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 Brüel & Kjær 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 (smiley)
- ISO plus 13 national standards
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 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.
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

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.
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

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).
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.

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.
Other Tasks

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

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.

Uploading Measurement Data to Measurement Partner Cloud

Types 2250 and 2270 can send measurement data to Measurement Partner Cloud (MP Cloud) where projects are immediately available for post-processing, sharing or storage subject to account capacity. Only authorized users have access to the data when it is the MP Cloud.

You can create a Cloud account by visiting the MP Cloud Web service at cloud.bksv.com. You open an account, register your analyzer serial number and perform a one-time pairing of analyzer and account, ensuring data security.

You can connect the hand-held analyzer to the Internet through a modem, LAN or Wi-Fi connected to a router. In the field, the analyzer can connect through Wi-Fi to a hotspot on a smart device (Wi-Fi using CF Card UL-1019 for G1 – G3 and Wireless USB-A Adapter UL-1050 for G4, respectively).

After measurement is completed and the project is saved, you log the analyzer into the Cloud, and projects are uploaded to the Cloud from the analyzer. To do this, you simply need to move your data to the Cloud folder, which is automatically created when you log on to your account. The data will now be ready for post-analysis in Measurement Partner Suite by anyone who has access to the relevant Cloud archive.
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 |
|-------------------------------|-----------------|-----------------|--------|----------|--------|--------|--------|--------|----------|--------|--------|--------|--------|--------|-----------------|
| Measurement                  | ISO             | DIN             | ÖNORM   | UNI     | BS     | BREW   | SS     | Sia    | NF-S31   | NBE     | CTE    | NEN    | NEN’06   | ASTM   |
| Airborne                      |                 |                 |         |         |        |        |        |        |          |         |        |        |          |        |
| Parameters                    |                 |                 |         |         |        |        |        |        |          |         |        |        |          |        |
| 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         | S 5100–1 | 8270–4 | 2750–4 | BREW   | EN     | 20140–4 | 181     | 054     | -057   | 74-040-84/4 | CTE 2008 |
| Facade                        | 140–5           | 16283–1         | S 5100–3 | 8270–5 | 2750–5 | EN     | 20140–5 | EN     | 20140–6 | 181     | 055     | -057   | 74-040-84/5 | CTE 2008 |
| Lab                           | 10140–3         | S 5101          | 8270–6 | 2750–6 | EN     | 20140–6 | -052   | 74-040-84/6 | CTE 2008 |
| Field                         | 140–7           | 16283–2         | S 5100–2 | 8270–4 | 2750–7 | EN     | 20140–7 | 181     | 056     | -057   | 74-040-84/7 | CTE 2008 |
| Rating                        | 3382–2          | S 2212          |        |        |        |        |        |        |          |        |        |        |          |        |
| Airborne                      | 717–1           | S 2210–4        | S 5100–1 | 8270–7 | 5821–1, 3 | BS     | EN 717–1 | S5-SISO 717–1 | 181     | -057   | NBeca-88 | CTE 2008 |

* Partially fulfilled (does not support correction of the result for the contribution of flanking transmission).
Brüel & Kjær provides a wide range of 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

Accredited Calibration Services at Brüel & Kjær

Ensure traceable measurement history from day one with accredited calibration for your Type 2250/2270. We recommend calibration at a Brüel & Kjær 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
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:

<table>
<thead>
<tr>
<th>Weighting</th>
<th>Microphone</th>
<th>Electrical</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>“A”</td>
<td>14.6 dB</td>
<td>12.4 dB</td>
<td>16.6 dB</td>
</tr>
<tr>
<td>“B”</td>
<td>13.4 dB</td>
<td>11.5 dB</td>
<td>15.6 dB</td>
</tr>
<tr>
<td>“C”</td>
<td>13.5 dB</td>
<td>12.9 dB</td>
<td>16.2 dB</td>
</tr>
<tr>
<td>“Z” 5 Hz–20 kHz</td>
<td>15.3 dB</td>
<td>18.3 dB</td>
<td>20.1 dB</td>
</tr>
<tr>
<td>“Z” 3 Hz–20 kHz</td>
<td>15.3 dB</td>
<td>25.5 dB</td>
<td>25.9 dB</td>
</tr>
</tbody>
</table>

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:** \(2048 \times 1536 \text{ pixels}\)
- **Viewfinder Size:** \(212 \times 160 \text{ pixels}\)
- **Format:** jpg with exif information

**SECURE DIGITAL SOCKET**

2 × SD sockets
Connect SD and SDHC memory cards

**LAN INTERFACE SOCKET**

- **Connector:** RJ45 Auto-MDI
- **Speed:** 100 Mbps
- **Protocol:** TCP/IP

**INPUT SOCKET**

One socket with Type 2250; two with Type 2270
- **Connector:** Triaxial LEMO
- **Input Impedance:** \(\geq 1 \, \text{M}\Omega\)
- **Direct Input:** Max. input voltage: \(\pm 14.14 \, \text{V}_{\text{peak}}\)
- **CCLD Input:** Max. input voltage: \(\pm 7.07 \, \text{V}_{\text{peak}}\)
- **CCLD Current/voltage:** \(4 \, \text{mA}/25 \, \text{V}\)

**TRIGGER SOCKET**

- **Connector:** Triaxial LEMO
- **Max. Input Voltage:** \(\pm 20 \, \text{V}_{\text{peak}}\)
- **Input Impedance:** \(>47 \, \text{k}\Omega\)
- **Precision:** \(\pm 0.1 \, \text{V}\)

**OUTPUT SOCKET**

- **Connector:** Triaxial LEMO
- **Max. Peak Output Level:** \(\pm 4.46 \, \text{V}\)
- **Output Impedance:** \(50 \, \Omega\)

**HEADPHONE SOCKET**

- **Connector:** 3.5 mm Minijack stereo socket
- **Max. Peak Output Level:** \(\pm 1.4 \, \text{V}\)
- **Output Impedance:** \(32 \, \Omega\) 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**
  - **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
- **Capacity:** 5200 mAh nominal
- **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

CLOUD
Connect to Measurement Partner Cloud on cloud.bksv.com for transferring data to an archive in the cloud for storage or easy synchronization with Measurement Partner Suite BZ-5503

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, 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

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
• 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

* Signal recording requires an SD card or USB stick for data storage and a license for Signal Recording Option BZ-7226
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
LAF and LCF 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 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 Vrms (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 μs
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
LAF spectrum for display only
L2eq 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: \( L_{20} \) spectra sampled at 5 ms intervals
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, Curve in %, etc.; extensive list of status information.
Quality indicators are available on reverberation time spectra 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
\( L_{20} \) spectrum for L1@Pos, L2@Pos, B2@Pos, L1, L2, B2, L1-L2, L2-B2

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

<table>
<thead>
<tr>
<th>Sampling Rate (kHz)</th>
<th>8</th>
<th>16</th>
<th>24</th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Pre-recording (s) 16-bit</td>
<td>G1 – 3</td>
<td>110</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>G4</td>
<td>470</td>
<td>230</td>
<td>150</td>
</tr>
</tbody>
</table>

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

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

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

<table>
<thead>
<tr>
<th>Maximum Pre-recording (s) 24-bit</th>
<th>G1 – 3</th>
<th>70</th>
<th>30</th>
<th>16</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G4</td>
<td>310</td>
<td>150</td>
<td>96</td>
<td>43</td>
</tr>
<tr>
<td>Memory (kB/s) 16-bit</td>
<td>16</td>
<td>32</td>
<td>48</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>Memory (kB/s) 24-bit</td>
<td>24</td>
<td>48</td>
<td>72</td>
<td>144</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sampling Rate (kHz)</th>
<th>Maximum Pre-recording (s)</th>
<th>Sound Quality</th>
<th>Memory (kB/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>470</td>
<td>Low</td>
<td>16</td>
</tr>
<tr>
<td>16</td>
<td>230</td>
<td>Fair</td>
<td>32</td>
</tr>
<tr>
<td>24</td>
<td>150</td>
<td>Medium</td>
<td>48</td>
</tr>
<tr>
<td>48</td>
<td>70</td>
<td>High</td>
<td>96</td>
</tr>
</tbody>
</table>

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
Specifications – Qualifier Type 7830

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 G B RAM
• Sound card
• DVD drive
• Mouse

Ordering Information

Building Acoustics Kits
The following kits are designed to 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

Note: Flight case KE-0449 for OmniPower sound source must be purchased separately

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 Adapter 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 Brüel & Kjær 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

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  Dual 10-pole Adaptor
KE-0449  Flight case for OmniPower Sound Source Type 4292-L
UA-0750  Tripod
UA-0801  Lightweight Tripod
UA-1317  ½” Microphone Holder
UA-1404  Outdoor Microphone Kit
UA-1476  Wireless Remote Control Unit
UL-0256  Wireless Audio System kit, Brüel & Kjaer specified
UL-0256-A  Wireless Audio System (AKG WMS 470 Set, RF Band VII-50 mW)
UL-1009  SD Memory Card for hand-held analyzers
UL-1013  CF Memory Card for hand-held analyzers, hardware versions 1 – 3
UL-1017  SDHC Memory Card for hand-held analyzers
ZG-0444  Charger for Battery Pack QB-0061

Brüel & Kjaer supplies a wide range of microphones and microphone accessories. Please contact your local Brüel & Kjaer 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 Adapter

SOUND SOURCES
Type 4292-L  OmniPower Sound Source
Type 4295  OmniSource™ 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

---

Brüel & Kjaer and all other trademarks, service marks, trade names, logos and product names are the property of Brüel & Kjaer or a third-party company.