Soundbook™

Universal multi-channel acoustic measuring system

- Sound level measurement
- Frequency analysis
- Sound recording
- Human vibration measurement
- Pass-by noise measurement
- Building acoustics
- Machine vibration measurement
- Modal analysis
- Order-Tracking analysis
- Operational vibration analysis

SINUS
Messtechnik GmbH

Soundbook™

Universal acoustic measuring system, sound level meter conforming to IEC standards, multi-channel real-time analyzer and personal computer suited for field applications

Soundbook™ is our universal portable measuring system for acoustic, vibration and engineering measurements in general. It is fully compatible with our measuring system HARMONIE™ and integrated in Panasonic's robust Toughbook CF-19.

The Soundbook allows you to work everywhere - at the office as well as outdoors. Neither heat, cold, rain, dust nor heavy mechanical shocks have an impact on the device. Having a weight of only 3 kilograms, a robust magnesium alloy exterior, a convertible powerful TFT display, a moderate power consumption and various interfaces the Soundbook unites the performance of a high-quality measuring device with the possibilities of a PC. According to your demands you may choose between equipment packages with 2, 4 or 8 measuring channels and an optional AES3 digital audio interface.

The Soundbook is particularly suitable for:
• Industrial safety and environmental protection
• Engineering services
• Quality assurance
• Research and development.

Our **SAMURAI™** software package includes sound level meters (SLM) for 2, 4 or 8 channels which comply with IEC60651 / IEC 60804 / IEC 61672. In Germany the system combined with the siNoise™ software is calibratable; **PTB certification 21.21/ 01.06**. Furthermore the device is certified as a SLM according to IEC 61672 and as a 1/3 octave analyzer according to IEC 61260 in Austria and Hungary.

SAMURAI provides a highly efficient and intuitive user interface. It allows you to store user-defined setups, supports various application modes and contains a comfortable transducer database (TEDS) with calibration options. You may replay stored measurements in **REPLAY Mode**.

In **Easy Operator Mode** you may create setups with restricted features for less experienced users. The measured values are displayed independently from the data acquisition and storage in up to 16 windowpanes. The display settings may be adjusted before, during and after the measurement.

In addition to the acoustic measuring channels the device offers 2 digital in/outputs and 5 auxiliary channels (2/4 ch units only) for the acquisition of slow signals. You may use the digital input channels for trigger, tachometer or GPS synchronization.

The output channels allow either the output of the input signals, stored signals or white and pink noise parallel to the measurement.

Furthermore you may record and replay an audio comment before and after the measurement.

SAMURAI contains the following virtual measuring devices as basic features for each channel:

Sound level meter
Class 1 SLM according to IEC 60651, IEC 60804, IEC 61672-1 allowing simultaneous measurements with the frequency weightings A, C, Z and the time weightings Fast, Slow, Impulse. The SLM also supports the processing of percentiles, automatic impulse detection, measurement of Takt maximal levels, impulsive and low-frequency characteristics as well as intelligent markers and triggers. Up to 59 measured values are stored simultaneously at freely adjustable time intervals.

Frequency analyzer
Real-time 1/3 octave analysis from 1/3 octave center frequencies of 0.04 Hz ... 40 kHz (class 0 according to IEC 61260) and FFT analysis of 100...25600 lines, each feature including freely adjustable averaging modes and storage intervals. In addition the sum levels are displayed and stored.

Sound signal storage
Triggered storage of the time signal from DC...40 kHz with freely adjustable decimation option (1/2 ... 1/2048) to reduce data volumes.

Reverberation time measurement
Measurement of the reverberation time in 1/3 octaves. Excitation types: switched-off noise, impulse and sine-sweep (multi generator option necessary).
You may use the 4 signal outputs as noise generators (white and pink noise).

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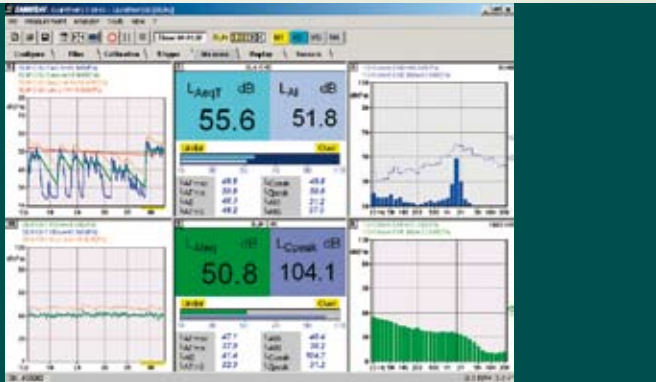
Software options for SAMURAI:

Option: HVMA

The **H**uman **V**ibration **M**ulti **A**nalyzer allows in each window up to 3-channel measurements according to all filter curves of ISO 8041. The vectors resulting from x, y, z for segmental or whole body vibrations with comfort and health weighting are displayed simultaneously in one window.

Option: Automation

Automatic comparison of a frequency analysis with reference spectra and their management as well as automatic detection by the device which displays a message, switches an output signal or starts an application (e. g. to send an email).

Option: Vibration Meter

This option allows the double integration of the time signal as well as third order high-pass and low-pass filtering with switch-selectable edge frequencies. The option complies with ISO 2954, ISO 7919 and DIN ISO 10816 (Vibration Meter).

Option: Fractional octaves

This option provides 1/1, 1/3, 1/6, 1/12 or 1/24 octaves up to 40 kHz in real time (1/3 octaves comply with class 0, IEC 61260).

Option: NoiseCam

A USB webcam allows you to store not only sound signals, but also videos with a freely adjustable compression rate. Two main values of a SLM or HVMA channel and the time display may be blended-in. The video export to a multimedia standard format grants clear measurement documentation.

Option: Multi generator

In addition to the noise generator this option provides the signal types: sine, rectangle, triangle, impulse, multi-sine, sine-sweep (lin and log) and pseudo-noise. Output of ∗.wav files simultaneously with data acquisition and FFT analysis is also possible.

Option: Transfer FRF

The transfer function of a structure is obtained using an impulse hammer or a triax accelerometer. The data storage corresponds with the measurement's geometry. Data export to ME'scope VES is possible.

Option: Pass-By Noise

Innovative measuring method to acquire noise data of a passing by vehicle according to ISO 362. A highly precise GPS system measures the vehicle's velocity as well as its drive-in and drive-out position. The driver controls the measurement and receives all information on a small TFT display at the windscreen.

Option: TCP/IP Interface

This option allows you to control SAMURAI including all features via network and integrate it into a complex measuring system.

Option: TCP/IP Client

Remote control of SAMURAI via network. Commands, status reports and measured values are transmitted via WLAN or GSM and displayed as on a Soundbook.

Option: Building acoustics (SAMBA)

The whole acoustic testing of airborne noise and impact sound insulation is organized according to ISO 717 and ISO 140. The measurements are prepared (rooms, partitions, measuring tasks) and implemented and the results are provided in printable form.

Option: Order tracking

This option allows measurement and display of spectra versus order of a basic frequency or RPM of a rotating machine.

Option: Sound power measurement

The sound power in 1/3 octaves and as a sum is measured together with further operational parameters in real time or sequentially using various geometries and numbers of microphones.
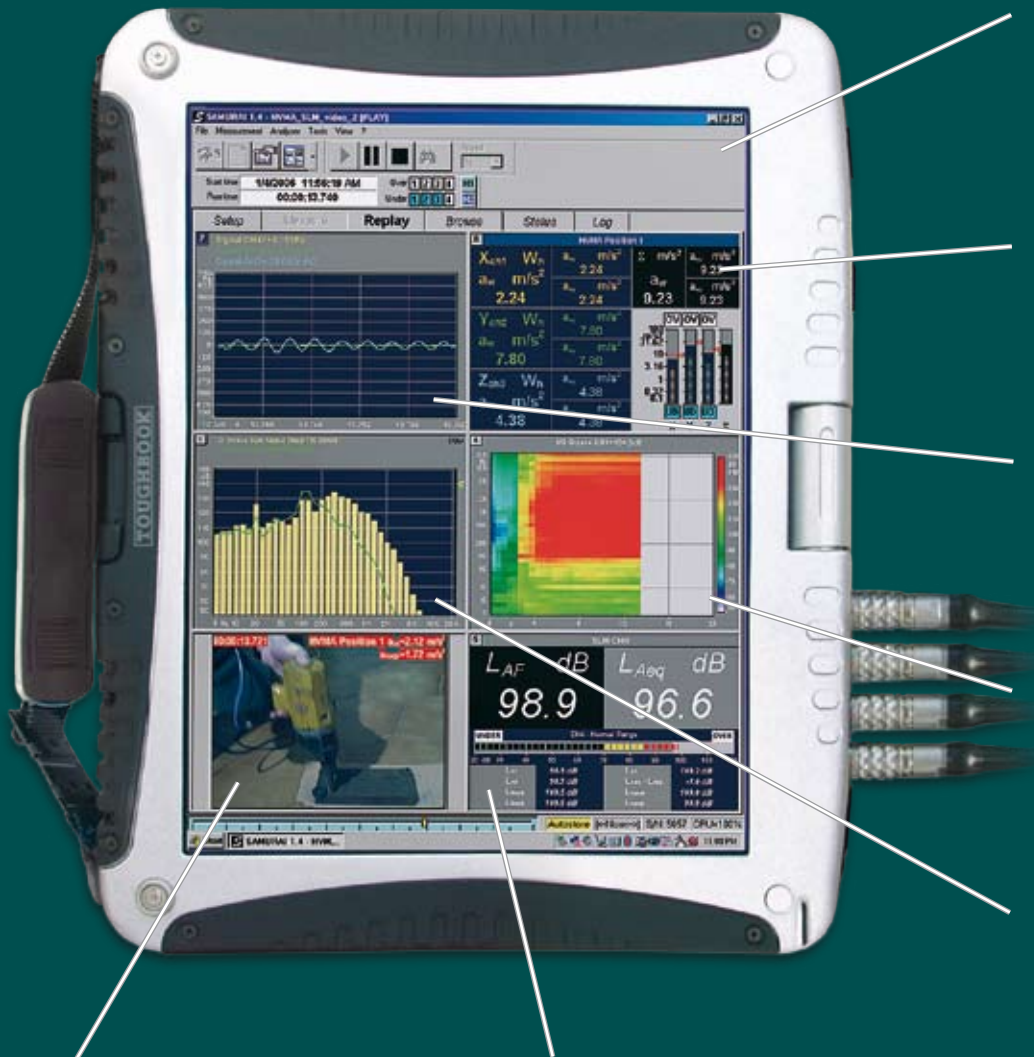
Option: Sound intensity

Sound intensity measurements according to ISO 9614 part 1 and part 2 with sound mapping on digital photos.

Other software options under development

SAMURAI™

General-purpose DSP software package for noise and vibration measurement

SAMURAI control windowpane:
- device status information
- device control buttons
- time information
- overload/underflow indicators

Human Vibration Multi Analyzer:
- 3 axial window with sum vector
- filter curves according ISO 2631
- digital and bar graph display
- 3 selectable values per axis

Signal:
- multi channel window
- scrolling & scaleable x-axis
- time signals from all channels
- quick scaling for y-axis

Sonogram:
- single channel window
- FFT- or 1/n octaves spectra
- scrolling & scaleable x-axis
- quick scaling for y- and z-axis

Frequency Analyzer:
- multi channel window
- FFT- or 1/n octaves parallel
- additional sum levels
- linear or log x-axis

NoiseCAM:
- measurement video documentation
- flexible resolution and frame rate
- values of one channel blended-in
- time stamp

Sound Level Meter:
- single channel window with 10 values
- 2 main values additional as bar graphs
- alarm level indicator in one bar graph
- table or level history below bar graphs

Other display types: History, 3D Waterfall, RPM ...

PTB APPROVAL

- TFT display with touchscreen/digitizer function
- magnesium case with protection rating IP54
- interface: Bluetooth, LAN, WLAN, USB, RS232, VGA, Modem, PCMCIA, SD-Card, Firewire

- battery and HDD detachable without tools
- HDD with heating and shock protection

- 2 x Output Connector LEMO3
- 4 x Input Connector LEMO7
- 1 x AUX-Connector LEMO8

Scope: **Soundbook + siNoise version 1.1.25**

Microphones/preamplifier:	2x MK221/MV203
Number of channels:	2 measuring channels in Extended Range mode
Accuracy:	Class 1 according to IEC 60651/ IEC 60804/ IEC 61672-1
Displayed values:	2x SPM, 2x 1/3 octave, 2x level recorder
Measuring range:	25 dB(A)...135 dB(A) @ crest factor 10
Frequency weighting:	A, C, Z (simultaneously)
Time weighting:	Fast, Slow, Impulse, Peak (simultaneously)
Measurement values:	L_{AF}, L_{Aeq}, L_{AS}, L_{AFmax}, L_{ZF}, L_{Atm5}, L_E, L_{AIeq}, L_{Cpeak}, L_{Zpeak},
Further values:	1/3 octaves 20 Hz...20 kHz, level recorder, time
Integration time:	Freely adjustable via Start / Stop
AC outputs:	2x audio signals of measuring channels
RS232 interface:	Start / Stop commands, output of all displayed values

General technical specification of Soundbook

The following data refer to the 4 channel version Soundbook_quadro

Basic device CF-19

Processor	Centrino™ Duo 1.1 GHz, 512 MB RAM
Display	10.4" TFT XGA, convertible, Touchscreen or Digitizer
Storage medium	HD 80 GByte
Interfaces	2x USB, RS232, LAN, WLAN, Modem, Cardbus, VGA, Bluetooth, SD-Card Firewire, ExpressCard
Operating system	WindowsXP multi lingual

Input channels 1-4

Resolution	20 bit (level), 16 bit (sound recording)
Real-time bandwidth	DC ... 40 kHz @ 4 channels
THD + noise	> 84 dB
Cross-talk attenuation	> 96 dB @ 1kHz
Random noise	< 1.4 µV(A), < 2.2 µV(Z) @ 0.1 Hz ... 40 kHz
Sampling rates	51.2 kHz / 102.4 kHz
Decimation rates	1, 2, 4, 8 ... 1024 (via DSP)
Anti-aliasing filter	yes
Max. input voltage	± 10 Vpeak
Amplification	-20 dB ... 40 dB in 10 dB steps
Overload detection	yes, also with out-of-band frequency
Phase mismatch	< 0.1° @ -20 dB-range, 20 Hz ... 20 kHz
Offset adjust	yes, automatically with self-calibration
Input filter	DC, AC 0.15 Hz, HP 10 Hz, LP 2 kHz
Channel cascading	possible, channels 1+2, channel 3+4
Sensor power supply	microphone ± 14 V, + 200 V, ICP 2 mA
Support of IEEE1451.4	yes

AUX channels 5-11

Resolution/ Total sampling rate	12 bit / 50 Hz
Input voltage	0 ... 15 V
Input impedance	12 kOhm for channels 5-9, 2.5 kOhm for channels 10 / 11
Tacho mode channels 10/11	Input frequency 1 / 60 Hz ... 1 MHz @ TTL level
Digital input mode 10/11	Sampling rate: 16 x sampling rate of channels 1-4 (max. 819.2 kHz)

Output channels 1-4

Sampling rates	51.2 kHz / 102.4 kHz
Bandwidth	DC ... 40 kHz (2ch), 20 kHz (4ch)
Max. output voltage	± 3.16 Vpeak
Attenuation	+10 dB ... -50 dB in 5 dB steps

2 / 8 channel Versions

2 channels = Soundbook_light	only 2 Input / Output channels (LEMO7)
8 channels = Soundbook_octav	8 Input channels, ICP (LEMO_Triax) / 2 Trigger (LEMO4) / no slow channel

Physical characteristics

Dimensions	280 mm x 220 mm x 65 mm
Weight	3100 g
Battery	Lithium Ion battery pack, capacity 4 h
External power supply	100 ... 240 VAC or 10 ... 36 VDC with adapters

Environmental conditions

Protection rating	IP54
Shock resistance	according to MIL-STD 810F
Humidity	30 % ... 90 %
Temperature range	-10 °C ... +50 °C
Storage conditions	-20 °C ... +60 °C, max. 95 % humidity

Electromagnetic compatibility

Emission	conforming with EN50081-1 (1992)
Immision	conforming with EN50082-1 (1997)

PLUS Option (quadro/light only)

Additional digital audio interface	AES3/SPDIF stereo I/O
Synchronization	via Digital inputs 10/11

Trade marks and owners

Microsoft Corp.	Windows XP™
Intel Corp.	Centrino™
Panasonic Corp.	Toughbook™
SINUS Messtechnik GmbH	Soundbook™, SAMURAI™, siNoise™
The MathWorks, Inc.	MATLAB™
Vibrant Technologies	ME'scope VES™