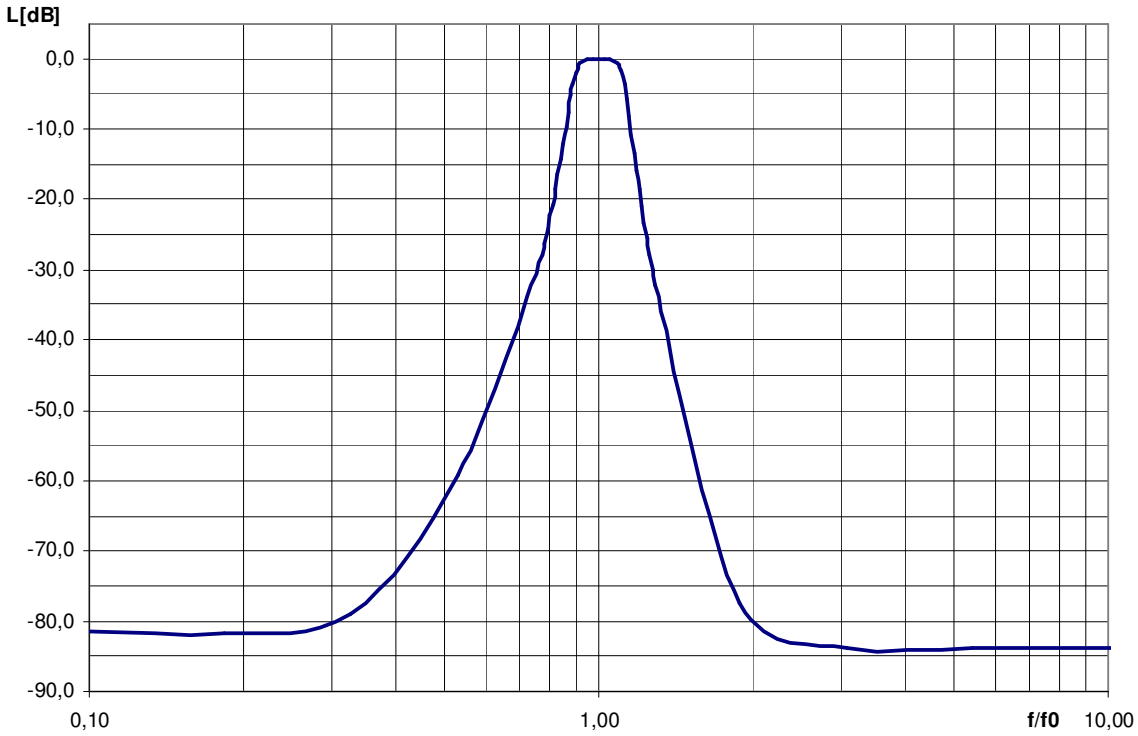


Fig. A.5. The characteristics of 1/3-octave bandpass filter (upper centre frequency), conformable to EN 61260:1995/A1:2001 class 1 requirements.

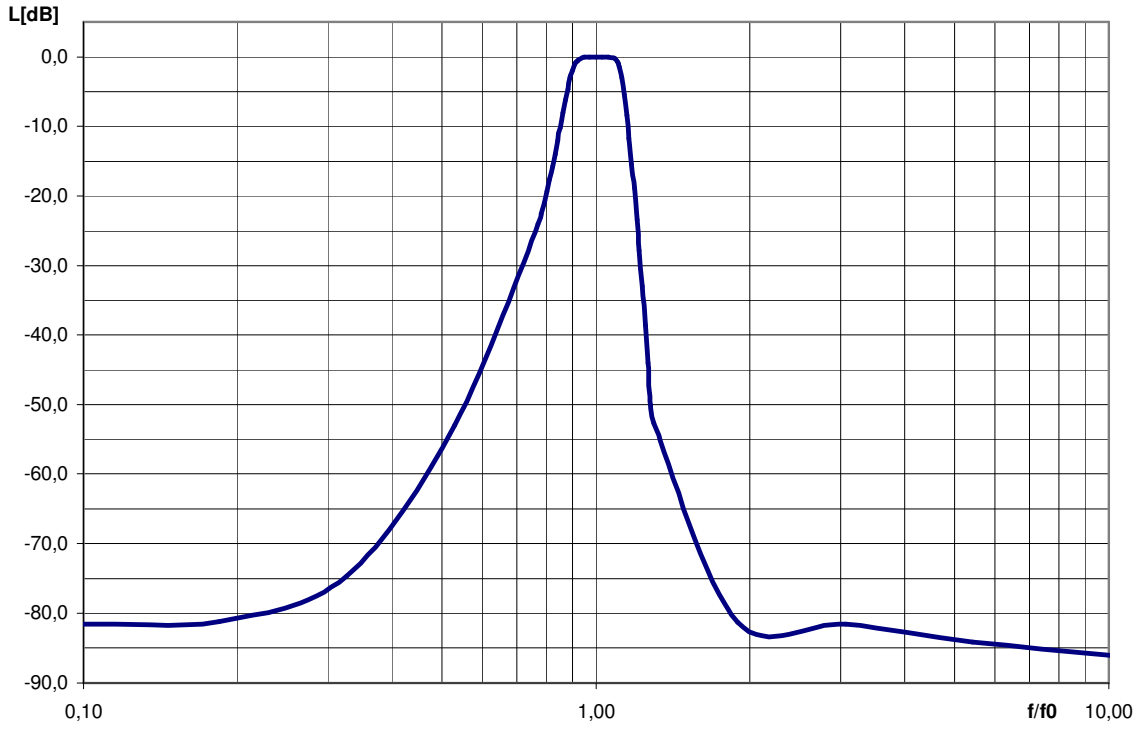


Fig. A.6. The characteristics of 1/3-octave bandpass filter (middle centre frequency), conformable to EN 61260:1995/A1:2001 class 1 requirements.

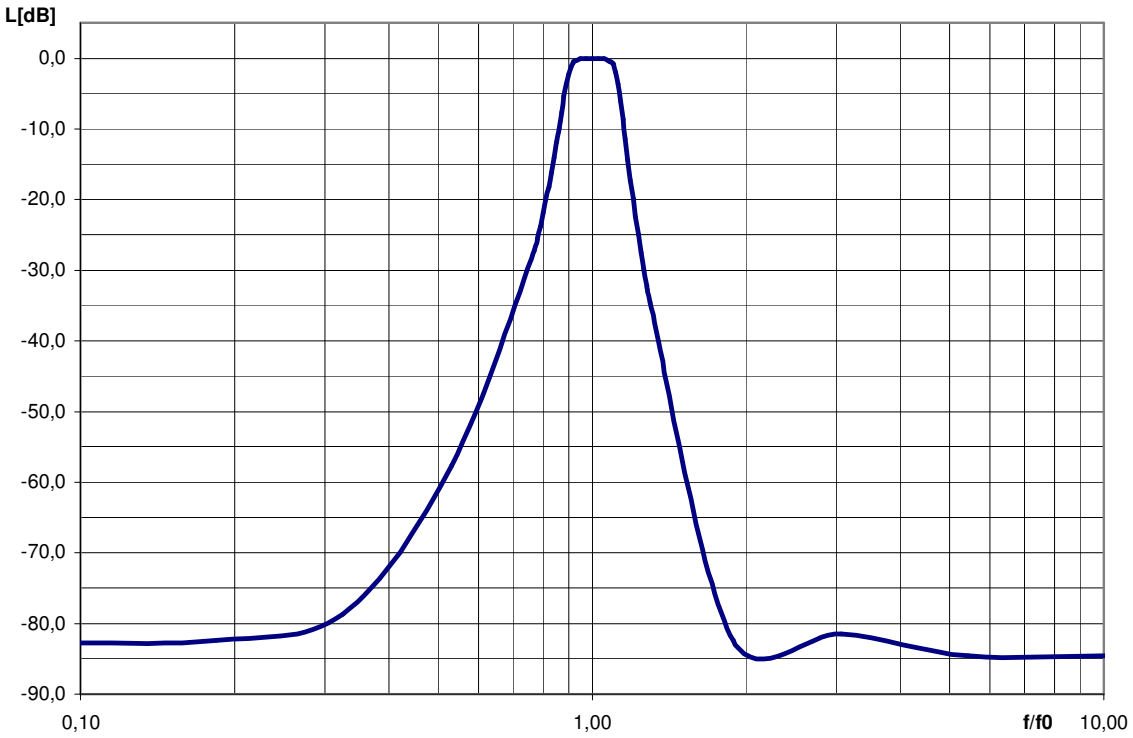
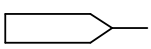
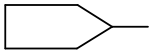


Fig. A.7. The characteristics of 1/3-octave bandpass filter (lower centre frequency), conformable to EN 61260:1995/A1:2001 class 1 requirements.

Appendix B. Directional responses

Instrument orientations corresponding to directional responses shown below:


inner curve


outer curve

WARNING! Dynamic range of logger used to made directional responses was equal 25dB, so scale interval equals 0.5dB and maximum scale value is 25dB.

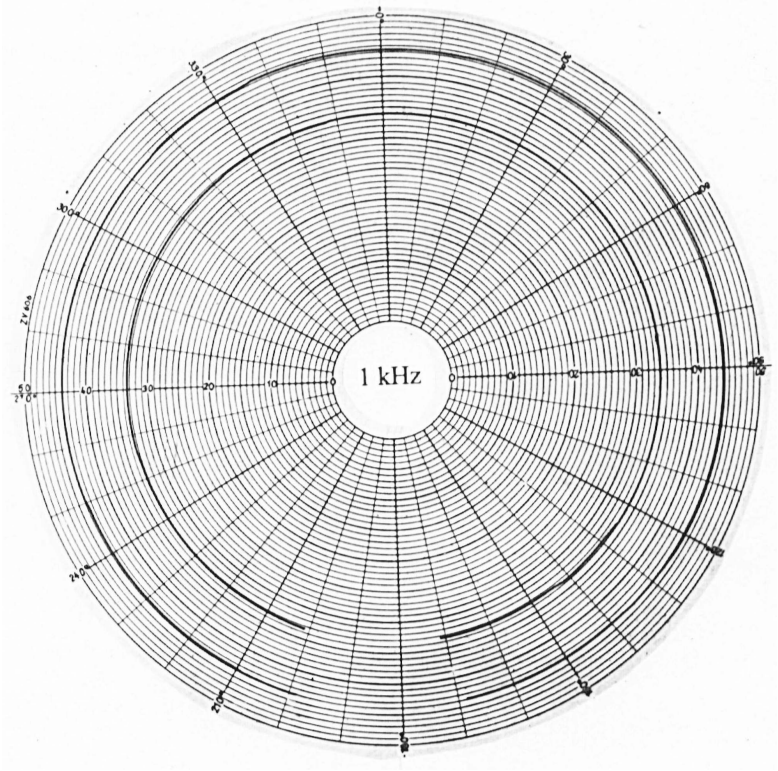


Fig. B.1. Directional response of the instrument at 1kHz.

WARNING! Dynamic range of logger used to made directional responses was equal 25dB, so scale interval equals 0.5dB and maximum scale value is 25dB.

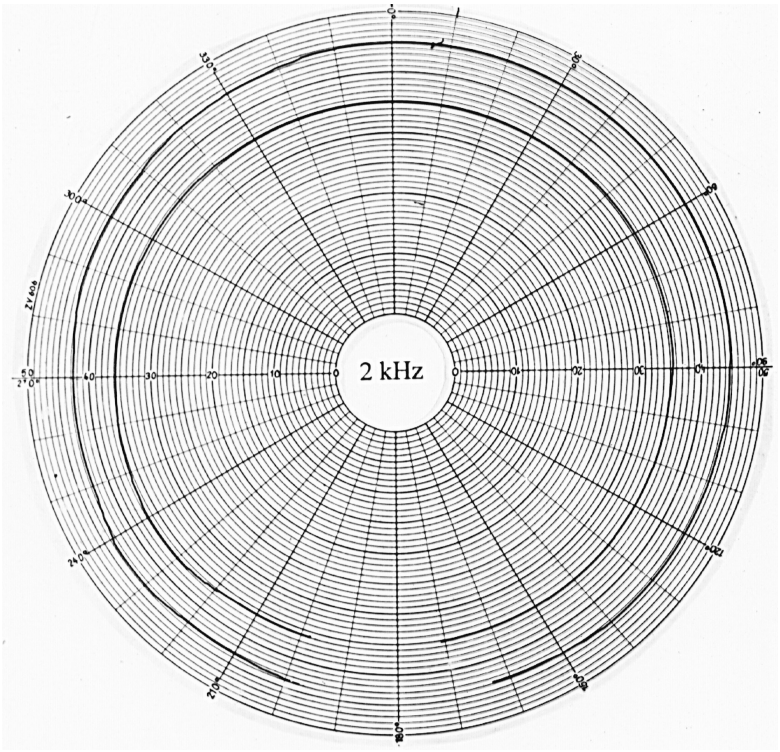


Fig. B.2. Directional response of the instrument at 2kHz.

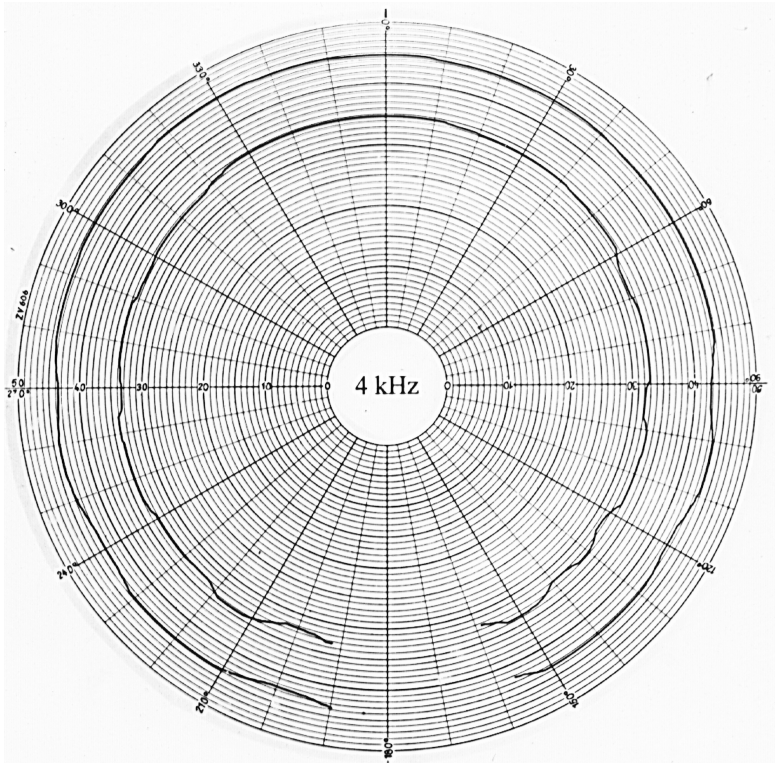


Fig. B.3. Directional response of the instrument at 4kHz.

WARNING! Dynamic range of logger used to made directional responses was equal 25dB, so scale interval equals 0.5dB and maximum scale value is 25dB.

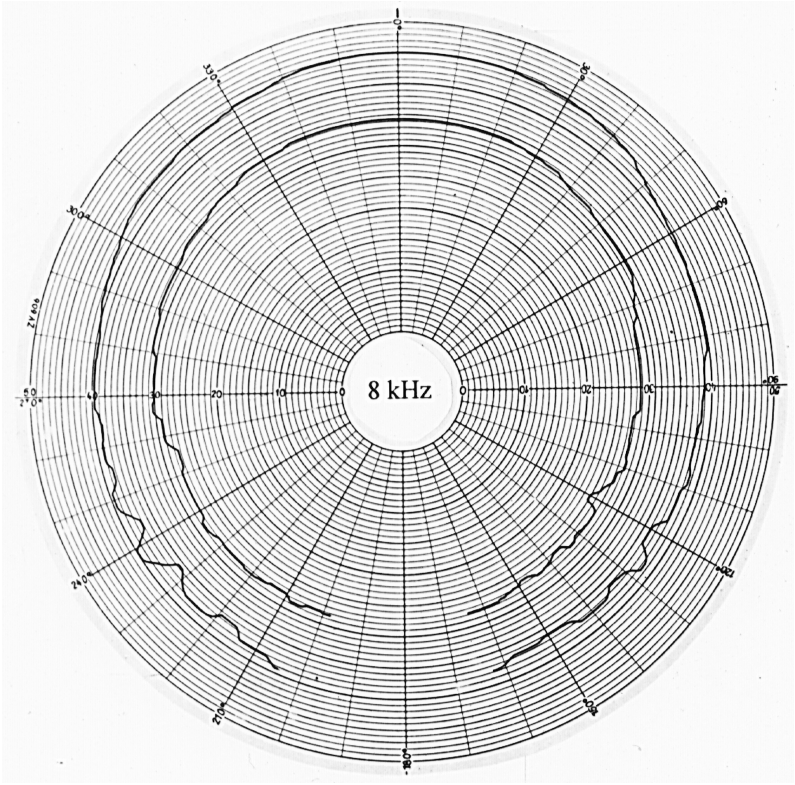


Fig. B.4. Directional response of the instrument at 8kHz.

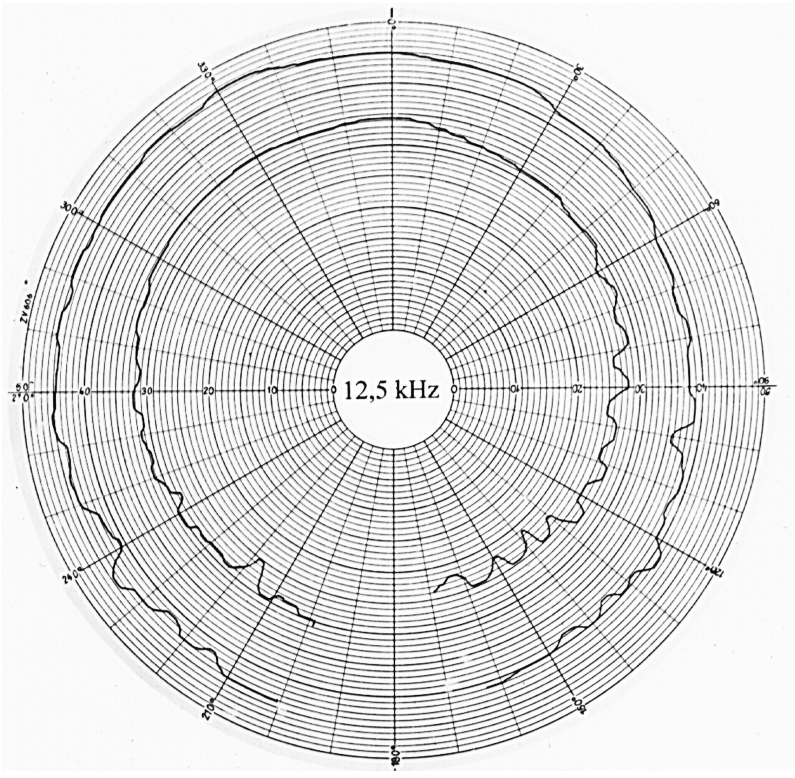
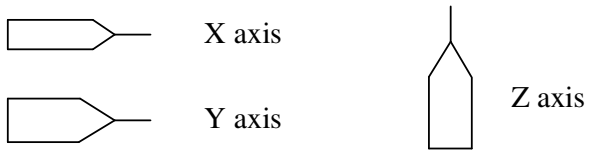


Fig. B.5. Directional response of the instrument at 12.5kHz.

Appendix C. Sensitivity to vibration

Instrument orientation used during vibration sensitivity determination:



⇒ O§ X

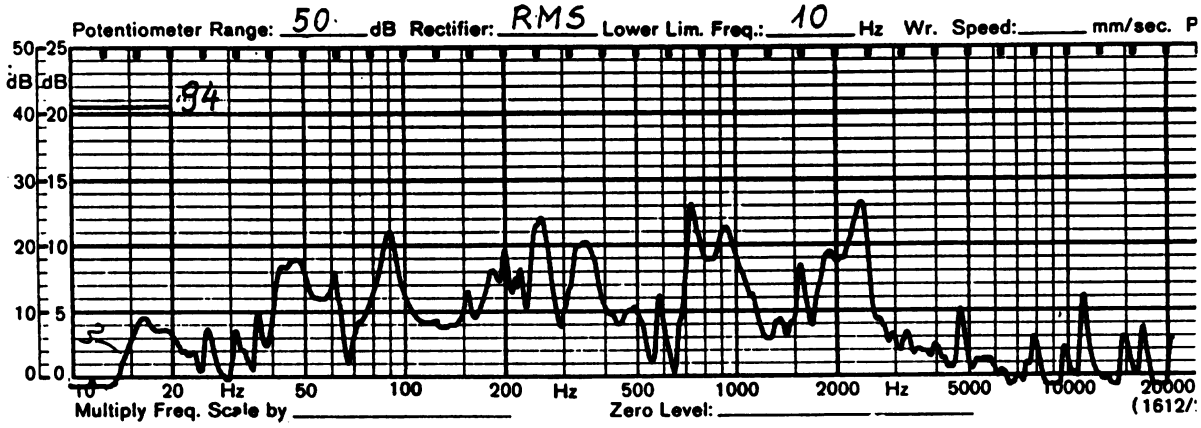


Fig. C.1. Sensitivity of DSA-50 to X-directed vibration.

⇒ O§ Y

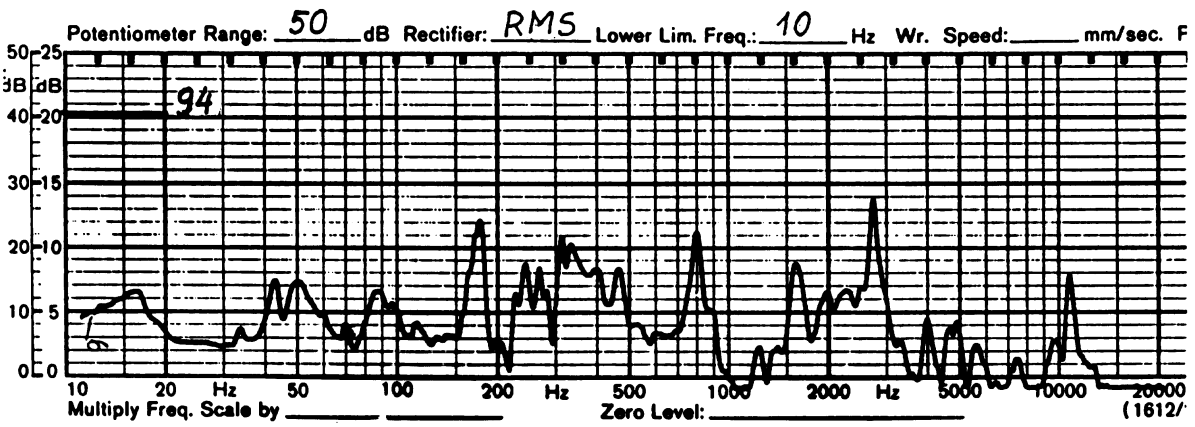


Fig. C.2. Sensitivity of DSA-50 to Y-directed vibration.

⇒ Oś Z

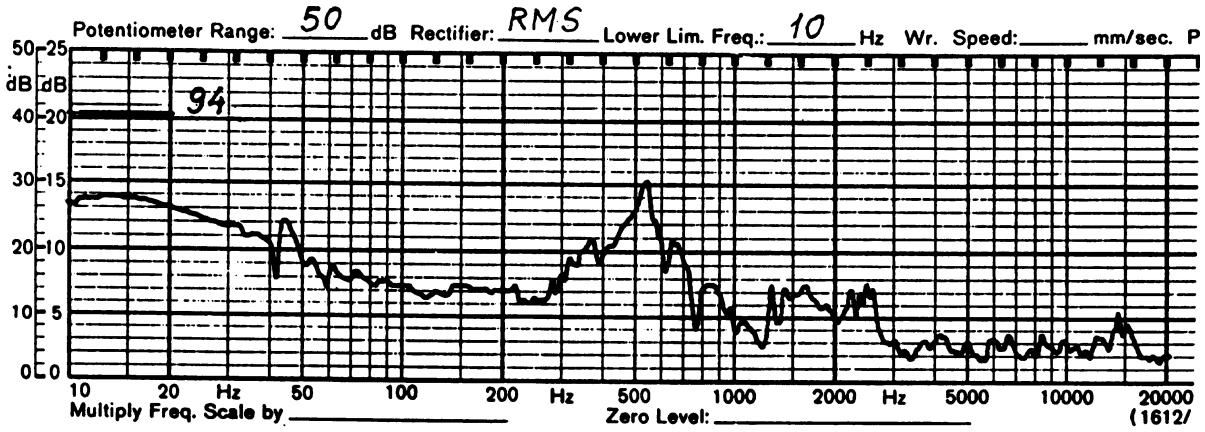


Fig. C.3. Sensitivity of DSA-50 to Z-directed vibration.