Hand-held Analyzers – Type 2250 and Type 2270, with Building Acoustics Software BZ-7228, Dual-channel Building Acoustics Software BZ-7229 and Qualifier Type 7830

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, and minimum standards are set in the building regulations of each country.

BZ-7228 software is available for Hand-held Analyzers Type 2250 (2250-J) and Type 2270 (2270-J). It provides the flexibility, ease of use and confidence in your results that field measurements require in building acoustics.

BZ-7229 software turns Type 2270 into a dual-channel building acoustics analyzer (2270-K).

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

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USES AND FEATURES

USES (BZ-7228 and BZ-7229)
- Measurement of:
  – Airborne sound insulation
  – Façade sound insulation
  – Impact sound insulation

FEATURES (BZ-7228 and BZ-7229)
- Complete hand-held building acoustics analyzer
- Measures source and receiving room level spectra
  – Built-in pink and white noise generator
  – Equalisation of sound source spectra
- Measures reverberation time spectra:
  – Impulse and Interrupted Noise methods
  – Built-in pink and white noise generator
- Measurement position management
- Calculates final results on the spot
  – ISO plus 12 national standards
- Measurement quality indicators

- Colour touch screen user interface
- Sound recording, voice commentary and integrated camera (Type 2270 only) to document test environment
- Single-channel measurements (Type 2250 and 2270)
- Dual-channel measurements (Type 2270 only)
- Complete systems available (single- or dual-channel) including airborne and impact sound sources

FEATURES (TYPE 7830)
- Calculate building acoustics results
- Analyse measurement results
- User data input, copy/paste and export facilities
- Document, archive and report results
- Standard and free report formats
- ISO plus 12 national standards

Brüel & Kjær

The Hand-held Analyzer

Fig. 1
Hand-held Analyzers
Type 2250 and 2270

Types 2250 and 2270 are robust, hand-held instrument 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.

Easy to use – their robust, light and ergonomic design make them easy to grip, hold and operate single-handedly. Their high-resolution colour touch screens show the instrument setup, status and data at a glance, and let you select what you want to see with the tap of a stylus. The "traffic light" indicator, positioned centrally on the pushbutton panel, shows you the current measurement status, even from a distance.

The Hand-held Analyzers are built for the tough environment of field measurements. They will work reliably in rain, dust, heat, frost, day or night, or on a tripod.

For documentation, you can add spoken or written comments to your measurements, and make sound recordings during any of the measurements. (Note that sound recording requires the Sound Recording Option BZ-7226.)

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

Tasks in Building Acoustics

The most common task in building acoustics measurements is airborne sound insulation and Fig. 2 shows a typical configuration for this task.

Fig. 2
Typical configuration for building acoustics measurements: sound source, generator, analyzer and PC for reporting
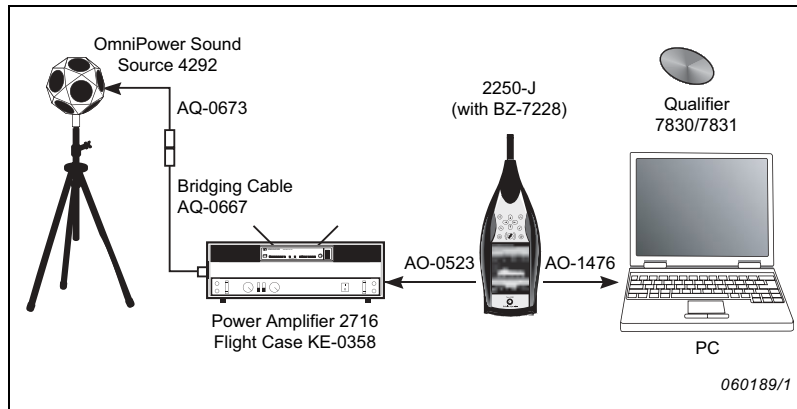
Fig. 3 shows a typical airborne task setup using a loudspeaker (emitting pink noise) and a number of microphone positions to measure the average source room spectrum L1, and the average receiving room spectrum L2.

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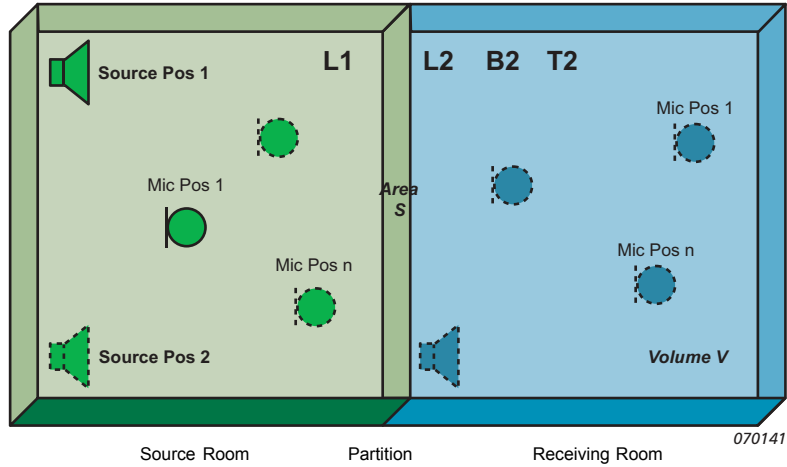
The sound level depends on the position in the rooms, so several microphone positions are used to measure the average of the source room level, L1, the average of the receiving room level L2 and the average of the background noise level B2. The average reverberation time T2 is also measured using several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

In Touch with your Measurements

The spectra required (L1, L2, etc.,) may be measured in any order, to suit field conditions and your preferences. Fig. 4, Fig. 5 and Fig. 6 show typical displays when performing both single- and dual-channel building acoustics measurements.

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 display when you are ready to measure the first L2 position, with source position 1*
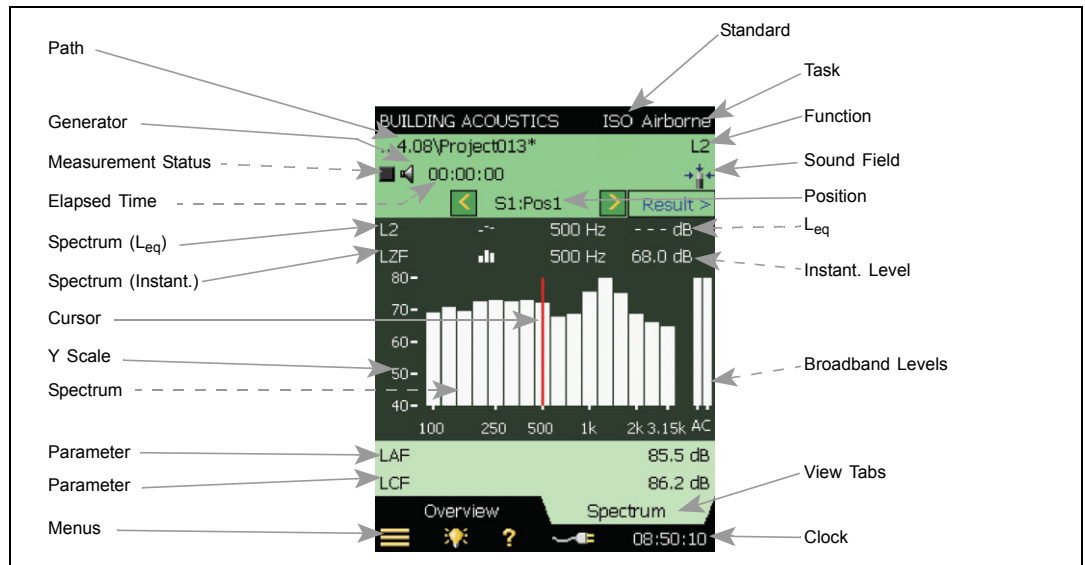
The instantaneous (live) spectrum is shown and the high-resolution, colour, touch screen shows the setup, status and data at a glance.

Using the stylus (or navigation pushbuttons) you can directly activate the indicated features (except those with dashed lines in Fig. 4 above).

You can check the generator and loudspeaker signal level by tapping the Generator icon to switch the generator on and off.

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Fig. 5

*Typical single-channel
display
Left: inspection phase
Right: save phase*

*Fig. 5
Typical single-channel display
Left: inspection phase
Right: save phase*
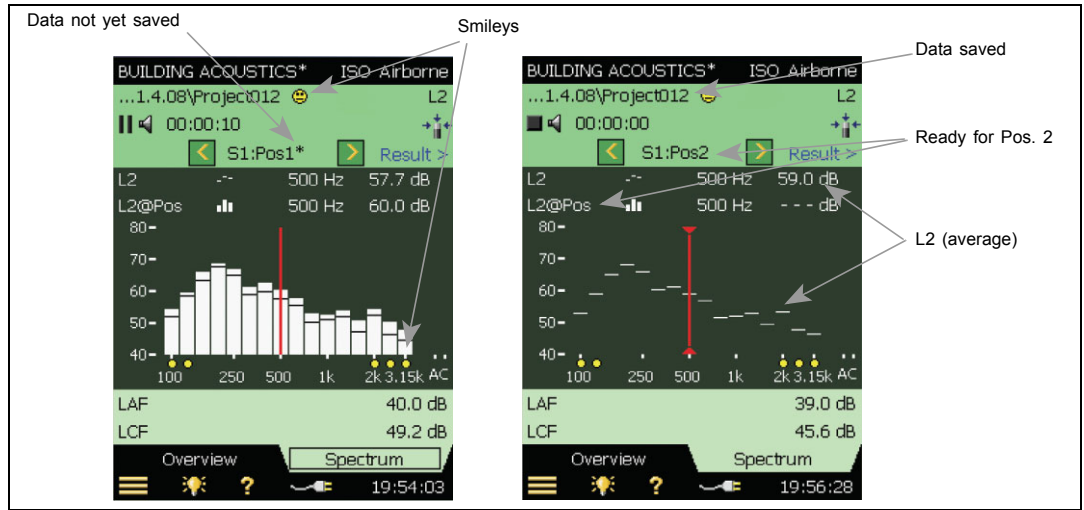
Once the spectrum at position 1 has been measured (for the preset time of 10 s), you may inspect the spectrum before saving (see Fig. 5, left).

A yellow 'smiley' icon indicates that you may be able to improve the measurement at one frequency band. Tap the smiley icon to read the explanation and take the necessary action.

Press the Save pushbutton to save the measurement (see Fig. 5, right). You are now ready to measure at position 2.

*Fig. 6
Left: Typical dual-channel inspection phase – Façade Sound Insulation is measured with traffic noise as a source. This is indicated by the car 'traffic' icon
Centre: Dual-channel save phase – overview
Right: Type 2270 connected to two microphones through the Dual 10-pole Adaptor (right)*
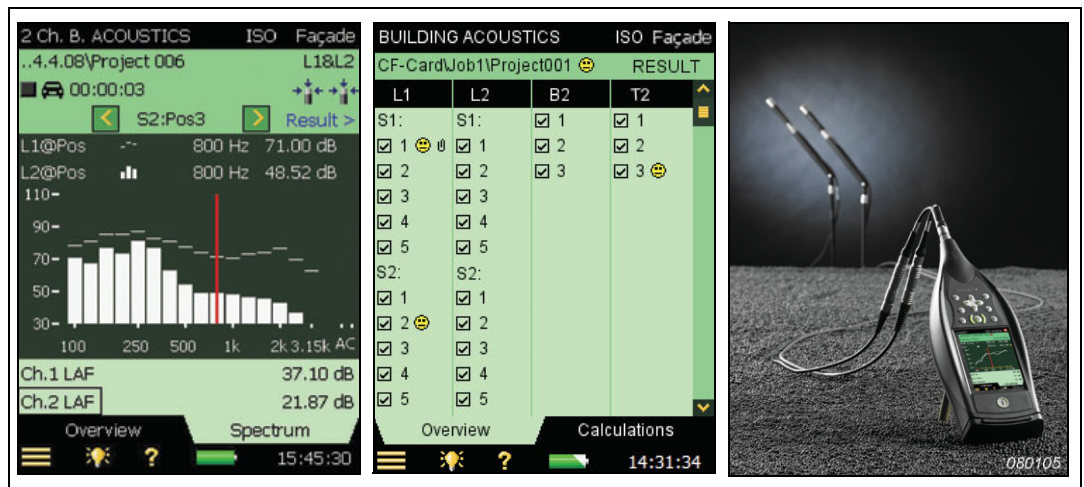
Dual-channel measurements (Type 2270) are as easy as single-channel measurements (Types 2250 and 2270).

In Fig. 6 (left), L1 and L2 Position 3 has been measured and saved. You are now ready to measure in the next dual position.

The Overview tab view (Fig. 6, centre) shows all the measured and saved positions, with any smiley icons and annotations (paper clip icon). Any position may be excluded from the average calculation by tapping the check mark.

Reverberation Time

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. The Reverberation Time may range from 0.1 seconds (or less) in anechoic chambers, to 10 or more seconds in large public spaces.

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

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 using either Impulsive Excitation (Schroeder Method), from a starting pistol or balloon burst, or by using Interrupted Noise (see Fig. 7).

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 up to 20 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 included in Fig. 8 (left). A yellow 'smiley' icon indicates that you may be able to improve the measurement at one (or more) frequency bands – if just one position shows a red smiley, then the 'master' smiley will also be red. Tap the relevant smiley icon to read the explanation. A reverberation decay curve for 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).

Note: A dedicated Reverberation Time Software module (BZ-7227) is also available. Please contact your Brüel & Kjær representative for details.

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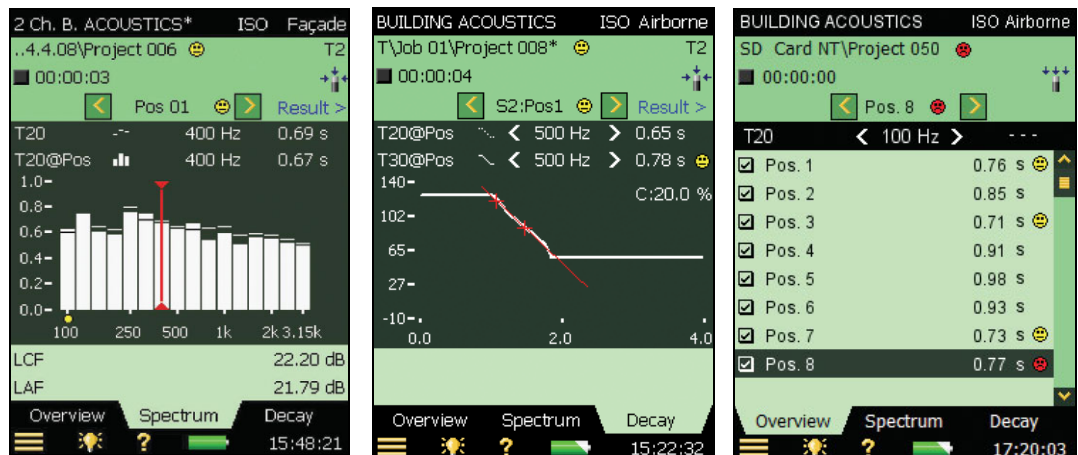
Standards

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, and the calculated parameters in Table 2, see page 10.

Results

In addition to measurement data, you may also need the receiving room volume and the partition area for some calculations. These can of course be entered using the stylus/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 re-use facility in the Explorer display.

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 you will know on site if your construction under test fulfils the minimum requirements of the local building regulations.

Examples of final results are shown in Fig. 9.

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
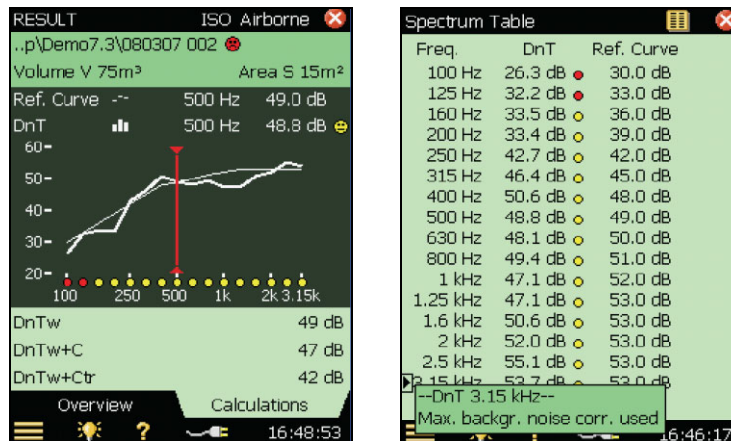
Other Tasks

Façade Sound Insulation

Façade 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 dual-channel measurements (Type 2270). The outdoor microphone positions are flush with the facade, or 2 m in front of it. Calculations are similar to those of the airborne sound insulation, but take the pressure increase at the microphone positions into account.

Impact Sound Insulation

Impact sound is typically caused by footsteps, and to measure impact sound insulation a standardised 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

In the field, using a wireless system can speed up measurements by reducing the number of cables and make it easier for you to move between microphone positions and rooms.

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

Archive and Export using Utility Software BZ-5503

Utility Software for Hand-held Analyzers (BZ-5503) is a PC archiving tool for Types 2250 and 2270 data and setups, providing the link between the hand-held analyzers and your PC. Using the browsing and overview facilities of BZ-5503 software, you select the data you want to export for post-processing, as illustrated in Fig. 11.

Fig. 11
Screenshot of a typical BZ-5503 building acoustics overview, including the Export menu for a building acoustics project to Qualifier Type 7830
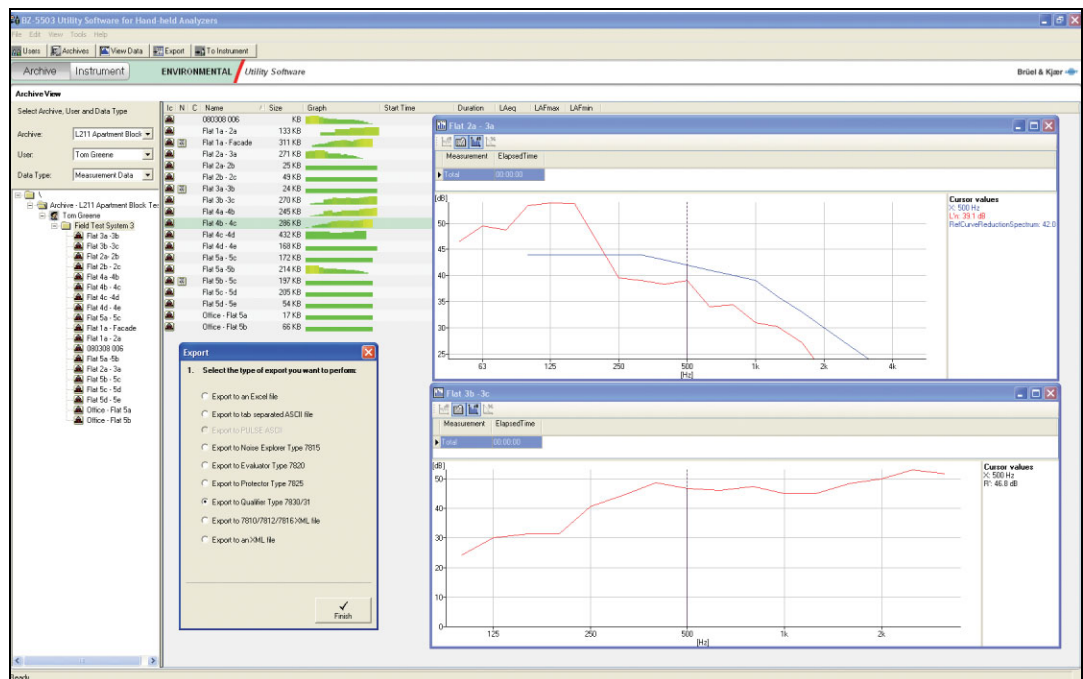
BZ-5503 Features

Control Type 2250/2270 from a PC
- Create users on hand-held analyzers
- Manage data on hand-held analyzers
- Transfer data to hand-held analyzers
- Create, edit and transfer setups to hand-held analyzers
- Remote control of analyzer via USB, or LAN

Manage and Archive Data on your PC
- Transfer data and setups from Type 2250/2270 to an archive on your PC
- Transfer data and setups between SD- and CF-Cards and an archive
- Keep data in archives, organised in job folders, per user – the way you organise data in Type 2250/2270
- See an overview of measurement data
- Export data to Type 7815, 7820, 7825, 7830 and 7831 for post-processing and reporting
- Export data to Microsoft® Excel® or as XML files

Keep your Type 2250/2270 Software Up-to-Date
- Update software
- Install licences

Reviewing and Reporting using Qualifier Type 7830

With Qualifier Type 7830, you can view, recalculate, document and report your data.

Viewing and Recalculating your Data
You can view any measured and calculated data just as you can in Type 2250/2270. In addition you can recalculate results including your selection and adjustment of data. The adjustment options include graphical alignment of reverberation decays, manual data entry, copy/paste of data and change of calculation standard (if the measured data is compatible). Any change of data is annotated as such in the user interface.

Fig. 12
Typical screen view of Qualifier Type 7830. On the left is a project tree for browsing and copy/paste of data folders. On the right, an airborne sound reduction index curve, a reverberation time 3-D plot and a table of measured data and results.
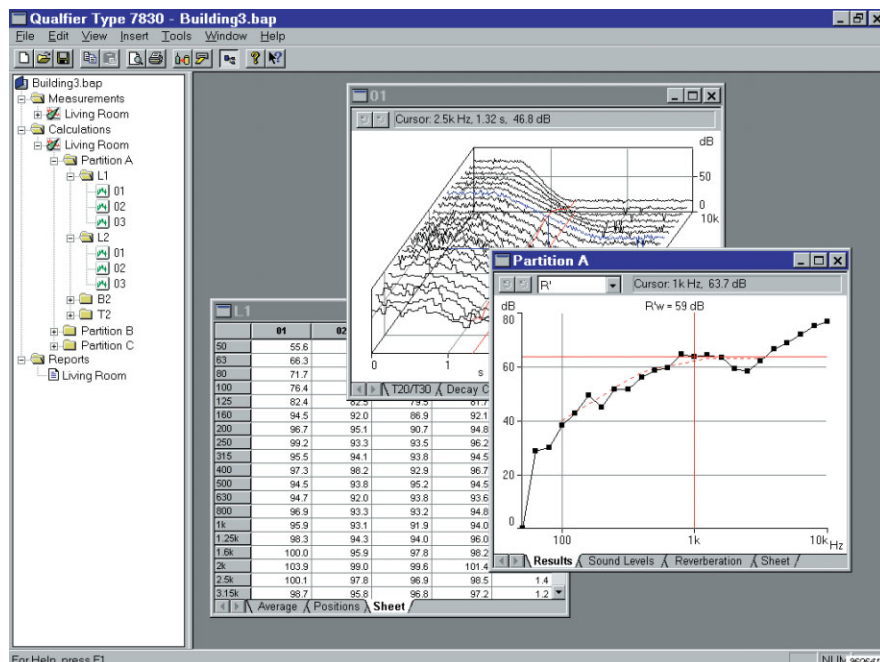
Reporting your Data
A customisable and a standard form report are available for your calculations (or recalculations).

Fig. 13
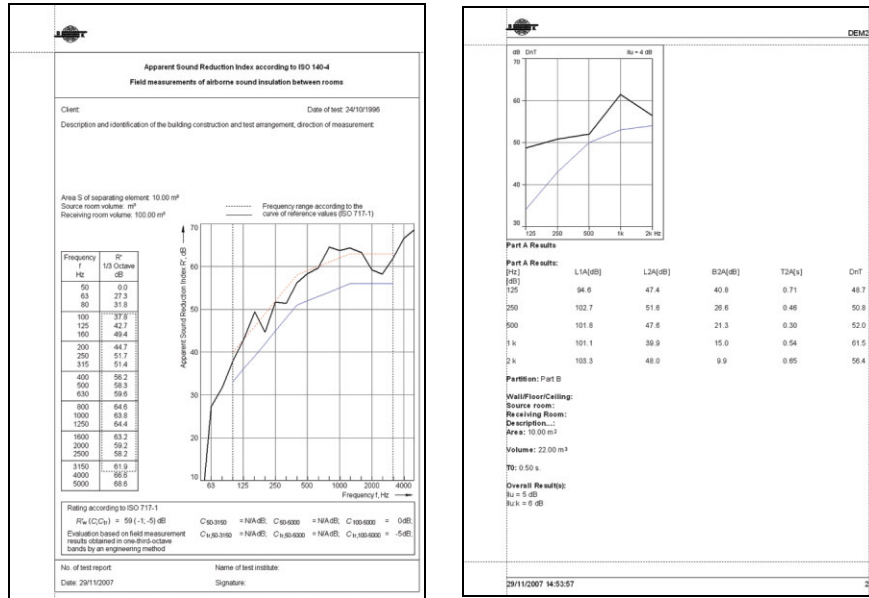*Example of a report in standard template format, e.g., ISO 140 A standard template is available for selected national and international standards.*
You may include your company's logo in the report

Complete System

Type 2250-J, Type 2270-J and Type 2270-K are complete hand-held analyzers needing only a sound source to measure building acoustics and provide sound insulation indices on the spot. However, a wide selection of accessories are available to extend the applications, 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 dual channel application (2270-J)
• Wireless transmission of generator signal and wireless remote control of tapping machine
• Rotating microphone boom
• Calibrators

Some of the options are shown in Fig. 14. Please refer to separate product data sheets for details. Ask your local Brüel & Kjær representative for more informaton on complete systems.

Fig. 14
Accessories for building acoustics measurements

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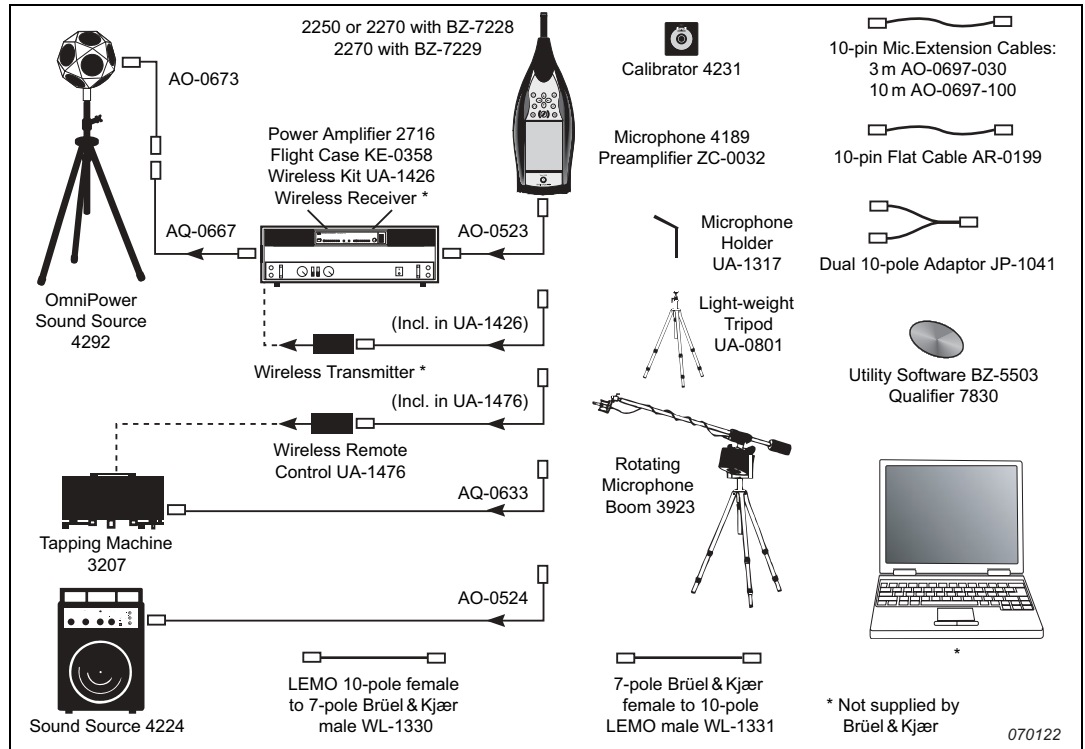
Building Acoustic Standards

Table 1 Building acoustics standards

Measurement		Sweden	Germany	Austria	UK	England Wales	Switzerland	Italy	France	Spain	Netherlands		USA
	ISO	SS	DIN	ÖNORM	BS	BREW	Sia	UNI	NF-S31	NBE	NEN	NEN'06	ASTM
Typical Parameters	R' $L'n$	R' $L'n$	R $L'n$	DnT $L'nT$	DnT $L'nT$	DnT	DnT $L'nT$	Dn Ln	$DnAT$ $LnAT$	$DnAT$ $LnAT$	Ilu Ico	DnT,A LnT,A	FTL Ln
Airborne Lab	140-3	EN 20140-3	EN 20140-3	S 5101	EN 20140-3			8270-1	051	74-040-84/3			
Airborne Field	140-4	EN 20140-4	52210-1	S 5100-1	2750-4	BREW	181	8270-4	054, -057	74-040-84/4	5077	5077	E336-90
Airborne Façade	140-5	EN 20140-5	52210-5	S 5100-3	2750-5		181	8270-5	055, -057	74-040-84/5	5077	5077	E966-90
Impact Lab	140-6	EN 20140-6	52210-1	S 5101	2750-6			8270-6	-052	74-040-84/6			
Impact Field	140-7	EN 20140-7	52210-1	S 5100-2	2750-7		181	8270-4	056, -057	74-040-84/7	5077		E1007-90
RT	3382-2		52212								5077	5077	
Rating Airborne	717-1	SS-ISO717-1	52210-4	S5100-1	5821-1,-3	BS EN 717-1	181	8270-7	-057	NBECA-88	5077	NPR 5079	E413-73 E1332-90
Rating Impact	717-2	SS-ISO717-2	52210-4	S5100-2	5821-2		181	8270-7	-057	NBECA-88	5077		E989

Calculated Parameters

Table 2 Calculated parameters

Standard	ISO, DIN, ÖNORM, UNI, BS, BREW	SS	Sia	NF	NBE	NEN	NEN'06	ASTM
Basic Standards	ISO 140 ISO 717	ISO 140 ISO 717	ISO 140 ISO 717	NF S31-05x	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	DnT --- Ilu Ilu;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 Dtr2m,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	Gi --- G_A $G_{A;K}$	Gi --- G_A $G_{A;K}$	OILR OITL --- OITC
Impact: Calculated parameters	L´nt 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	LnT --- Ico	---	Ln --- IIC

Accredited Calibration Services at Brüel & Kjær

To ensure traceable measurement history from day one, you can order accredited calibration with your new Type 2250/2270.

We recommend that your Type 2250/2270 is calibrated in a Brüel & Kjær ISO 17025 certified laboratory bi-annually or annually. If any errors are detected by the technician during calibration, repair will be performed prior to returning the instrument to you.

Compliance with Standards

CE C	CE-mark indicates compliance with the EMC Directive and Low Voltage Directive. C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand.
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. CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Rules, Part 15: Complies with the limits for a Class B digital device. IEC 61672–1, IEC 61260, IEC 60651 and IEC 60804: Instrumentation standards. Complies with Canadian standard ICES–001
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

Type 2250/2270 Platform

Specifications apply to Type 2250/2270 fitted with Microphone Type 4189 and Microphone Preamplifier ZC-0032 and used as a single-channel instrument, indicated as Single Range, unless otherwise stated. For Type 2270 used as a dual-channel instrument measuring both channels simultaneously, the full measuring range is covered in two ranges. High Range indicates the least sensitive range and Low Range indicates the most sensitive range

SUPPLIED MICROPHONE
Type 4189: Prepolarized 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)

MICROPHONE PREAMPLIFIER 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
Accessory Detection: Windscreen UA-1650 can be automatically detected when fitted over ZC-0032

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

KEYBOARD
Pushbuttons: 11 keys with backlight, optimised for measurement control and screen navigation

ON-OFF BUTTON
Function: Press for 1 s to turn on; press for 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 touch screen
240 × 320 dot matrix
Colour Schemes: Five different – optimised for different usage scenarios (day, night, etc.)
Backlight: Adjustable level and on-time

USER INTERFACE
Measurement Control: Using pushbuttons on keyboard
Setup and Display of Results: Using stylus on touch screen or pushbuttons on keyboard
Lock: Keyboard and touch screen can be locked and unlocked

USB INTERFACE
USB 1.1 OTG Mini B socket

MODEM INTERFACE
Hayes compatible GSM or standard analogue modems connected through the Compact Flash slot

COMPACT FLASH SOCKET
For connecting CF memory card, CF modem or CF LAN Interface

LAN INTERFACE SOCKET (TYPE 2270 ONLY)
Connector: RJ 45
Speed: 10 Mbps
Protocol: TCP/IP

INPUT SOCKET (2 – TYPE 2270 ONLY)
Connector: Triaxial LEMO
Input Impedance: $\geq 1\,M\Omega$
Direct Input: Max. input voltage: $\pm 14.14\,V_{peak}$
CCLD Input: Max. input voltage: $\pm 7.07\,V_{peak}$
CCLD Current/voltage: $4\,mA/25\,V$

TRIGGER SOCKET
Connector: Triaxial LEMO
Max. Input Voltage: $\pm 20\,V_{peak}$
Input Impedance: $> 47\,k\Omega$

OUTPUT SOCKET
Connector: Triaxial LEMO
Max. Peak Output Level: $\pm 4.46\,V$
Output Impedance: $50\,\Omega$

HEADPHONE SOCKET
Connector: 3.5 mm Minijack stereo socket
Max. Peak Output Level: $\pm 1.4\,V$
Output Impedance: $32\,\Omega$ in each channel

MICROPHONE FOR COMMENTARY
Microphone, which utilises Automatic Gain Control (AGC), is incorporated on underside of instrument. Used to create voice annotations for attaching to measurements

CAMERA (TYPE 2270 ONLY)
Camera with fixed focus and automatic exposure is incorporated on underside of instrument.
Used to create image annotations for attaching to measurements
Image Size: 640×480
Viewfinder size: 212×160
Format: jpg with exif information

EXTERNAL DC POWER SUPPLY REQUIREMENTS
Used to charge the battery pack in the instrument
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

BATTERY PACK
Type: Li-Ion rechargeable
Typical Operating Time: > 8 hours

STORAGE SYSTEM
Internal Flash-RAM (non-volatile): 20 Mbyte for user setups and measurement data
External Secure Digital Memory Card (SD-card): For store/recall of measurement data

External Compact Flash Memory Card (CF-card): For store/recall of measurement data

CLOCK
Back-up battery powered clock. Drift $< 0.45\,s$ per 24 hour period

WARM-UP TIME
From Power Off: < 2 minutes
From Standby: < 10 seconds for prepolarized microphones

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), $< 0.1\,dB$
Storage Temperature: -25 to $+70°C$ (-13 to $+158°F$)

HUMIDITY
IEC 60068–2–78: Damp Heat: 90% RH
(non-condensing at 40°C (104°F)).
Effect of Humidity: $< 0.1\,dB$ for 0% $< RH < 90\%$ (at 40°C (104°F) and 1 kHz)

MECHANICAL
Environmental Protection: IP44
Non-operating:
IEC 60068–2–6: Vibration: 0.3 mm, $20\,m/s^2$, $10 - 500\,Hz$
IEC 60068–2–27: Shock: $1000\,m/s^2$
IEC 60068–2–29: Bump: 4000 bumps at $400\,m/s^2$

WEIGHT AND DIMENSIONS
650 g (23 oz.) including rechargeable battery
$300 \times 93 \times 50$ mm ($11.8 \times 3.7 \times 1.9''$) including preamplifier and microphone

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, Croatian, Czech, Danish, English, Flemish, French, German, Hungarian, Japanese, Italian, Polish, Portuguese, Romanian, Serbian, Slovenian, Spanish, Swedish and Turkish

HELP
Concise context-sensitive help in Chinese, English, French, German, Italian, Japanese, Polish, Portuguese, Romanian, Serbian, Slovenian and Spanish

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Software Specifications – Building Acoustics Software BZ-7228 and Dual-Channel Building Acoustics Software BZ-7229

Specifications apply to BZ-7228 and BZ-7229 unless otherwise stated. Dual-Channel Building Acoustics Software BZ-7229 is for Type 2270 only

STANDARDS
Conforms with the relevant parts of the following:
• IEC 61672–1 (2002–05) 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 (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

• ISO, SS, DIN, Önorm, BS, BREW, Sia, UNI, NF-S31, NBE, NEN, NEN'06, ASTM, see tables 1 and 2
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

CHANNELS (TYPE 2270 ONLY)
All measurements are made from either Ch. 1 or Ch. 2 or both simultaneously

TRANSDUCERS
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, 4193, 4950 and 4952, BZ-7228/7229 are able to correct the frequency response to compensate for sound field and accessories

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
Under Range Detector: Monitors the under range of all the frequency weighted detectors when set to High Range. Under range 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
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: $\leq$20.5 to 140 dB
High Range: $\leq$39.1 to 140 dB
Low Range: $\leq$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, 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 μs
Control: See Measurement Control

Measurements

Measurements are done at a number of positions and categorised 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 hour
Range (L1 and L2 simultaneously only): Autorange 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. 20 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 on page 10

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
Sound Recording: Recording of the Z-weighted measured signal can be done at each position
Sound Recording requires a CF or SD Card for data storage
Sound Recording requires license for Sound Recording Option BZ-7226

Measurement Status

On Screen: Information such as *overload*, *awaiting trigger* and *running/paused* are displayed on screen as icons or text
Traffic Light: 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

Calibration

Initial calibration 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 instrument

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

Voice Annotations

Voice annotations can be attached to the building acoustics project and to measurements at each position
Playback: Playback of voice annotations or sound recordings can be listened to using earphone/headphones connected to the headphone socket
Gain Adjustment: −60 dB to 0 dB

Text & Image Annotations

Text and image (Type 2270 only) annotations can be attached to the building acoustics project and to measurements at each position

Data Management

Project Template: Defines the display and measurement setups
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
Re-use of data: Data for L1, B2 or T2 in one project can be re-used in another project
Job: Projects are organised in Jobs
Explorer facilities for easy management of data (copy, cut, paste, delete, rename, view data, open project, create job, set default project name)
Note: For specifications and details on Qualifier Type 7830, please refer to Product Data BP 1691

Software Specifications – Sound Recording Option BZ-7226

Sound Recording Option BZ-7226 is enabled with a separate license.
Sound Recording requires a CF or SD Card for data storage

RECORDED SIGNAL
Z-weighted signal from the measurement transducer

SAMPLING RATE AND PRE-RECORDING
Sound is buffered for the pre-recording of sound. This allows the beginning of events to be recorded even if they are only detected later

FUNCTIONS WITH BZ-7228 AND BZ-7229
Automatic Control of Recording: Start of recording when measurement is started

Sampling Rate (kHz)	Maximum Pre-recording (s)	Sound Quality	Memory (KB/s)
8	100	Low	16
16	50	Fair	32
24	30	Medium	48
48	10	High	96

PLAYBACK

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

RECORDING FORMAT

The recording format is 16-bit wave files (* .wav) attached to the data in the project, easily played-back afterwards. Calibration information is stored in the WAV file, allowing PULSE (the Brüel & Kjær Analyzer Platform) to analyse the recordings

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Software Specifications – Utility Software for Hand-held Analyzers BZ-5503

BZ-5503 is included with Type 2250/2270 for easy synchronisation of setups and data between PC and Type 2250/2270. BZ-5503 is supplied with Environmental Software BZ-5298 on CD-ROM

ON-LINE DISPLAY OF TYPE 2250/2270 DATA

Measurements on Type 2250/2270 can be controlled from the PC and displayed on-line with the PC, using the same user interface on the PC as on Type 2250/2270

DATA MANAGEMENT

Explorer: Facilities for easy management of Instruments, Users, Jobs, Projects and Project Templates (copy, cut, paste, delete, rename, create)
Data Viewer: View measurement data (results of projects)
Template Editor: Editor for changing setups in Project Templates
Synchronisation: Project Templates and Projects for a specific user can be synchronised between PC and Type 2250/2270

USERS

Users of Type 2250/2270 can be created or deleted

EXPORT FACILITIES

Excel: Projects (or user specified parts) can be exported to Microsoft® Excel®
Type 7830: Building acoustics projects can be exported to Qualifier Type 7830

TYPE 2250/2270 SOFTWARE UPGRADES AND LICENSES

The utility software controls Type 2250/2270 software upgrades and licensing of the Type 2250/2270 applications

INTERFACE TO TYPE 2250/2270

USB ver. 1.1, or Hayes compatible GSM or standard analogue modem

PC REQUIREMENT

Operating System: Windows® 2000/Windows® XP/Windows Vista®, Microsoft®.NET
Recommended PC: Pentium® III (or equivalent) processor, 1024 Mbyte RAM, SVGA graphics display/adaptor, sound card, CD ROM drive, mouse, USB, Windows® XP

Ordering Information

Type 2250-J	Hand-held Analyzer Type 2250 with Sound Level Meter Software BZ-7222 and Building Acoustics Software BZ-7228
Type 2270-J	Hand-held Analyzer Type 2270 with Sound Level Meter Software BZ-7222 and Building Acoustics Software BZ-7228
Type 2270-K	Hand-held Analyzer Type 2270 with Sound Level Meter Software BZ-7222 and Dual-channel Building Acoustics Software BZ-7229
Type 2250-J-001	Building Acoustics System including Type 2250-J, OmniPower Sound Source Type 4292 and Power Amplifier Type 2716
Type 2270-J-001	Building Acoustics System including Type 2270-J, OmniPower Sound Source Type 4292 and Power Amplifier Type 2716
Type 2270-K-001	Dual-channel Building Acoustics System including Type 2270-K, OmniPower Sound Source Type 4292 and Power Amplifier Type 2716
BZ-7228-200	Building Acoustics Kit as per Type 2250-J-001, or Type 2270-J-001, excluding Hand-held Analyzer (for Types 2250 & 2270 users intending to upgrade to a full Building Acoustics measurement system)
BZ-7229-200	Dual-channel Building Acoustics Kit as per Type 2270-K-001, excluding Type 2270 (for Type 2270 users intending to upgrade to a full Dual-channel Building Acoustics measurement system)

COMPONENTS INCLUDED WITH TYPES 2250-J, 2270-J AND 2270-K HAND-HELD ANALYZERS

BZ-7222	Sound Level Meter Application
BZ-7228	Building Acoustics Software[a]
Type 4189	Prepolarized Free-field 1/2″ Microphone
ZC-0032	Microphone Preamplifier
AO-1476	USB Standard A to USB Mini B Interface Cable, 1.8 m (6 ft)

BZ-5298	Environmental Software, including BZ-5503 Utility Software for Hand-held Analyzers
UA-1650	90 mm dia. Windscreen with AutoDetect
UA-1651	Tripod Extension for Hand-held Analyzer
UA-1673	Adaptor for Standard Tripod Mount
DH-0696	Wrist Strap
KE-0440	Travel Bag
KE-0441	Protective Cover
FB-0699	Hinged Cover for Type 2270
FB-0679	Hinged Cover for Type 2250
	HT-0015Earphones
UA-1654	Five Extra Styli
AO-1449	LAN Interface Cable (Type 2270 only)
QB-0061	Battery Pack
ZG-0426	Mains Power Supply

COMPONENTS INCLUDED WITH TYPE 2250-J-001 AND 2270-J-001 SYSTEMS

Type 2250-J or 2270-J plus the following:

Type 4292	OmniPower Sound Source (Tripod included)
Type 2716	Power Amplifier
Type 4231	Sound Calibrator Class 1 and LS, 94 and 114 dB, 1 kHz
KE-0358	Carrying case for Type 2716 Amplifier, Hand-held Analyzer and Wireless Receiver
KE-0449	Flight Case for Type 4292 OmniPower Sound Source
KE-0364	Carrying Bag for Type 4292 Loudspeaker Tripod
UA-0801	Lightweight Tripod
UA-1426	Mounting Kit for wireless transmission with Hand-held Analyzer, Type 2716 and Type 4292, requires receiver/pocket transmitter
UA-0237	Windscreen for 1/2″ microphones, 90 mm diameter
AQ-0667	Bridging Cable for Type 2716
AO-0523-D-100	Signal cable, Triaxial LEMO to XLR3M, 10 m (33 ft)
Type 7830	Qualifier – software for reporting of results on PC

Note: These systems do not include a wireless transmitter receiver unit. Please contact your local Brüel & Kjær office for further information.

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a. For Type 2270-K, BZ-7228 is replaced by BZ-7229 Dual-channel Building Acoustics Software.

COMPONENTS INCLUDED WITH TYPE 2270-K-001 SYSTEM

Type 2270-K plus the following:

Type 4292	OmniPower Sound Source (Tripod included)
Type 2716	Power Amplifier
Type 4231	Sound Calibrator Class 1 and LS, 94 and 114 dB, 1 kHz
KE-0358	Carrying case for Type 2716 Amplifier, Hand-held Analyzer and Wireless Receiver
KE-0449	Flight Case for Type 4292 OmniPower Sound Source
KE-0364	Carrying Bag for Type 4292 Loudspeaker Tripod
UA-1426	Mounting Kit for wireless transmission with Hand-held Analyzer, Type 2716 and Type 4292, requires receiver/pocket transmitter
AQ-0667	Bridging Cable for Type 2716
AO-0523-D-100	Signal cable, Triaxial LEMO to XLR3M, 10 m (33 ft)
3 × UA-0801	Lightweight Tripod
Type 4189	Prepolarized Free-field 1/2″ Microphone
ZC-0032	Microphone Preamplifier (for Type 2270)
JP-1041	Dual 10-pole Adaptor
AR-0199	Flat cable, 10-pin LEMO, 1 m (3.3 ft)
2 × UA-1317	1/2″ Microphone Holder
2 × UA-0237	Windscreen for 1/2″ microphones, 90 mm diameter
2 × AO-0697-100	Microphone Extension Cable, 10-pin LEMO, 10 m (33 ft)
Type 7830	Qualifier – software for reporting of results on PC

Note: This system does not include a wireless transmitter receiver unit. Please contact your local Brüel & Kjær office for further information

SOFTWARE MODULES AVAILABLE SEPARATELY

BZ-7228	Building Acoustics Software for Types 2250 and 2270
BZ-7228-100	Upgrade of BZ-7227 Reverberation Time software to BZ-7228 Building Acoustics Software
BZ-7229	Dual-channel Building Acoustics Software for Type 2270
BZ-7229-100	Upgrade of BZ-7228 to BZ-7229 Dual-channel Building Acoustics for 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	Sound Recording Option (requires SD or CF memory card for Analyzer)
BZ-7227	Reverberation Time Software
BZ-7230	FFT Analysis Software
BZ-7231	Tone Assessment Option

PC SOFTWARE

Type BZ-5503	2250 Utility software (supplied as standard with Type 2250 and 2270 Hand-held Analyzers)
Type 7830	Qualifier – software for reporting of results on PC

MEASUREMENT ACCESSORIES

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, 1 m (3.3 ft)
JP-1041	Dual 10-pole Adaptor
UA-0587	Tripod
UA-0801	Lightweight Tripod
UA-1317	1/2″ Microphone Holder
UA-1404	Outdoor Microphone Kit
UL-1009	SD Memory Card for Hand-held Analyzers
UL-1013	CF Memory Card for Hand-held Analyzers
ZG-0444	Charger for QB-0061 Battery Pack
Type 3923	Rotating Microphone Boom

SOUND SOURCES

Type 4292	OmniPower Sound Source
Type 4295	OmniSource Sound Source
Type 4224	Portable, Battery & Mains Powered Sound Source
Type 3207	Tapping Machine
Type 2716	Power Amplifier

For further information on sound sources and accessories please refer to the 'Sound Sources for Building Acoustics' Product Data, BP 1689.

Service Products

ACCREDITED CALIBRATION

2250/2270-CAI	Accredited Initial Calibration of Types 2250/2270
2250/2270-CAF	Accredited Calibration of Types 2250/2270
2250/2270-CTF	Traceable Calibration of Types 2250/2270

HARDWARE MAINTENANCE

2250/2270-EW1	Extended Warranty, one year extension (Types 2250/2270)

CALIBRATORS AND PISTONPHONES

Type 4231	Sound Calibrator
Type 4226	Multifunction Acoustic Calibrator
Type 4228	Pistonphone

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

Brüel & Kjær