APPENDIX C - DATA SPECIFICATIONS

C1. SVAN 912AE handheld sound & vibration analyser

Direct input:

Connector:	7-pin LEMO compatible socket type ENG.1B.307 (the connector type FGG.0B.307) or BNC connector with SC 08A cable.
Impedance:	1 MΩ / 75 pF (with the SC 08A cable).
Measurement range:	4 ranges with the nominal values: 3.16 mV, 31.6 mV, 316 mV, 3.16 V (20 dB step).
Input voltage range:	3.16 μV_{RMS} ÷ 10.2 V_{RMS} (10 dB ÷ 140.2 dB related to 1 μV_{RMS}).
High pass filters:	
HP filter - meter mode:	1.61 Hz / -0.1 dB (0.78 Hz / -3 dB), with 18 dB / octave slope,
HP filter - analyser mode:	1.0 Hz / -0.1 dB (0.165Hz / -3 dB), with 12 dB / octave slope.
Lin filter - meter mode:	14.5 Hz / -0.1 dB (5.00 Hz / -3 dB), with 18 dB / octave slope.
Lin filter - analyser mode:	30.0 Hz / -0.1 dB (5.00 Hz / -3 dB), with 12 dB / octave slope.

Microphone input:

Connector:	7-pin LEMO compatible socket type ENG.1B.307 (the connector type FGG.0B.307) or BNC connector with SC 08A cable.
Impedance:	1 MΩ / 40 pF.
Measurement range:	4 ranges with the nominal values: 3.16 mV, 31.6 mV, 316 mV, 3.16 V (20 dB step).
Input voltage range:	3.16 μV_{RMS} ÷ 10.2 V_{RMS} (10 dB ÷ 140.2 dB related to 1 μV_{RMS}).
Microphone polarisation:	0 V or 200 V.
Microphone preamplifier powering:	28 V.
High pass filters:	
HP filter - analyser mode:	1.0 Hz / -0.1 dB (0.165Hz / -3 dB), with 12 dB / octave slope.
Lin filter - meter mode:	14.5 Hz / -0.1 dB (5.00 Hz / -3 dB), with 18 dB / octave slope.
Lin filter - analyser mode:	30.0 Hz / -0.1 dB (5.00Hz / -3 dB), with 12 dB / octave slope.

Charge input:

Connector:	7-pin LEMO compatible socket type ENG.1B.307 (the connector type FGG.0B.307) or BNC connector with SC 08A cable.
Impedance:	220 Ω / 255 pF (with the SC 08A cable).
Time constant of the integration circuit:	4.6 s.
Measurement range:	4 ranges with the nominal values: 3.16 pC, 31.6 pC, 316 pC, 3.16 nC (20 dB step).
Range of the measured charge:	25 fC_{RMS} ÷ 10.2 nC_{RMS} (**HP** filter).
High pass filters:	
HP filter - meter mode:	1.61 Hz /-0.1 dB (0.78 Hz / -3 dB), with 18 dB / octave slope,
HP filter - analyser mode:	0.84 Hz /-0.1 dB (0.138 Hz / -3 dB), with 12 dB / octave slope.
Lin filter - meter mode:	12.2 Hz /-0.1 dB (4.75 Hz / -3 dB), with 18 dB / octave slope.
Lin filter - analyser mode:	30.0 Hz /-0.1 dB (5.50 Hz / -3 dB), with 12 dB / octave slope.
Low Pass filter (**LP_FILT.**):	for 1 kHz the attenuation is smaller or equal to -0.2 dB), for 15.0 kHz the attenuation is greater or equal to -30 dB) with -12 dB / octave slope, selected by the user.

Accelerometer input:

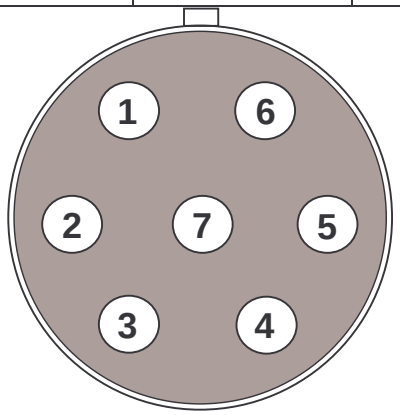
Connector:	7-pin LEMO compatible socket type ENG.1B.307 (the connector type FGG.0B.307) or BNC connector with SC 08A cable.
Impedance:	1 MΩ / 75 pF (with the SC 08A cable).
Vibration transducer powering:	28 V/4 mA current source.
Measurement range:	4 ranges with the nominal values: 3.16 mV, 31.6 mV, 316 mV, 3.16 V (20 dB step).
Range of the measured voltage:	3.16 μ V_{RMS} ÷ 10.2 V_{RMS} (10 dB ÷ 140.2 dB related to 1 μV_{RMS}).
High pass filters:	
HP filter - meter mode:	1.61 Hz / -0.1 dB (0.78 Hz / -3 dB), with 18 dB / octave slope,
HP filter - analyzer mode:	1.0 Hz / -0.1 dB (0.165Hz / -3 dB), with 12 dB / octave slope.
Lin filter - meter mode:	14.5 Hz / -0.1 dB (5.00 Hz / -3 dB), with 18 dB / octave slope,
Lin filter - analyzer mode:	30.0 Hz / -0.1 dB (5.00 Hz / -3 dB), with 12 dB / octave slope.

Digital audio data input:

Connector:	7-pin LEMO compatible connector type ENG.1B.307.
Interface standard:	AES/EBU, IEC 958, S/PDIF, EIAJ CP-340.
Receiver type:	Balanced, with 110 Ω / ± 20% impedance.

Below, the SVAN 912AE, 7-pin LEMO compatible connector pinout is given. Some other condenser microphone preamplifier available on the market, are also presented.

	SVAN 912AE (female)	SVANTEK SV01A	G.R.A.S. 26AB	NORSONIC 1201	B&K 2669
1	remote control	-	-	heater 225 Ω	calibration
2	signal ground	ground	signal ground	signal ground	signal ground
3	200 V	200 V	200 V	200 V	200 V
4	input (analog./+dig.)	output	output	output	output
5	input (-digital)	-	-	28 V	-
6	+28 V	+28 V	120 V	120 V	28 V÷120 V
7	supply ground	supply ground	supply ground	supply ground	ground (neg. supp.)
shield	signal ground	signal ground	?	?	chassis



LEMO compatible connector type ENG.1B.307 (external view)

Internal noise level:

Wideband noise level measured with the voltage input short-circuit (22.6 kHz band):

- for **HP** & **LIN** filter: < 1.8 μV_{RMS},
- with **A** filter < 1,5 μV_{RMS},
- with **C** filter: < 1.1 μV_{RMS}.

Noise level in the charge channel measured with the 1 nF equivalent capacitance of the transducer:

- with **HP** filter: < 14 f C,
- with **Lin** filter: < 10 f C.

Maximum input voltage:

The SVAN 912AE analyser is the instrument with the II security class according to the international standard IEC 348. The maximum voltage between the signal source ground and the ground can not exceed 42 V_{PEAK} or its current output has to be limited to 5 mA of the peak value.

Maximum input voltage: 200 V_{PEAK} or 50 V_{DC} value for the direct and microphone input.

Overload detection:

The instrument has the built-in overload detectors. The overload in the measurement channel (in its analogue part) and the overload of the analogue/digital converter are both detected.

Antialiasing filters:

Pass band (-0.3 dB): 43.0 kHz or 21.5 kHz,
(-1 dB): 44.0 kHz or 22.08 kHz.

Stop band : 51.0 kHz or 25.5 kHz,
Attenuation in the stop band: > 80 dB.

Sampling frequency:

internal: 48 kHz or 96 kHz.

Analogue/Digital conversion:

16 bits.

Total linearity error:

from 0 dB to 70 dB below the full scale <± 0.5 dB,

Reference range:

90 dB for the direct and microphone input, 150 dB for the charge and accelerometer input (for the **Val** function - the vibration acceleration measurement).

Level indication range:

from -80 dB to +10.2 dB related to the nominal range level.

Basic accuracy:

<± 0.2 dB for the temperature T=+23℃ ± 5℃ for sinusoidal signal 94 dB_{RMS} in the band 20 Hz – 20 kHz with the **HP** or **Lin** input filter.

Measurement error in the full temperature range:

< ± 0.3 dB when the temperature is from -10℃ to +50℃ for the sinusoidal signal 94 dB_{RMS} in the band 20 Hz – 20 kHz with the **HP** or **Lin** input filter.

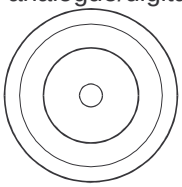
Input divider accuracy: ± 0.1 dB.

Amplitude indication stability: ± 0.1 dB.

Accuracy and stability of the frequency indication: 0.01 %.

Analogue outputs:

AC Out - standard voltage on the input of the analogue/digital converter:



LEMO compatible connector, type ERN.00.250 (external view)

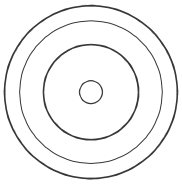
Pin number	ERN.00.250
1	output
shield	ground

Connector: 1-pin LEMO compatible connector type ERN.00.250.

Voltage level: 316 mV_{RMS} (± 3%) for the input sinusoidal signal conforming to the nominal range value; the frequency band of the signals on the AC Out (-3 dB) is equal 3.39 Hz – 100 kHz for the analogue **Lin** filter and 0.11 Hz – 100 kHz for the analogue **HP** filter.

Output type: single ended, with 51 Ω / 1% output impedance.

Noise Out - output of internal reference noise source:



LEMO compatible connector, type ERN.00.250 (external view)

Pin number	ERN.00.250
1	output
shield	ground

Connector: 1-pin LEMO compatible connector type ERN.00.250.

Signal type: pseudo-random binary white noise.

Voltage level: 31.6 mV_{RMS} (± 0.2 dB), in the band of 22.5 kHz.

Output type: single ended, with 51 Ω / 1% output impedance.

Digital filters

Low-pass filters:

14 eigth-order elliptic filters with the cut-off frequencies from 11.8 kHz to 1.38 Hz in the binary sequence.

Ripple in the pass band: ± 0.1 dB.

Attenuation in the stop band: > 80 dB.

HP - high-pass filter

meter mode: cut-off frequency: 1.57 Hz / -0.1 dB (0.773 Hz / -3 dB),
pass-band ripple < 0.1 dB with 12 dB / octave slope,
analyser mode: cut-off frequency: 0.70 Hz / -0.1 dB (0.106 Hz / -3 dB),
pass-band ripple < 0.1 dB with 6 dB / octave slope.

Lin - high-pass filter

meter mode: cut-off frequency: 12.2 Hz / -0.1 dB (4.75 Hz / -3 dB),
pass-band ripple < 0.1 dB with 12 dB / octave slope,
analyser mode: cut-off frequency: 30.0 Hz / -0.1 dB (4.50 Hz / -3 dB),
pass-band ripple < 0.1 dB with 6 dB / octave slope.

1/1 octave filters:

14 eighth-order elliptic filters with the centre frequencies from 2 Hz to 16 kHz conforming to the DIN 45651, IEC 1260 (Typ 0, ΔB + 0.04) and ANSI S1.11-1986 standards.

1/3 octave filters:

44 sixth-order elliptic filters with the centre frequencies from 1 Hz to 20 kHz conforming to the DIN 45651, IEC 1260 (Type 1, ΔB + 0.17) and ANSI S1.11-1986 standards.

Integrating filters for the vibration velocity and displacement measurement:

- **Vel1** 1 Hz to 330 Hz; with 6 dB / octave slope,
- **Vel3** 3 Hz to 1000 Hz; with 6 dB / octave slope,
- **Vel10** 10 Hz to 3000 Hz; with 6 dB / octave slope,
- **Dil1** 1 Hz to 18 Hz; with 12 dB / octave slope,
- **Dil3** 3 Hz to 57 Hz; with 12 dB / octave slope,
- **Dil3** 10 Hz to 181 Hz; with 12 dB / octave slope.

Weighting filters:

Filters for sound measurements:

- **A** conforms to the IEC 651 standard, Type 0,
- **C** conforms to the ISO 8041 standard, Type 0.

Filter for infra-sounds measurements:

- **G** 1 Hz to 100 Hz; conforms to the ISO / DIS 7196 standards,

Filters for the vibration measurement influencing the human body:

- **W-Bxy** 1 Hz to 80 Hz; conforms to the ISO 8041 standard,
- **W-Bz** 1 Hz to 80 Hz; conforms to the ISO 8041 standard,
- **W-Bc** 1 Hz to 80 Hz; conforms to the ISO 8041 standard,
- **H-A** 8 Hz to 1000 Hz; conforms to the ISO 5349 standard,
- **HP** filter for the linear measurements of the vibration level, conforms to the above standards,
- **KB** 1 Hz to 80 Hz; for the vibration measurements on ships **KB** = **W-Bc** +28.9 dB.

Filter for the evaluation of the state of machines:

- **MF-Vel** 10 Hz to 1000 Hz; conforms to the ISO 10816 standard.

RMS detector:

Digital with the 90 dB dynamics range and the 0.1 dB sampling step.

Peak detector:

Digital with the 90 dB dynamics range and the 0.1 dB sampling step.

Display:

Graphical, the liquid crystals (LCD) type with the back light and 128x128 pixels.

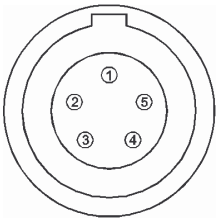
Memory:

1MB of the non-volatile RAM memory (with the battery supply of the stored contents). Within this:

- up to 400 kB buffer for the registration of the time wave forms (transients) and spectra,
- up to 768 kB RAM-disk for storing the measurement data.

RS 232 interface

It conforms to the EIA Standard RS 232C. It enables the user to programme remotely all instrument's functions and the transmissions to and from the analyser with the speed from 300 bit/s to 38400 bit/s. Below, the SVAN 912AE RS232C socket, LEMO compatible connector type FGG.0B.305 and SC 07 cable, DB 09 F - pin female connector pinout is given.



LEMO compatible connector type ENG.0B.305 (external view)

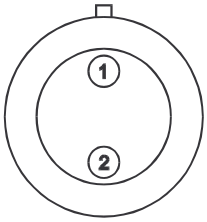
PC RS232, 9 -pin connector - Signal name	type ENG.0B.305 Pin number	DB 09 F Pin number
1 – LSD	-	1 (not connected)
2 – RXD	3	3
3 – TXD	4	2
4 – DTR	1	6
5 – GND	5	5
6 – DSR	2	4
7 – RTS	-	8 connected to pin 7
8 – CTS	-	7 connected to pin 8
9 – GND	-	9 (not connected)

Digital audio data output

Connector: 2-pin LEMO compatible connector type ENG.0B.302.

Interface standard: AES/EBU, IEC 958, S/PDIF, EIAJ CP-340.

Transmitter type: Balanced, with 110 Ω / ± 20% impedance

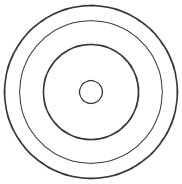


LEMO compatible connector type ENG.0B.302 (external view)

Pin number	ENG.0B.302
1 – TXP	output - positive phase
2 – TXN	output - negative phase
shield	digital ground

External input

Dedicated to the triggering and synchronising impulses in the CMOS standard level (+5 V) with the active rising edge.



LEMO compatible connector type ERN.00.250 (external view)

Pin number	ERN.00.250
1	input
shield	ground

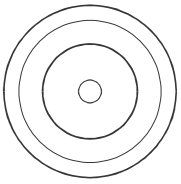
Powering:

Instrument can be powered from an external supply (AC adapter or battery), voltage range of 8 V to 24 V DC. Ripple and noise should not exceed ± 5%. Supply current capability depends of the supply voltage and for general voltage values is specified for instance:

- 8 V / 700 mA DC,
- 9 V / 630 mA DC,
- 12 V / 470 mA DC,
- 24 V / 240 mA DC.

The SVAN 912AE is powered from its internal battery – it is its base mode of work.

The internal battery (6 V/3 Ah) enables the instrument the 8 hours of continuous operation. The instrument contains built-in battery charging circuit. The totally uncharged battery has to be powered approx. 14 hours to restore its normal state. Please, refer to Chap. 7 for proper battery attendance.



SWITCHCRAFT connector type 722A 5.0/2.1 mm (external view)

	722A 5.0/2.1 mm
shield	ground
central	+ 12V

Weight with the battery: 1.8 kg.

Dimensions: 66x112x250 mm.

Influence of the electromagnetic field:

The 80 A/m field intensity introduces the increase of the noise level not greater than 10 dB.

Electromagnetic compatibility
EMC emission - conforms to EN 50081-2 (1993)
EMC imission - conforms to EN 50082-2 (1995)

Safety: conforms to EN 61010-1 (1993) and IEC 1010-1 (1990).

Environmental parameters:

- Working temperature range: -10°C ÷ +50°C.
- Storing temperature range: -20°C ÷ +50°C.
- Humidity: 90% RH in 30°C (uncondensed vapour).

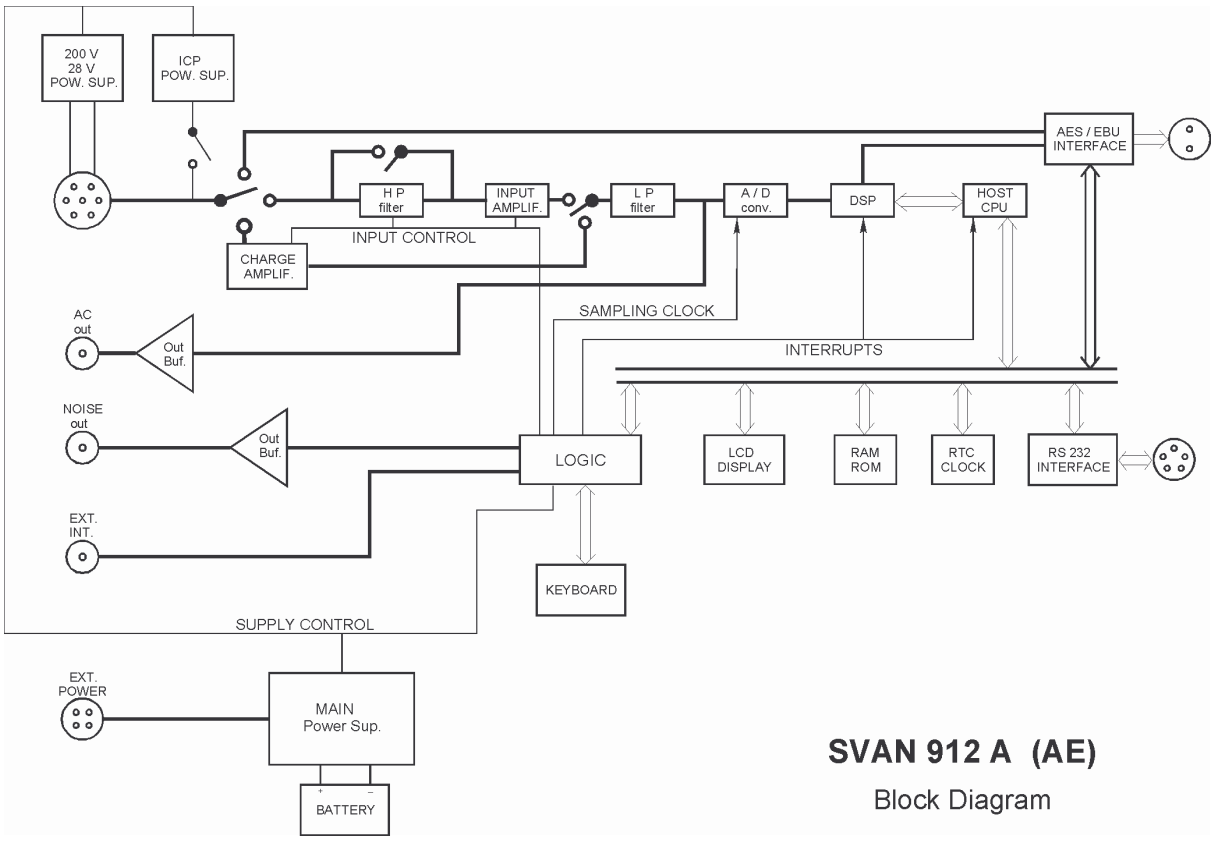


Fig. C.1.1. Block diagram of the SVAN 912AE instrument

C2. System for sound measurements

System conforms to the international IEC 651 and IEC 804 standards for the Type 1 sound measurement meters.

System configuration:

- Handheld sound & vibration analyser SVAN 912AE,
- 1/2" microphone preamplifier SV 01A,
- Measurement microphone SV 02 / C4 (or other, e.g. G.R.A.S. AN40).
- Microphone calibrator: SV 03A, SV 30A or any other compatible.

Advised way of mounting the microphone preamplifier SV 01A to the SVAN 912A analyser is shown in Fig. C.2.1.

Notice: Taking into account the cubic shape of the analyser the proposed mounting of the microphone preamplifier (it is using "goose neck" SA 05 or holder / extender SA 03 / 04 mounted on the tripod) is necessary to obtain the directional characteristics of the instrument conforming to the IEC 651 and IEC 804 standards for Type 1 sound measurement meters.

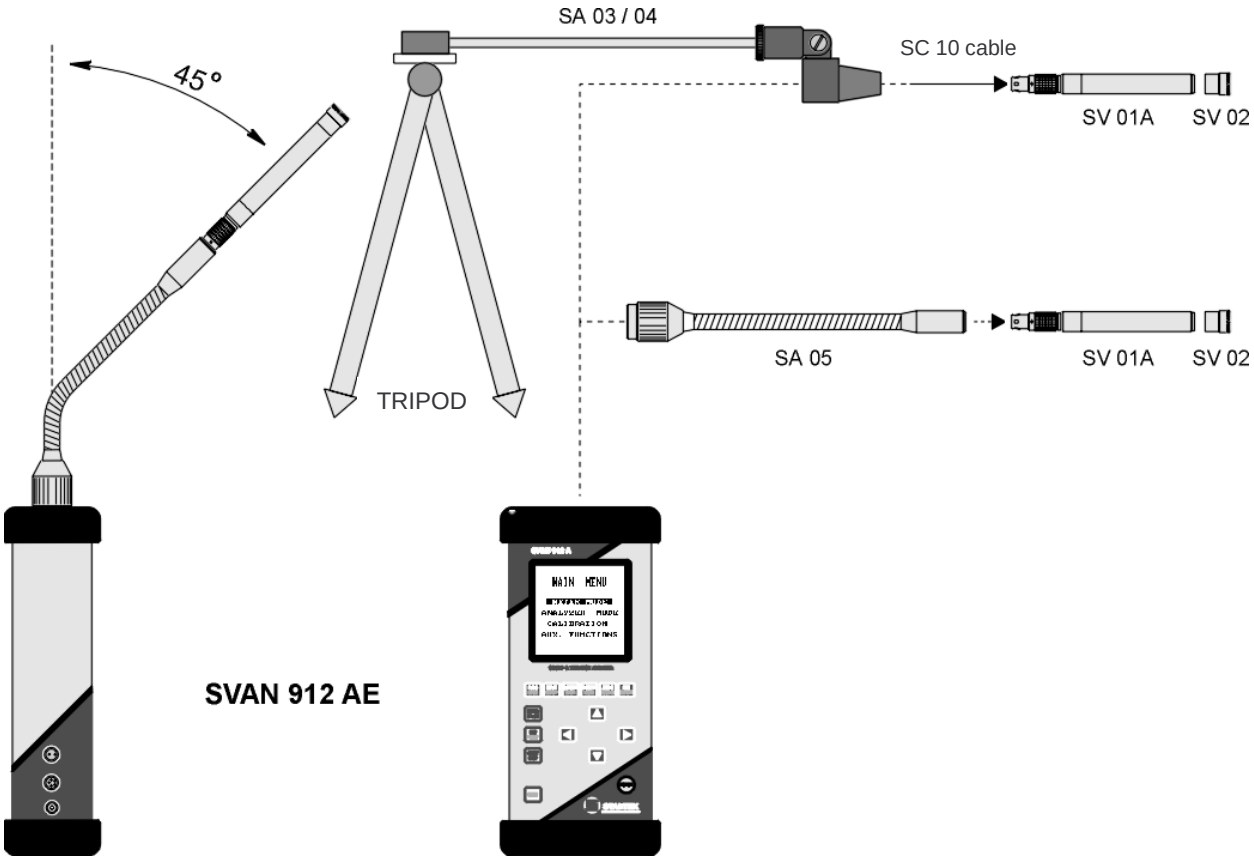


Fig. C.2.1. Advised way of mounting the microphone preamplifier SV 01A to the SVAN 912AE analyser

Measurement range: 4 ranges: 70 dB, 90 dB, 110 dB and 130 dB.

Values of the measured sound pressure level (for equivalent microphone impedance)**:**

14 dB ÷ 136 dB (RMS related to 20 μPa) with the measurement error < 0.7 dB, (distance from noise > 7 dB – IEC 804),
42.5 dB ÷ 139 dB (PEAK related to 20 μPa) with the measurement error < 0.7 dB, (distance from noise min. 22.5 dB – IEC 804)

and

12 dB ÷ 136 dB (RMS related to 20 μPa) with the measurement error < 1.2 dB, (distance from noise > 5 dB – IEC 804),
25 dB ÷ 139 dB (PEAK related to 20 μPa) with the measurement error < 3.9 dB, (distance from noise 5 dB – IEC 804 >).

Values of the measured sound level (for equivalent microphone impedance)**:**

15 dBA ÷ 136 dBA (RMS related to 20 μPa) with measurement error < 0.7 dB, (distance from noise 7 dB – IEC 804 >),
14 dBC ÷ 136 dBC (RMS related to 20 μPa) with measurement error < 0.7 dB, (distance from noise > 7 dB – IEC 804),

and

13 dBA ÷ 136 dBA (RMS related to 20 μPa) with measurement error < 1.2 dB, (distance from noise > 5 dB – IEC 804),
12 dBC ÷ 136 dBC (RMS related to 20 μPa) with measurement error < 1.2 dB, (distance from noise min. 5 dB – IEC 804).

The measurement ranges conforming to the IEC 804 standard with the application of the SV 02 microphone are given in the table below. The level of thermal noise for the SV 02 microphone is equal to ca. 15 dB_A .

RANGE	Range of measurements	
70 dB_A	from 23 dB_A	to 80 dB_A
90 dB_A	from 30 dB_A	to 100 dB_A
110 dB_A	from 50 dB_A	to 120 dB_A
130 dB_A	from 70 dB_A	to 136 dB_A

Notice: *In the measurement of the signal with the* ***crest factor n > 1.41 the upper measurement range for the RMS value is reduced****. Its value can be calculated from the equation:* $A_n = A + 10 - 20\log(n / \sqrt{2})$ *[m], where* ***A*** *is the given range for the sinusoidal signal.*
E.g. for ***n = 10*** *and* ***A*** *=* ***110*** *the value of* A_{10} *is equal to* ***= 103 dB****.*

Frequency range of the measured sound pressure level: 2 Hz ÷ 20 000 Hz.

Notice: *in the case of the application of the different microphone types the measurement can be performed in the range: 0.8 Hz ÷ 45200 Hz.*

Basic error of the acoustic pressure level measurement: < ± 0.4 dB.

For the temperature range from -10℃ to +50℃, for the sinusoidal signal 1000 Hz, 94 dB RMS, with the **A**, **C** or **Lin** input filter.

Instrument's pre-heating time: 1 minute.

Measurement channel calibration:

acoustical:	by the measurement of the standard signal generated by the external calibrator (e.g. the SV 30).
digital:	by the declaration of the microphone's sensitivity.

Notice: *The calibration by the declaration of the microphone's sensitivity does not take under consideration the influence of temperature, humidity and atmospheric pressure. It can lead to up to ± 0.5 dB additional absolute error of the measurement. That is why the acoustic calibration by means of a calibrator or a pistonphone is strongly recommended.*

C3. System for vibration measurements

System conforms to the ISO 8041, ISO 2631 and ISO 5349 standards for the Human response to the mechanical vibration meeting requirements for Type 1 Meter.

System configuration:

- Handheld sound & vibration analyser SVAN 912AE ,
- Measurement transducer with the sensitivity from 0.01 pC/ms^{-2} to 1500 pC/ms^{-2}.

or

- Measurement IEPE transducer with the sensitivity from 0.01 mV/ms^{-2} to 1500 mV/ms^{-2}.

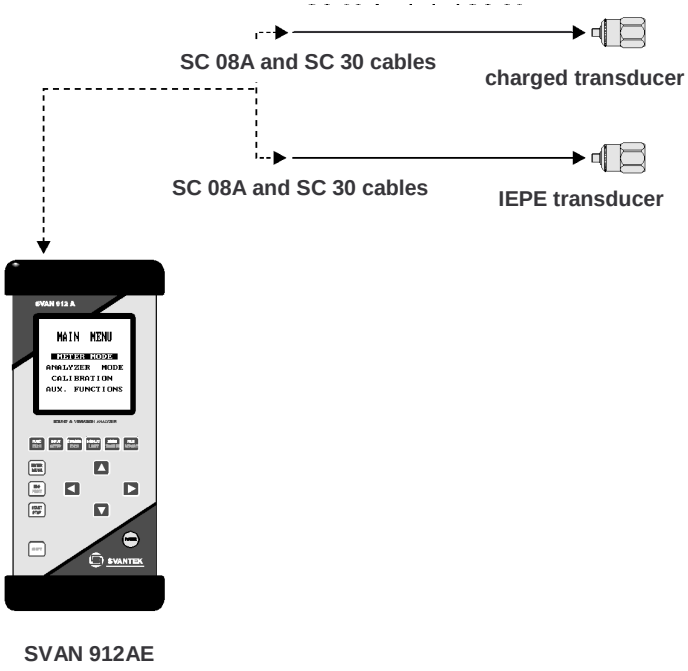


Fig. C3.1 Different accelerometers connected to the SVAN 912AE analyser

Measurements of the vibration's acceleration

Measurement ranges for the acceleration (for the transducer with the sensitivity equal to 10 pC/ms^{-2} or 10 mV/ms^{-2}):

4 ranges with the nominal values: 316 mms^{-2}, 3.16 ms^{-2}, 31.6 ms^{-2}, 316 ms^{-2}
(110 dB, 130 dB, 150 dB, 170 dB related to 10^{-6} ms^{-2}).

Values of the measured acceleration (for the transducer with the sensitivity equal to 10 pC/ms^{-2} or 10 mV/ms^{-2}):

- linear measurement (with the **HP** or **Lin** filter) **INPUT: ACCELER.**
  the measurement ranges for the distance from noise > 5 dB
  from 0.002 ms^{-2} to 1000 ms^{-2} (the sinusoidal signal RMS),
  from 0.01 ms^{-2} to 1410 ms^{-2} (PEAK),

  the measurement range (PEAK) with the measurement error < ± 0.5 dB
  from 0.1 ms^{-2} to 1410 ms^{-2},

RANGE (RMS)	Range of measurements	
316 mms^{-2} (110 dB)	from 2,00 mms^{-2} (66,0 dB)	to 1 ms^{-2} (120,0 dB)
3,16 ms^{-2} (130 dB)	from 3,16 mms^{-2} (70,0 dB)	to 10 ms^{-2} (140,0 dB)
31,6 ms^{-2} (150 dB)	from 31,6 mms^{-2} (90,0 dB)	to 100 ms^{-2} (160,0 dB)
316 ms^{-2} (170 dB)	from 316 mms^{-2} (110,0 dB)	to 1000 ms^{-2} (180,0 dB)

- linear measurement (with the **HP** or **Lin** filter) **INPUT: CHARGE**
  the measurement ranges for the distance from noise > 5 dB
  from 3.16 mms^{-2} to 1000 ms^{-2} (the sinusoidal signal RMS),
  from 0.01 ms^{-2} to 1410 ms^{-2} PEAK,

  the measurement range (PEAK) with the measurement error < ± 0.5 dB
  from 0.1 ms^{-2} to 1410 ms^{-2},

RANGE (RMS)	Range of measurements	
316 mms^{-2} (110 dB)	from 3,16 mms^{-2} (70,0 dB)	to 1 ms^{-2} (120,0 dB)
3,16 ms^{-2} (130 dB)	from 3,16 mms^{-2} (70,0 dB)	to 10 ms^{-2} (140,0 dB)
31,6 ms^{-2} (150 dB)	from 31,6 mms^{-2} (90,0 dB)	to 100 ms^{-2} (160,0 dB)
316 ms^{-2} (170 dB)	from 316 mms^{-2} (110,0 dB)	to 1000 ms^{-2} (180,0 dB)

- corrected measurement (with the **W-Bxy**, **W-Bz**, **W-Bc**, **H-A** or **KB** filter) **INPUT: ACCELER.**
  the measurement ranges for the distance from noise > 5 dB
  from 0.001 ms^{-2} to 1000 ms^{-2} (the sinusoidal signal RMS),
  from 0.003 ms^{-2} to 1410 ms^{-2} (PEAK),

  the measurement range (PEAK) with the measurement error < ± 0.5 dB
  from 0.03 ms^{-2} to 1410 ms^{-2},

RANGE (RMS)	Range of measurements	
316 mms^{-2} (110 dB)	from 1,00 mms^{-2} (60,0 dB)	to 1 ms^{-2} (120,0 dB)
3,16 ms^{-2} (130 dB)	from 3,16 mms^{-2} (70,0 dB)	to 10 ms^{-2} (140,0 dB)
31,6 ms^{-2} (150 dB)	from 31,6 mms^{-2} (90,0 dB)	to 100 ms^{-2} (160,0 dB)
316 ms^{-2} (170 dB)	from 316 mms^{-2} (110,0 dB)	to 1000 ms^{-2} (180,0 dB)

- corrected measurement (with the **W-Bxy**, **W-Bz**, **W-Bc**, **H-A** or **KB** filter) **INPUT: CHARGE**
  the measurement ranges for the distance from noise > 5 dB
  from 0.002 ms^{-2} to 1000 ms^{-2} (the sinusoidal signal RMS),
  from 0.002 ms^{-2} to 1410 ms^{-2} (PEAK),

  the measurement range (PEAK) with the measurement error < ± 0.5 dB
  from 0.02 ms^{-2} to 1410 ms^{-2},

RANGE (RMS)	Range of measurements	
316 mms^{-2} (110 dB)	from 2,00 mms^{-2} (66,0 dB)	to 1 ms^{-2} (120,0 dB)
3,16 ms^{-2} (130 dB)	from 3,16 mms^{-2} (70,0 dB)	to 10 ms^{-2} (140,0 dB)
31,6 ms^{-2} (150 dB)	from 31,6 mms^{-2} (90,0 dB)	to 100 ms^{-2} (160,0 dB)
316 ms^{-2} (170 dB)	from 316 mms^{-2} (110,0 dB)	to 1000 ms^{-2} (180,0 dB)

Notice: *In the measurement of the signal with the* ***crest factor n > 1.41 the upper measurement range for the RMS value is reduced****. Its value can be calculated from the equation:* $A_n = A + 10 - 20\log(n / \sqrt{2})$ *[m], where* ***A*** *is the given range for the sinusoidal signal.*
E.g. for ***n = 10*** *and* ***A*** *=* ***130*** *the value of* A_{10} *is equal to* ***= 123 dB****.*

Notice: *In the measurement conditions with the strong electromagnetic disturbances (e.g. near the high-voltage transmission lines) the lower measurement limit can be drastically shifted as the result of the external field influence on the measurement cables. In such cases the careful shielding of the measurement cables is strongly recommended. It is worth to underline that the estimation of the external influence can be performed in-site in the* ***ANALYZER MODE*** *of the instrument by the observations of the measurement signal spectrum.*

Frequency ranges for the acceleration measurement (for the transducer with the sensitivity equal to 10 pC/ms^{-2} or 10 mV/ms^{-2}):

0.2 Hz ÷ 200 Hz in the vibration measurement influencing human body - **W-Bxy**, **W-Bz** and **W-Bc** filters,
0.8 Hz ÷ 1 kHz in the vibration measurement influencing human body - **H-A** filter,
0.8 Hz ÷ 22.6 kHz in the linear measurements with the **HP** filter,
5.8 Hz ÷ 22.6 kHz in the linear measurements with the **Lin** filter.

Notice: *With the application of another vibration transducer the frequency range given above for the* ***HP*** *and* ***Lin*** *filter can be limited.*

Basic error for the acceleration measurement: < ± 0.7 dB.

Measurements of the vibration's velocity

Measurement ranges for the velocity (for the transducer with the sensitivity equal to 10 pC/ms^{-2} or 10 mV/ms^{-2}):
9 ranges 0.003 m/s, 0.01 m/s, 0.03 m/s, 0.1 m/s, 0.3 m/s, 1 m/s, 3 m/s, 10 m/s and 30 m/s (or 130 dB, 140 dB, 150 dB, 160 dB, 170 dB, 180 dB, 190 dB, 200 dB and 210 dB in relation to 10^{-9} ms^{-1}).

Values of the measured velocity (for the transducer with the sensitivity equal to 10 pC/ms^{-2} or 10 mV/ms^{-2}):

- the **Vel1** filter, **INPUT: CHARGE** or **INPUT: ACCELER.**

RANGE (RMS)	Measurement range f = 1 Hz	f = 330 Hz
31,6 mm/s (150 dB)	from 100 μm/s to 0,148 m/s	from 100 μm/s to 0,5 mm/s
0,316 m/s (170 dB)	from 500 μm/s to 1,48 m/s	from 500 μm/s to 5 mm/s
3,16 m/s (190 dB)	from 5 mm/s to 14,8 m/s	from 5 mm/s to 50 mm/s
31,6 m/s (210 dB)	from 50 mm/s to 148 m/s	from 50 mm/s to 0,5 m/s

- the **Vel3** filter, **INPUT: CHARGE** or **INPUT: ACCELER.**

RANGE (RMS)	Measurement range f = 3 Hz	f = 1000 Hz
0,01 m/s (140 dB)	from 50 μm/s to 48 mm/s	from 50 μm/s to 0,16μm/s
0,1 m/s (160 dB)	from 160 μm/s to 0,48 m/s	from 160 μm/s to 1,6 mm/s
1 m/s (180 dB)	from 1,6 mm/s to 4,8 m/s	from 1,6 mm/s to 16 mm/s
10 m/s (200 dB)	from 16 mm/s to 48 m/s	from 16 mm/s to 160 mm/s

- the **Vel10** filter, **INPUT: CHARGE** or **INPUT: ACCELER.**

RANGE (RMS)	Measurement range f = 10 Hz	f = 3000 Hz
3,16 mm/s (130 dB)	from 20 μm/s to 14,8 mm/s	from 20 μm/s to 0,05 mm/s
31,6 mm/s (150 dB)	from 50 μm/s to 148 mm/s	from 50 μm/s to 0,5 mm/s
0,316 m/s (170 dB)	from 0,5 mm/s to 1,48 m/s	from 0,5 mm/s to 5 mm/s
3,16 m/s (190 dB)	from 5 mm/s to 14,8 m/s	from 5 mm/s to 50 mm/s

- the **MF-Vel** filter, **INPUT: CHARGE** or **INPUT: ACCELER.**

RANGE (RMS)	Measurement range f = 10 Hz	f = 1000 Hz
3,16 mm/s (130 dB)	from 20 μm/s to 14,8 mm/s	from 20 μm/s to 0,15 mm/s
31,6 mm/s (150 dB)	from 50 μm/s to 148 mm/s	from 50 μm/s to 1,5 mm/s
0,316 m/s (170 dB)	from 0,5 mm/s to 1,48 m/s	from 0,5 mm/s to 15 mm/s
3,16 m/s (190 dB)	from 5 mm/s to 14,8 m/s	from 5 mm/s to 150 mm/s

Notice: *In the measurement of the signal with the* ***crest factor n > 1.41 the upper measurement range for the RMS value is reduced****. Its value can be calculated from the equation:* $A_n = A + 10 - 20\log(n / \sqrt{2})$ *[m], where* ***A*** *is the given range for the sinusoidal signal.*
E.g. for ***n = 10*** *and* ***A*** *=* ***170*** *the value of* A_{10} *is equal to* ***= 163 dB****.*

Basic error for the velocity measurement:

< ± 8%.

Measurements of the vibration's displacement

Measurement ranges for the displacement (for the transducer with the sensitivity equal to 10 pC/ms^{-2} or 10 mV/ms^{-2}):
6 ranges 0,0001 m, 0,001 m, 0,01 m, 0,1 m, 1 m and 10 m (or 160 dB, 180 dB, 200 dB, 220 dB, 240 dB and 260 dB in the relation to 10^{-12} m).

Values of the measured displacement (for the transducer with the sensitivity equal to 10 pC/ms^{-2} or 10 mV/ms^{-2}):

- the **Dil1** filter, **INPUT: CHARGE** or **INPUT: ACCELER.**

RANGE (RMS)	Measurement range f = 1 Hz	f = 18 Hz
0,01 m (200 dB)	from 20 μm to 23 mm	from 20 μm to 80 μm
0,1 m (220 dB)	from 80 μm to 0,23 m	from 80 μm to 0,8 mm
1 m (240 dB)	from 0,8 mm to 2,3 m	from 0,8 mm to 8 mm
10 m (260 dB)	from 80 mm to 23 m	from 80 mm to 80 m

- the **Dil3** filter, **INPUT: CHARGE** or **INPUT: ACCELER.**

RANGE (RMS)	Measurement range f = 3 Hz	f = 57 Hz
0,001 m (180 dB)	from 3 μm to 2,5 mm	from 3 μm to 8 μm
0,01 m (200 dB)	from 8 μm to 25 mm	from 8 μm to 80 μm
0,1 m (220 dB)	from 80 μm to 0,25 m	from 80 μm to 0,8 mm
1 m (240 dB)	from 0,8 mm to 2,5 m	od 0,8 mm to 8 mm

- the **Dil10** filter, **INPUT: CHARGE** or **INPUT: ACCELER.**

RANGE (RMS)	Measurement range f = 10 Hz	f = 181 Hz
0,0001 m (160 dB)	from 0,2 μm to 0,23 mm	from 0,2 μm to 0,8 μm
0,001 m (180 dB)	from 0,8 μm to 23 mm	from 0,8 μm to 8 μm
0,01 m (200 dB)	from 8 μm to 0,23 m	from 8 μm to 80 μm
0,1 m (220 dB)	from 80 μm to 2,3 m	from 80 μm to 0,8 mm

Notice: *In the measurement of the signal with the* ***crest factor n > 1.41 the upper measurement range for the RMS value is reduced****. Its value can be calculated from the equation:* $A_n = A + 10 - 20\log(n / \sqrt{2})$ *[m], where* ***A*** *is the given range for the sinusoidal signal.*
E.g. for ***n = 10*** *and* ***A*** *=* ***220*** *the value of* A_{10} *is equal to* ***= 213 dB****.*

Basic error for the displacement measurement:

< ± 8%.

Instrument's pre-heating time: 1 minute.

Measurement channel calibration:

vibrational: by the measurement of the standard signal generated by the external vibration calibrator,

digital: by the declaration of the transducer's sensitivity.