PRODUCT DATA

SoundCheck™ Electroacoustic Test Software — BZ 5320

SoundCheck is a modular, PC-based test solution for characterising the performance of electroacoustic transducers and products. With the simplicity of operation and measurement repeatability required for production line testing, yet the extensive analysis tools necessary for lab-work, SoundCheck is suitable for use throughout the design and manufacturing process. The test software is designed and developed by Listen Inc. in cooperation with Brüel & Kjær. Listen Inc. has specialised in the development of dedicated electroacoustic analyzer software since 1994. Together with Brüel & Kjær's foundation within electroacoustic test solutions, this extensive industry experience ensures that SoundCheck is designed with the user in mind, featuring simple, graphical interfaces similar in appearance to the conventional, well-proven, hardware-based systems. It features, therefore, all the tests necessary for the manufacturer of electroacoustic devices whether the task is production-line testing (QC), sample testing (QA) or component verification and development (R&D).

APPLICATIONS

- High-speed production line testing – Quality Control
- Incoming inspection, sample testing – Quality Assurance
- Component verification – Research and Development

TESTING

- Loudspeakers, micro speakers, receivers, earphones, loudspeaker systems
- Microphones
- Communication devices, headsets
- Hearing aids
- Telephones
- Cross-overs, equalizers, mixer consoles (electrical tests)

FEATURES

- SoundWare™ family of Virtual Instruments: Signal Generator, Multimeter, Oscilloscope, Spectrum Analyzer and Real-time Analyzer
- SLEAP™ – Test Sequencer
- Frequency, Time, and Phase Response
- Distortion: Harmonic, THD, Rub & Buzz and Loose Particles
- Impedance, Thiele-Small parameters and electrical tests
- Polar-plot for directivity measurements
- Attack and Release for hearing aid testing
- Loudness Ratings (IEEE/ITU-T) for telephone testing
- User-defined PASS/FAIL Limits
- Quick system verification/calibration routines
- Extensive data handling capabilities
- Statistical analysis
- Assignable security levels
- Easy integration into the manual as well as the automated production line

BENEFITS

- One common, modular electroacoustic platform within your company
- Full data compatibility between your QC, QA and R&D departments
- Improved productivity and controllable, documented product quality and throughput

LISTEN INC

Brüel & Kjær

What is SoundCheck?

General

SoundCheck is test software designed and optimised for fast, repeatable and accurate testing of Electroacoustic (EA) transducers. It is a dedicated analyzer platform for EA measurements and is fully integrated into the Windows® 95/98/2000/XP/Windows NT® environment. Generally, anything that contains a loudspeaker and/or a microphone, can be tested (see Applications section for further details)

The Philosophy

The philosophy of SoundCheck is to reproduce the functionality of the original, well known Brüel & Kjær Electroacoustic Test Systems. SoundCheck is programmed using LabView™ software and is a highly versatile test system based on a set of Virtual Instruments (VI) designed for swept and noise-based frequency, phase and time response measurements. For example, instruments such as Multimeters, Generators, Filters, Analyzers and Level Recorders are all integrated into SoundCheck, creating a new virtual electroacoustic test bench, all on your PC.

The Link between Manufacturing and Engineering

In an ideal world, production could run the same advanced tests as engineering without impacting throughput. These tests would be simple to carry out with no room for operator error. Defective products would never leave your factory, but would be completely categorized by their failure mode. You could easily bring the equivalent of your complete test lab to a vendor site in a briefcase. Engineering and production would have 100% compatible test methods and databases.

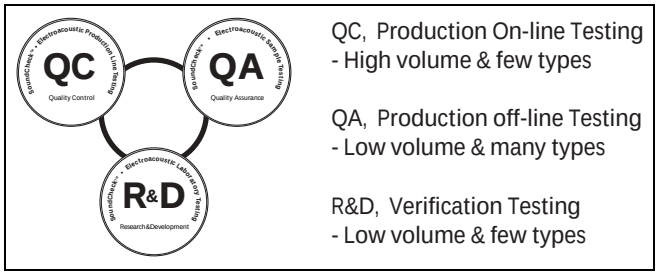


Fig. 1
SoundCheck is the link between Manufacturing and Engineering in your factory, enabling increased efficiency and communication between the three areas typically included in your product's lifecycle

Should there be any problems, your engineers would be able to carry out advanced analysis on production line results. Production line data could be transmitted from your manufacturing facility to a remote R&D laboratory. And the system that could offer all this would run on any standard PC and be easy to maintain and upgrade.

Although nothing is ideal, SoundCheck enables you to get closer to this perfect world than ever before.

SoundCheck can be used for all acoustic tests throughout the product lifecycle including:

- Rapid testing and characterising prototype designs
- Easy transition of product testing from engineering to manufacturing
- Complete testing on the production line
- Efficient qualification of vendors and suppliers
- Continuous improvement of product quality and productivity

Application Areas

Introduction

As described above, SoundCheck is designed to be used in 3 main areas:

- Production on-line testing (QC)
- Production off-line testing, incoming- and sample inspection (QA)
- Verification Testing (R&D)

It links the QC, QA and R&D areas together, ensuring full data compatibility. So instead of comparing and discussing measurement setups, procedures and data reliability between the three areas, finally you are now able to concentrate on essential matters; your product's performance. This means that you now have a firmer grip of your entire production cycle.

Production On-line Testing (QC)

Production lines cannot tolerate downtime. The SoundCheck concept virtually eliminates this problem and ensures fast production shifts and the possibility of line troubleshooting. Since professional audio sound cards are used for data acquisition, you can afford to keep spares on hand. SoundCheck runs on practically any Windows® based computer, so replacement parts are easy to purchase and inexpensive

to maintain. Should any problem occur, it is easy for your own staff to get the line back up and running, and optional remote diagnosis via the Internet enables immediate assistance.

The tests (or part of them) developed in engineering for a specific product can easily be transferred to production. SoundCheck's advanced algorithms allow very fast and accurate testing even in high noise environments. Simple, step by step on-screen instructions guide the user through calibration, limits and test set-up. The software can be configured for one click access to commonly used tests – the operator simply chooses the product model and the test from a pre-programmed list. The tests are then executed, the data analysed and the results compared to predefined pass/fail limits. Assignable levels of operator access can be set to prevent modification to the test sequence. SoundCheck can even be integrated with programmable logic controllers, barcode systems and external hardware and software systems.

Production Off-line Testing (QA)

As downtime is critical to production lines, incoming inspection and sample testing is sensitive to measurement errors and correct reporting to the next (or previous) link in the production cycle. With SoundCheck's capabilities of sequence importing, data handling and statistics, the effects of low quality batches passing your Quality Assurance department is reduced. With documented measurement data and derived statistics, you are now able to approach your supplier with facts to help maintain or increase product quality. In addition, you can provide your customers with measured statistical figures to document your products' reliability.

Identical virtual laboratories can be re-created around the world, making it easy for manufacturing facilities to carry out the same tests assuring uniform conditions and comparable measurement data. With the software's different language options and the use of the Internet to transfer data, the possibilities are endless.

Verification Testing (R&D)

SoundCheck is an effective tool for R&D engineers. It uses powerful measurement algorithms to enable rapid characterisation of prototypes, performing comprehensive tests such as frequency response, phase, sensitivity, distortion, directivity, impedance and Thiele-Small parameters in a matter of seconds. This saves time, as there is no need to conduct the test and then spend additional valuable engineering time doing calculations or importing raw data into other applications for analysis. The software incorporates a wide range of pre-programmed measurement and post-processing functionality including an ever-expanding suite of industry-standard conformance based tests (ANSI, IEC, IEEE, ITU-T, TIA, etc.).

Customised test sequences are easily developed using SoundCheck's unique visual scripting tool, SLEAP™ (Simple Language for Electro-Acoustic Programming). No programming knowledge is required as this simple point and click interface enables complex tests to be built in a flowchart-like format by selecting pre-programmed or user-defined options for each step in the setup, stimuli generation, data acquisition, analysis and output stages of the test. A saved test routine enables you to carry out an entire test with a click of the mouse, from setup through measurement and analysis to report writing, archiving and review.

Data can be output to user-definable SoundCheck reports and it can also be exported to software packages such as Microsoft® Word or Excel and databases such as Microsoft® Access or Oracle™ for archiving, post-processing or report writing. Alternatively, SoundCheck can be integrated into larger test applications using National Instruments' TestStand™ or ActiveX® environments.

For initial test development, SoundCheck incorporates a complete virtual audio test bench which includes a manual signal generator, multimeter, oscilloscope, spectrum analyzer and a real-time analyzer.

Applications

The following paragraphs describe in detail the various types of EA transducer that can be tested using SoundCheck applications. Each section contains a short description of the application, tests that can be carried out using the application and typical test setup requirements.

Loudspeakers, Micro speakers, Receivers, Earphones, Loudspeaker systems

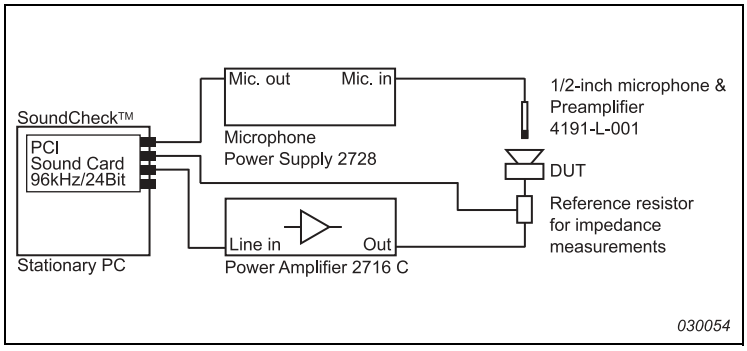
Description

SoundCheck's ability to simultaneously measure harmonic distortion and impedance with one frequency sweep saves considerable measurement time. Typically, measuring frequency, phase, sensitivity, polarity, impedance and THD can be done in less than 1 second. Thiele-Small parameters can be calculated from a curve fit of the impedance using the Post-processing and Equation Editors.

Tests

- Frequency and phase response (up to 100 kHz depending on sound card configuration)
- Time response
- Sensitivity
- Polarity
- Impedance
- Distortion (Harmonic, THD, Rub & Buzz, Loose Particles)
- Simulated Free-field (Time Selective Response)
- Directivity (Polar-plot)
- Thiele-Small Parameters

Fig. 2
Loudspeaker test setup



Test Setup

Fig. 2 shows a typical loudspeaker test situation, performing both acoustic and electrical analysis simultaneously. The whole setup can be quickly verified/calibrated using SoundCheck's user-friendly Calibration Editor and Brüel & Kjaer's Sound Level Calibrator Type 4231, for the measurement microphone.

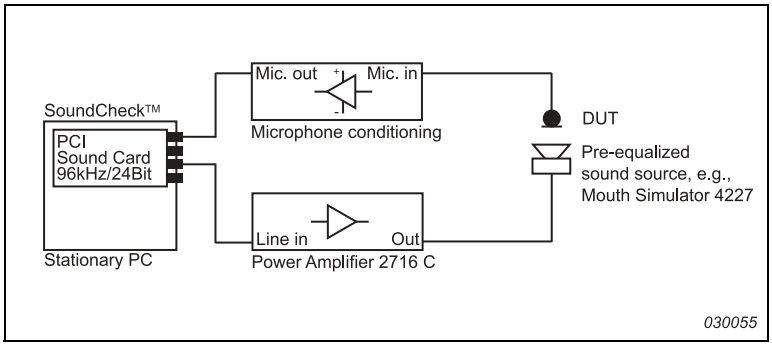
Omni- and Directional Microphones

SoundCheck makes it easy to set up the sound source including corrections of source amplitude and phase non-linearity. Again, this is done using the Calibration Editor (see Specifications). Turntable System Type 9640 can be controlled over an IEEE-488 GPIB interface for directional measurements.

Tests

- Frequency and phase response (up to 100 kHz depending on sound card configuration)
- Time response
- Sensitivity
- Noise
- Impedance
- Distortion (Harmonic, THD)
- Directivity (Polar-plot)

Fig. 3
Microphone test setup



Test Setup

Fig. 3 shows a typical microphone test situation using Brüel & Kjaer hardware together with the manufacturer's own microphone conditioning for power supply and impedance adaptation of the DUT. The sound source is pre-equalized using SoundCheck's Calibration Editor.

Hearing Aids

Tests can be performed according to ANSI, IEC, JIS or user-specified standards. Utilizing powerful measurement algorithms, SoundCheck can perform comprehensive tests, e.g., ANSI S3.22–1996, in less than 20 seconds. SoundCheck is an easily configurable system enabling efficient and comprehensive testing of hearing aids.

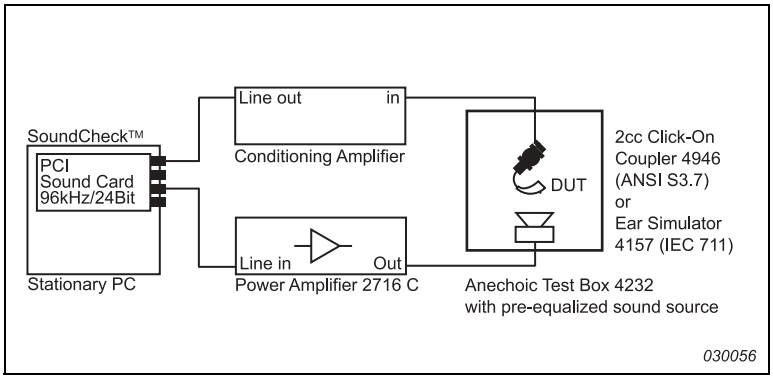
Utilizing a variety of readily available software and Brüel & Kjær hardware, including anechoic test box, ear simulators, measurement microphones, databases and word processors, SoundCheck can measure and report all parameters related to hearing aid test and measurement. In addition, it can control external devices, such as Hi-Pro or Turntable System Type 9640. Limits can easily be created from a measured response by offsetting the curve in frequency, amplitude, or time.

When testing to a specific standard, such as ANSI S3.22–1996, the limit curves can float in either amplitude or frequency as defined in Sec. 6.10 of the standard.

Tests

- Frequency, phase and time response
- OSPL 90
- HFA OSPL90
- Full-on gain
- HFA FOG
- Reference-test gain
- Equivalent Input Noise
- SPLITS
- HFA SPLITS
- Input vs. output level
- Attack & Release Time
- Battery Current Drain
- Acoustic/Telecoil
- Tests based on following standards: ANSI S3.22–1996, ANSI S3.42–1992, IEC 60118–7, JIS, C 5512, Chinese National Standard GB 7263–87

Fig. 4
Hearing aid test setup



Test Setup

Fig. 4 shows a BTE tested in the Anechoic Test Box, Type 4232, using the new 2cc Click-on Coupler, Type 4946. The magnitude and phase of the sound source from the test box is equalized for a flat response. Typical sound pressure variation at the hearing aid's microphone position is within ± 0.2 dB from 100 Hz to 10 kHz.

Analog and Digital Telephones

Test of PSTN, ISDN, IP and Cellular Phones is possible depending on the telephone interface used. Send, Receive and Sidetone measurements can be performed and Loudness Ratings (IEEE and ITU-T) calculated. Sine or speech-based excitation stimuli can be used. Calibration of the artificial ear and mouth equalization is easily accomplished by selecting the appropriate Brüel & Kjær Type in the Calibration Editor.

Tests

Send:

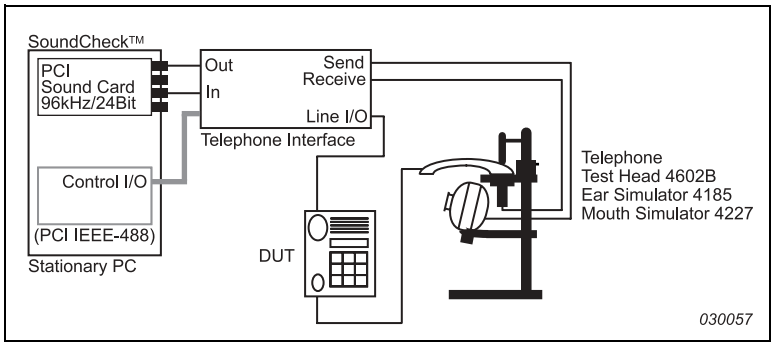
- Frequency, phase and time response
- Loudness Rating (TOLR & SLR)
- Linearity
- Total Harmonic Distortion (THD)
- Noise
- Muting

Receive:
- Frequency Response,
- Loudness Rating (ROLR& RLR)
- Linearity
- Total Harmonic Distortion (THD, Rub & Buzz, Loose Particles)
- Noise
- Volume Controls
- Magnetic Field for Hearing Aid Coupling

Sidetone:
- Masking Rating (SOLR & STMR)
- Echo Delay
- Total Harmonic Distortion (THD)

Other:
- Complex Impedance
- Stability
- Echo Return Loss
- DTMF
- Weighted Terminal Coupling Loss
- Tests based on following standards: Standards: IEEE–269, IEEE–1329,ITU–T P.79, TIA–470–B, TIA–470–C,TIA–810A

Fig. 5
Telephone test setup



Test Setup

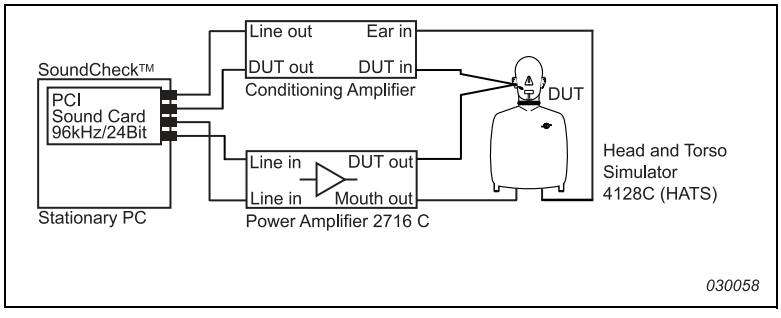
Fig. 5 shows a typical PSTN or ISDN telephone test setup, using an appropriate telephone interface with built-in conditioning for the ear and mouth simulators and the possibilty of controlling IEEE–488 by using SoundCheck.

Headset and Communication Devices

Use SoundCheck's multichannel capabilities to measure both signal paths simultaneously in the same test sequence. Also measure additional performance characteristics as noise attenuation, squelch, gain and maximum SPL.

Tests
- Frequency and phase response (up to 100 kHz depending on sound card configuration)
- Time response
- Sensitivity
- Polarity
- Impedance
- Distortion (Harmonic, THD, Rub & Buzz)
- Noise attenuation
- Squelch
- Gain
- Maximum SPL
- Loudness Rating
- Simulated Free-field (Time Selective Response)

Fig. 6
Headset test setup



Test Setup

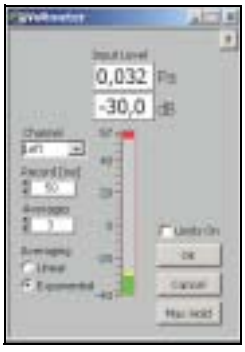
Fig. 6 shows an "ear-set" (receiver and microphone on boom for telephones) being tested in both signal directions using Head and Torso Simulator Type 4128 C.

Virtual Electroacoustic Test Bench – A Complete Laboratory in Your PC

Traditional methods for making audio measurements involve several dedicated instruments; a sweep sine generator to provide the excitation signal, a tracking filter/voltmeter to measure the output from the DUT, and finally a level recorder to provide a hard copy printout of the test results. SoundCheck provides the same functionality as these instruments but in a computerised or "virtual" environment.

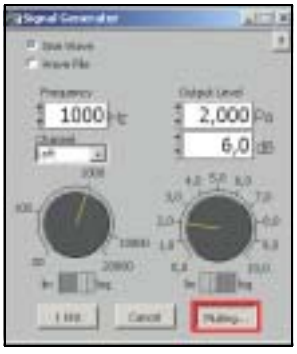
The virtual test bench includes a Signal Generator, Multimeter, Oscilloscope, FFT Analyzer, and true Real-time Analyzer that utilizes 1/1-, 1/3-, 1/6-, 1/12-, and 1/24- octave digital recursive filters. The Signal Generator can operate as a stand-alone instrument or in conjunction with the other instruments. Sinusoidal signals as well as complex signals (white and pink noise, artificial speech, noise bursts, multitone, etc,) can be used as stimuli.

Fig. 7
Typical Multimeter display



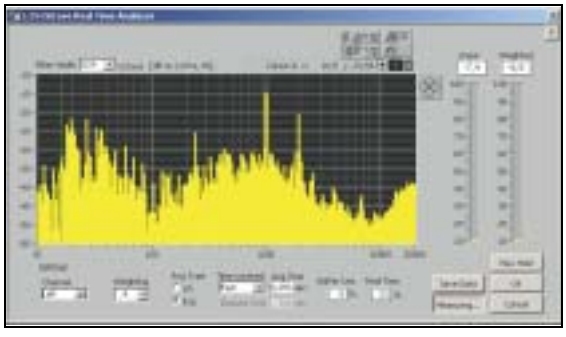
Multimeter
- Real-time monitoring of overall RMS levels (e.g. volts, SPL, ohms, etc.)
- Selectable averaging time
- Overload indication
- Max hold
- Selectable Max/Min values with Pass/Fail indication

Fig. 8
Typical Manual Signal Generator display



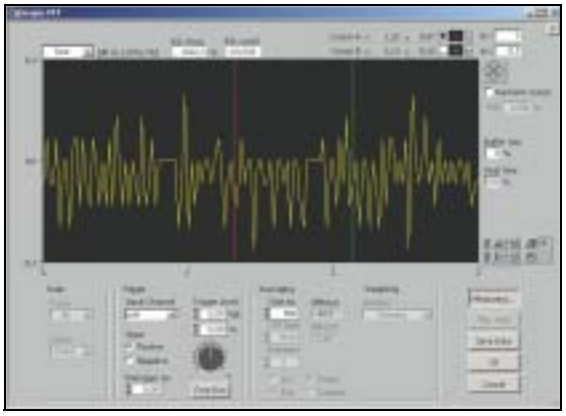
Manual Signal Generator
- Variable frequency and amplitude sine wave excitation via keyboard or virtual knobs
- Play any selected WAV file at a user-defined level
- Equalize any selected WAV file at a user-defined level

Fig. 9
Typical Real-time Analyzer display



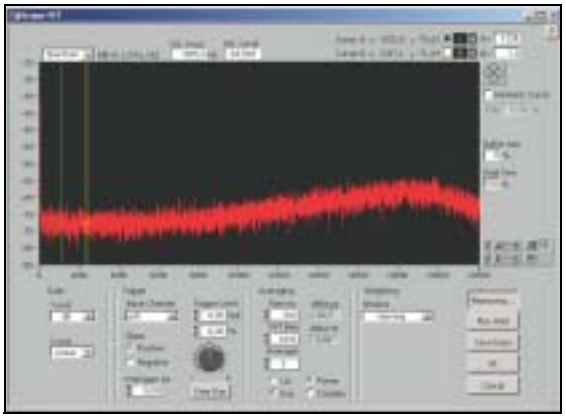
Real-time Analyzer
- 1/1-, 1/3-, 1/6-, 1/12-, 1/24- octave filters with true digital recursive filters
- A-, B-, and C- weighting filters
- Complies with ANSI S1.11 and IEC 1260
- Max. Hold
- Exponential and Linear time averaging including Fast and Slow sound level meter response

Fig. 10
Typical Oscilloscope display



Oscilloscope
- Waveform peak detection
- Delta cursor
- Selectable zoom

Fig. 11
Typical Spectrum Analyzer display



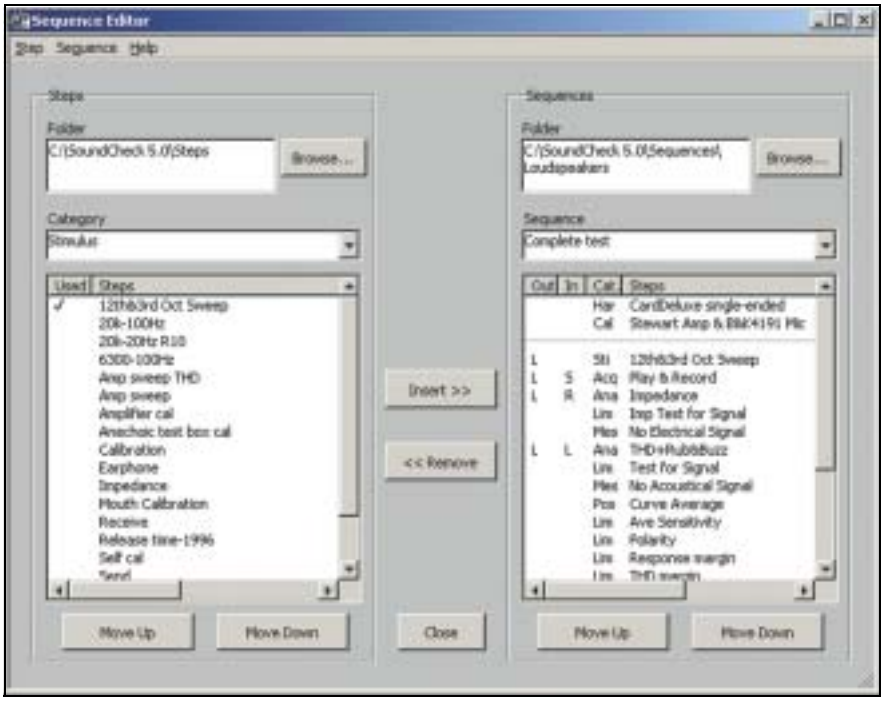
Spectrum Analyzer
- FFT and DFT with any number of lines
- Frequency and amplitude extraction
- Delta and Harmonic Cursor with THD readout
- Power averaging
- None, Hanning, Hamming, Blackman-Harris, and Flat-top windows
- Max. hold
- Selectable averaging time (Lin. and Exponential)
- Selectable Triggering

SLEAP™ Test Development using the Sequence Editor

SLEAP (Simple Language for Electro-Acoustic Programming), SoundCheck's visual scripting tool for test creation, requires no knowledge of formal programming languages. Instead, a simple point and click user interface guides the operator through the entire test setup, see Fig. 12. The complete test sequence consists of a series of step categories; at each step category, an option is chosen from a library of pre-configured steps. Any step can be modified or new steps added to the library. Complex tests can be built from a library of saved sub-sequences.

All test procedures are designed using SLEAP and controlled in the Sequence Editor. The Sequence Editor enables you to modify the default sequences or build your own customized sequences from scratch. Change the measuring sequence according to the changing DUTs. Using the import/export wizard, the sequences are easily exchanged between other SoundCheck PCs and sequences can be quickly modified to fit individual peripheral hardware components at these locations.

Fig. 12
The Sequence Editor



The current step categories in the Sequence Editor are:

- **Hardware:** to set sound card, digital I/O, and external interface parameters
- **Calibration:** to calibrate measurement transducers and external devices such a amplifiers and mouth simulators
- **Messages:** to provide messages in local language to test operators, or send/receive digital I/O, RS-232, and IEEE-488 messages
- **Stimulus:** to create sine-based stimuli or play and *.WAV files
- **Acquisition:** to enable play/record functions of sound card or utilize the Virtual Audio Test Bench in a sequence
- **Analysis:** to analyze response in frequency and time domain
- **Recall:** to recall correction curves or curves from “golden” units for comparison purposes
- **Post-processing:** to process data and test results mathematically and statistically
- **Limits:** to compare curves and single values against user-defined Pass/Fail limits
- **Display:** to create display templates in SoundCheck
- **Serial Number:** where the product serial number can be entered manually or incremented automatically
- **Statistics:** to calculate statistical parameters of data, results, and yield in real-time
- **Autosave:** to automatically save data and results in multiple formats
- **Printing:** to automatically print the display layout created in the Display step(s) of the sequence
- **Custom**

Hardware Description

Professional Sound Cards

SoundCheck runs on a standard PC utilising professional audio PCI, PCMCIA, USB or IEEE-1394 sound cards for signal generation and data acquisition. The frequency range of the stimuli and analyzed responses is limited only by the sampling rate of the soundcard. The only analyzer hardware is the soundcard and your computer, both of which are easily and cost-effectively upgradeable.

Brüel & Kjær supports the use of three types of verified sound cards:

- 24-bit/96 kHz (freq. range up to 48 kHz) 2-ch., PCI (supplied with system)
- 24-bit/206 kHz (freq. range up to 100 kHz) 4-ch., PCI (optional)
- 24-bit/48 kHz (freq. range up to 24 kHz) 2-ch., PCMCIA for laptops (optional)

See Ordering Information for details.

Professional Audio Sound Card

ANALOG INPUT
Number of Channels: 2 balanced TRS (tip-ring-sleeve) ¼″ jacks and Stereo S/PDIF (RCA connector)
Type of DAC: Dual 8- to 24-bit and 22 to 96 kHz sampling rates
Input Levels: ±2.6 V_p and ±10.5 V_p, jumper selectable when operating
Maximum Input Voltage: ±20 V peak
Input Coupling: AC
Input Impedance: 5.4 kHz (single-ended); 10.8 kHz (balanced)
Amplitude Linearity: ±0.3 dB
Amplitude Flatness: 20 to 20 kHz ±0.05 dB
Dynamic Range: 110 dB typical
THD @ 1 kHz: 0.001% typical
Phase Linearity: ±5°

ANALOG OUTPUT
Number of Channels: 2 balanced TRS ¼″ jacks and Stereo S/PDIF (RCA connector)
Type of DAC: Dual 8- to 24-bit and 22 to 96 kHz sampling rates
Output Levels: ± 2.6 V_P, ± 10.5 V_P, jumper selectable
Output Coupling: AC
Output Impedance: 600 Ω (single-ended), 300 Ω (balanced)
Amplitude Flatness: 20 to 20 kHz ±0.25 dB
Dynamic Range: 114 dB typical
THD @ 1 kHz: 0.001% typical
Crosstalk @ 1 kHz: –110 dB

PHYSICAL
Bus Slot: PCI, 32-bit

SoundCheck Virtual Audio Test Bench

Manual Signal Generator
- Variable frequency and amplitude sine wave excitation via keyboard or virtual knobs
- Play any selected WAV file at a user-defined level
- Equalise any selected WAV file at a user-defined level (optional)

Multimeter
- Real-time monitoring of overall RMS levels (e.g., volts, SPL, ohms, etc.)
- Selectable averaging time
- Max. hold
- Selectable Max./Min. values with Pass/Fail indication

Oscilloscope
- Waveform peak detection
- Delta cursor
- Selectable zoom

Spectrum Analyzer
- FFT and DFT with any number of lines
- None, Hanning, Hamming, Blackman-Harris, and Flat-top windows
- Max. hold
- Selectable averaging time (Lin. and Exponential)
- Selectable Triggering
- Frequency and amplitude extraction
- Delta and Harmonic Cursor with THD readout
- Power averaging

Real-time Analyzer (optional)
- 1/1-, 1/3-, 1/6-, 1/12-, 1/24- octave filters with true digital recursive filters
- A-, B-, and C- weighting filters
- Complies with ANSI S1.11 and IEC 1260
- Max. Hold
- Exponential and Linear time averaging including Fast and Slow sound level meter response

SLEAP™ – Simple Language for Electro-Acoustic Programming

Test Sequence Editor (optional)
- A sequence consists of series of individual operations that are performed automatically
- Unlimited number of operations
- Ability to call a sequence from within a sequence
- Conditional branching with iterations
- Load instruction files upon opening a sequence

SoundCheck Step Editors

Hardware
- Modify sound cards settings, such as bit depth and sampling rate; select communication mode with peripheral devices including RS-232, GPIB (IEEE–488), DCConnect™ programmable DC power supply and measuring amplifier, and digital I/O cards; port width for digital I/O is user-defined. No limitation on number of external interfaces used.

Calibration
- User-defined units and transducer sensitivities enable SoundCheck to measure any dynamic signal. SoundCheck can be calibrated with external, absolute source including acoustic or voltage. SoundCheck will correct for amplitude and phase of input and output devices (e.g., microphones and amplifiers). If the output device is an acoustic source, (e.g., loudspeaker, mouth simulator), SoundCheck will automatically equalize output when using sine-based excitation.

Messages
- Message steps initiated based on Pass/Fail conditions
- Operator
  - Display text message in local language on PC monitor
  - Operator can input a numeric value (e.g., temperature or humidity); value is then available in memory list for further use
  - Operator can answer "Yes" or "No" using mouse to a question in a message step
  - Message can be display for user-defined time period
- Digital I/O
  - Send/receive 8-bit messages
  - User-defined wait period
  - User-defined number of input/output ports
- IEEE-488 Interface
  - Write/Read message
  - Interface message
    - Device Clear
    - Selected Device Clear
    - Group Execute Trigger
    - Go to Local
    - Local Lockout
    - Unlisten
  - Serial Poll
  - Wait for Service Request
- RS-232 Interface
  - Write/Read message
  - Set Control Lines
  - Read Control Lines
- Device Clear

Stimulus
- Stimulus type include frequency stepped sweep (Stweep™), amplitude sweep, and WAV file, DC voltage, and frequency log sweep (used in conjunction with optional Time Selective Response analysis algorithm)
- Stweep step size includes 1/3-, 1/6-, 1/12-, and 1/24- octave; user-defined linear and log
- Any number of Stweep and/or amplitude sweeps can be concatenated using "Add" function (e.g., 20 Hz to 20 kHz Stweep followed by 1 kHz tone burst)
- EAI 426B power test signals (optional)

Acquisition
- Data acquisition modes include:
  - Simultaneously play and record in two channels
  - Record only
  - Manual Signal Generator (only plays the signal manually chosen)
  - Multimeter (displays the overall level for either Left or Right channel)
  - Signal Generator & Multimeter (both instruments used manually)
  - [1]Oscilloscope and/or FFT
  - [1]Realtime Analyzer
  - [1]Signal Generator & Oscilloscope/FFT
  - [1]Signal Generator & Real-time Analyzer
- Capture response time waveform as a WAV file

Analysis
- Amplitude values in linear units (e.g., volts, Pascals, etc.) or dB
- Envelope of response time waveform
- Impedance curves
- Autodelay to automatically compensate for delay times
- Manually enter delay in milliseconds, centimetres, or inches
- Broadband RMS to measure unfiltered level of an AC or DC signal
- Spectrum calculates the FFT of the response waveform
- [1]Time Selective Response to measure free-field and impulse response of fundamental AND harmonics (HarmonicTrak module required)
- Heterodyne to measure frequency and phase response only; relative or absolute response
- [1]HarmonicTrak™
  - Algorithm power sums a range of user-selected harmonics including sub-harmonics; no limit to number of harmonics
  - Frequency and phase response including harmonic amplitude and phase Classic THD and rub & buzz (harmonics compared to amplitude of fundamental at excitation frequency)
  - Normalized THD and rub and buzz distortion – TemmeCurve™ (harmonics are frequency-shifted to actual frequency and then compared to fundamental)
  - Relative or absolute response
- Loose particle detection where the envelope of the high-pass filtered time response is analyzed according to user-defined pulse width and statistical criteria

1.Optional modules

Recall
- Automatically recall a data or results

Post-processing (optional)
- Addition, subtraction, multiplication, division, offset by constant (X, Y, or Z dimensions), change sign, reciprocal, absolute value, square, square root, exponential, logarithm, average, maximum, minimum, estimated resonance and notch
- Search range to find intersection of two curves (e.g., –3dB points of crossover network)
- Curve smoothing with 1/3-, 1/6-, 1/12-, and 1/24- octave or user-defined linear or log resolution
- Loudness rating according to IEEE–661 and ITU-T R79; example sequences for TIA and other industry standards included (Optional)
- Attack & Release Time calculates the time for the response signal to rise or decay, respectively, by a user-defined amplitude in dB or linear units (optional)
- Equation Editor (optional)
  - Thiele-Small parameters using added mass or added volume
  - Algebraic equations written in "Excel-like" form (e.g., A*x^2 + B*y + C to represent Ax^2+By+C); any number of equations can be strung together
  - Variables can be given user-defined descriptive names (e.g. Qms for speaker Q with added mass)
  - Additional Functions include:
    - Absolute value
    - Trigonometric, inverse trigonometric, and hyperbolic
    - Natural log, Log10, Log2 and inverse log
    - Min and max of two values
    - Sine integral of x, where x is a real number
    - Square and square root

Statistics
- Real-time updates of:
  - Overall yield
  - Yield for an individual test (e.g., sensitivity)
  - ± x sigma of any measured curve, result, yield, or calculated value
  - Max., min., and mean of any measured curve, result, yield, or calculated value

Limits (optional)
- Limits applied to any measured curve, value, or calculated value
- Upper only, lower only, upper and lower
- Limits can be entered manually, recalled from a file, offset a curve or portion of the curve by user-defined amount (e.g., ±3 dB), or changed graphically by "dragging" limit points using mouse
- Floating, absolute, align to a point (e.g. 1 kHz aligned to 0 dB), individual points
- X axis can be "floated"

Display
- Multiple displays can be placed on the screen to view curves, single values, and test results with PASS/FAIL indicators; display layout can be transferred to Word or as HTML document; curves with different units (e.g., dBSPL and Ohms) can be displayed in one graph with no limit to number of curves displayed in a single graph; data from any one graph can be exported directly to a new Excel file or pre-defined template
- Displays include XY graph, table, results, embedded

Printing
- Automatically print display layout to default printer or HTML

Computer System Requirements
Intel® Pentium® or equivalent with PCI or PCIMCIA slots
Windows® 95/98/2000/XP, Windows NT®
128 MB RAM (256 MB recommended)
50 MB of hard disk space
SVGA monitor

Ordering Information

Three standard system packages with increasing functionality are available as described below. A package consists of respective software modules and the standard Certified Data Acquisition Board for frequency measurements up to 48 kHz.
Should these three systems not target your application area completely, optional software modules and Data Acquisition Boards can be added to the nearest standard system package. The optional modules are described below.

SoundCheck Basic Electroacoustic Test Software – BZ 5320 C

Items/modules
BZ 5320-001 SoundCheck Basic Software
BZ 5320-010 Stimulus Editor Module (Stweep & Amplitude Sweep & WAV)
BZ 5320-006 Signal Generator Module
BZ 5320-007 Voltmeter Module
ZE-0770-B-001 Certified Data Acquisition Board (PCI Sound Card, 96 kHz SR /24-bit, 2 in/2 out)

SoundCheck Electroacoustic Test Software for Production Test – BZ 5320 B

Items/modules
BZ 5320-001 SoundCheck Basic Software
BZ 5320-010 Stimulus Editor Module (Stweep & Amplitude Sweep & WAV)
BZ 5320-006 Signal Generator Module
BZ 5320-007 Voltmeter Module
BZ 5320-003 Limits Tester Module (+)
BZ 5320-002 HarmonicTrak Module for Distortion (THD, Rub & Buzz) and Loose Parts Detection (+)
ZE-0770-B-001 Certified Data Acquisition Board (PCI Sound Card, 96 kHz SR /24 bit, 2in/2out)

SoundCheck Electroacoustic Test Software for Test Development – BZ 5320 A

Items/modules
BZ 5320-001 SoundCheck Basic Software
BZ 5320-010 Stimulus Editor Module (Stweep & Amplitude Sweep & WAV)
BZ 5320-006 Signal Generator Module
BZ 5320-007 Voltmeter Module
BZ 5320-003 Limits Tester Module
BZ 5320-002 HarmonicTrak Module for Distortion (THD, Rub & Buzz) and Loose Parts Detection
BZ 5320-004 Sequence Editor Module (+)
BZ 5320-005 Post-processing Module (+)
BZ 5320-008 FFT Spectrum Analyzer and Oscilloscope Module (+)
ZE-0770-B-001 Certified Data Acquisition Board (PCI Sound Card, 96 kHz SR /24-bit, 2 in/2 out)

Note: Software and hardware options can be added to (but not removed from) the three standard configurations.

SoundCheck Software Options

Modules for general electroacoustic use
BZ 5320-001 SoundCheck Basic Module
BZ 5320-007 Voltmeter Module
BZ 5320-006 Signal Generator Module
BZ 5320-010 Stimulus Editor Module (Stweep & Amplitude Sweep & WAV)
BZ 5320-003 Limit Tester Module
BZ 5320-004 Sequence Editor Module

Modules for extended electroacoustic use
BZ 5320-002 HarmonicTrak Module for Distortion (THD, Rub & Buzz) and Loose Parts Detection
BZ 5320-008 FFT Spectrum Analyzer and Oscilloscope Module
BZ 5320-009 Real-time Analyzer Module (1/1-, 1/3-, 1/6-, 1/12-, and 1/24-octave)
BZ 5320-005 Post-processing Module
BZ 5320-014 Equation Editor Module[1]
BZ 5320-015 Database Module (saves data directly to SQL, Access, or Oracle database formats)
BZ 5320-016 Wave File Equalizer Module (for noise based testing)

For Loudspeaker Measurements
BZ 5320-011 Simulated Free-field Measurement and Analysis Module[2] (Log TSR)
BZ 5320-012 Polar Plotting Module (incl. sequence to operate Turntable System Type 9640 via GPIB)

For Hearing Aid Measurements
BZ 5320-013 Attack and Release Time Module[1] (incl. sample hearing aid test sequences based on ANSI S3.22–1996, IEC 118–7, and JIS C 5512 standards)

For Telephone Measurements
BZ 5320-017 Loudness Ratings Module[1] (IEEE/ITU) (incl. sample telephone test sequences based on TIA 470C)

Software Upgrade
BZ 5320 MS-1 Upgrade Contract

SoundCheck Hardware Options

For measurements up to 48 kHz
ZE-0770-B-001 Certified Data Acquisition Board (PCI Sound Card, 96 kHz SR /24-bit, 2 in/2 out)

For measurements up to 100 kHz
ZE-0770-B-002 Certified Data Acquisition Board (PCI Sound Card, 215 kHz SR /24-bit, 2 in/6 out)
ZE-0770-B-003 Certified Data Acquisition Board (PCI Sound Card, 215 kHz SR /24-bit, 4 in/4 out)
ZE-0770-B-004 Certified Data Acquisition Board (PCI Sound Card, 215 kHz SR /24-bit, 6 in/2 out)

For measurements up to 24 kHz (For Laptop Computers)
ZE-0770-B-005 Certified Data Acquisition Board (PCMCIA Sound Card, 48 kHz SR/24-bit, 2 in/2 out)

1.Requires Post Processing Module BZ 5320-005
2.Requires HarmonicTrak Module BZ 5320-002

Additional Hardware

Microphones

Type 4191	½" Free-field Measurement Microphone
Type 4939	¼" Free-field Measurement Microphone
Type 4144	1" Pressure-field Microphone
Type 4192	½" Pressure-field Microphone
Type 4947	½" Pre-polarized Pressure-field Microphone

Pre-amplifiers

Type 2669 L	Falcon Range® ½" Microphone Preamplifier
Type 2670	Falcon Range® ¼" Microphone Preamplifier
Type 2671	½" DeltaTron® Preamplifier
Type 2695	½" DeltaTron® Preamplifier

Couplers

Type 4128 C	Head and Torso Simulator
Type 4128 D	Head and Torso Simulator (with Handset Positioner)
Type 4152	Ear Simulator
Type 4153	Ear Simulator
Type 4157	Ear Simulator
Type 4185	Ear Simulator
Type 4195	Wideband Ear Simulator
Type 4195 Q	Wideband Ear Simulator for QC
Type 4227	Mouth Simulator
Type 4930	Artificial Mastoid
Type 4946	2cc Click-on Coupler

Conditioning/Microphone Power Supplies

Type 2690	NEXUS Microphone Conditioning Amplifier
Type 2693	NEXUS Microphone Conditioning Amplifier
Type 2829	4-channel Microphone Power Supply
Type 4416 B	Battery Powered ISOTRON™ Conditioner

Power Amplifier

Type 2716 C	Power Amplifier

Turntable System

Type 9640	Turntable System

Anechoic Test Box

Type 4232	Anechoic Test Box

Calibrators

Type 4228	Pistonphone
Type 4231	Sound Level Calibrator

Telephone Test Head

Type 4602 B	Telephone Test Head

Note: Product data information is available from your local Brüel & Kjær representative or download from Brüel & Kjær's website.

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HEADQUARTERS: DK-2850 Nærum · Denmark · Telephone: +45 4580 0500
Fax: +45 4580 1405 · bksv.com · e-mail: info@bksv.com

Australia (+61) 2 9889-8888 · Austria (+43) 1 865 74 00 · Brazil (+55) 11 5188-8166
Canada (+1) 514 695-8225 · China (+86) 10 680 29906 · Czech Republic (+420) 2 6702 1100
Finland (+358) 9-755 950 · France (+33) 1 69 90 71 00 · Germany (+49) 421 17 87 0
Hong Kong (+852) 2548 7486 · Hungary (+36) 1 215 83 05 · Ireland (+353) 1 803 7600
Italy (+39) 0257 68061 · Japan (+81) 3 3779 8671 · Republic of Korea (+82) 2 3473 0605
Netherlands (+31) 318 55 9290 · Norway (+47) 66 77 11 55 · Poland (+48) 22 816 75 56
Portugal (+351) 21 47 11 4 53 · Singapore (+65) 377 4512 · Slovak Republic (+421) 25 443 0701
Spain (+34) 91 659 0820 · Sweden (+46) 8 449 8600 · Switzerland (+41) 1 880 7035
Taiwan (+886) 22 713 9303 · United Kingdom (+44) 14 38 739 000 · USA (+1) 800 332 2040

Local representatives and service organisations worldwide

Brüel & Kjær