

BRÜEL & KJÆR® Sound Level Meters

Hand-held Analyzer Types 2250 and 2270 for Building Acoustics Measurements with Building Acoustics Software BZ-7228

Building Acoustics is the assessment of sound insulation in buildings and building elements. It is important for the well-being of people in their homes, workplace or public venues, thus minimum standards are set in the building regulations of each country.

BZ-7228 software is available for Hand-held Analyzer Type 2250 and Type 2270. It provides the flexibility and ease of use and is optimized for field rather than laboratory measurements

Type 2270 analyzers with 2-channel Option BZ-7229 can be used as 2-channel building acoustics analyzers. BZ-7229 is a standard application included on all new Type 2270 analyzers.

Back at the office, Qualifier Type 7830 offers versatile post-processing and reporting of your measurement results.

For customers only requiring reverberation time measurements, Reverberation Time Software BZ-7227 is also available. Please contact your HBK representative for details.



Uses and Features

Uses (BZ-7228)

- Measurement of:
 - Airborne sound insulation
 - Facade sound insulation
 - Impact sound insulation

Features (BZ-7228)

- Complete hand-held building acoustics analyzer
- Built-in pink and white noise generator
- Measures source and receiving room level spectra:
 - Equalization of sound source spectra
 - Parallel or serial measurements
- Measures reverberation time spectra:
 - Impulse and Interrupted Noise methods
- Measurement position management
- Calculates final results on the spot: ISO 16283, ISO 140 plus 13 national standards
- Measurement quality indicators
- Colour touch screen user interface
- Signal recording, voice commentary and integrated camera (Type 2270 only) to document test environment
- Single-channel measurements (Types 2250 and 2270)
- 2-channel measurements (Type 2270 only, requires BZ-7229 which is included on all new Type 2270 analyzers)

Uses (Type 7830)

- Building acoustics calculation
- Report generation
- Data archiving

Features (Type 7830)

- Building acoustics results calculation
- Analysis and report generation in one application
- Automatic data integrity checking (smileys)
- ISO plus 13 national standards

The Hand-held Analyzers

Fig. 1
Hand-held Analyzer
Types 2250 and 2270



Types 2250 and 2270 are robust, hand-held analyzer platforms designed to host a wide range of sound and vibration measurement applications. Their uses range from assessing environmental and workplace noise to industrial quality control and product development ([product data BP 2025](#)).

Easy to use – their light and ergonomic design makes them easy to grip, hold and operate single-handedly. Their colour touch screens show the analyzer setup, status and data at a glance, and with a tap of the stylus, you can make quick selections. The “traffic light” indicator, positioned centrally on the pushbutton panel, shows you the current measurement status, even from a distance.

Robust – the hand-held analyzers are built for the tough environment of field measurements. They will work

reliably in rain, dust, heat, frost, and during day or night.

To document your measurement, you can add spoken or written comments and make signal recordings during any measurement.

NOTE: Signal recordings require Signal Recording Option BZ-7226.

Type 2250 is a single-channel analyzer, while Type 2270 is 2-channel and has additional features such as a built-in camera (allowing you to attach photos to your measurements).

Tasks in Building Acoustics

Fig. 2
Typical configuration for
building acoustics
measurements: sound
source, amplifier, analyzer
(including signal
generator) and PC for
reporting

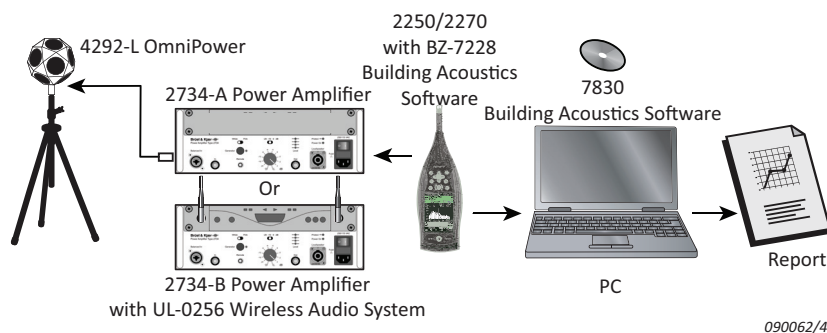


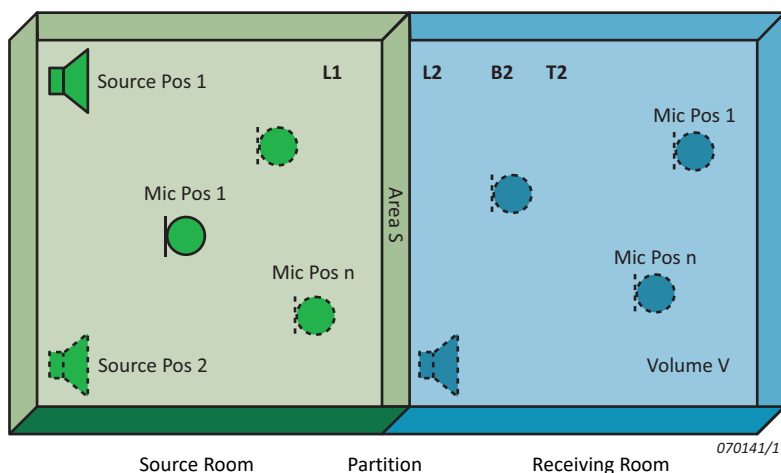
Fig. 2 shows a typical configuration for the most common task in building acoustics measurements: airborne sound insulation.

Fig. 3 shows a typical airborne task setup using a loudspeaker (emitting pink noise) and a number of microphone positions to measure the average source room spectrum L1, and the average receiving room spectrum L2. The average background noise spectrum B2 is also measured to verify the true L2 spectrum.

The average reverberation time spectrum, T2, is measured to correct for the amount of absorption in the receiving room. Finally, the single number result (for example: D_{nTw}) is calculated from the L1, L2, B2 and T2 spectra, and the result can then be compared with the minimum requirements stated in the building regulations.

Fig. 3
Sound source and microphone positions for measuring airborne sound insulation

L1 = Source room level
L2 = Receiving room level
B2 = Background level
T2 = Reverberation Time



The sound level depends on the position in the rooms, so several microphone positions are used to measure the average of the source room level, L1, the average of the receiving room level L2 and the average of the background noise level B2. The average reverberation time T2 is also measured using several positions.

In Touch with your Measurements

The spectra required (L1, L2, etc.) can be measured in any order, to suit field conditions and your preferences. Fig. 4 shows a typical building acoustics display when you are ready to measure the first L2 position, with source position 1.

Fig. 4
Typical single-channel Spectrum display when you are ready to measure the first L2 position, with source position 1

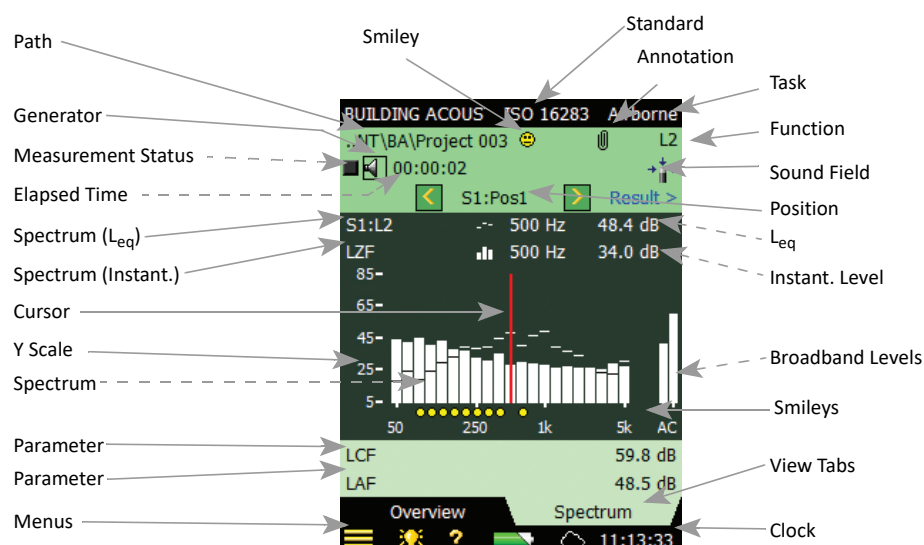
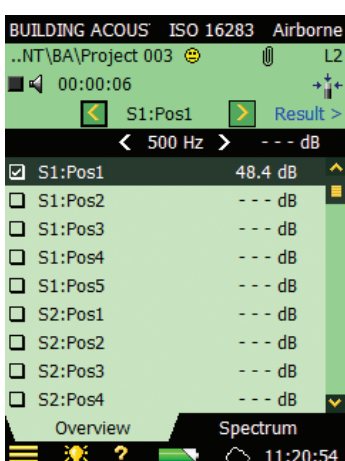


Fig. 5
Typical single-channel Overview display



The instantaneous (live) spectrum is shown and the high-resolution, colour, touchscreen shows the setup, status and data at a glance. Using the stylus (or navigation pushbuttons) you can directly activate the indicated features (except those with dashed lines in Fig. 4). You can check the generator and loudspeaker signal level by tapping the Generator icon to switch the generator on and off.

Fig. 6
Type 2270 connected to two microphones through the Dual 10-pole Adaptor



2-channel measurements (Type 2270 only) are as easy as single-channel measurements with the advantage that you can reduce the total measurement time by measuring source and receiver positions simultaneously or by measuring two positions in the same room simultaneously.

Reverberation Time

Fig. 7
Reverberation time measurement – measured using the interrupted noise method



Reverberation time (RT) is an important parameter describing the acoustic quality of a room or space. It is important for sound levels, speech intelligibility and the perception of music. In building acoustics, it is used to correct for the effects of RT on building acoustics and sound power measurements.

Reverberation Time is the decay time for sound in a room after the excitation stops. It is the time for a 60 dB drop in level, but the decay is usually measured over a 20 or 30 dB drop and then extrapolated to the 60 dB range. It is labelled T20 and T30, respectively, for those two evaluation ranges.

Reverberation time varies between positions in a room, so it is usually

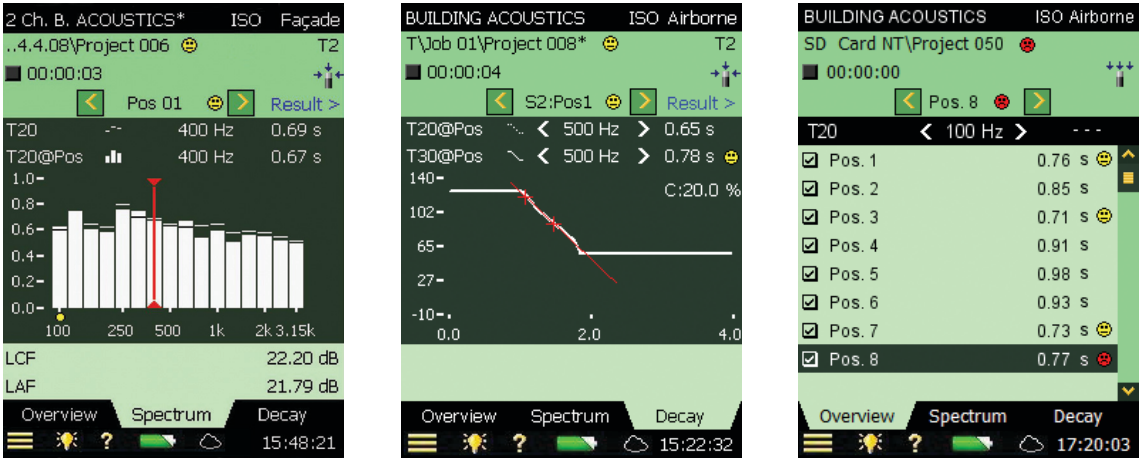
measured at several positions. The average can be determined for the *RT spectra*, or the *decays* for each frequency band can be averaged and the reverberation time spectrum then calculated for the averaged decays (ensemble average).

Reverberation time can be measured by using either impulsive excitation (Schroeder Method), from a starting pistol or balloon burst, or interrupted noise.

All it takes to measure reverberation time is to press the Start/Pause pushbutton (and burst the balloon in the case of impulsive excitation). Reverberation times from 0.1 to up to 30 seconds are then measured at peak sound levels up to 143 dB. No trial measurements, no overloads, and the 'traffic light' clearly shows the measurement status from a distance.

A Reverberation time spectrum, showing T20 and T30, is shown in Fig. 8 (left). A reverberation decay curve for a 1/3-octave band is included in Fig. 8 (centre) and an overview of results at one frequency band is included in Fig. 8 (right).

Fig. 8
Reverberation time
spectrum (left);
reverberation decay curve
(centre); and overview of
results (right)



Calculations

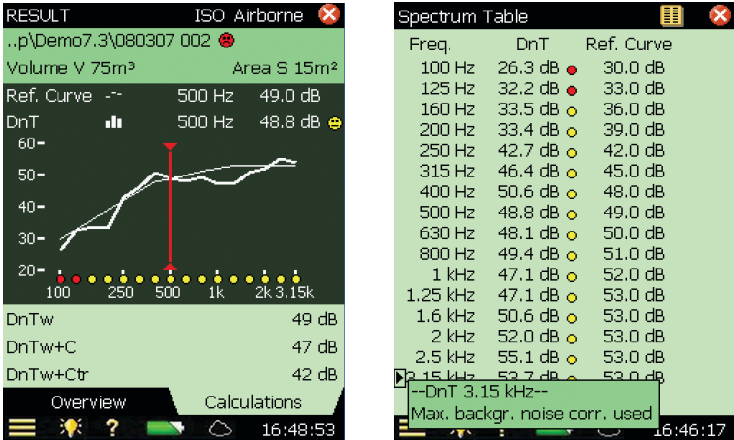
Standards

Even though the measurement functions (L1, L2, B2, T2) are the same for any building acoustics measurement, the detailed measurement setup and calculation procedures depend on your national building regulations. To ensure that your measurements comply, select the relevant standard before you save your first measurement. This will automatically activate the required setup for measurement and calculation. An overview of the available standards is shown in Table 1 (page 7), and the calculated parameters in Table 2 (page 8).

Results

In addition to measurement data, you may also need the receiving room volume and the partition area for some calculations. These can be entered using the stylus or navigation pushbuttons on the appropriate instrument display page. You may want to reuse some of your earlier measurements (like a T2 spectrum known from a similar receiving room), to save time. This is also possible, by using a reuse facility in the Explorer display.

Fig. 9
With the required data
measured, final results are
shown, including the
reference curve.
For some results, the
volume of the receiving
room and the area of the
partition must be entered



The calculations use a reference curve for frequency weighting of the sound reduction spectrum, resulting in a single number like $R'w = 52$ dB (the weighted field sound reduction index according to the ISO 140-4). This means that you will know on site whether your construction under test fulfils the minimum requirements of the local building regulations. Examples of final results are shown in Fig. 9.

Facade Sound Insulation

Facade sound insulation is a variant of airborne sound insulation, with its own standards. The “source room” is the space outside the facade, and the sound source may be road traffic or a loudspeaker representing outdoor noise. When using traffic noise, the indoor and outdoor sound levels must be measured simultaneously, requiring 2-channel measurements (Type 2270 only).

Impact Sound Insulation

Impact sound is typically caused by footsteps, and to measure impact sound insulation a standardized impact sound source (tapping machine) is placed in the source room. The receiving room levels are measured as for airborne sound insulation, with several positions of the tapping machine. Calculations are like those for airborne sound insulation, except the results represent absolute (not relative) levels.

Wireless Systems

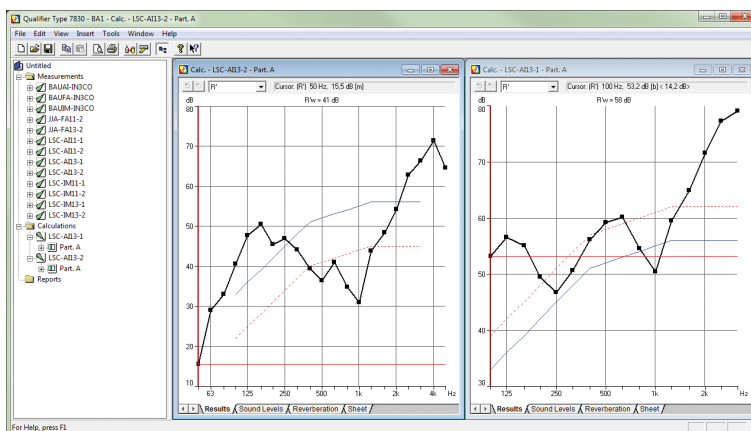
Fig. 10
Optional wireless systems are available to control the sound source for airborne and impact sound insulation measurements



In the field, using Wireless Audio System Kit UL-0256 can speed up measurements by reducing the number of cables and make it easier for you to control the amplifier when not in the same room.

Reviewing and Reporting using Qualifier Type 7830

Fig. 11
Typical building acoustics project using Type 7830



With Qualifier Type 7830, you can view, recalculate, document and report data. Measured and calculated data are viewed just as with Types 2250 and 2270. Qualifier's Project Tree enables easy browsing and copy/pasting across data folders. Selected data can be displayed as tables, 3D plots and graphs. Editing options include adjustment of reverberation decay graphical alignment, manual data entries, copy/paste data and changing the calculation standard (where compatible). All changes to data are annotated accordingly.

Qualifier also allows you to report your calculations (or recalculations) using templates based on specific standards. Templates are available for a selection of national and international standards. You can also customize a template to include your company's logo in the report, or create a report from a blank report template.

Building Acoustics Measurement Standards

Table 1 Building acoustics standards supported by BZ-7228 and Qualifier Type 7830

		INTERNATIONAL	GERMANY	AUSTRIA	ITALY	UK	ENGLAND WALES	SWEDEN	SWITZERLAND	FRANCE	SPAIN		NETHERLANDS		USA
Measurement		ISO	DIN	ÖNORM	UNI	BS	BREW	SS	Sia	NF-S31	NBE	CTE	NEN	NEN'06	ASTM
Typical Parameters		R' $L'n$	R $L'n$	DnT $L'nT$	Dn Ln	DnT $L'nT$	DnT	R' $L'n$	DnT $L'nT$	$DnAT$ $LnAT$	$DnAT$ $LnAT$	DnT,A $L'nT$	Ilu Ico	DnT,A LnT,A	FTL Ln
AIRBORNE	Lab	10140-2*	EN 20140-3	S 5101	8270-1	EN 20140-3		EN 20140-3		051	74-040-84/3	CTE 2008			
	Field	140-4 16283-1	52210-1	S 5100-1	8270-4	2750-4	BREW	EN 20140-4	181	054, -057	74-040-84/4	CTE 2008	5077	5077	E336-90
	Facade	140-5 16283-1	52210-5	S 5100-3	8270-5	2750-5		EN 20140-5	181	055, -057	74-040-84/5	CTE 2008	5077	5077	E966-90
IMPACT	Lab	10140-3*	52210-1	S 5101	8270-6	2750-6		EN 20140-6		-052	74-040-84/6	CTE 2008			
	Field	140-7 16283-2	52210-1	S 5100-2	8270-4	2750-7		EN 20140-7	181	056, -057	74-040-84/7	CTE 2008	5077		E1007-11
RT		3382-2	52212										5077	5077	
RATING	Airborne	717-1	52210-4	S5100-1	8270-7	5821-1, -3	BS EN 717-1	SS-ISO 717-1	181	-057	NBECA-88	CTE 2008	5077	NPR 5079	E413-73 E1332-90
	Impact	717-2	52210-4	S5100-2	8270-7	5821-2		SS-ISO 717-2	181	-057	NBECA-88	CTE 2008	5077		E989

* Partially fulfilled (does not support correction of the result for the contribution of flanking transmission).

Table 2 Calculated parameters

	MEASUREMENT STANDARDS								
	ISO, DIN, ÖNORM, UNI, BS, BREW	SS	SIA	NF	NBE	CTE	NEN	NEN'06	ASTM
Basic Standards	ISO 16283* ISO 140 ISO 717	ISO 140 ISO 717	ISO 140 ISO 717	NF S31-05X	ISO 140	ISO 140	NEN 5077	NEN 5077-2006	ASTM E336, 1007, E966, E1332
Airborne Calculated Parameters	D Dn DnT R' R Dw Dw+C Dw+Ctr Dnw Dnw+C Dnw+Ctr DnTw R'w or Rw +C +Ctr +C ₅₀₋₃₁₅₀ +C ₅₀₋₅₀₀₀ +C ₁₀₀₋₅₀₀₀ +Ctr ₅₀₋₃₁₅₀ +Ctr ₁₀₀₋₅₀₀₀ +Ctr ₅₀₋₅₀₀₀	ISO plus: Dw8 DnTw8 R'w8 Rw8	ISO plus: DnTw+C-Cv	D DnT R DnATrose DnATroute Rrose Rroute	ISO plus: DA DnAT RA R'A	ISO plus: DA DnA DnT,A RA R'A	DnT llu llu;k	DnT DnT,A DnT,A,k	NR NNR FTL NIC NNIC FSTC
Facade Calculated Parameters	R'45° R'tr,s Dls,2m Dls,2m,n Dls,2m,nT Dtr,2m Dtr,2m,n Dtr,2m,nT Dls,2m,w Dls,2m,n,w Dls,2m,nT,w Dls,2m,nT,w+C Dls,2m,nT,w+Ctr Dtr,2m,w Dtr,2m,n,w Dtr,2m,nT,w+C Dtr,2m,nT,w+Ctr R'45°w or R'tr,s,w +C +Ctr +C ₅₀₋₃₁₅₀ +C ₅₀₋₅₀₀₀ +C ₁₀₀₋₅₀₀₀ +Ctr ₅₀₋₃₁₅₀ +Ctr ₁₀₀₋₅₀₀₀ +Ctr ₅₀₋₅₀₀₀	See ISO	ISO plus: D45°nT Dls,2m,nT,w+C-Cv Dtr,2m,nT,w+C-Cv D45°nT,w+Ctr-Cv	DnT45° DnTtr DnATroute45° DnATroute	ISO plus: R'A45° Dls,2m,nAT Dtr,2m,nAT Dtr,2m,A Dls,2m,A Dls,2m,n,w+C Dls,2m,n,w+Ctr	ISO plus: R'45°A R'45°Aav R'45°Aef R'45°Atr R'A R'Atr D2m,A D2m,Aav D2m,Aef D2m,Atr D2m,n,A D2m,n,Aav D2m,n,Aef D2m,n,Atr D2m,nT,A D2m,nT,Aav D2m,nT,Aef D2m,nT,Atr Dls,2m,n,w+C Dls,2m,n,w+Ctr	Gi G _A G _{A,k}	Gi G _A G _{A,k}	OILR OITL OITC
Impact Calculated Parameters	L'nT Ln L'nw L'nTw or LnW +Ci +Ci ₅₀₋₂₅₀₀	ISO plus: L'nw8 L'nTw8 Lnw8	See ISO	LnT Ln LnAT LnA	ISO plus: LnAT LnA	See ISO	LnT lco		LnT Ln IIC NISR

* ISO 16283: Additional low-frequency measurement procedure for low frequencies in small rooms. The L_{Corner} and L_{LF} results are used for calculating and displaying the final results.

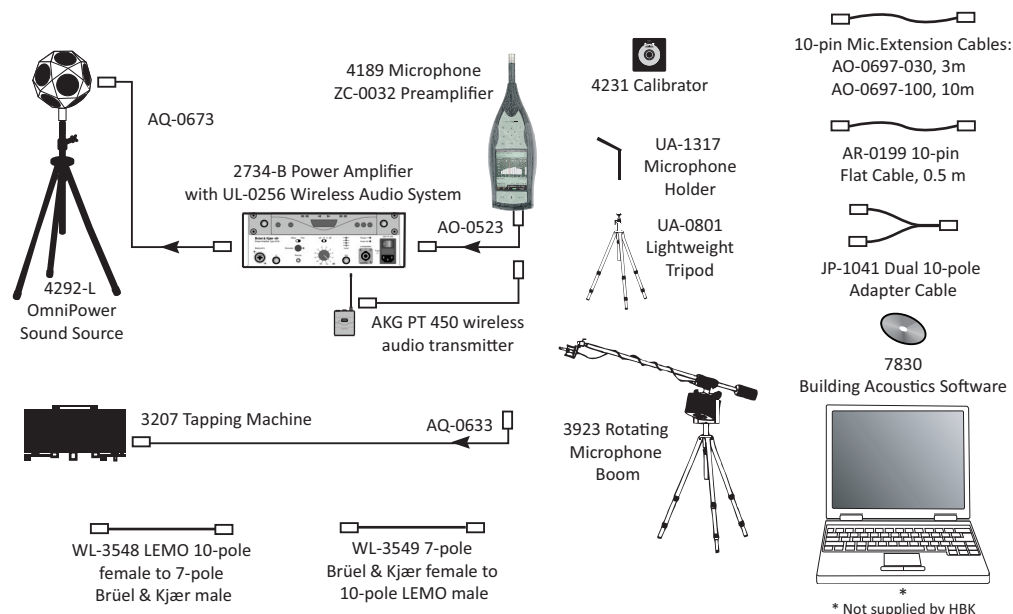
Complete System

HBK provides a wide range of Brüel & Kjær accessories (Fig. 12) to help you build a complete building acoustics measurement system, such as:

- Power amplifier and a choice of sound sources
- Tapping machine for impact sound insulation measurements
- Tripods, extension cables and flat cables
- Microphone and cable for 2-channel applications
- Wireless transmission of generator signal and wireless remote control of tapping machine
- Rotating microphone boom
- Calibrators

The combination of cables and accessories necessary will depend on whether it is a single- or 2-channel measurement, whether wireless transmission of the generator signal is being used and the layout of the partition and rooms being measured.

Fig. 12
Accessories for building
acoustics measurements



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Accredited Calibration Services at HBK

Ensure traceable measurement history from day one with accredited calibration for your Type 2250/2270. We recommend calibration at an HBK ISO 7025 certified laboratory biannually or annually. Any errors detected during calibration will be repaired prior to returning the instrument to you.

Compliance with Environmental Standards

	The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME China RoHS mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China WEEE mark indicates compliance with the EU WEEE Directive
Safety	EN/IEC 61010–1, ANSI/UL 61010–1 and CSA C22.2 No.1010.1: Safety requirements for electrical equipment for measurement, control and laboratory use
EMC Emission	EN/IEC 61000–6–3: Generic emission standard for residential, commercial and light industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits IEC 61672–1, IEC 61260, IEC 60651 and IEC 60804: Instrumentation standards NOTE: The above is only guaranteed using accessories listed in this document
EMC Immunity	EN/IEC 61000–6–2: Generic standard – Immunity for industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements IEC 61672–1, IEC 61260, IEC 60651 and IEC 60804: Instrumentation standards NOTE: The above is only guaranteed using accessories listed in this document
Temperature	IEC 60068–2–1 & IEC 60068–2–2: Environmental Testing. Cold and Dry Heat Operating Temperature: –10 to +50 °C (14 to 122 °F) Storage Temperature: –25 to +70 °C (–13 to 158 °F)
Humidity	IEC 60068–2–78: Damp Heat: 93% RH (non-condensing at +40 °C (104 °F)). Recovery time 2 ~ 4 hours
Mechanical	Non-operating: IEC 60068–2–6: Vibration: 0.3 mm, 20 m/s², 10 – 500 Hz IEC 60068–2–27: Bump: 1000 bumps at 400 m/s² IEC 60068–2–27: Shock: 1000 m/s², 6 directions
Enclosure	IEC 60529 (1989): Protection provided by enclosures: IP 44*

* With preamplifier, extension cable or protection plug connected to the top socket and the hinged cover protecting the bottom connectors.

General Specifications

Transducer

SUPPLIED TRANSDUCER

One of the Following Microphones:

- Type 4189: Prepolarized Free-field ½" Microphone
- Type 4190: Free-field ½" Microphone
- Type 4966: Free-field ½" Microphone

Nominal Open-circuit Sensitivity: 50 mV/Pa (corresponding to –26 dB re 1 V/Pa) ±1.5 dB

Capacitance: 14 pF (at 250 Hz)

SUPPLIED MICROPHONE PREAMPLIFIER

Part No.: ZC-0032

Nominal Preamplifier Attenuation: 0.25 dB

Connector: 10-pin LEMO

Extension Cables: Up to 100 m in length between the microphone preamplifier and Type 2250/2270, without degradation of the specifications

MICROPHONE POLARIZATION VOLTAGE

Selectable between 0 V and 200 V

SELF-GENERATED NOISE LEVEL

Typical values at 23 °C for nominal microphone open-circuit sensitivity:

WEIGHTING	MICROPHONE	ELECTRICAL	TOTAL
"A"	14.6 dB	12.4 dB	16.6 dB
"B"	13.4 dB	11.5 dB	15.6 dB
"C"	13.5 dB	12.9 dB	16.2 dB
"Z" 5 Hz–20 kHz	15.3 dB	18.3 dB	20.1 dB
"Z" 3 Hz–20 kHz	15.3 dB	25.5 dB	25.9 dB

Hardware Interface

PUSHBUTTONS

11 buttons with backlight, optimized for measurement control and screen navigation

ON-OFF BUTTON

Function: Press 1 s to turn on; press 1 s to enter standby; press for more than 5 s to switch off

STATUS INDICATORS

LEDs: Red, yellow and green

DISPLAY

Type: Transflective back-lit colour touchscreen 240 × 320 dot matrix

Colour Schemes: Five different – optimized for different usage scenarios (day, night, etc.)

Backlight: Adjustable level and time

USER INTERFACE

Measurement Control: Using pushbuttons

Set-up and Display of Results: Using stylus on touchscreen or pushbuttons

Lock: Pushbuttons and touchscreen can be locked and unlocked

USB INTERFACE

USB 2.0 OTG Micro AB and USB 2.0 Standard A sockets for Wireless

USB-A Adapter UL-1050, printer or weather station

MODEM INTERFACE

Connection to Internet through GPRS/EDGE/HSPA modem connected through the USB Standard A Socket.

Supports DynDNS for automatic update of IP address of host name

PRINTER INTERFACE

PCL printers, Mobile Pro Spectrum thermal printer or Seiko DPU S245/S445 thermal printers can be connected to USB socket

MICROPHONE FOR COMMENTARY

Microphone, which utilizes automatic gain control (AGC), is incorporated in underside of analyzer. Used to create voice annotations for attaching to measurements

CAMERA (TYPE 2270 ONLY)

Camera with fixed focus and automatic exposure is incorporated in underside of analyzer.

Used to create image annotations for attaching to measurements

Image Size: 2048 × 1536 pixels

Viewfinder Size: 212 × 160 pixels

Format: jpg with exif information

SECURE DIGITAL SOCKET

2 × SD sockets

Connect SD and SDHC memory cards

LAN INTERFACE SOCKET

• Connector: RJ45 Auto-MDIX

• Speed: 100 Mbps

• Protocol: TCP/IP

INPUT SOCKET

One socket with Type 2250; two with Type 2270

Connector: Triaxial LEMO

Input Impedance: ≥1 MΩ

Direct Input: Max. input voltage: ±14.14 V_{peak}

CCLD Input: Max. input voltage: ±7.07 V_{peak}

CCLD Current/voltage: 4 mA/25 V

TRIGGER SOCKET

Connector: Triaxial LEMO

Max. Input Voltage: ±20 V_{peak}

Input Impedance: >47 kΩ

Precision: ±0.1 V

OUTPUT SOCKET

Connector: Triaxial LEMO

Max. Peak Output Level: ±4.46 V

Output Impedance: 50 Ω

HEADPHONE SOCKET

Connector: 3.5 mm Minijack stereo socket

Max. Peak Output Level: ±1.4 V

Output Impedance: 32 Ω in each channel

Storage

INTERNAL FLASH-RAM (NON-VOLATILE)

512 MB for user set-ups and measurement data

EXTERNAL MEMORY CARD

SD and SDHC Card: For store/recall of measurement data

USB MEMORY STICK

For store/recall of measurement data

Power

EXTERNAL DC POWER SUPPLY REQUIREMENTS

Used to charge the battery pack in the analyzer

Voltage: 8 – 24 V DC, ripple voltage <20 mV

Current Requirement: min. 1.5 A

Power Consumption: <2.5 W, without battery charging, <10 W when charging

Cable Connector: LEMO Type FFA.00, positive at centre pin

EXTERNAL AC MAIN SUPPLY ADAPTOR

Part No.: ZG-0426

Supply Voltage: 100 – 120/200 – 240 V AC; 47 – 63 Hz

Connector: 2-pin IEC 320

BATTERY PACK

Rechargeable Li-Ion battery

Part No.: QB-0061

Voltage: 3.7 V

Nominal Capacity: 5500 mAh (typical); 5200 mAh (minimum)

Typical Operating Time:

Single-channel: >11 h (screen backlight dimmed); >10 h (full screen backlight)

Dual-channel: >10 h (full screen backlight)

Battery Cycle Life: >500 complete charge/discharge cycles

Battery Aging: Approximately 20% loss in capacity per year

Battery Indicator: Remaining battery capacity and expected working time may be read out in % and in time

Battery Fuel Gauge: The battery is equipped with a built-in fuel gauge, which continuously measures and stores the actual battery capacity in the battery unit

Charge Time: In analyzer, typically 10 hours from empty at ambient temperatures below 30 °C (86 °F). To protect the battery, charging will be terminated completely at ambient temperatures above 40 °C (104 °F). At 30 to 40 °C, charging time will be prolonged. With External Charger ZG-0444 (optional accessory), typically 5 hours

Note: It is not recommended to charge the battery at temperatures below 0 °C (32 °F) or over 50 °C (122 °F). Doing this will reduce battery lifetime

CLOCK

Back-up battery powered clock. Drift <0.45 s per 24-hour period

Environmental

WARM-UP TIME

From Power Off: <2 min

From Standby: <10 s for prepolarized microphones

WEIGHT AND DIMENSIONS

650 g (23 oz) including rechargeable battery

300 × 93 × 50 mm (11.8 × 3.7 × 1.9") including preamplifier and microphone

Software Interface

USERS

Multi-user concept with login. Users can have their own settings with jobs and projects totally independent of other users

PREFERENCES

Date, time and number formats can be specified per user

LANGUAGE

User interface in Catalan, Chinese (People's Republic of China), Chinese (Taiwan), Croatian, Czech, Danish, English, Flemish, French, German, Hungarian, Japanese, Italian, Korean, Polish, Portuguese, Romanian, Russian, Serbian, Slovenian, Spanish, Swedish, Turkish and Ukrainian

HELP

Concise context-sensitive help in Chinese (People's Republic of China), English, French, German, Italian, Japanese, Polish, Romanian, Serbian, Slovenian, Spanish and Ukrainian

UPDATE OF SOFTWARE

Update to any version using BZ-5503 through USB or update via Internet

REMOTE ACCESS

Connect to the analyzer using:

- Measurement Partner Suite BZ-5503
- the 2250/2270 SDK (software development kit)
- a REST interface through HTTP
- an Internet browser supporting JavaScript

The connection is password protected with two levels of protection:

- Guest level: for viewing only
- Administrator level: for viewing and full control of the analyzer

Input

DUAL CHANNELS (Type 2270 only)

All measurements are made from either Ch. 1 or Ch. 2 or both simultaneously

TRANSDUCER DATABASE

Transducers are described in a transducer database with information on Serial Number, Nominal Sensitivity, Polarization Voltage, Free-field Type, CCLD Required, Capacitance, and additional information. The analogue hardware is set up automatically in accordance with the selected transducer

CORRECTION FILTERS

For microphone Types 4189, 4190, 4191, 4192, 4193, 4950, 4952, 4964 and 4966, BZ-7228 is able to correct the frequency response to compensate for sound field and accessories

Calibration

Initial calibration for each transducer is stored for comparison with later calibrations

ACOUSTIC

Using Sound Calibrator Type 4231 or custom calibrator. The calibration process automatically detects the calibration level when Sound Calibrator Type 4231 is used

ELECTRICAL

Uses internally generated electrical signal combined with a typed-in value of microphone sensitivity

CALIBRATION HISTORY

Up to 20 of the last calibrations made are listed and can be viewed on the analyzer

Data Management

METADATA

Up to 30 metadata annotations can be set per project (text from keyboard or text from pick list, number from keyboard or auto-generated number)

PROJECT TEMPLATE

Defines the display and measurement set-ups. Set-ups can be locked and password-protected

PROJECT

Measurement data for all positions defined in source room (L1) and in receiving room (L2, B2 and T2) are stored with the Project Template

JOB

Projects are organized in jobs.

Explorer facilities for easy management of data (copy, cut, paste, delete, rename, open project, create job, set default project name)

REUSE OF DATA

Data for L1, B2 or T2 in one project can be re-used in another project

Measurement Control

Measurement Sequence: Supports measuring:

- at all microphone positions before using another source
- at a microphone position for all sources before measuring at a new position
- at subsequent microphone positions without source information
- at manually selected source and microphone positions

Measurements are started manually and can be automatically stored on completion of measurement

Generator (L1, L2 and T2): The noise generator is turned on and off automatically

Escape Time: 0 to 60 s

Build-up Time: 1 to 10 s

The generator can be turned on and off manually for checking equipment and sound levels

EXCITATION T2

Interrupted Noise: Measurements are started manually and can be automatically stored on completion of measurement

Number of Decays per Measurement: 1 to 100, ensemble averaged into one decay

Impulse: Manual start of first measurement. When level (say from starter pistol) exceeds the user-selected trigger level, the decay is recorded and backwards integration performed (Schroeder method). The trigger can then be armed automatically for measuring at the next position

Signal Recording: Recording of the Z-weighted measured signal can be done at each position*

BACK-ERASE

The last 5 s of data can be erased without resetting the measurement

* Signal recording requires an SD card or USB stick for data storage and a license for Signal Recording Option BZ-7226

Measurement Status

ON SCREEN

Information such as overload, awaiting trigger and running/paused are displayed on screen as icons

TRAFFIC LIGHTS

Red, yellow and green LEDs show measurement status and instantaneous overload as follows:

- Yellow LED flashing every 5 s = stopped, ready to measure
- Green LED flashing slowly = awaiting trigger or calibration signal
- Green LED on constantly = measuring
- Yellow LED flashing slowly = paused, measurement not stored
- Red LED flashing quickly = intermittent overload, calibration failed

NOTIFICATIONS

Sends an SMS or email daily at a specified time or if an alarm condition is fulfilled

Alarm Conditions:

- Disk Space below set value
- Trig. Input Voltage below set value
- Internal Battery enters set state
- Change in Measurement State

Specifications – Building Acoustics Software BZ-7228

Specifications apply to BZ-7228 unless otherwise stated.

2-channel Option BZ-7229 is for Type 2270 only

Standards

Conforms with the relevant parts of the following:

- IEC 61672 – 1 (2013) Class 1
- IEC 60651 (1979) plus Amendment 1 (1993–02) and Amendment 2 (2000–10), Type 1
- ANSI S1.4–1983 plus ANSI S1.4A–1985 Amendment, Type 1
- IEC 61260–1 (2014), 1/1-octave Bands and 1/3-octave Bands, Class 1
- IEC 61260 (1995–07) plus Amendment 1 (2001–09), 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI S1.11 – 1986, 1/1-octave Bands and 1/3-octave Bands, Order 3, Type 0–C
- ANSI S1.11 – 2004, 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI/ASA S1.11–2014 Part 1, 1/1-octave Bands and 1/3-octave Bands, Class 1
- ISO 16283, ISO 140, SS, DIN, Önorm, BS, BREW, Sia, UNI, NF-S31, NBE, NEN, NEN'06, ASTM, see tables under “Building Acoustics Standards”

Note: The international IEC standards are adopted as European standards by CENELEC. When this happens, the letters IEC are replaced with EN and the number is retained. Type 2250/2270 also conforms to these EN standards

Broadband Analysis

DETECTORS

A- and C-weighted: Broadband detectors with Fast exponential time weighting

Overload Detector: Monitors the overload outputs of all the frequency weighted channels

Underrange Detector: Monitors the under range of all the frequency weighted detectors. Underrange is set if level is below lower limit of linear operating range

Type 2270: Detectors available for both Ch. 1 and Ch. 2

MEASUREMENTS

L_{AF} and L_{CF} for display as numbers or quasi-analogue bars

MEASURING RANGES

When using Microphone Type 4189:

Dynamic Range: From typical noise floor to max. level for a 1 kHz pure tone signal, A-weighted:

- Single Range: 16.6 to 140 dB
- High Range: 28.5 to 140 dB
- Low Range: 16.6 to 110 dB

Primary Indicator Range: In accordance with IEC 60651, A-weighted:

- Single Range: 23.5 to 123 dB
- High Range: 41.7 to 123 dB

- Reboot of analyzer

Annotations

VOICE ANNOTATIONS

Voice annotations can be attached to measurements so that verbal comments can be stored together with the measurement

Playback: Playback of voice annotations can be listened to using an earphone/headphones connected to the headphone socket

Gain Adjustment: –60 dB to +60 dB

TEXT ANNOTATIONS

Text annotations can be attached to measurements so that written comments can be stored with the measurement

GPS ANNOTATIONS

A text annotation with GPS information can be attached (Latitude, Longitude, Altitude and position error). Requires connection to a GPS receiver

IMAGE ANNOTATIONS (TYPE 2270 ONLY)

Image annotations can be attached to measurements. Images can be viewed on the screen

- Low Range: 23.5 to 93 dB

Linear Operating Range: In accordance with IEC 61672, A-weighted: 1 kHz:

- Single Range: 24.8 to 140 dB
- High Range: 43.0 to 140 dB
- Low Range: 24.8 to 110 dB

Frequency Analysis

CENTRE FREQUENCIES

1/1-octave Band Centre Frequencies: 63 Hz to 8 kHz

1/3-octave Band Centre Frequencies: 50 Hz to 10 kHz

MEASURING RANGES

When using Microphone Type 4189:

Dynamic Range: From typical noise floor to max. level for a pure tone signal at 1 kHz 1/3-octave:

- Single Range: 1.1 to 140 dB
- High Range: 11.3 to 140 dB
- Low Range: 1.1 to 110 dB

Linear Operating Range: In accordance with IEC 61260:

- Single Range: ≤ 20.5 to 140 dB
- High Range: ≤ 39.1 to 140 dB
- Low Range: ≤ 20.5 to 110 dB

Internal Generator

Built-in pseudo-random noise generator

Spectrum: Selectable Pink or White

Crest Factor:

- Pink Noise: 4.4 (13 dB)
- White Noise: 3.6 (11 dB)

Bandwidth: Follows measurement frequency range

- Lower Limit: 50 Hz (1/3-oct.) or 63 Hz (oct.)
- Upper Limit: 10 kHz (1/3-oct.) or 8 kHz (oct.)

Output Level: Independent of bandwidth

- Max.: $1 V_{rms}$ (0 dB)
- Gain Adjustment: –80 to 0 dB

When bandwidth is changed, the level for all bands is automatically adjusted to comply with the set output level

Correction Filters: For sound sources Type 4292-L, Type 4295 and Type 4296: Flat or Optimum

Turn-on Time and Turn-off Time: Equivalent to RT = 70 ms

Repetition Period: 175 s

Output Connector: Output Socket

Control: See Measurement Control

External Generator

Selectable as alternative to internal generator

For controlling external noise generator

Levels: 0 V (Generator off), 3.3 V (Generator on)

Rise-time and Fall-time: 10 μ s
Control: See Measurement Control

Measurements

Measurements are done at a number of positions and categorized in functions (L1 for source room levels, L2 for receiving room levels, B2 for receiving room background noise levels and T2 for receiving room reverberation time measurements)

LEVELS L1, L2 AND B2

L_{ZF} spectrum for display only
 L_{Zeq} in 1/1-octave or 1/3-octave bands
 L1 and L2 simultaneously or as single channels

Averaging time: 1 s to 1 h

Range (L1 and L2 simultaneously only): Auto-range or manually set to High Range or Low Range

Averaging: Up to 10 source positions each with up to 10 measurement positions or up to 100 measurements may be averaged

Status Indications: Overload, under range, etc.

Crosstalk:

- 5 Hz – 10 kHz <– 110 dB
- 10 kHz – 20 kHz <– 100 dB

REVERBERATION TIME T2

T20 and T30 in 1/1-octave or 1/3-octave bands

Decays: L_{Zeq} spectra sampled at 5 ms intervals

Evaluation Range: –5 to –25 dB for T20 and –5 to –35 dB for T30

Measurement Time: Automatic selection of measurement time for the decays based on the actual reverberation time of the room

Maximum Measurement Time: From 2 to 20 s

Averaging: T20 and T30 measurements can be averaged (arithmetic averaging or ensemble averaging)

T20 and T30 Calculation: From slope in evaluation range

Slope Estimation: Least squares approximation

Quality Indicators: Quality indicators with status information like Overload, Curvature in %, etc.; extensive list of status information. Quality indicators are available on reverberation time spectra for each frequency band, and as overall quality indicators for each measurement position and for the averaged result

Reverberation Time Range: Max. 30 s, min. 0.1 – 0.7 s, depending on bandwidth and centre frequency

Manual Data Entry: A T2 value may be entered in any frequency band of a measured spectrum

Measurement Displays

OVERVIEW

Table of measurement positions for each function (L1, L2, B2 or T2) with readout for selectable frequency band on each position together with quality indicator.

Positions can be included/excluded from average

SOUND LEVEL SPECTRUM

LZF spectrum plus A and C broadband bars

L_{Zeq} spectrum for L1@Pos, L2@Pos, B2@Pos, L1, L2, B2, L1-L2, L2-B2
Y-axis: Range: 5, 10, 20, 40, 60, 80, 100, 120, 140 or 160 dB. Auto-zoom or auto-scale available

Cursor: Readout of selected band quality indicator for each frequency band

REVERBERATION TIME SPECTRUM

One or two spectra can be displayed

Y-axis: Range: 0.5, 1, 2, 5, 10 or 20 s. Auto-zoom available

Cursor: Readout of selected band quality indicator for each frequency band

SPECTRUM TABLE

One or two spectra can be displayed in tabular form

DECAY

Decay curve for a position or the room average available for each frequency band (if Ensemble Average selected)

Display of evaluation range and regression line

Readout of Curvature in %

Y-axis: Range: 5, 10, 20, 40, 60, 80, 100, 120, 140 or 160 dB. Auto-zoom or auto-scale available

Result Displays

OVERVIEW

Table of measurement positions for all functions (L1, L2, B2 or T2) with readout of quality indicators.

Positions can be included/excluded from result

CALCULATIONS

Shows the sound reduction index (spectrum and weighted) according to the selected standard, along with the reference curve (if any), or deviations (from the reference curve). See Table 2 under "Building Acoustics Measurement Standards"

Signal Monitoring

Input signal A-, C- or Z-weighted can be monitored using an earphone/headphones connected to the headphone socket

Headphone Signal: Input signal can be monitored using this socket with headphones/earphones

Gain Adjustment: –60 dB to 60 dB

Software Specifications – Signal Recording Option BZ-7226

Signal Recording Option BZ-7226 is enabled with a separate license. It works with all analyzer software: Sound Level Meter, Frequency Analysis, Logging Software, Enhanced Logging Software and Reverberation Time Software.

For data storage, signal recording requires:

- SD Card
- USB Memory Stick

RECORDED SIGNAL

A-, B-, C- or Z-weighted signal from the measurement transducer

AUTOMATIC GAIN CONTROL

The average level of the signal is kept within a 40 dB range, or the gain can be fixed

SAMPLING RATE AND PRE-RECORDING

The signal is buffered for the pre-recording of the signal. This allows the beginning of events to be recorded even if they are only detected later

SAMPLING RATE (KHZ)	MAXIMUM PRE-RECORDING (S)	SOUND QUALITY	MEMORY (KB/S)
8	470	Low	16
16	230	Fair	32
24	150	Medium	48
48	70	High	96

PLAYBACK

Playback of signal recordings can be listened to using the earphone/headphones connected to the headphone socket

RECORDING FORMAT

The recording format is either 24- or 16-bit wave files (extension .wav) attached to the data in the project, easily played back afterwards on a PC using BZ-5503. Calibration information is stored in the .wav file allowing BZ-5503 and BK Connect to analyse the recordings

STANDARDS

See Tables 1 and 2 under “Building Acoustics Measurement Standards”

LANGUAGES

English, French, German, Italian and Spanish

VIEWS

Result Level Views: A collection of views showing the resulting single values, reduction curve and underlying average curves (L1, L2, B2 and T20/T30)

Average Level Views: Each of the parameters (L1, L2 and B2) has a corresponding view showing all of the measurement curves included in the average calculation and a view of the resulting average curve.

In T20/T30 Average mode, it is possible to see all of the T20/T30s included in the average calculation. In Ensemble Average mode, it is possible to see the averaged 3D and averaged single frequency decay curves. Both modes gives the user the ability to see the resulting T20/T30 spectrum

Position Level Views: Each of the level measurements (L1, L2 and B2) can be viewed as a spectrum. In addition, the T2 reverberation measurement can be viewed as 3D-multispectra and as single frequency decay curves. Furthermore it is possible to see the calculated T20/T30 spectrum

Data Sheets: All of the measurement and the most relevant intermediate and final results can be viewed as values in a table (not decays)

CURSOR READ-OUT

All curves have cursor read-out

MANUAL INPUT

Allows graphical input and modification of the regression line in reverberation decay curves. Calculated sound reduction curves can

also be adjusted graphically (The impact on the single value index is shown simultaneously). To give maximum flexibility, position, average and calculated data can be overridden by manually inputting data in the data sheets

CALCULATIONS

Supports calculation of insulation and reverberation tasks. Insulation calculations include airborne and impact sound insulation (lab/field). In addition, airborne facade calculation is supported

REPORT GENERATION

Based on document templates it is possible to make reports conforming to the supported standards

OUTPUT

Relevant views and sheets can be printed or exported to the clipboard. Text or graphs may be transferred to word processors in RTF (rich text format)

HELP

Online context-sensitive and user guide

DATA TRANSFER

- Via USB using Measurement Partner Suite BZ-5503

MINIMUM PC

- Windows® 7, 8 or 8.1 (all in 32-bit or 64-bit versions)
- Intel® Core™ i3
- 2 GB RAM
- Sound card
- DVD drive
- Mouse

Ordering Information

Building Acoustics Kits

These kits provide Type 2250 and Type 2270 users with the necessary accessories to perform single-channel building acoustics measurements:

BZ-7228-200 Building Acoustics Kit for single-channel airborne sound insulation

includes:

- BZ-7228: Building Acoustics Software (includes Reverberation Time Software BZ-7227)
- Type 2734-A: Power Amplifier
- Type 4292-L: OmniPower™ Sound Source (tripod and carrying bag KE-0462 included)
- AO-0523-D-100: Signal Cable, Triaxial LEMO to XLR3M, 10 m (33 ft)
- AQ-0673: Speaker Cable, speakON® 4-pin (M) to speakON 4-pin (M), 10 m (33 ft)
- KE-0364: Carrying bag for Type 4292-L Tripod
- UA-0801: Tripod for Type 2250

BZ-7228-300 Building Acoustics Kit for single-channel airborne or impact sound insulation

includes the same items as BZ-7228-200 plus:

- Type 3207: Tapping Machine
- UA-1477: Battery Kit for Type 3207

TWO-CHANNEL MEASUREMENTS

Type 2270 users ONLY can upgrade a BZ-7228-200 or BZ-7228-300 kit to perform 2-channel building acoustics measurements with a combination the following accessories, depending on your measurement scenario:

- BZ-7229: 2-channel Option
- Type 4189: Prepolarized Free-field ½" Microphone
- AO-0697-D-100: Microphone Extension Cable, 10-pin LEMO, 10 m (33 ft)
- AR-0199: Flat Cable, 10-pin LEMO, 0.5 m (1.64 ft)
- JP-1041: Dual 10-pole Adaptor Cable
- UA-0801: Lightweight Tripod
- UA-1317: ½" Microphone Holder
- ZC-0032: Microphone Preamplifier

For help determining the type and quantity of required accessories, please contact your local HBK sales representative

Software and Accessories Available Separately

SOFTWARE MODULES

BZ-7228	Building Acoustics Software for Types 2250 and 2270
BZ-7228-100	Upgrade of Reverberation Time Software BZ-7227 to Building Acoustics Software BZ-7228
BZ-7229	2-channel Option Type 2270
BZ-7223	Frequency Analysis Software
BZ-7224	Logging Software
BZ-7225	Enhanced Logging Software
BZ-7225-UPG	Upgrade from Logging Software BZ-7224 to Enhanced Logging Software BZ-7225 (does not include memory card)
BZ-7226	Signal Recording Option
BZ-7227	Reverberation Time Software
BZ-7230	FFT Analysis Software
BZ-7231	Tone Assessment Option
BZ-7234	Enhanced Vibration and Low Frequency Option

PC SOFTWARE

Type 7830	Qualifier
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MEASUREMENT ACCESSORIES

Type 3923	Rotating Microphone Boom
Type 4231	Sound Calibrator
AO-0440-D-015	Signal Cable, LEMO to BNC, 1.5 m (5 ft)
AO-0646	Sound Cable, LEMO to Minijack, 1.5 m (5 ft)
AO-0697-030	Microphone Extension Cable, 10-pin LEMO, 3 m (10 ft)
AO-0697-100	Microphone Extension Cable, 10-pin LEMO, 10 m (33 ft)
AR-0199	Flat Cable, 10-pin LEMO, 0.5 m (1.64 ft)

JP-1041

KE-0449

UA-0750

UA-0801

UA-1317

UL-0256

UL-0256-A

UL-1009

UL-1017

ZG-0444

HBK supplies a wide range of Brüel & Kjær microphones and microphone accessories. Please contact your local HBK office for more information regarding the different types and their use, or visit the website at www.bksv.com.

INTERFACING

AO-1449-D-010	LAN Cable
UL-0250	USB to RS-232 Converter
UL-1050	Wireless USB-A Adaptor

SOUND SOURCES

Type 4292-L	OmniPower Sound Source
Type 3207	Tapping Machine
Type 2734-A	Power Amplifier
Type 2734-B	Power Amplifier with Wireless Audio System
UL-0256	

For further information please refer to the Sound Sources for Building Acoustics product data, [BP 1689](#)

Service Products

ACCREDITED CALIBRATION

SLM-ADV-CAF	SLM Advanced, Accredited Calibration incl. microphone
SLM-ADV-CAI	SLM Advanced, Initial Accredited Calibration incl. microphone

HARDWARE MAINTENANCE

2250-EW1	Extended Warranty of Type 2250, one year extension
2270-EW1	Extended Warranty of Type 2270, one year extension

