Technical Documentation

Hand-held Analyzer Type 2250

With 2250 Sound Level Meter Software BZ-7222,
2250 Frequency Analysis Software BZ-7223,
2250 Logging Software BZ-7224,
2250 Enhanced Logging Software BZ-7225,
2250 Sound Recording Option BZ-7226 and
2250 Reverberation Time Software BZ-7227

User Manual

Brüel & Kjær

English BE 1713 – 18

Hand-held Analyzer Type 2250

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User Manual

BE 1713 – 18 December 2006

Safety Considerations

This apparatus has been designed and tested in accordance with IEC 61010 – 1 and EN 61010 – 1 *Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use*. This manual contains information and warnings which must be followed to ensure safe operation and to retain the apparatus in safe condition. Special note should be made of the following:

Safety Symbols

The apparatus will be marked with this symbol when it is important that you refer to the associated warning statements given in the manual.

Protective Earth Terminal Hazardous Voltage

Explosion Hazard

The equipment is not designed to be used in potentially explosive environments. It should not be operated in the presence of flammable liquids or gases.

Warnings

- Switch off all power to equipment before connecting or disconnecting their digital interface. Failure to do so could damage the equipment.
- Whenever it is likely that the correct function or operating safety of the apparatus has been impaired, it must be made inoperative and be secured against unintended operation.
- Any adjustment, maintenance and repair of the open apparatus under voltage must be avoided as far as possible and, if unavoidable, must be carried out only by trained service personnel.

- Do not dispose of electronic equipment as unsorted municipal waste
- It is your responsibility to contribute to a clean and healthy environment by using the appropriate local return and collection systems
- Hazardous substances in electronic equipment may have detrimental effects on the environment and human health
- The symbol shown to the left indicates that separate collection systems must be used for any discarded equipment marked with that symbol
- Waste electrical and electronic equipment may be returned to your local Brüel & Kjær representative or to Brüel & Kjær Headquarters for disposal

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Contents

Chapter 1

Introduction

Welcome

This user manual describes the Type 2250 Hand-held Analyzer platform, including 2250 Sound Level Meter Software BZ-7222, 2250 Frequency Analysis Software BZ-7223, 2250 Logging Software BZ-7224, 2250 Enhanced Logging Software BZ-7225, 2250 Sound Recording Option BZ-7226 and 2250 Reverberation Time Software BZ-7227.

The manual explains how to perform a basic sound measurement, which parameters you can measure and how the instrument should be operated. In addition, some practical hints and guidelines are provided, including all relevant technical specifications. Finally, a glossary is added to help with specific terminology found in this manual.

How to Use this Manual

Conventions Used in this Manual

Instructions and descriptions that refer to Type 2250 pushbuttons are shown with the pushbutton icons as seen on the instrument. See Chapter 2 for a list of pushbutton icons and their functions.

Menu items and buttons/tabs used on the screen

Indicated by bold type face (for example, select **Calibration** from the list of options).

Parameter Text Appearing on the Screen

Parameters, instructions and descriptions appearing on the screen are indicated by italics (for example, *Measurement Mode*).

Path Denotations

Indicated by capitals (for example, SETUP\BZ7222\).

Beginners

Before you read the rest of this manual, read Brüel & Kjær's primer on Measuring Sound. This will give you a basic idea of acoustic measurements. It can be found on the www.bksv.com website, by typing 'Primer' in the search window. The website also contains lots of other information you might find useful.

Further information is available in the On-line Help installed on Type 2250.

Experienced Users of Acoustic Measurement Equipment

The manual is designed so that you don't have to read all of it to be able to use the instrument. It is built around the most frequently used operations, these are as follows:

- Assembling your Type 2250 (see Chapter 2)
- Making your First Measurement (see Chapter 3)
- Getting to Know Your Type 2250 (see Chapter 4)
- Calibration (see Chapter 5)
- Data Management (see Chapter 6)
- Transferring Data to Your PC, Post-processing and Reporting (see Chapter 7)
- Advanced Use of Type 2250 – Tips and Tricks (see Chapter 8)
- Updating and Upgrading Applications, Maintenance and Troubleshooting (see Chapter 9)

However, it is recommended that you read the entire manual for appropriate procedures on how to use Type 2250 to obtain accurate sound level measurement results.

Chapter 2

Assembling your Type 2250

Introduction

This chapter describes how to assemble and set up your Type 2250 system. It provides brief description and an associated diagram showing the instrument components and the various input and output connections. This enables you to start getting familiar with the instrument, while assembling your system.

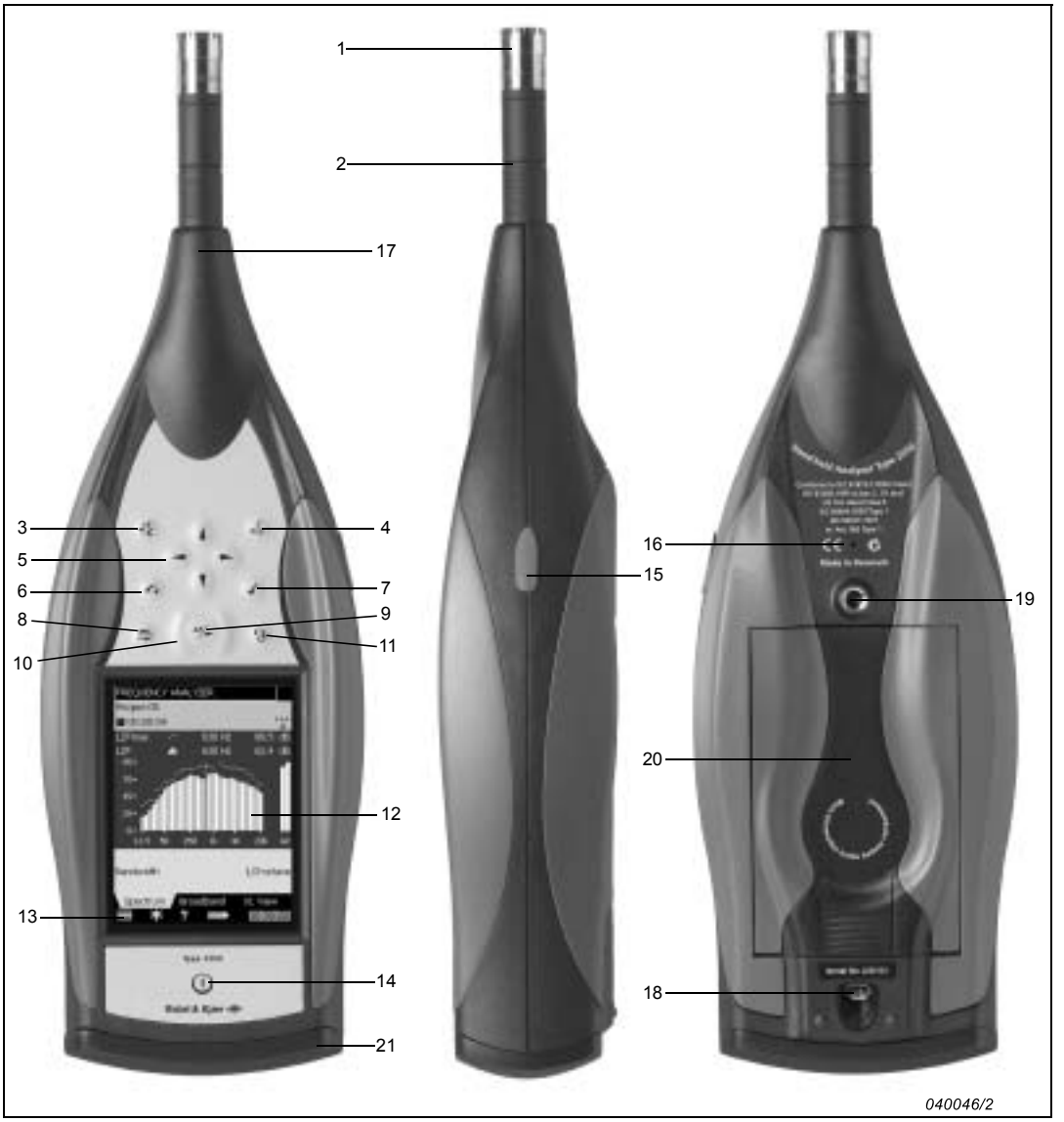
This is followed by an overview of the hardware components, showing all the main configurations of the instrument and its accessories.

Finally, instructions are provided that explain how to assemble standard and optional hardware components used in your system. Once you have followed the assembly instructions, your Hand-held Analyzer will be ready to make measurements.

Instrument Components

An overview of the main instrument components is provided in Fig.2.1. The descriptions that follow refer to those components.

Fig. 2.1 *Instrument components*



1) **Measurement Microphone:** A Brüel & Kjær Prepolarized Free-field ½″ Microphone is used. A robust and reliable microphone with a wide frequency range.

2) **Preamplifier:** Used to convert the high-impedance output of the microphone to low impedance, suitable for driving long extension cables.

3) ⊛ **(Manual Event Pushbutton):** This allows you to manually indicate events during a measurement. Using BZ-7222 and BZ-7223 software you can control sound recording (this requires a license for the BZ-7226 option), and using BZ-7224 Logging Software or BZ-7225

Enhanced Logging Software you can insert an Event Marker and control sound recording (the latter requires a license for the BZ-7226 option).

4) **(Commentary Pushbutton):** This allows you to add recorded audio messages to your measurement files.

5) , , , **(Navigation Pushbuttons):** These move the active screen component (Field Selector) and navigate the user interface.

6) **(Back-erase Pushbutton):** This allows you to erase the last 5 seconds of measurement data or to insert an Exclude Marker (BZ-7224 Logging Software or BZ-7225 Enhanced Logging Software only).

7) **(Accept Pushbutton):** This allows you to accept any changes you make to the instrument's setup.

8) **(Reset Measurement Pushbutton):** This allows you clear the current measurement from the screen, rather like the 'C' or cancel button on a calculator.

9) **(Start/Pause Pushbutton):** Press this to start, pause or continue with a measurement.

10) **(Status Indicator):** The red, yellow or green lights, (or LEDs), referred to as the 'Traffic Light' either side of the **Start/Pause** pushbutton, indicate important states of the instrument during operation, i.e., measurement stopped, paused or running. See Chapter 4 for further details.

11) **(Save Pushbutton):** This allows you to save measurement results.

12) **Display Screen:** A high-contrast, colour, touch-sensitive screen.

13) **(Main Menu icon):** This calls up the Main Menu, which allows you to navigate immediately to all the main functions of the instrument, such as **Setup**, **Explorer** (or Databrowser), **Preferences**, and the **Calibration** procedure.

14) **(Power-on Pushbutton):** Turns the instrument on and off. If held in for 1 second, the instrument goes into standby mode; if held in for more than 4 seconds, it turns the instrument off.

15) **Stylus:** Stored in a holder on the side of the instrument, for use on the touch-sensitive screen. You can choose to use the stylus or the hardkeys, depending on your preference and the measurement situation. (Also see "Use of Stylus and Navigation Pushbuttons" in Chapter 4.)

16) **Secondary Microphone:** This is used to add recorded comments to measurements and is positioned on the underside of the instrument.

17) **Top Socket:** This is the main microphone input socket for Type 2250. The Measurement Microphone and Preamplifier (items 1 and 2 resp.) are normally connected directly to this socket. For more details see Description of Inputs/Outputs that follows.

18) **Tripod Mounting Thread:** Use this to mount Type 2250 onto the tripod and/or tripod extension.

19) **Wrist Strap/Tripod Mounting Thread:** Use this to attach the wrist strap to Type 2250 for added security, or use it to mount Type 2250 onto the tripod and/or tripod extension using the tripod adaptor UA-1673.

20) **Internal Battery Pack:** Rechargeable, high-capacity Li-Ion battery pack to power the Type 2250.

21) **Hinged Cover:** A removable plastic cover is provided, which is hinged at the top to provide protection for the connector panel underneath. To remove, simply open the cover and pull the hinge out of the slot at the top of the connector panel. The cover includes a rubber insert printed with an overview of the main connectors and reset button for easy recognition. Six indents are provided on the inside of the cover (behind the insert) which allow you to drill holes in the plastic cover, giving access to the main connectors underneath, so you can fit the cover while power is connected, for example.

Description of Inputs/Outputs

Top Socket

This 10-pin LEMO connector is the main microphone input for Type 2250 (see item 17 in Fig. 2.1). Microphone Type 4189 (including Preamplifier ZC-0032) is normally connected directly to this connector. If required, however, one of two microphone extension cables (AO-0441-D-030, 3 m and AO-0441-D-100, 10 m), can be fitted between the input stage and the main microphone input socket, to extend the distance to the desired length.

USB Interface

The USB Interface (see item 1 in Fig. 2.2) provides high-speed direct communication with a PC's USB port. It is used to synchronise measurement and setup data with a host PC. Use the supplied cable, AO-1476.

The USB Interface is also used for connection to a printer. (See "Printer Settings" on page 61.) Use cable AO-0657 for connection to a printer that supports PCL language.

Earphone

The 3.5 mm minijack earphone socket (see item 2 in Fig. 2.2) enables the instrument to be connected to a set of headphones/earphones, for reviewing recorded comments or for monitoring the measured sound. Use the supplied earphones, HT-0015.

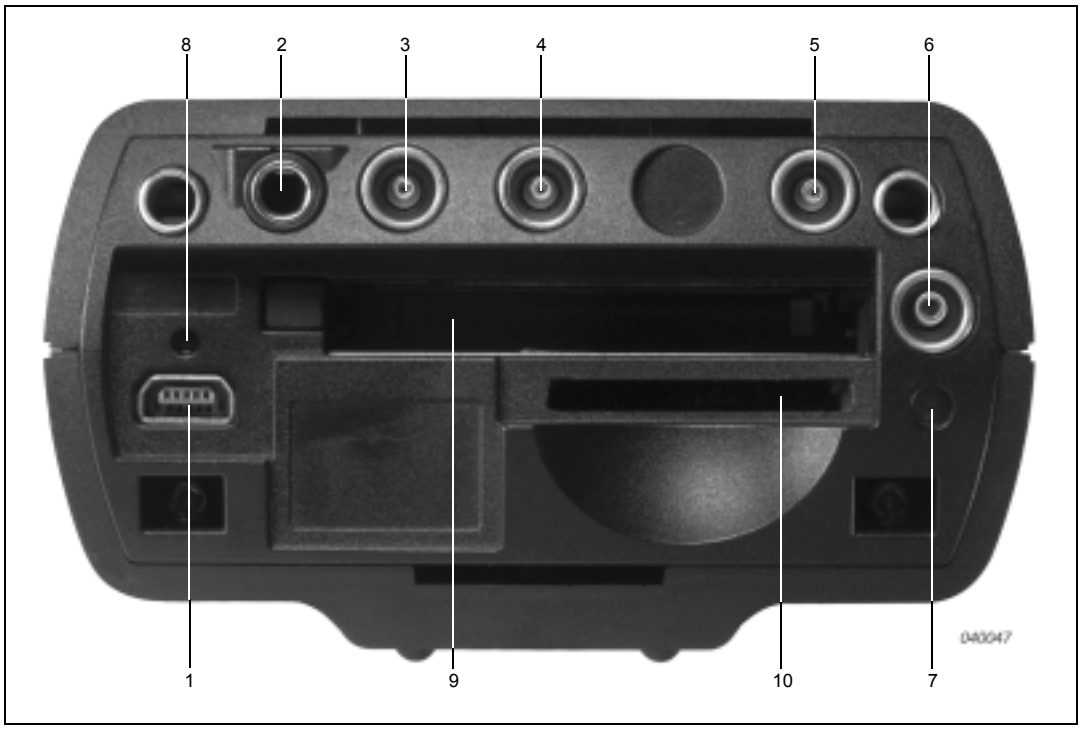
Output

This triaxial LEMO connector (see item 3 in Fig. 2.2) is used to output the conditioned input signal, for monitoring purposes, or to output the generator signal. Use cable AO-0440-D-015 (LEMO to BNC).

Trigger Input

This triaxial LEMO connector (see item 4 in Fig.2.2) is used for the external trigger input, or start/stop signals to the instrument. Using BZ-7222, BZ-7223 and BZ-7226 software you can control sound recording (this requires a license for the BZ-7226 option). If you want to start and stop the recording using an external device, connect it to this input. See details in Appendix A.

Fig.2.2 *Connector panel of Type 2250*



Input

This triaxial LEMO connector (see item 5 in Fig.2.2) is used for AC or CCLD inputs to the instrument. It can be used when analysing electrical signals, from (for example) transducers or sound recordings. Use cable AO-0440-D-015 (LEMO to BNC).

Note: This connector is referred to as the **Rear Socket**, also in the software.

External Power

⚠ **CAUTION:** Use specified battery charger only.
Charging below 0°C (32°F) is not recommended. **Note:** If you charge the battery pack below 0°C, the lifetime of the batteries will be reduced.
Do not charge battery pack in temperatures above 60°C.
Do not dissassemble or expose battery pack to fire or water.

Type 2250 is powered by an internal rechargeable battery pack. An indication of available charge is shown by the battery icon  at the bottom of the screen. If the charge remaining is low or empty, the batteries can be recharged by connecting Mains Power Supply (Part No. ZG-0426) to the 'Ext. Power' socket (see item 6 in Fig.2.2). When the power supply lead is connected, the  icon will be displayed in place of the battery icon.

Battery Charge Indicator

A battery charge light, (LED), indicates when the battery pack is being charged from external power, (see item 7 in Fig.2.2). It shows a steady green light when external power is applied (and the battery is charging), and a flashing green light when charging has finished.

Reset Button

Located above the USB connector (see item 8 in Fig.2.2), it is used to reset the Type 2250 if you have problems with the instrument and cannot get it to operate. To reset, press the button with the point of the stylus – see chapter 9 for troubleshooting.

Slot for Compact Flash (CF) Cards

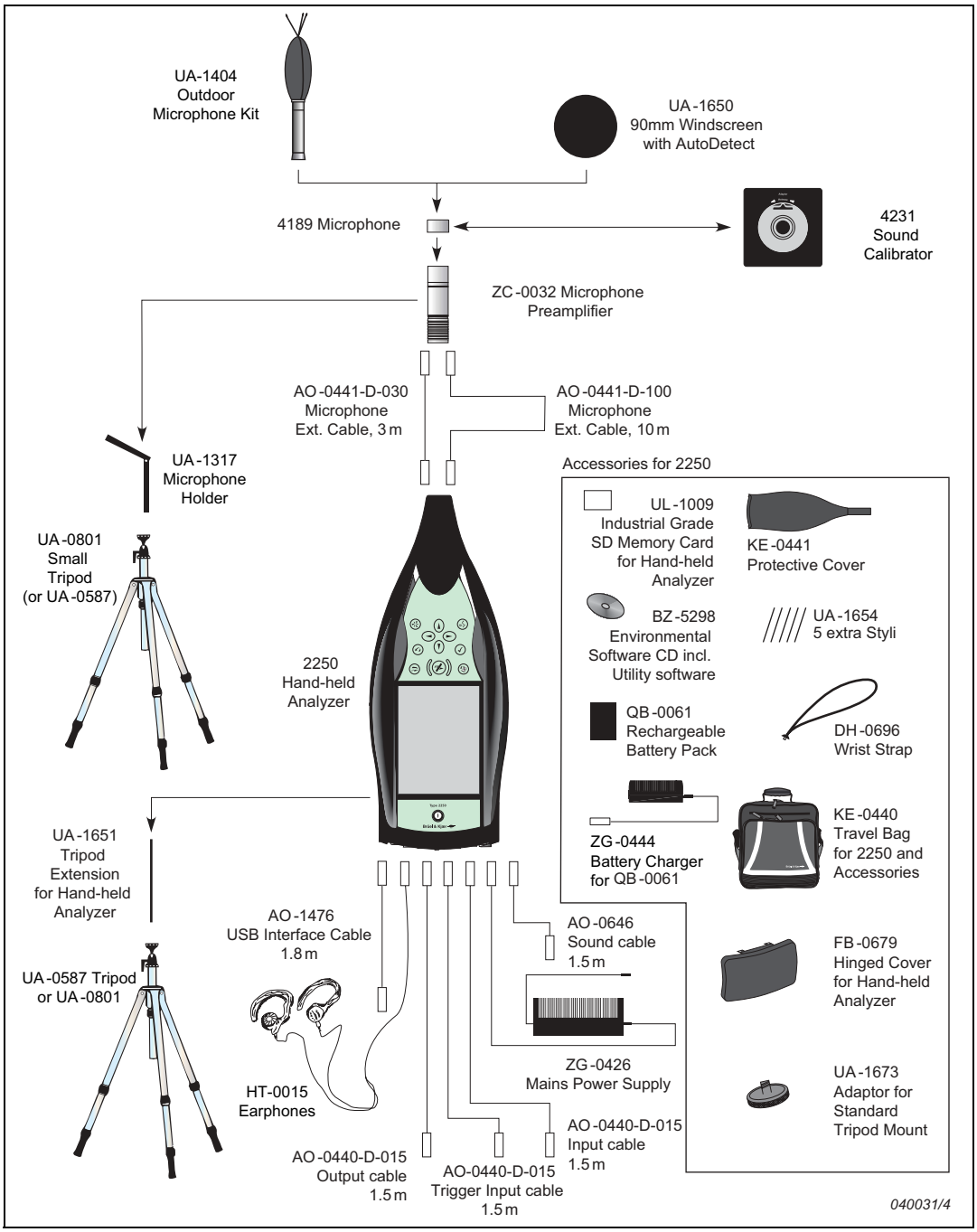
This slot (see item 9 in Fig.2.2) accepts CF sized cards and can be used for memory or, for example, a modem.

Slot for Secure Digital (SD) Cards

This slot (see item 10 in Fig.2.2) accepts SD memory cards and is typically used to save measurement data. Capacities in excess of 1 gigabyte are acceptable.

Hardware Setup

Fig. 2.3 *Type 2250 – hardware overview*



Assembling Type 2250

Charging the Battery for the First Time

Battery Pack QB-0061 comes charged to approximately half capacity on initial delivery. Before assembling your Type 2250 for the first time, it is recommended that you fully charge the battery pack, by connecting Mains Power Supply ZG-0426 to the external power socket, (see item 6 in Fig. 2.2). It should take approximately 8 – 10 hours.

The battery charge light, (see item 7 in Fig. 2.2), shows a steady green light when external power is applied (and the battery is charging), and a flashing green light when charging has finished. You can leave Type 2250 with external power on, even when the battery is fully charged. Also see "Note: The read/write performance of SD and CF memory cards varies a lot. The performance depends on the manufacturer of the card, the type of card, the size of card and even on the day of production of the card – two 'identical' cards can have a different performance because the manufacturer has changed the internal technology without notice." on page 67.

Making Good Measurements

The fact that you are using your Type 2250, which fully complies with the IEC 61672–1 standard, ensures you always make good measurements. Type 2250 should be set up using the following recommended assembly instructions. This is to minimise the influence of acoustical reflections during measurements. All the components described below are shown in Fig. 2.1 and Fig. 2.3.

Another set of instructions are provided in the "Alternative Measurement Method (Extended Microphone)" on page 12, for situations where users need to position the microphone at a distance from the Type 2250, while still complying with the standard.

Placing the Measurement Microphone

The measurement microphone must be placed away from shielding, reflecting, or absorbing objects. In a diffuse sound field, absorbing objects will reduce the measured sound levels. In a free sound field, reflecting objects can change the measured sound levels. Typically, the sound level 0.5 m from a plane reflecting wall is 3 dB higher than if there was no wall.

The operator of the system may be personally shielding, absorbing, and reflecting, and can be an additional noise source. Measure downwind in dry conditions with a windspeed less than 5 m/s.

The optimum position for the microphone is best found by trying different positions and observing the resulting sound levels.

Mounting the Measurement Microphone

Before mounting the measurement microphone, note the following precautions:

- When screwing on the microphone, **do it gently** to avoid damaging threads
- Keep dust and foreign matter off the microphone diaphragm. **Do not touch** the diaphragm with anything – it is very delicate

Note: Once the measurement microphone and preamplifier have been assembled and connected to your Type 2250, they should normally be left connected to the instrument.

To connect

1) Gently screw Microphone Type 4189 onto Preamplifier ZC-0032, see items 1 and 2 in Fig.2.1.

2) Insert the male plug of the preamplifier into the top socket of the Hand-held Analyzer (see item 17 in Fig.2.1) and push gently until it snaps into position.

To Disconnect

1) To remove the preamplifier and microphone, grip the locking collar firmly and slide back, to remove the preamplifier and microphone combination from the Type 2250.

Mounting the Windscreen

For short outdoor noise measurements (or indoor measurements exposed to air movement) mount Windscreen UA-1650 onto the microphone and preamplifier combination, making sure it 'snaps' into place over the windscreen sensor. The sensor is built into the preamplifier, see item 2 in Fig.2.1. Icons in the status field on the screen indicate whether the windscreen is detected or not. For longer-term outdoor measurements, see Mounting the Outdoor Microphone Kit below.

Mounting Type 2250 onto the Tripod Extension Stem and Tripod

Mount Type 2250 onto the Tripod Extension Stem UA-1651 and Small Tripod UA-0801, as follows:

1) Screw Tripod Extension Stem UA-1651 onto the threaded stud of the ball-joint on Small Tripod UA-0801. Secure the ball-joint in a roughly vertical position (i.e., in-line with the tripod) until ready to follow instructions in step 4).

2) Screw the Extension Stem UA-1651 into the Type 2250, using the threaded socket situated on the underside of Type 2250, at the back, (see item 18 in Fig.2.1).

3) Set Small Tripod UA-0801 (including Type 2250) in the required position, and adjust it to the required height. Ensure that one of the three legs is pointing in roughly the same direction as your Type 2250 needs to point. (We will refer to this leg as the front leg.)

4) Position the extension stem at an angle of 45° to the horizontal and vertically in-line with the front leg of the tripod – this is to ensure the whole setup is stable.

Note: The procedure is the same if Tripod UA-0587 is used instead of Small Tripod UA-0801.

Once you have carried out these instructions, you are ready to start measuring, see Chapter 3.

Alternative Measurement Method (Extended Microphone)

The measurement microphone can be placed a distance from Type 2250 by connecting an extension cable and fitting the microphone to a microphone holder or to Outdoor Kit UA-1404. Type 2250 should be set up using the following assembly instructions. This is to ensure that the accessories have limited acoustical influence on the instrument during measurement. All the components described below are shown in Fig. 2.1 and Fig. 2.3.

Mounting the Outdoor Microphone Kit

For longer-term outdoor measurements, an Outdoor Microphone Kit UA-1404 will be required as an alternative to the windscreen. If this is the case, mount the kit onto the microphone and preamplifier combination according to assembly and mounting instructions in the User Manual for the Outdoor Microphone Kit, BE 1077.

Connecting a Microphone Extension Cable

There are two optionally available extension cables which are recommended for use with Type 2250. These are:

- AO-0441-D-030 – 3 m long
- AO-0441-D-100 – 10 m long

Note: Connecting a recommended microphone extension cable has no acoustical effect on the Hand-held Analyzer's measurement and has no effect on the instrument's calibration. However, although it is not essential to re-calibrate, it is good measurement practice to calibrate the whole measurement chain (including microphone extension cable) before starting a measurement.

Decide which cable you require and assemble as follows:

1) Gently screw Microphone Type 4189 onto Preamplifier ZC-0032, see items 1 and 2 in Fig. 2.1.

2) Insert the preamplifier into the female plug of the extension cable and push gently until it snaps into position.

3) Insert the male plug of the extension cable into the top socket of the Hand-held Analyzer (see item 17 in Fig. 2.1) and push gently until it snaps into position.

Mounting the Measurement Microphone on the Microphone Holder and Tripod

Mount the microphone and preamplifier combination onto Microphone Holder UA-1317 and Small Tripod UA-0801, as follows:

1) Set Small Tripod UA-0801 in the required position, and adjust to the required height.

2) Screw Microphone Holder UA-1317 onto the threaded stud on the tripod ball-joint, and position the holder as required.

3) Push the microphone and preamplifier combination carefully into the microphone holder, so that it grips onto the body of the microphone and preamplifier. Ensure that the microphone lead sits properly in the plastic guide.

Once you have carried out these instructions, you are ready to start measuring, see Chapter 3.

Measuring for Convenience

Measurements that need to be done at short notice, with no particular accuracy can be carried out by simply holding the instrument or using any combination of hardware components and accessories shown in Fig. 2.3.

Chapter 3

Making your First Measurement

Introduction

This chapter describes how to make a basic measurement and how to save and document the results. It assumes you have just received your Hand-held Analyzer Type 2250 and are turning it on for the first time. If the instrument has been used before, and the previous user has initiated the multi-user facility, then the screens that are displayed may not follow the sequence described below. If this is the case, please refer to the “Multi-user Facility” on page 60.

Note: A stylus is stored in a holder on the side of the instrument, see item 15 in Fig.2.1. This can be used on the touch-sensitive screen to select icons and functions during the procedures that follow. Alternatively, you can use the various pushbuttons, see items 3 to 11 in Fig.2.1.

The following procedures assume that the measurement microphone and preamplifier have been mounted as described in Chapter 2 and Type 2250 has a fully charged battery, see “Charging the Battery for the First Time” on page 10.

“Point and Shoot”

Using the following basic procedure you will be able to start using your hand-held analyzer immediately to make measurements and start the familiarisation process:

1) Switch on by pressing ⏻ and make sure the **SOUND LEVEL METER** Project Template is selected.

2) Check that the data path at the top of the screen displays the correct job/project, (i.e., where you want to save the new data).

3) Set *Measurement Mode* to manual and change any setup parameters by tapping the Main Menu icon ☰ and selecting **Setup** from the drop-down that appears.

4) Press the **Start/Pause** pushbutton, then monitor the status indicator (traffic light).

5) Use the **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons to control the measurement.

6) When measurement has finished, press the **Save** pushbutton to save your data.

7) Add any spoken comments to the measurements by pressing the **Commentary** pushbutton, and add any written comments by tapping the Main Menu icon and selecting **Add Note to Current Measurement** from the drop-down that appears.

8) To view and organise your data, tap the Main Menu icon and select **Explorer**.

Note: You are not required to set any measurement ranges on Type 2250, the instrument has a dynamic range of more than 120 dB, from 140 dB down to the noise floor of the microphone, (if the microphone has nominal sensitivity).

Congratulations!

You should now be familiar with the basic principles of the Type 2250. If you need more help, the following section goes into the measurement process in more detail. If not, please refer to "Getting to Know Your Type 2250" on page 25.

Making a Measurement

What is a Project Template?

A Project Template contains all the common display settings and measurement setups required to perform a noise measurement. The template does not contain any measurement data – this data is saved as individual projects, stored in job folders, see "Description of Jobs and Projects" on page 47. The Project Templates covered by this manual, are:

- Sound Level Meter Project Template (included in BZ-7222 software)
- Frequency Analysis Project Template (included in BZ-7223 software)
- Logging Project Template (included in BZ-7224 software)
- Enhanced Logging Project Template (included in BZ-7225 software)
- Reverberation Time Project Template (included in BZ-7227 software)

Note: The Sound Recording Option BZ-7226 does not contain a specific template – the sound recording options are available in all templates included in BZ-7222/23/24/25/27.

If you make any changes to the settings in a Project Template, an '∗' will appear next to the template name to indicate that the new settings have not been saved. Select **Template Explorer** from the Main Menu and tap the Save icon to save the settings in the current template.

Switching On

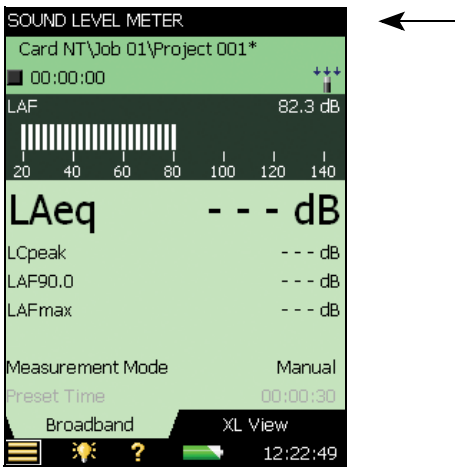
Switch Type 2250 on by pressing . The start-up time depends on the state the instrument was in when last switched off and it may take up to 2 minutes from a cold start, or up to 10 seconds if the instrument is already in Standby Mode, (i.e., from a warm start).

Note: A cold start is described as a re-boot of the instrument from ROM. This normally occurs after the instrument has been turned off for some time, either by the user or following an automatic power-down. A warm start takes the instrument quickly from Standby Mode to Operating Mode without having to re-boot. (The battery needs to be charged for this to happen, see "Charging the Battery for the First Time" on page 10.)

Set the Sound Level Meter Project Template

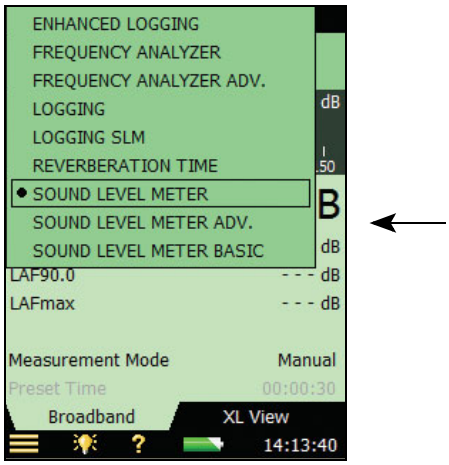
After initialisation, the screen shown in Fig. 3.1 appears:

Fig. 3.1
Initial sound level meter screen



1) Check that the **SOUND LEVEL METER** Project Template is displayed at the top of the screen, see Fig. 3.1. If not, use the stylus to tap on the bar at the top of the screen to reveal a drop-down list and select **SOUND LEVEL METER** from the list, see Fig. 3.2.

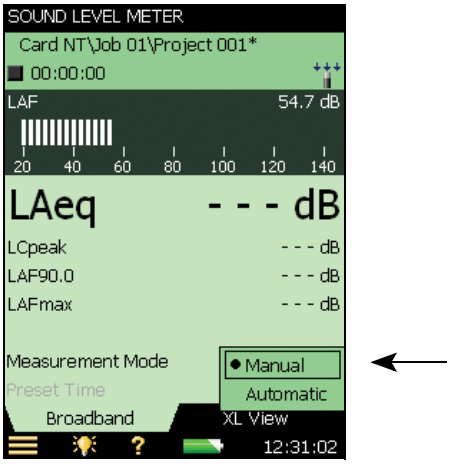
Fig. 3.2
Changing the project template



2) Tap on *Measurement Mode* in the view area and set to *Manual*, see Fig. 3.3.

Note: The bar-graph showing the sound pressure level L_{AF} is now live, but parameters such as L_{Aeq} are not. This is because L_{AF} is an instantaneous value, always available for display, whereas L_{Aeq} is a measured value that needs to be averaged over a period of time. Therefore, it cannot be displayed before you have started a measurement using the **Start/ Pause** pushbutton.

Fig. 3.3
Setting the measurement mode



3) Press the **Start/Pause** pushbutton to start the measurement.

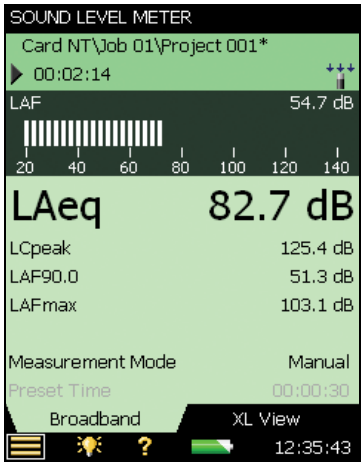
   Note: *Start* appears on the screen as feedback when you press the **Start/Pause** pushbutton.

   Notice the Start Icon ▶ on the screen and monitor the red, yellow, green 'traffic light' status indicators around the **Start/Pause** pushbutton while you are measuring. The indications should be as follows:

   - yellow status indicator flashing every 5 s before you start the measurement
   - steady green status indicator after you have pressed the **Start/Pause** pushbutton and during the measurement (if everything is OK)
   - short green flash every second means the measurement is waiting for the trigger
   - yellow status indicator flashing every 5 s when you have stopped, saved the measurement and are ready to do another measurement
   - yellow status indicator flashing slowly, 0.5 s on, 0.5 s off, if you pause the measurement
   - red status indicator flashing rapidly if you encounter an overload condition during the measurement

4) Use the **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons to control the measurement. The status field at the top of the screen will give short textual feedback on the pushbutton operation. A visual indication of measurement status is also displayed on the status line, by way of the *Stopped* icon ■, the *Running* icon ▶ and the *Pause* icon ||. See Fig. 3.4.

Fig. 3.4
Measurement feedback in the status field



5) Toggle between different display parameters, as required, by tapping on each parameter field (for example LAF90.0 in Fig. 3.4) with the stylus and selecting other parameters from the drop-down lists that appear.

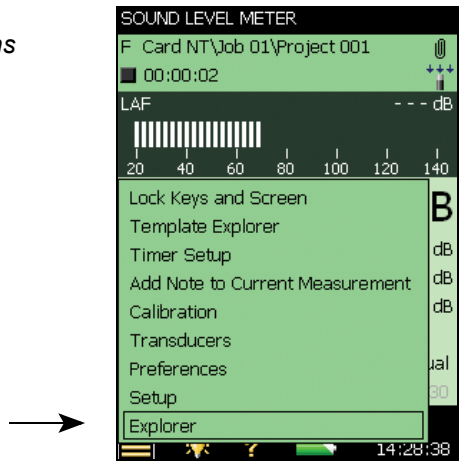
   Note: The tabs at the bottom of the screen allow you to choose different ways of displaying the measurement results.

   - The *Broadband* view shows an instantaneous L_{AF} readout, with associated bar graph and four measurement parameters, followed by two measurement setup parameters. (The first parameter is displayed in a larger font size for better readability, see Fig. 3.4)
   - The *XL View* increases the size of the first parameter readout to a 4 digit, full-screen display (including decimal point)

6) Set *Measurement Mode* to *Automatic* and choose a preset time for your measurement. Then repeat steps 3 and 4. The measurement will automatically pause after the preset time. This allows you to either save your measurement or continue measuring, as required.

7) Tap the Main Menu icon and select **Setup** from the list of options, see Fig. 3.5.

Fig. 3.5
Main Menu options



Change the broadband weighting parameters by tapping on the 'plus' icon + next to *Frequency Weightings*, then on the weighting parameter field on the right-hand side of the screen. A weighting drop-down menu will appear, see Fig. 3.6. Change the parameters as required.

Fig. 3.6
Changing the broadband frequency weightings

8) Return to the bar-graph screen of the **SOUND LEVEL METER** template, by tapping and you are ready to make a new measurement.

Save your Measurement

When you have completed your measurement, you need to save it. By default Type 2250 creates a job folder called *JOB 01*. Job folders represent the upper level of the data (or file) management system, with individual measurements or sets of data, represented by projects

appearing under the relevant job. By default Type 2250 also creates a project called *Project 001* under *JOB 01*. (Subsequent measurements will be labelled *Project 002*, *Project 003*, etc., under *JOB 01*. This will happen each time you have saved a measurement[a].)

Check that the data path at the top of the screen displays *\JOB 01\Project 001** and save your measurement by pressing the **Save** pushbutton. For more details refer to "Organising Measurements" on page 47.

Note: An asterisk will appear alongside the project at the top of the status field as soon as you start your measurement, see Fig.3.7. This signifies that the measurement has not been saved. It will disappear once you have saved the measurement.

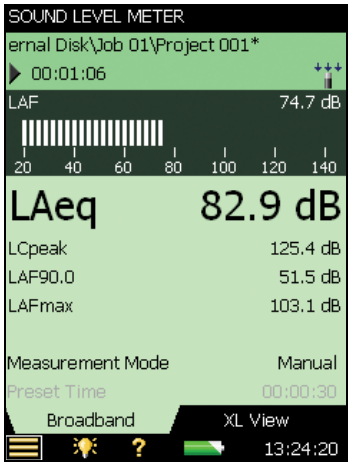


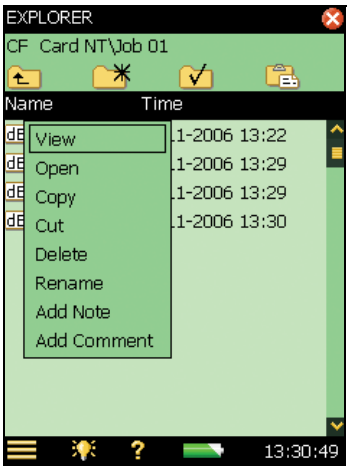
Fig.3.7
Saving your measurement

Viewing the Saved Measurement

1) To view the saved measurement, tap the Main Menu icon and select **Explorer** from the list of options. Tap on the name of your measurement (*Project 001* in this case) and select *View* from the drop-down that appears, see Fig.3.8. (Or just tap on the measurement icon to the left of the name.)

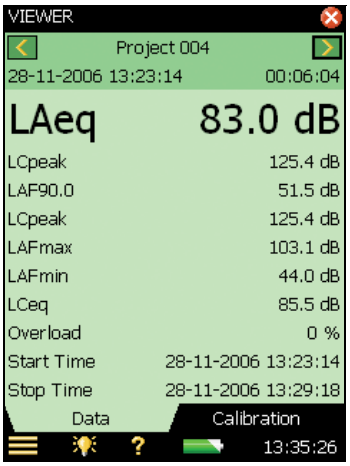
a. If you are using Reverberation Time Software BZ-7227, (see Chapter 14), please note that there are **more** measurements stored in Reverberation Time projects than Sound Level Meter, Frequency Analyzer or Logging Projects, which all contain one measurement within each project.

Fig. 3.8
Viewing your measurement in Explorer



2) This opens the Data Viewer, see example in Fig. 3.9. The viewer displays the data in a pre-defined format, where you can select and view different parameters, as necessary.

Fig. 3.9
The Data Viewer



3) When finished, tap ⊗ to return to Explorer and ⊗ to return to the measurement screen.

Document your Measurement

One method for documenting your measurement is by attaching a short spoken comment to the project you are working on. This is done before, during[a] or after saving the measurement by pressing and holding down the **Commentary** pushbutton, while talking to the instrument.

a. For Logging Software BZ-7224 and Enhanced Logging Software BZ-7225, annotations can be added directly to the measurement profile during the measurement, see “Controlling the Measurement” on page 83.

(The microphone situated on the underside of the Type 2250 will pick up your comments.) Recording stops when you release the pushbutton.

Note: A paperclip icon appears in the status field of the measurement and next to your project in Explorer when you have finished recording the comment. This is to indicate that the project has been annotated. Tap on the paperclip icon to see a list of all annotations in the project and tap on the loudspeaker icon in the annotation to hear the comment using the earphones plugged into the earphone socket.

Another method is to make a short written comment and attach it to the project you are working on. This is done before, during or after saving the measurement by tapping the Main Menu icon and then tapping on **Add Note** in the list of options. A blank 'note' screen will appear, where you can make written comments about the measurement, using the standard full character keyboard that appears at the bottom of the note screen. See the example in Fig. 3.10.

Note: When finished, tap on the icon to return to the measurement screen. A paperclip icon appears in the status field of the measurement and next to your project in Explorer. Tap on the paperclip icon to see a list of all annotations in the project and tap on the text icon in the annotation to view the comment.

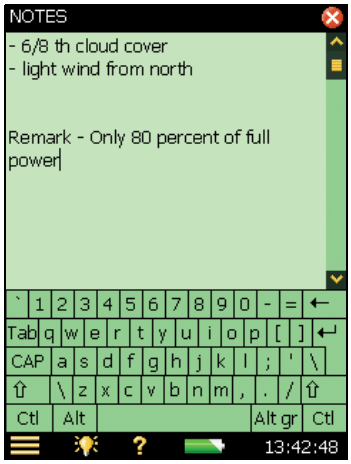


Fig. 3.10
Example of a written annotation that is attached to a measurement

To get more familiar with this process, try the following:

1) Make a new measurement (see "Point and Shoot" section on page 15 if unsure).
2) Make a short written comment and attach it to the new measurement (as previously described). Notice the paperclip icon in the data path.
3) Make a short spoken comment (as previously described).
4) Tap on the paperclip icon and check that you have two annotations – select one of them to see/hear the comment.

Switching Off

Switch Type 2250 off by pressing ⏻. If held in for 1 second, the instrument goes into standby mode; if held in for more than 4 seconds, it switches the instrument off.

The instrument will automatically switch off, when it has been in standby mode without external power for more than 30 hours.

Chapter 4

Getting to Know Your Type 2250

What is a Sound Level Meter?

A Sound Level Meter (SLM) is an instrument that is designed to measure sound levels in a standardised way. A sound level meter comprises a microphone, a preamplifier, a main processor and a read-out unit.

The microphone converts the sound signal into an equivalent electric signal. The electric signal that the microphone creates is at a very low level, so it is made stronger with the help of a pre-amplifier before it is processed by the main processor.

Processing includes applying frequency and time weightings to the signal as specified by international standards, such as IEC 61672-1, to which Type 2250 conforms.

Frequency weighting adjusts how the sound level meter responds to different sound frequencies. This is necessary because the human ear's sensitivity to sound varies according to the sound's frequency. The most commonly used frequency weighting is A-weighting, which adjusts a signal in a way that best resembles the human ear's response at medium-range levels. It is the weighting required for nearly all environmental and workplace noise measurements, and is specified in international and national standards and guidelines. All of Type 2250's measurement parameters apply A- or B-weighting, and a choice of C- or Z-weighting, except for the measurement of peak levels where a single weighting (typically the 'C' frequency weighting) is applied. In this case, C-weighting is used to take into account the energy present at low frequencies even when they are not particularly annoying.

Time weighting specifies how the sound level meter reacts to changes in sound pressure. It is an exponential averaging of the fluctuating signal, providing an easy-to-read value. Type 2250 applies the Fast, Slow and Impulse (or 'F', 'S' and 'I') time weightings, which are the required weightings according to the vast majority of international and national standards and guidelines.

Once the signal is processed through the weighting filters, the resulting sound pressure level is displayed in decibels (dB) referenced to 20 µPa on the instrument's screen. In Type 2250, the sound pressure level values are updated at least once per second.

Assessing a fluctuating noise level means getting a value for a level that is, in simple terms, the average level. The 'equivalent continuous sound level', L_{eq}, is known around the globe as the essential averaged parameter. L_{eq} is the level that, had it been a steady level during the meas-

urement period, would represent the amount of energy present in the measured, fluctuating sound pressure level. It is a measure of the averaged energy in a varying sound level. It is not a direct measure of annoyance, though extensive research has shown that L_{eq} correlates well with annoyance.

L_{eq} is measured directly with a hand-held analyzer, such as Type 2250 running 2250 Sound Level Meter Software BZ-7222. If an A-weighting filter is used, it is expressed as L_{Aeq}, defined as *the measurement of the equivalent continuous sound level using the A-weighted filter network*.

A full range of measurement parameters is given in Appendix B.

What is Hand-held Analyzer Type 2250?

Hand-held Analyzer Type 2250 is a versatile hardware platform suitable for covering a wide range of different applications. Together with 2250 Sound Level Meter Software BZ-7222, it is a Class 1 modular precision integrating-averaging sound level analyzer with an easy to use interface for quick and simple measurement setups.

2250 Sound Level Meter Software Module BZ-7222

Type 2250 Sound Level Meter Software BZ-7222 allows you to measure a comprehensive set of parameters used for rating noise in terms of its impact on the environmental and working environments and on occupational noise evaluation.

The more commonly used parameters, which cover a large range of applications, are either instantaneous measured parameters (available at any time) or timed measured parameters (measured within a controlled time interval):

Timed Measured Parameters

- Equivalent Continuous Sound Levels (L_{eq} – example: L_{Aeq})
- Peak Sound Levels (L_{peak} – example: L_{Cpeak})
- Time for Peak Sound Level (example: T_{Cpeak})
- Maximum Time-weighted Sound Levels (L_{max} – example: L_{AFmax})
- Minimum Time-weighted Sound Levels (L_{min} – example: L_{AFmin})
- Percentile Levels (L_N – example: $L_{AF90.0}$)
- Sound Exposure Level (example: L_{AE})
- Sound Exposure (example: E)
- Daily Noise Exposure Levels (example: $L_{ep,d}$ or $L_{EX,8h}$)
- Noise Dose (example: based on ISO standards: Dose, based on US standards: DoseS5)
- Number of peaks (example: #CPeaks(>140 dB))
- Time Weighted Average (example: TWA)
- Level Average with Exchange Rates 4, 5 or 6 (example: L_{avS5})

Instantaneous Measured Parameters

- Instantaneous Time-weighted Sound Levels (L_p – example: L_{AF})
- Sound Pressure Levels (max levels once per second – example: L_{AF}(SPL)
- Instantaneous Peak Sound Levels (example: $L_{Cpeak,1s}$)

Note: See Appendix B for a comprehensive list of all parameters.

2250 Sound Level Meter software BZ-7222 incorporates a simple user interface which is easy to learn and uses intuitive data storage and recall. Comprehensive security features means no loss of data, even on accidental power-off. Smart features are built-in for field use, for example, allowing you to personalise your measurements. 2250 Sound Level Meter software BZ-7222 also provides connectivity between your PC and other sound analysis software.

This highly versatile hand-held analyzer platform includes a range of optional software modules, that are enabled through easily activated software license keys. The combination of software modules and innovative hardware makes the instrument a dedicated solution for performing all your high-precision measurement tasks. The following optional software module is covered in this manual:

2250 Frequency Analysis Software Module BZ-7223

This software module allows real-time frequency measurements in 1/1- and 1/3-octave bands, making it a simple matter to, for example, select suitable hearing protection, qualify noise from heat and ventilation systems and assess tonality.

2250 Logging Software Module BZ-7224

This software module allows logging of broadband and spectral data[a] to obtain a time history for later analysis, for example, for use in environmental noise as well as workplace noise assessment. It allows free selection of up to 10 parameters to log at periods from 1 s to 24 h. Results are logged directly to CF or SD memory cards.

2250 Enhanced Logging Software Module BZ-7225

This software module is optimised for long-term monitoring. It has the functionality of the Logging and Frequency Analysis software, and in addition it can measure continuously, save data in manageable portions (every 24 hours), make periodic reports (i.e., every hour) and measure L_{dn} and L_{den}, etc.

2250 Sound Recording Option BZ-7226

This option allows recording of sound during measurement using one of the software modules BZ-7222, BZ-7223, BZ-7224, BZ-7225 or BZ-7227. The sound recording can be controlled manually or by using an external trigger signal. The recording can also be triggered when a measured parameter exceeds a preset level (BZ-7224 and BZ-7225 only). The recorded sound can be played back and listened to using the supplied earphones, HT-0015. Sound is recorded directly to CF or SD memory cards.

a. Requires Frequency Analysis Software BZ-7223

2250 Reverberation Time Software BZ-7227

This software module allows measurement of reverberation time using Impulsive excitation and backwards integration of the impulse, or using Interrupted Noise from the built-in noise generator. Measurements can be made in a number of positions in the room and the average reverberation time for the room is calculated.

Built-in Help

If you need more detailed information at any time during operation, tap the Help icon on the instrument's screen. The resulting screen will explain that particular item in much more detail. You can scroll up and down the explanatory text using either the and pushbuttons, or the scrollbar on the screen. Return to the normal display screen by tapping .

If you need to view any of the previous 10 screens you have visited in the help system, tap the icon at the top of the display.

Software and Hardware Versions

Once in the help system, you can access the list of installed software versions and licenses, together with information about the hardware. This information is always available and is accessed by selecting **About** from the top of the display.

What is Utility Software for Hand-held Analyzers BZ-5503?

Utility Software for Hand-held Analyzers BZ-5503 functions as the link between the Type 2250 and reporting software on a PC, such as Noise Explorer Type 7815, Evaluator Type 7820/21, Protector Type 7825 or Qualifier Light Type 7831.

The software enables you to do the following:

- setup or control Type 2250 from a PC
- retrieve data from Type 2250
- manage and archive data from Type 2250
- export data to Type 7815, Type 7820, Type 7825, Type 7831 or Microsoft® Excel
- update the software in Type 2250
- install license for use of software modules in Type 2250

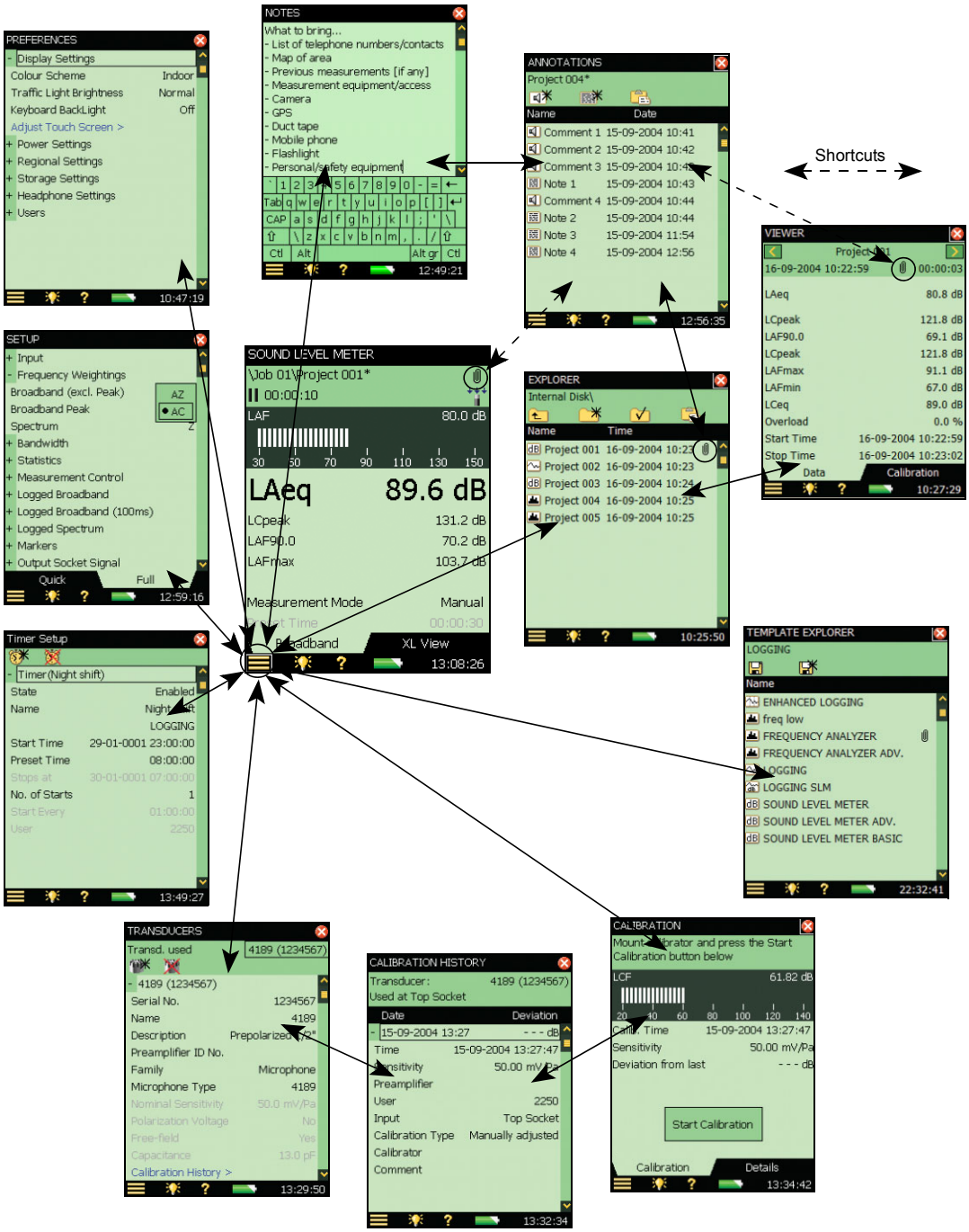
Utility Software for Hand-held Analyzers BZ-5503 is supplied on the Environmental Software CD-ROM (BZ-5298), which is included with your Type 2250.

Basic Principles when using Type 2250

Navigation Principles – 'Star' Navigation Concept

The main principle is that all the main menus are accessible via a single tap of the stylus. The Main Menu icon forms the centre of the 'star' navigation concept, see Fig.4.1:

Fig. 4.1 *The 'Star' navigation concept*



This configuration gives you immediate access to screens you need most, i.e., those you will need to perform, save and document your measurements. The Main Menu allows you to navigate to the following screens:

- Explorer
- Setup
- Preferences
- Transducers
- Calibration
- Add Note to Current Measurement
- Template Explorer
- Timer Setup

In addition, the Main Menu also allows you to perform the following actions:

- Lock Keys and Screen
- Log Off

Explorer

The **Explorer** screen is accessed from the Main Menu, and gives you access to the instrument's Data/Project manager. This allows you to view the overall project structure, including job folders and projects, and to view all the individual measurements. When you have finished, tap to return to the measurement screen.

You can tap on any measurement file to view the saved measurement and if there are any voice or text annotations attached, these can be viewed by tapping the paperclip icon visible next to all measurement files with attachments. When you have finished reading or listening to the comments, tap to return to the **Explorer** screen.

Setup

The **Setup** screen is accessed from the Main Menu and gives you access to the various setup parameters, such as frequency weightings, control of the measurement, bandwidth, statistics and the type of input currently connected. You can change these as required, see "How to Change Parameter Values" on page 36.

The *Full* tab at the bottom of the screen allows you to view the complete list of setup parameters, while the *Quick* tab allows you to access the more frequently used parameters defined by yourself. When you have finished viewing or updating the parameters, tap to return to the measurement screen.

Changes made to the setup will only be applied temporarily, i.e., until you select another project template or open another project to re-use the setup from that project. However, if you want the setup changes to be saved in the current template, select the **Template Explorer** option from the Main Menu and tap the Save icon.

Note: If you make changes to the setup that you do not want to keep, (and you have not yet saved the template), you can undo them by selecting the template again from the Project Template bar at the top of the screen.

Preferences

The **Preferences** screen is accessed from the Main Menu and gives you access to the instrument's preferences (if Multi User is disabled) or your own preferences (if Multi User is enabled). These include things such as regional settings, appearance of the screen, power management, user profiles and language. You can change these as required, see "How to Change Parameter Values" on page 36. For more information refer to "Setting your Preferences on Type 2250" on page 55. When you have finished viewing or updating the parameters, press to return to the measurement screen.

Transducers

The **Transducers** screen is accessed from the Main Menu, you can view/set which transducer is connected to the instrument and add new ones if required. Details can be changed for existing transducers or entered for new ones, see "How to Change Parameter Values" on page 36. When you have finished viewing or updating the details, tap to return to the measurement screen.

When a transducer is selected, you can tap on the *Calibration History* link at the bottom of the transducer details and open the *Calibration History* screen, see Fig. 4.1. This screen includes the calibration history for the transducer (i.e., microphone) that is currently selected. When you have finished viewing or updating the details, tap to return to the **Transducers** screen.

Calibration

The **Calibration** screen is accessed from the Main Menu, and gives you access to the instrument's calibration procedure. To calibrate the instrument, follow the instructions in the status field. For more information refer to "Acoustic Calibration" on page 41. When you have finished calibrating or viewing the details, tap to return to the measurement screen.

The *Calibration* tab at the bottom of the calibration screen allows you to perform and monitor the calibration, while the *Details* tab allows you to view the details of the calibration and the calibrator that are being used to calibrate the instrument. While you are viewing the *Details* tab, you can tap on the *Calibration History* link at the bottom of the calibration details and open the *Calibration History* screen, see Fig. 4.1. This screen includes the calibration history for the currently selected transducer, tap to return to the *Calibration* screen.

Add Note to Current Measurement

The *Notes* screen is accessed from the Main Menu by selecting **Add Note to Current Measurement**. This screen allows you to create a text annotation that you can attach to your measurement. Text is inserted using a character keyboard, similar to the one covered in "How to Change Parameter Values" on page 36. When you have finished, tap to return to the measurement screen.

Template Explorer

The *Template Explorer* is accessed from the Main Menu and gives you access to managing your project templates. When you have finished, tap to return to the measurement screen.

Timer Setup

The *Timer Setup* is accessed from the Main Menu and enables you to control the analyzer via one or more of the analyzer's timers. The purpose of a timer is to initiate measurements in the absence of an operator. When you have finished, tap to return to the measurement screen.

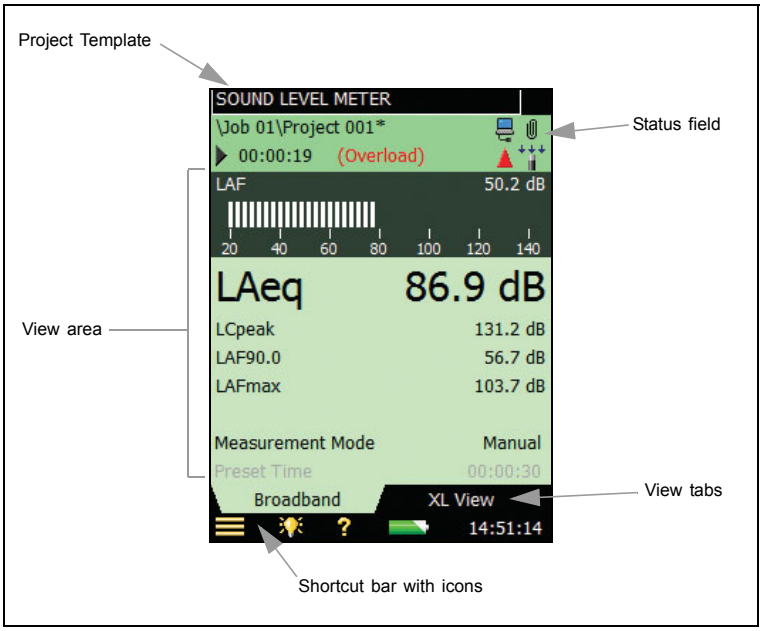
The Display Screen

During normal operation, you will use the display screen to view your measurements and carry out a variety of functions, which are described in the following sections.

CAUTION: The touch-sensitive screen is susceptible to damage from sharp objects, such as pencils, fingernails, etc., we therefore recommend you use the stylus provided to activate items on screen. See also "Use of Stylus and Navigation Pushbuttons" on page 36.

A typical screen is shown in Fig.4.2.

Fig.4.2
Typical screen when making a measurement



The key areas, starting at the top of the screen, are as follows:

Project Template Bar

This bar displays the name of the Project Template which contains all the screen settings and measurement setup for the current project. Tap on the text to open a drop-down list containing all the available templates. If you make any changes to the setup in a template an '∗' will appear next to the template name to indicate that the new settings have not been saved. Select **Template Explorer** from the Main Menu and tap the Save icon to save the settings in the current template.

Status Field

The area just below the Project Template bar is called the Status field. Depending on the template, this field displays status information using up to three lines of text, as follows:

First Line:

- Path and name of the current project. (See "Description of Jobs and Projects" on page 47.) Tap it to change the name of the project. To change the path, tap the Main Menu icon and select **Explorer** from the list of options, navigate to the desired job (path) and tap the icon to save this path as the default measurement path. As in the project template, an '∗' will appear next to the project name to indicate that the project has not been saved. Press the **Save** push-button if you want to save the measurement
- The PC icon indicates connection to a PC
- The commentary icon indicates when a spoken commentary is being recorded, together with an indication of the available recording time
- The recording icon indicates when the measurement signal is being recorded
- A paperclip icon indicates that a spoken or written comment is attached to the project. Tap the icon to view, or listen to, the comment

Second Line:

- Measurement state represented as icons: Stopped ■, Running ▶ and the Pause icon ❙❙
- Elapsed time of the measurement
- Feedback on the action of pressing the following pushbuttons: **Reset**, **Back-erase**, **Start/Pause** and **Save**
- Indication that the measurement microphone is uncalibrated. In this case the word *Uncal.* appears in the Status Field
- Four icons are used to represent whether, or not, the windscreen is fitted and whether you are measuring in a free-field or diffuse field. For example, no windscreen fitted, measuring in a free-field – ; no windscreen fitted, measuring in a diffuse field – ; windscreen fitted, measuring in a free-field – ; windscreen fitted, measuring in a diffuse field –
- Immediate textual feedback on overload situation and latched overload indicated with an overload icon

Third Line:

- Used for Logging and Enhanced Logging, see "Status Field" on page 84, **or** used for Reverberation Time, see "Status Field" on page 112

Central View Area

The Central View Area contains the screens required for a particular measurement, such as bar graphs, result readouts and various frequently used setup parameters (i.e., *Meas. mode*). The template defines the content of this area. More than one screen can be used for displaying the information. Select the screen using the View Tabs at the bottom of the View area.

Changes made to the screens will only be applied temporarily, i.e., until you select another project template or open another project to re-use the screen from that project. However, if you want the screen changes to be saved in the current template, select the **Template Explorer** option from the Main Menu and tap the Save icon.

Note: If you make changes to the screen that you do not want to keep, (and you have not yet saved the template), you can undo them by selecting the template again from the Project Template bar at the top of the screen.

Shortcut Bar

The Shortcut Bar, at the bottom of the screen, displays a number of fixed icons that are always accessible. These include:

- Main Menu icon, giving access to the Main Menu. This allows you to navigate to a specific function, see description earlier under Navigation Principles
- Backlight icon, allows you to select a backlight level
- Help icon, a quick way to get context-sensitive help from any screen by tapping on the icon at the bottom. Closing the help window will return you to the previous screen
- Battery/power status icon, shows the condition of the battery. All green shows a fully charged battery, while red means power levels are low. Tap the icon to get more details of the battery condition. (When the Power Supply lead is connected, the icon will be displayed in place of the battery icon.)
- The clock in the lower right corner displays the current time. Tap the readout to get details of the time and date, or to set the clock

Use of Pushbuttons for Controlling Measurements

The design of the Type 2250 is such that the layout of the pushbuttons has been optimised for single-handed operation.

Reset Pushbutton

Use the **Reset** pushbutton to reset a measurement, i.e., to reset all detectors, averagers, maximum and minimum hold, etc. If the measurement is paused (i.e., Pause icon || is displayed in the status field), then the measurement reverts to a 'stopped' state after a reset, (i.e., stopped icon ■ displayed with a zeroed readout). If the measurement is running, then the measurement will be automatically re-started after the reset.

Start/Pause Pushbutton

Use the **Start/Pause** pushbutton for controlling the measurement. The function of this key depends on the current measurement state, see Table 4.1:

Save Pushbutton

Use the **Save** pushbutton to save the measurement data together with the current project template (including all the screen settings and setup information) and the calibration documentation.

Table 4.1 *Start/Pause pushbutton functions*

Current Measurement State	Function of Start/Pause Pushbutton	Next Measurement State
■ Stopped	Start the measurement	▶ Running
▶ Running	Pause the measurement	❙❙ Pause
❙❙ Pause	Continue the measurement	▶ Running

Pressing **Save** will affect the pause and running states. In both cases the measurement state will be 'stopped' shortly after pressing the pushbutton (stopped icon ■ displayed).

Back-erase Pushbutton

For BZ-7222 and BZ-7223 Software:

Use the **Back-erase** pushbutton ⟲ to erase the last 5 seconds completely from the measurement. (This includes, of course, overload indications you would like to erase.)

If used when the current measurement is running, then the measurement will be paused. The status field displays *Pause, Back erase* briefly, and then displays the shortened elapsed time along with the Pause icon ❙❙.

For BZ-7224 and BZ-7225 Software:

Pressing the **Back-erase** pushbutton ⟲ will start drawing an Exclude Marker on the display, see "Marking Sound Categories" on page 86. Pressing it again will stop drawing the marker on the display (toggle function).

On-screen Feedback and Traffic Light

Feedback is given on screen in the Status Field, see Fig.4.2, and the Traffic Light indicates important states of the instrument, see Table 4.2:

Table 4.2 *Traffic Light Indications*

State	Light Scheme
During power-on or loading template	Nothing
■ Stopped. Ready to measure	Short yellow flash every 5 s
▶ Awaiting trigger, searching for calibration signal	Short green flash every second
▶ Running measurement, everything OK	Steady green light
❙❙ Pause. Measurement not saved	Slow yellow flash on 1/2 s, off 1/2 s
▲ Overload	Fast red flash

Use of Stylus and Navigation Pushbuttons

The stylus and navigation pushbuttons are used for setting up Type 2250, navigating through the screens and managing the results.

A number of items that appear on the screen (parameter values or icons) can be selected, updated and activated. For instance, a new parameter value can be selected from a drop-down list. The selection and activation of items on the screen can be done in two ways:

- tapping once on the item on the screen will select and activate it, or
- move the field selector around using the navigation keys until the item you want is highlighted. Then press the **Accept** pushbutton ✓ to activate it

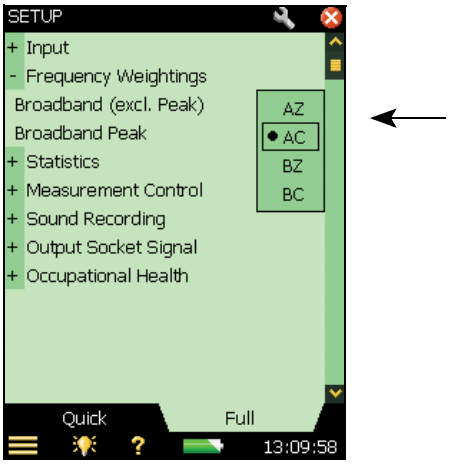
You can choose to use the stylus or the pushbuttons, depending on your preference and the measurement situation. (For instance, if the amount of noise generated by the instrument needs to be kept to an absolute minimum, consider using the pushbuttons rather than the stylus – this is because tapping of the stylus on the touch-sensitive screen may create extra noise. However, if speed is of major importance, the stylus can navigate through the setup and measurement screens quicker.)

Throughout the manual we have described how to perform the measurement procedures using the stylus only, but you may also use the alternative method (using the Navigation and Accept pushbuttons) if you prefer.

How to Change Parameter Values

Most parameter values are changed by selecting a new value from a drop-down list, which appears when the parameter field is selected. See the example in Fig. 4.3.

Fig. 4.3
Changing parameter values



Stylus Usage

Tap on the value you want in the drop-down, or tap outside the list to cancel the selection.

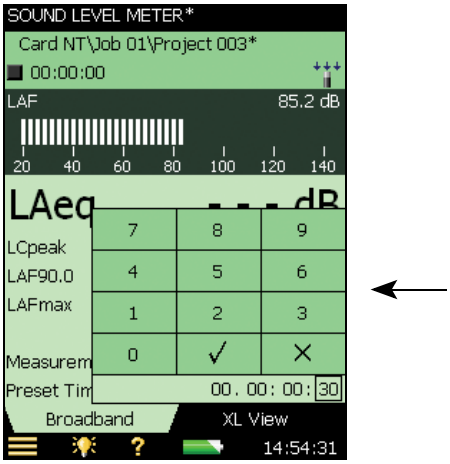
Pushbutton Usage

Use the navigation pushbuttons (up arrow ▲, or down arrow ▼) to select the value you want and press the **Accept** pushbutton ✓ to activate it. Use the left arrow ◄ to cancel the selection.

Number Keyboard

When activating a number, a number keyboard appears, see Fig. 4.4.

Fig. 4.4
Number keyboard as it appears on the screen

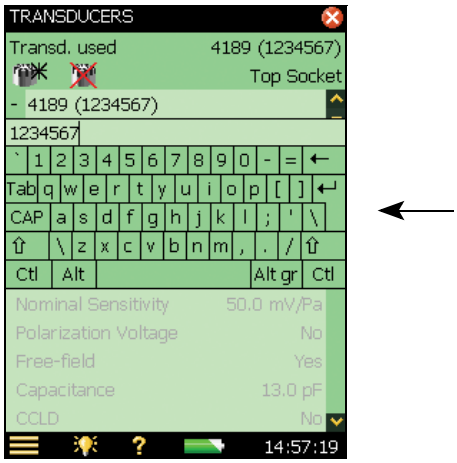


Tap on the digits or use up arrow ▲/down arrow ▼ to increment/decrement the number. Use left arrow ◄/right arrow ► to select other digits if necessary. Press the **Accept** pushbutton ✓ or tap the ✓ button on the screen to enter the number for the parameter. Tap on the × button on the screen, or outside the number keyboard to cancel the change of value.

Character Keyboard

When activating a text value, a standard full character keyboard appears on the screen, see Fig. 4.5.

Fig. 4.5
Character keyboard as it appears on the screen



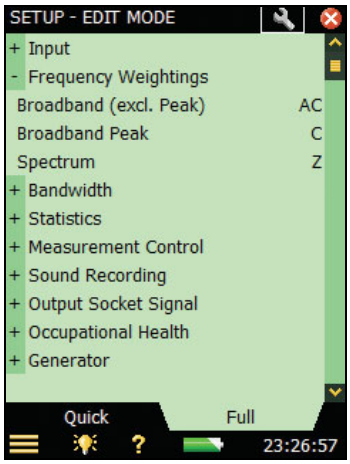
The character keyboard has all the functionality of a normal keyboard, enter text as required by tapping the individual keys with the stylus. Tap the Enter key ↵ to accept the changes, or tap outside the keyboard to cancel.

How to Personalise your Setup

Setup contains all the settings for the measurement and some settings for post-processing.

Select **Setup** from the Main Menu ☰, and the Setup screen appears:

Fig. 4.6
The Setup screen – Edit Mode



The *Full* tab at the bottom of the screen allows you to view the complete list of setup parameters, while the *Quick* tab allows you to access the more frequently used parameters defined by yourself. Press the Edit icon 🔧 on top of the screen to enter Edit mode.

This mode allows you to copy parameters from the Full View to the Quick View simply by tapping on the parameters in the Full View – and to remove parameters from the Quick View by tapping on the parameters in the Quick View.

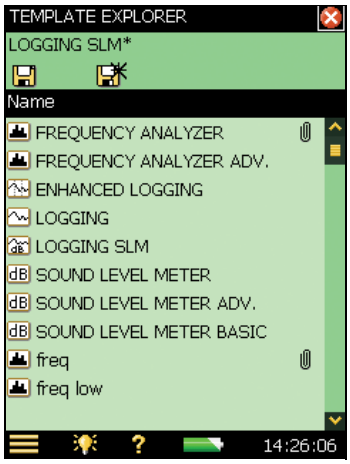
When you have finished, tap the Edit icon again to exit Edit mode.

How to Manage the Project Templates

The Project Templates containing all the display and measurement settings required to perform a measurement are selected in the Project Template Bar at the top of the display screen, see Fig.4.2.

You can save changes to the project template, create new templates, rename templates or delete templates from the Template Explorer screen. Select **Template Explorer** from the Main Menu , and the following screen will appear:

Fig.4.7
Template Explorer



The topmost line in the status area (LOGGING SLM* in Fig.4.7) contains the name of the current template. If you make any changes to the settings in the current template, an '*' will appear next to the template name to indicate that the new settings have not been saved.

The next line contains icons for saving the settings. Tap on the Save icon to save the settings in the current template.

Tap on the Save As icon to save the settings in a new template. Use the keyboard that pops up to define the name of the template.

The rest of the screen is used for listing the defined templates with an icon, a template name and possibly an annotation icon (paper clip):

1) Tap on the template icon to open and use the template.

2) Tap on the template name to get a drop-down list with the options:
   - Open (open and use the selected template),

- Clone (create a copy of the selected template),
- Delete (delete the selected template),
- Rename (rename the selected template),
- Add Note (or commentary) to the template,
- View Annotations on the template

3) Tap on the annotation icon to get the list of annotations attached to the project.

Note 1: Annotations on templates are for describing the template and will not be copied to the project, when starting or saving a measurement.

Note 2: If you delete all templates of a certain type (for example, the Frequency Analyzer) and you want a template of this type again, then you either have to open a project made with this template and save the template, or you have to use the BZ-5503 Utility Software for Hand-held Analyzers to transfer a template of this type to Type 2250.

Locking the Pushbuttons and Display

The pushbuttons and display can be locked to prevent inadvertent operation.

To Lock: Select the **Lock Keys and Screen** option from the Main Menu  .

To Unlock: Press the left arrow pushbutton ◄, followed by the right arrow pushbutton ►, then the **Accept** pushbutton ✓.

If you attempt to press a pushbutton, or tap on the screen, while the instrument is locked, an information window pops up with instructions on how to unlock it.

Chapter 5

Calibration

Introduction

Calibration is an adjustment of your sound level meter to measure and display correct values. The sensitivity of the microphone as well as the response of the electronic circuitry can vary slightly over time, or could be affected by environmental conditions such as temperature and humidity. While you are unlikely to ever experience a large drift or change in sensitivity with Type 2250, it is nevertheless good practice to perform regular calibrations, normally before and after each set of measurements. Often calibration is required by measurement standards, such as IEC 61672-1.

Acoustic Calibration

Acoustic calibration is the preferred calibration method, particularly when standards and regulations require calibration before a measurement. The method involves applying an acoustic signal of known magnitude and frequency to the microphone, which calibrates all the instrument's components (microphone, preamplifier and electrical circuitry).

Sound Level Calibration

To perform the acoustic calibration use Sound Calibrator Type 4231. It provides a stable sound pressure at 1 kHz and has minimal susceptibility to environmental factors. The procedure itself is relatively simple, and on Type 2250 the procedure is referred to as the Standard Calibration procedure.

The procedure for performing an acoustic calibration and instructions on how to fit the calibrator are given in the following section.

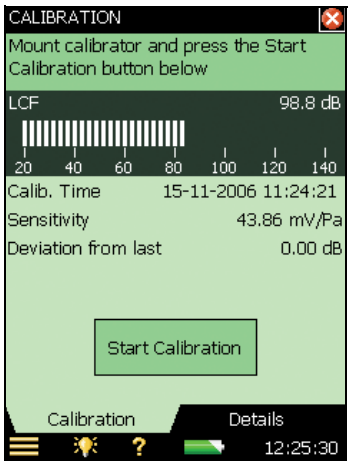
Standard Calibration

1) Stand away from loud sound sources that may interfere with the calibrator's signal.

2) Switch on Type 2250 by pressing ⏻.

3) Tap on the Main Menu icon and select **Calibration** from the list of options. The following screen will appear:

Fig. 5.1
Initial Calibration screen



The screen contains a bar graph showing the actual sound pressure level and three place-holders for displaying information about the last calibration.

4) Following the first part of the instruction in the status field, fit Sound Calibrator Type 4231 carefully onto the microphone of the Hand-held Analyzer. (To avoid handling vibrations to disturb the calibration rest the assembly in a roughly horizontal position on a table or other flat surface.)

   Ensure that the calibrator fits snugly on the microphone.

5) Switch on the Calibrator. Wait a few seconds the level to stabilise.

6) Tap the Start Calibration button on the screen to start the calibration.

   Note: *Detecting level...* appears on the screen as feedback.

7) While Type 2250 is searching for the calibration signal and the signal level is stabilising, the 'traffic light' indicates a short green flash every second. When the level is stable, the traffic light indicates a steady green and the signal is measured and used for calibration. **Once the calibration has been completed successfully, the traffic light indicates a short yellow flash every 5 seconds.** The *Sensitivity* is automatically calculated and displayed in a pop-up together with the deviation from the last calibration. Press *Yes* to accept and use the new sensitivity and save it in the calibration history. Press *No* to disregard the new calibration and continue with the old calibration.

   If the calibration deviates more than ±1.5 dB from the initial calibration, then the calibration is stopped without changing the calibration of the instrument. The traffic light will indicate a fast flashing red and an error description will appear in the status field.

   Hint: If the microphone is separated from Type 2250 using a microphone extension cable then place Type 2250 so it can be seen from the location of the microphone. Start the calibration process, (select the **Calibration** screen and tap the Start Calibration button on the

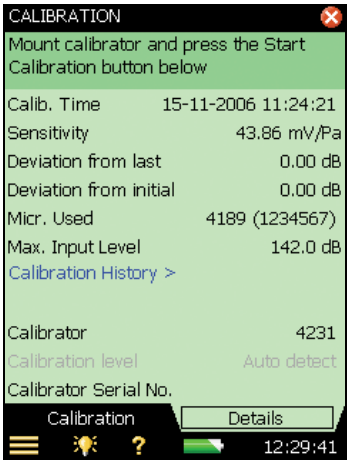
screen, then go to the microphone and fit the Calibrator onto the microphone, switch on the Calibrator and monitor the traffic light on the Type 2250, as discussed previously.

8) Once you have completed the calibration, tap the Exit Calibration button and remove the calibrator. It will automatically switch off after a few seconds.

Calibration Settings

Select the *Details* tab on the **Calibration** screen to view the calibration details, see Fig. 5.2.

Fig. 5.2
Calibration details screen



This screen displays the following information:

- Details of the last calibration: date, sensitivity, deviation from last calibration and deviation from initial calibration
- The connected transducer: type and serial number

  Note: you select a new transducer by tapping on the Main Menu icon and selecting **Setup**, followed by *Input*)
- A *Calibration History* link: which is provided to enable you to view a history of transducer and calibration settings, see below
- *Max. Input Level*: the maximum sinusoidal input level to be measured without overload indication

The calibration settings can be adjusted as follows:

- *Calibrator*: select between Type 4231 and a custom calibrator
- *Calibration Level*: type in the specific level of your custom calibrator. If you are using Type 4231 calibrator, and the microphone being used is connected to the top socket, then the level of the calibrator is automatically detected, (shown as *Auto detect* on the screen).

  Note: The *Auto detect* setting enables the calibration process to automatically detect the calibration level. For free-field types of microphones (like Type 4189) the calibration level from a Type 4231 Calibrator is either 93.85 dB or 113.85 dB. For diffuse or pressure field types, the calibration level is either 94 dB or 114 dB. The calibration process automatically determines the correct level.

- *Calibrator Serial Number*: type in the serial number for your calibrator. The calibrator will be documented in the calibration history

Electrical Calibration

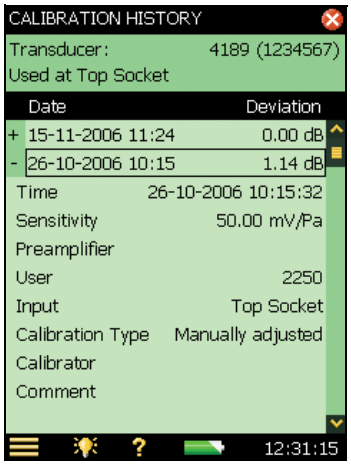
If no sound level calibrator is available (or a known amplification is introduced, i.e., by analyzing a tape recorded signal) then you can type the sensitivity directly into the *Sensitivity* field. Type 2250 will be regarded as un-calibrated and the text '*Uncal.*' will appear in the status field.

Calibration History

You select the calibration history by tapping on the *Calibration History* link on the Calibration Details screen, see Fig. 5.2.

Type 2250 saves the last 20 calibrations, plus the initial calibration, which can be viewed on the *Calibration History* screen, see Fig. 5.3. When you have finished, tap to return to the calibration details screen and then tap again to return to the measurement screen.

Fig. 5.3
Calibration History screen

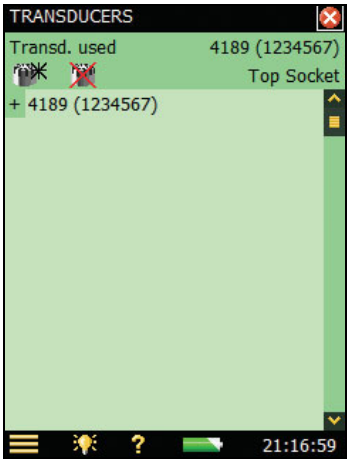


Transducer Database

The specifications for Microphone Type 4189 (and Preamplifier ZC-0032), which come fitted in the top socket of Type 2250, are described in a transducer database.

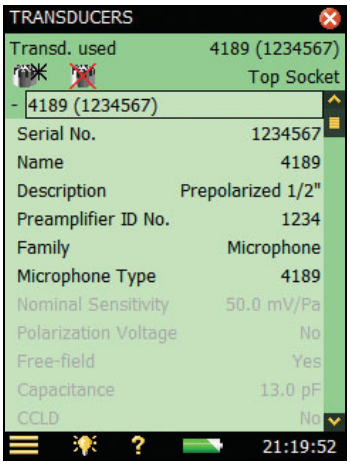
1) Select the Transducer Database by tapping the Main Menu icon and choosing **Transducers** from the list of options. The following screen will appear:

Fig. 5.4
Transducer Database screen



2) Tap on the transducer name/number, or select the plus icon + next to name/number, to view the details in the database, see Fig. 5.5.

Fig. 5.5
Details in the Transducer Database



All the details for the currently selected microphone can be found in the database. You can add other transducers by tapping on the Add New Transducer icon and filling in the details of your particular transducer parameters. See “Transducer Setup” on page 174. This is done by selecting the item from the drop-down list that appears on some parameter fields, or by entering the data via the keyboard that appears on other parameter fields.

A number of parameters are set automatically for a known microphone type, such as Type 4189.

Note: If the microphone type is known to the Type 2250 (as in the example in Fig. 5.5, where Type 4189 details are known), then the parameters *Nominal Sensitivity*, *Polarization Voltage*, *Free-field*, *Capacitance* and *CCLD* are set automatically. See details in Appendix C. The analyzer can then make sound field correction and windscreen correction as specified in the setup. To

confirm which type of correction is being applied, an icon is displayed in the measurement Status field, as described on page 31. If the microphone is unknown to Type 2250, no corrections can be made and no icon appears in the Status field. The parameters mentioned above have to be set manually (i.e., typed in). We recommend that you insert the value for Nominal Sensitivity directly from the calibration chart. Nominal Sensitivity is used in the automatic level detection calculations, when calibrating using the Type 4231 Calibrator, to determine whether the level is 94 or 114 dB.

In the top line of the status field you can select which transducer is currently connected to Type 2250. This can also be done via the **Setup** screen by selecting *Input,* then selecting the transducer in the *Transducer Used:* field.

In the second line of the status field you can select whether the transducer is connected to the top socket or the rear socket of Type 2250. This can also be done via the **Setup** screen by selecting *Input*, then selecting the socket in the *Input:* field.

To change which input the transducer uses to connect to Type 2250, tap the Main Menu icon  and select **Setup** from the list, next tap on the *Input* value field and finally, choose the required input from the drop-down list: *Top socket* or *Rear Socket*. (*Rear Socket* refers to the **Input** socket on the connector panel of Type 2250).

At the bottom of the parameter list you can select the calibration history for the currently selected transducer by tapping on the *Calibration History* link. See “Calibration History” on page 44 and Fig. 5.2.

You can delete a transducer by tapping on the Delete Transducer icon  and selecting the transducer to delete from the drop-down that appears.

Note: Only transducers that are not connected can be deleted. The calibration history will also be deleted.

When you have finished, tap  to return to the measurement screen.

Chapter 6

Data Management

Organising Measurements

Description of Jobs and Projects

When saving a set of measurement results, they are organised together with setup information, calibration information, annotations and sound recordings in a project.

A project contains the following:

- Measurement results:
  - Broadband values (for example, L_{Aeq}, L_{AFmax}, L_{AFmin}, etc.)
  - Frequency spectra (if Frequency Analysis software BZ-7223 is enabled on your Type 2250 and you have selected a Frequency Analyzer template)
- Measurement Setup
- Display Setup (parameters you have selected)
- Information on the microphone
- Calibration
- Annotations – Commentary (attached to measurements as required)
- Annotations – Text (attached to measurements as required)
- Sound Recordings (attached to measurements as required)

The Project name is automatically created by combining the Project Name Prefix with a number (starting from 001), i.e., Project 001 for the first project, Project 002 for the next, etc.

If preferred, the Project Name Prefix can be changed from the default name of ‘Project’. To do this, tap the Main Menu icon  , then **Preferences** followed by **Storage Settings** to reveal the Project Name Prefix. Tap on the current name to reveal a keyboard for you to type in the required name.

Projects are saved in folders which are called ‘jobs’ on your Type 2250. These are similar to folders in the Windows® filing system.

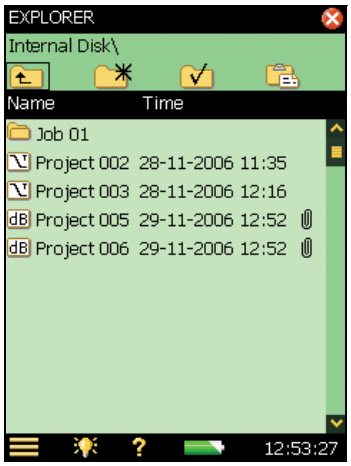
Jobs can be created in the internal memory, on a Secure Digital (SD) Card or on a Compact Flash (CF) Card.

Navigating in Jobs

On Type 2250, a results browser called Explorer is used to navigate through the jobs and projects.

To view all jobs and projects, tap the Main Menu icon and select **Explorer** from the list of options. A screen similar to Fig.6.1 will appear.

Fig.6.1
The Explorer screen



The example from Explorer in Fig.6.1 displays a list of jobs and then some projects which have not been stored under a job name.

The topmost line in the status area (*Internal Disk* in the example in Fig.6.1) shows the location in the memory.

The next line in the status area contains 4 icons for navigation.

Tap the icon to go up one level in the job-levels. The top level is the Memory level, where physical memory devices can be selected. You can select between:

- Internal Disk
- SD Card (if available in SD Slot)
- CF Card (if available in CF Slot)

If Multi-user is enabled (see Chapter 8), then each user can access data on the three devices. However, a user cannot see or access jobs for other users.

To go down one level (i.e., exit the Memory level), you tap on the job name (*Internal Disk* in this case) and select *Open* from the dropdown list – or you simply tap on the memory icon next to *Internal Disk*.

Tap the icon to create a new job folder. The first job folder name will be 'Job 01', subsequent job folders will be labelled 'Job 02', 'Job 03', etc. You can rename the job folder name by tapping on the name and selecting *rename* from the dropdown list. Use the keyboard to key in a new name – accept by tapping on the Enter key .

To go down one level (open a job), you tap on the job name in the list and select *Open* from the dropdown list – or you simply tap on the job icon to the left of the job name.

You can move a job/project (and its content) to another job by tapping the job name/project name and selecting *Cut* from the dropdown list. Then navigate to the job you want as the new holder of the moved job/project and tap on the Paste icon  , or navigate to the level above and tap on the job name and select paste from the dropdown list.

In order to copy a job/project do as described above, but use *Copy* instead of *Cut* from the dropdown list.

Select *Delete* from the dropdown list in order to delete the job/project and all of its contents.

Selecting Default Measurement Job/Path

Tap the  icon to select the current job as the default measurement job, where all projects will be saved when you press the **Save**  pushbutton. The job name, followed by the current project name, will appear in the topmost line in the status area to confirm which job you have selected.

Recalling Measurements

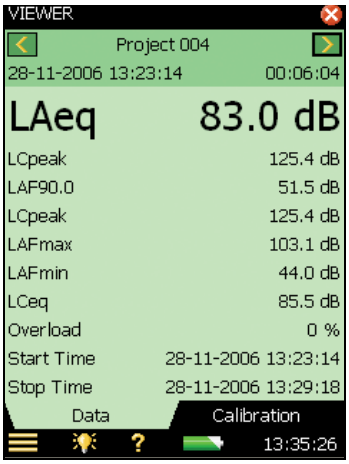
You can recall your measurement results in one of two ways:

- To display the measured results (and calibration details) only, use the results viewer – this can be done during an ongoing measurement and is a convenient way of browsing several sets of measurement data, see below
- To re-use setups from previously saved projects or view logged data as a profile, use the *Open* command in Explorer – this will recall the project template (display settings and measurement setup used on the saved results) along with the results. This will, however, stop and reset the current measurement

Viewing Data

Use Explorer to locate the project with the results you want to view, then tap on the project name and select *View* from the dropdown that appears (or simply tap on the project icon). This will open the Viewer (Fig. 6.2).

Fig. 6.2
The Viewer for Sound Level Meter data



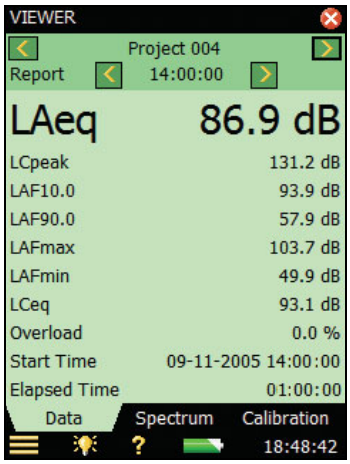
The project name is displayed at the top of the Viewer, along with two buttons: and . These are used to view results on the previous or next project in the job folder.

For Sound Level Meter and Frequency Analysis data the line below this shows the start time and elapsed time for the measurement.

For Logging and Enhanced Logging data the second line shows the Result Selector (selects between *Total*, *Logged*, *100 ms* and *Report* data) and the start time for the measurement, along with two buttons: and . These are used to view results on the previous or next interval in the project, see Fig. 6.3. The Overview profile is also available.

For Reverberation Time Data the second line shows the Position Selector.

Fig. 6.3
The Viewer for Logging and Enhanced Logging data



All the measured values are displayed below the top two lines – Sound Level Meter data on the *Data* tab and spectrum information (Frequency Analysis only) on the *Spectrum* tab. Tap on the spectrum parameters or broadband parameters to select other parameters.

The *Calibration* tab allows you to view the calibration details for the measurement.

You can view data on projects without disturbing the ongoing measurement.

To exit the Viewer, tap on the icon.

Re-using Setups from Projects

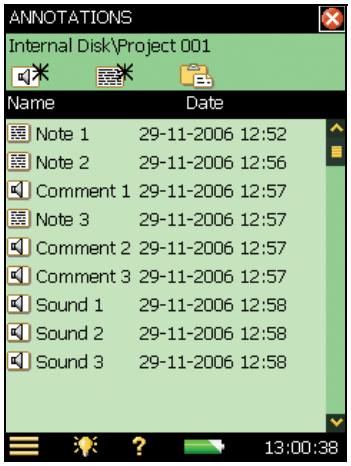
Use Explorer to locate the project with the setup you want to re-use, then tap on the project name and select *Open* from the dropdown that appears. This will stop and reset the current measurement and load the project including all setups and data. You are now using the same screens as the ones you were using just before you saved the data. Use the screens to browse the results. Pressing **Start/Pause** will start a new measurement using the setups from the project.

You can save the setup information in a template by tapping the Main Menu icon and selecting **Template Explorer**, see "How to Manage the Project Templates" on page 39.

Viewing or Listening to Annotations

Use Explorer to locate the project with the annotations you want to view/hear, then tap on the project name and select *Annotations* from the dropdown that appears (or simply tap on the annotations icon). This will show all annotations attached to the project:

Fig. 6.4
Example of an annotation attached to a project



The icon represents a verbal annotation, or commentary. Tap the annotation name and select *Play* from the dropdown that appears (or tap the icon) to play the commentary using the headphone output.

Note: you can also rename or delete annotations, or copy or move annotations to other projects or jobs.

The Text icon represents written annotations, or notes. Tap the annotation name and select *Open* from the dropdown that appears (or tap the icon) to open the Notes Editor. View the comments and, if required, edit the comments using the simulated keyboard that appears at the bottom of the screen. Tap on the icon to accept the changes and return to the previous screen.

Inserting Annotations Using Explorer

In addition to inserting commentary or text annotations on your current measurement, see “Document your Measurement” on page 22, you can insert commentary or text annotations on projects or jobs using Explorer.

Tap on a job or project name and select *Add note* or *Add Comment* from the drop-down that appears.

Chapter 7

Transferring Data to Your PC, Post-processing and Reporting

Transferring Measurement Data to Your PC

Utility Software for Hand-held Analyzers BZ-5503 is used for all communication between your PC and Type 2250. Connect Type 2250 to your PC using the supplied USB Cable AO-1476 or using a modem connection (see Chapter 8).

Use this software to:

- Transfer measurement data and templates from Type 2250 to your PC, and vice versa
- Organise data on Type 2250
- Create users on Type 2250
- Upgrade software on Type 2250
- Install software licenses on Type 2250

Using this software, measurements on Type 2250 can be controlled from your PC and displayed on-line, using the same user interface on the PC as on Type 2250.

Data transferred to the PC are organised in Archives.

View the measurement data in the Archives or edit the project templates.

Data in the archives can be exported to:

- Noise Explorer Type 7815
- Evaluator Type 7820
- Protector Type 7825
- Qualifier Light Type 7831
- Predictor Type 7810
- Lima Type 7812
- Acoustic Determinator Type 7816
- Microsoft® Excel for further post-processing and reporting

Sound Recordings can be input to the Brüel & Kjær PULSE™ Analyzer Platform for further analysis – please contact your local Brüel & Kjær representative for further information.

Post-processing and Reporting

The software modules are further enhanced by Brüel & Kjær's post-processing software suite, including Utility Software for Hand-held Analyzers BZ-5503 for data transfer, setup and remote display (included with your Type 2250), Noise Explorer Type 7815 for viewing data, Evaluator Type 7820 for assessing environmental noise, Protector Type 7825 for assessing workplace noise and Qualifier Light Type 7831 for documenting reverberation time measurements.

For further information, please refer to the on-line help included with the relevant PC Software. This software is supplied on the Environmental Software CD-ROM (BZ-5298), which is included with your Type 2250.

Chapter 8

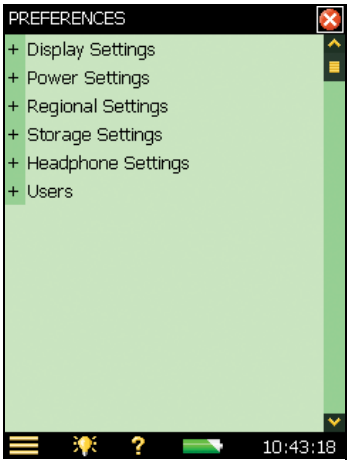
Advanced Use of Type 2250 – Tips and Tricks

Setting your Preferences on Type 2250

You can specify a number of parameters controlling display settings, power settings, regional settings, storage settings and users. These parameters are grouped together under Preferences.

You access preferences by tapping on the Main Menu icon and selecting **Preferences** from the list of options. The following screen will appear:

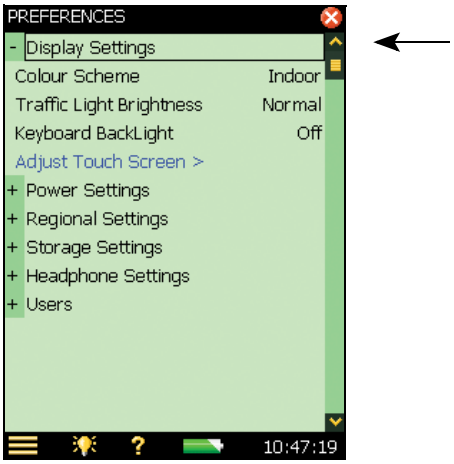
Fig. 8.1
The Preferences screen



Display Settings

Tap on *Display Settings*, or select the plus icon + next to *Display Settings*, to expand the list of available display settings, see Fig. 8.2. These parameters allow you to select a suitable colour scheme for your display. This may vary, depending on the lighting conditions at the time of the measurement.

Fig. 8.2
Display Settings screen



There are five different colour schemes you can choose:

- The *Indoor* scheme – a colour scheme for everyday use
- The *Alhambra* and *Arcade* schemes – alternative colour schemes, designed for everyday use
- The *Outdoor* scheme – a scheme for very bright conditions, where you need as much contrast as possible on the screen
- The *Night* scheme – a scheme which is made especially for measuring under very dark conditions, where you need to keep your night vision while measuring

For each colour scheme you can select the optimum choice of brightness for the traffic light (e.g., *High* for *Outdoor* in bright light conditions and *Low* for *Night* in dark conditions) and you can select whether to have backlight on the keyboard, or not. In very bright lighting conditions you will not be able to see the backlight, so set it to *Off* to save some power.

A link is also provided in *Display Settings* to adjust the touch-sensitive screen. Tap on *Adjust Touch Screen >* to display a full screen with guidance on how to tap on a cross five times at different places on the screen. At the end of the adjustment procedure you can save the values or cancel the adjustment.

Finally, you can change the number of decimal places on your dB results readout – tap on *Number of Decimal Places* and set to either 1 or 2 decimal places, as required. This setting is for display only and has no effect on the measurement precision or resolution.

When you have made your choices, tap on *Display Settings*, or on the minus icon -, to collapse the list.

Power Settings

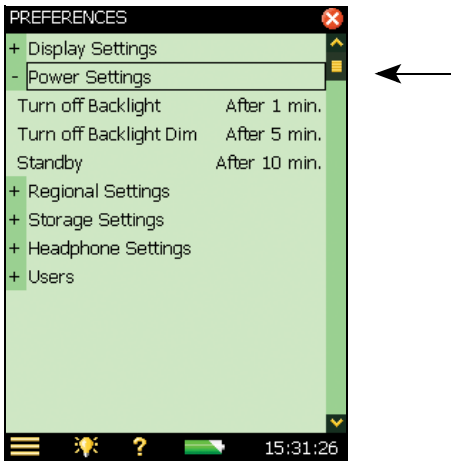
Type 2250 has an advanced power management function, that takes care of supplying the different circuits with adequate power and switches off those circuits that are not in use. These power management functions can be changed via the *Power Settings* screen, see Fig. 8.3.

Tap on *Power Settings*, or select the plus icon + next to *Power Settings*, to expand the list of available power settings.

There are three different power settings to choose from:

- *Turn Off Backlight*
- *Turn Off Backlight Dim*
- *Standby*

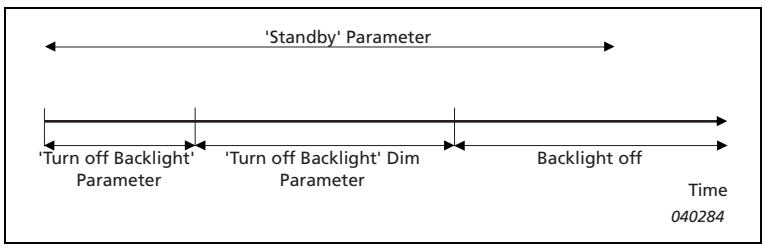
Fig. 8.3
Power Settings screen



The backlight will be switched on as soon as you operate the instrument, either by using the keyboard or the stylus on the touch-sensitive screen. The backlight brightness will be one of the 6 levels set by tapping on the backlight icon at the bottom of the screen. Select the *Minimum* level for minimum brightness and (power consumption), and *Maximum* level for maximum brightness and (power consumption). Once you have chosen the level, select *Close* to save the settings.

When the instrument has been left unused for the time specified in the *Turn off Backlight* parameter, the backlight level will change to the dim level (*Minimum*). This state will hold for the time specified in the *Turn off Backlight Dim* parameter (if still left unused). If the instrument has been left unused for the time specified in the *Turn off Backlight* parameter, plus the *Turn off Backlight Dim* time period, then the backlight will be switched off completely (see Fig. 8.4). Use the keyboard or tap on the screen to switch the backlight on again.

Fig. 8.4
Power Settings overview



If the instrument is left unused, not measuring and not communicating over the USB interface, it will go to standby after the time specified in the *Standby* parameter. If in standby mode, you have to press the power-on pushbutton ⏻ to switch the instrument on again.

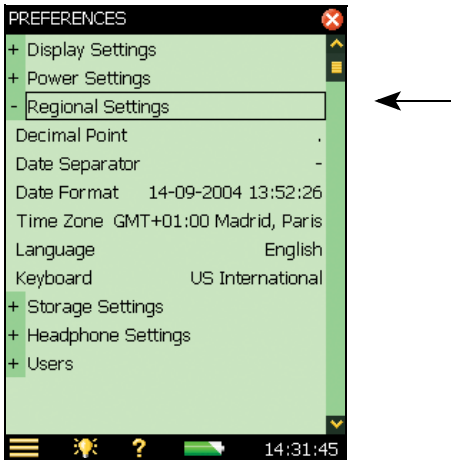
Note: If the instrument is externally powered, then the settings of the *Backlight* and the *Standby After* parameters are ignored. The backlight, in this case, is always on. It will never dim and the instrument will never go to standby.

When you have made your choices, tap on *Power Settings*, or on the minus icon -, to collapse the list.

Regional Settings

Tap on *Regional Settings*, or select the plus icon + next to *Regional Settings*, to expand the list of available regional settings, see Fig. 8.5.

Fig. 8.5
Regional Settings screen



Select your preferred settings for *Decimal Point* and *Date Separator* and select your preferred date/time format from the six different formats provided in the drop-down. Then select your time zone from the list.

A number of different languages are available for your Type 2250. Select your preferred language – if it is not in the list, then it might be available for installation using BZ-5503.

Built-in help is provided in the more commonly used languages – if your particular language is not covered, English will be chosen automatically.

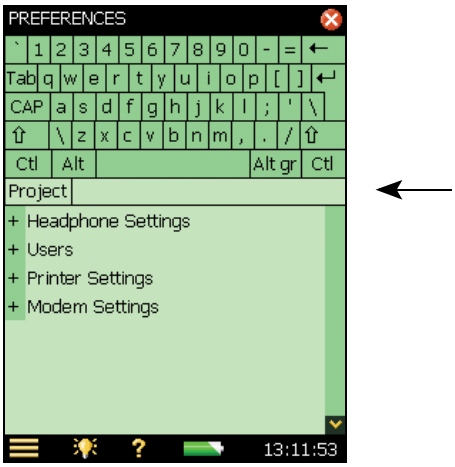
Select a keyboard matching the one you prefer when using your PC.

When you have made your choices, tap on *Regional Settings*, or on the minus icon -, to collapse the list.

Storage Settings

Each time you save the results of a measurement, Type 2250 suggests a project name and number for the project. The Project Name Prefix can be generated automatically (from the start date of the project as Year, Month, Date in the format YYMMDD, e.g., 051112 as 2005, November 12th) or you can specify a *Project Name Prefix* (max. 8 characters), using the standard full character keyboard that pops up when you tap on the current name set as the project name prefix, see Fig. 8.6. (The field where you type in the project name prefix will appear at the top or bottom of the pop-up keyboard, depending on how many settings you have expanded in the list.) The project suffix number will be generated automatically.

Fig. 8.6
Storage Settings screen



Headphone Settings

The headphone settings allow you to control the output to the headphone socket on the connector panel (see item 2 in Fig. 2.2).

Commentary annotations on measurements can always be heard on the headphones, regardless of the options chosen in *Headphone Settings*.

In addition to the commentary annotations, you can listen to the measured signal for monitoring purposes. Select between A/B-weighted, C-weighted or Z-weighted. (A/B-weighting is determined by setting the parameter in *Setup*, *Frequency Weightings*, *Broadband (excl. Peak)*).

The measured signal covers approx. 120 dB (from approx. 20 dB to 140 dB with a Type 4189 microphone of nominal sensitivity). The output of the headphone socket covers approx. 75 dB. Use the gain settings for the measured signal to adjust the output level to suit the listening conditions. If the signal has a very high dynamic range (or the levels are unknown), you can set *Automatic Gain Control* to *On* – this will convert the 120 dB input range to 40 dB output range enabling you to hear signals of any level clearly.

Individual gain settings are provided for the commentary annotations and the measured signal. Tap on the gain parameter and use the keypad to enter a new setting. Use '@' to assign the new value for immediate response at the output – or use the up/down navigation keys to increment/ decrement the value.

Note 1: A 0 dB gain on the measurement signal means you get a 1 V output for a 1 V input (when the measured signal *Automatic Gain Control* is set to *Off*).

Note 2: While playing back an annotation, you can use the up/down navigation keys to increase/ decrease the gain of the annotation.

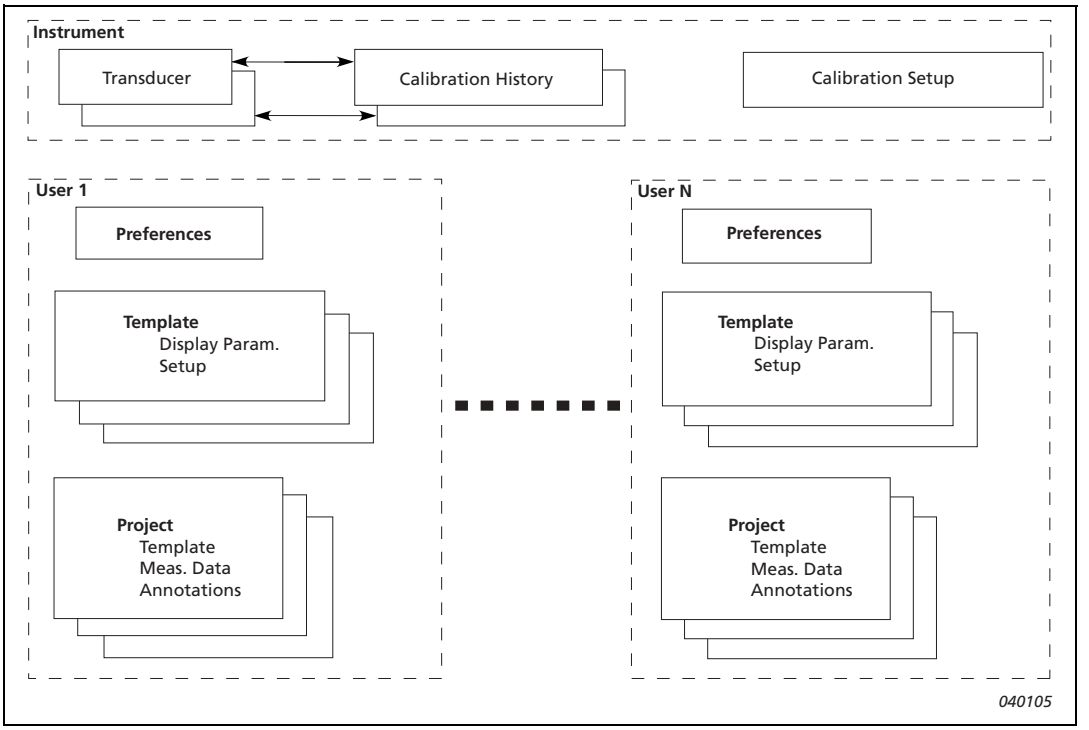
Note 3: If you do not want to listen to the input signal, then set the *Listen to Signal* parameter to *No*, to economise on power.

Multi-user Facility

Type 2250 can handle more than one user of the instrument. Each user can have their own set of preferences, templates and jobs and projects – completely invisible to other users. This can also be very useful in organising large measurement jobs, or cases – you can separate the cases completely from each other by handling each case as a separate user.

The transducers, the calibration setup and the calibration histories of the transducers are common to all users, as shown in the overview provided in Fig. 8.7

Fig. 8.7 *Overview of Multi-user Facility*



Tap on *Users*, or the plus icon +, then select *Yes* in the *Multi User Enabled* drop-down to distinguish between different users.

The instrument, when delivered, has one default user called '2250'.

You require Utility software for Hand-held Analyzers BZ-5503 (included with Type 2250) to set up new users on the instrument, see "Transferring Measurement Data to Your PC" on page 53.

Printer Settings

You can make screen dumps on a printer connected to Type 2250 using USB cable AO-0657. Use the Printer Settings to select your preferred printer.

When a printer has been selected under the *Printer Used* parameter, then the **Print Screen** command in the Main Menu appears. Use this command to print a screen dump of any screen on Type 2250.

The printer must either be an MPS type, or accept the PCL® printer language (PCL: Printer Control Language developed by Hewlett-Packard – see details on their website: www.hp.com):

- *MPS*: Mobile Pro Spectrum thermal printer from AM-TECH, see details on website: www.amteq.co.kr
- *PCL*: printers accepting PCL printer language
- *PCL Inkjet*: suitable for Inkjet printers and supports colour printing
- *PCL Laser*: suitable for Laser printers

For the PCL printers you can use the *Top* and *Left Margin* parameters to position the print on the paper, and use *Width* and *Height* parameters to set the size of the print.

Modem Settings

You can use Type 2250 for monitoring in remote places and control it using Utility Software for Hand-held Analyzers BZ-5503 via a telephone connection – wired or wireless – using suitable modems. When you connect via modem you will see the contents of Type 2250 in the Instrument Task, as if you had made the connection via USB. You then have the same possibilities for transferring data to the Archive and organising data on Type 2250, as if you were connected via the USB connector. Please refer to the on-line manual of BZ-5503 for details of how to make a connection and dial-up.

Hayes compatible modems (GSM or standard analogue modems) are supported. The modem connected to Type 2250 should either be a Compact Flash modem, or a modem with an RS-232 serial interface, to be connected via a Compact Flash to Serial converter.

To use the modem you only need to set the *Modem* parameter to *Enabled* in the *Modem Settings*. No other settings are necessary.

Note: Before you connect or disconnect a modem (or switch it on or off), the *Modem* parameter should be set to *Disabled*, or Type 2250 must be in standby mode or switched completely off – the latter is recommended.

Compact Flash Modems

Compact flash modems can be inserted directly in the compact flash socket of Type 2250 (see item 9 in Fig. 2.2).

Analogue Modems

The following modems have been tested:

- CF 56 K Modem Card from Socket – see details on website: www.socketcom.com
- 56 K CompactModem from Pretec – see details on website: www.pretec.com

GSM Modems

The following modems have been tested:

- Audiovox RTM-8000P GSM/GPRS CF modem – functionally identical to CONNECT2AIR GPRS Compact Flash Card
- CompactGPRS from Pretec – see details on website: www.pretec.com

Note: The SIM card should be usable without pin-code.

Modems with RS-232 Serial interfaces

Modems with an RS-232 serial interface can be connected using a Compact Flash to Serial converter inserted in the compact flash slot of Type 2250. The following Compact Flash to Serial converter has been tested:

- Serial I/O CF Card – Ruggedized, from Socket – see details on website: www.socketcom.com

Analogue Modems

The following modem has been tested:

- MT5600ZDXe from MultiTech Systems (Brüel & Kjær order number: ZM-0069) – see details on website: www.multitech.com

GSM Modems

The following modems have been tested:

- GSM Module M1 from Siemens
- WMOD2B-G900/1800 Dual Band Modem from Wavecom (Brüel & Kjær order number: WQ-1238) – see details on website: www.wavecom.com

Note: The SIM card should be usable without pin-code.

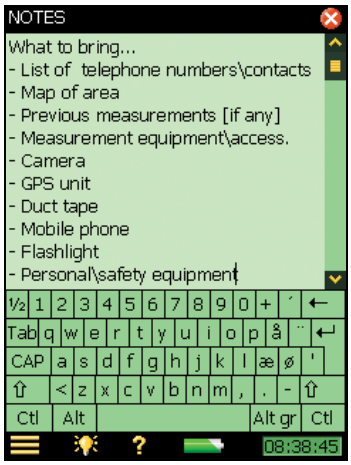
Preparing your Measurements

You can prepare your measurements in advance by making job folders, setting up the correct measurement parameters in the templates, and by making checklists (see example in Fig. 8.8) either as memos containing addresses and phone numbers of relevant people, or notes that have been partly filled-in beforehand, where you just have to fill in the final information on location. The notes can be attached to jobs as annotations, and can be copied onto projects, when necessary.

When you have finished typing in your note, tap on the icon to accept the changes and save it as a text annotation. See “Document your Measurement” on page 22 for more details on annotations.

The job folders, templates and notes can be made in advance on the PC using the Utility software for Hand-held Analyzers BZ-5503. The notes can be made as txt files using a standard notepad editor, however, save the text in Unicode or UTF-8 format, if the text contains non-ASCII characters.

Fig. 8.8
Example notes screen



Timers and Automatic Measurements

Automatic control of the analyzer is available via one or more of the analyzer’s timers (up to ten).

The purpose of a timer is to initiate measurements in the absence of an operator. Basically, a timer will:

- Switch on the analyzer at a preset time
- Load a preselected template
- Start a measurement as specified in the template
- Stop the measurement after a preset time defined by the Timer Setup
- Save the measurement
- Switch the analyzer off
- Repeat the above a preset number of times at preset intervals

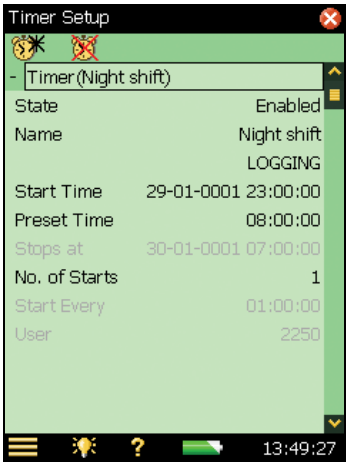
For a timer to work, the analyzer must be in the ‘switched off’ state.

A timer will never interrupt the analyzer if it is already in use manually. If a switch-on time is during the time the analyzer is in use, the timer opportunity is lost.

You can control the analyzer during a timer-initiated measurement as long as this does not affect the measurements. If you try to change any parameters affecting the measurement you will be warned of this. If you persist, the analyzer will revert to manual control and timer control cannot be resumed.

The Timer Setup lists the timers that have been defined previously on the analyzer (i.e., added by you or previous users).

Fig. 8.9
Example Timer Setup



In the topmost line you can add other timers by tapping on the Add New Timer icon . You can delete a timer from the list by tapping on the Delete Timer icon . Only timers created by the current user can be deleted – to delete a timer defined by another user, you have to logon as the other user and then delete the timer.

For each timer you can specify:

- *State:* Enable or disable the timer
- *Name:* Name the timer
- *Template:* Select the template you want to use for the measurement.
  Note: Reverberation Time templates are not available for timer control
- *Start Time:* Set the start time – at least 3 minutes ahead of current time
- *Preset Time:* Set the preset time for the measurement – regardless of the settings in the template used by the timer
- *Stop Time:* The time when the measurement stops – for information only
- *No. of Starts:* Set to the total number of times you want to start the measurement
- *Start Every:* The time interval between the start of each successive measurement. This interval must be greater than *Preset Time* + 3 minutes
- *User:* The user who specified the timer. Cannot be changed

Chapter 9

Updating and Upgrading Applications, Maintenance and Troubleshooting

How to Install New Applications

2250 Sound Level Meter Software BZ-7222, 2250 Frequency Analysis Software BZ-7223, 2250 Logging Software BZ-7224, 2250 Enhanced Logging Software BZ-7225, 2250 Sound Recording Option BZ-7226 and 2250 Reverberation Time Software BZ-7227 are pre-installed on Type 2250. However, a valid license is required to run the software. If you have purchased Type 2250 together with the software application(s), then the relevant license(s) will come pre-installed on the instrument.

If you purchase a separate software application for your Type 2250, then you have to install the license on the instrument. This is done using Utility Software for Hand-held Analyzers, BZ-5503, please consult the on-line help included with the BZ-5503 software for instructions on how to install a license.

Tap on the Help icon ? on the instrument's screen, then select **About** to get a list of installed software and licenses.

How to Update/Upgrade Applications and Install New Languages

When new versions of Type 2250 software become available, you may want to install the software on your instrument. This is done using the Utility Software for Hand-held Analyzers, BZ-5503. Some software versions will be free updates, and some will be upgrades requiring that a new license is purchased. The BZ-5503 software will clearly indicate if the new software version is an update (free of charge) or an upgrade (license fee). Please consult the on-line help included with the BZ-5503 software for instructions on how to install upgrades/updates of the software, together with your preferred language.

Tap on the Help icon ? on the instrument's screen, then select **About** to get a list of installed software and licenses.

How to Move a License

If you have more than one Type 2250, you may want to share application software between the instruments. You can do this by moving the license from one Type 2250 to another by using Utility Software for Hand-held Analyzers BZ-5503, together with the License Mover VP-0647.

If you lend out your Type 2250, you may want to temporarily 'un-install' applications not needed. This can be achieved by moving the license of the application to License Mover VP-0647. When needed again, you move the license back to your Type 2250.

Please consult the on-line help included with the BZ-5503 software for instructions on how to move a license.

Troubleshooting

Type 2250 Measurements

If your Type 2250 measurement seems to be wrong, then:

- Check the cabling, if any
- Check that the microphone, including preamplifier, is correctly mounted in the top socket (or correctly connected to the extension cable)
- Check that the *Input* parameter is set to *Top Socket*/*Rear Socket* in agreement with how you are going to use the input. This is found by tapping the Main Menu icon , then **Setup,** followed by *Input*
- Check that the transducer you have mounted on your Type 2250 is selected as the *Transducer Used* parameter, this is also found in the **Setup** menu
- Check whether the parameters for the selected transducer (*Transducer Used*) are set correctly, especially the *Microphone Type* and *Polarization Voltage* parameters. These are found by tapping the Main Menu icon , then **Transducers**
- Check that the *Sound Field* and *Windscreen Correction* parameters have been set correctly These are found by tapping the Main Menu icon , then **Setup,** followed by *Input*
- Check if the calibration is OK (make a new calibration using an external calibrator)

SD and CF Cards

The Logging, Enhanced Logging and Sound Recording software requires that measurements are saved on SD or CF memory cards. If you experience problems in storing or recalling data on memory cards, you can check and repair the integrity of the file system on the memory card or even re-format it, by doing the following:

1) Insert the memory card in the correct slot of the connector panel of Type 2250, see Fig.2.2.
2) You will be notified that a memory card has been inserted – select *Yes* to change the default measurement path to the memory card.
3) Tap the Main Menu icon and then **Explorer**.

4) Tap on the  icon to go up folder levels until you have reached the topmost level with a list of the available memory devices.

5) Tap on the name of the memory card (not the icon) to get a list of available commands.

6) Select **Check and Repair** to start the procedure. If any errors are found in the file system, they are fixed. When finished, you will be informed whether the memory device was OK or that errors have been fixed.

   Note: the checking procedure can take several minutes, depending on the size of the memory card.

Formatting a memory card:

7) Select **Format** to start the formatting procedure.

⚠ **WARNING:** All data on the memory card will be erased during the formatting process.

Note: the formatting procedure can take several minutes – depending on the size of the memory card.

⚠ **WARNING:** Do not remove the memory card or switch off the instrument during the procedure – this might damage the file system and data and make the card unusable.

Note: The read/write performance of SD and CF memory cards varies a lot. The performance depends on the manufacturer of the card, the type of card, the size of card and even on the day of production of the card – two 'identical' cards can have a different performance because the manufacturer has changed the internal technology without notice.

In general, as a rule of thumb, you should select cards aimed for the industrial or professional photographer market.

The cards delivered by Brüel & Kjær have all been tested for their read/write performance in a Type 2250 and can be used for the applications available in a Type 2250. If you need more (or other) types of card, please consult your local Brüel & Kjær representative.

Remember to regularly re-format the card (especially before a long unattended measurement) – this will ensure the best performance of the card.

Battery Pack and Recalibration of Battery Charge Indicator

The software keeps the capacity of the battery pack updated. Over time the total capacity of the battery pack decreases. If you find that the 'Time Remaining' estimate (tap on the battery icon  to get this information) does not match the real time remaining (e.g., the instrument switches off automatically because of lack of power while the Time Remaining estimate indicates at least ½ hour), then you should manually re-calibrate the capacity of the battery pack. This is done using the following method:

- Drain all the power from the battery:
  - Switch the instrument on
  - Disconnect external power
  - Disconnect the instrument from the PC
  - In the **Preferences** menu, under *Power Settings*, set *Standby After* to *Never*

  - You may want to set *Backlight On* to *Always* (in the same menu) and select the maximum level of display backlight in order to drain the battery faster (use the Backlight icon at the bottom of the screen)
  - Leave the instrument until the battery voltage becomes so low that the instrument switches itself off
- Charge the battery fully (at least 10 hours):
  - Connect the Mains Power Supply ZG-0426 to the instrument
  - Switch the instrument on (and leave it on) and remember to reset the *Standby After* and *Backlight On* to your preferred settings
  - Tap the battery icon and a pop-up appears, giving details of the battery condition. This will indicate 'Calibrating Battery' initially. Let the battery charge until the battery charge indicator just below the power socket starts flashing and the 'Calibrating Battery' indication has disappeared from the pop-up window

Touch Screen

If tapping with the stylus on the screen seems to be getting more inaccurate, you can adjust the touch sensitive screen, as follows:

- In the **Preferences** menu, under *Display Settings* activate the link *Adjust Touch Screen*. This displays a full screen with guidance on how to tap on a cross five times at different places on the screen. The adjustment procedure ends with saving the values or canceling the adjustment.

Reset Options

Reset Button

WARNING: Unsaved data or setups will be lost when you reset the instrument.

If your Type 2250 stops responding to pushbutton presses, or stylus taps, then you can do the following:

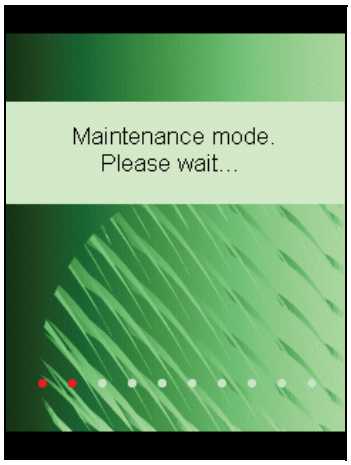
- Reset and reboot the instrument by pressing the reset button (located on the connector panel – see Fig. 2.2 in Chapter 2) with the point of the stylus

Instrument Reset

If you still experience problems, then you can

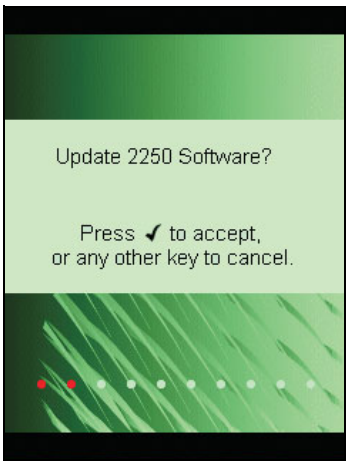
- Reset the instrument to a default state, where the user is set to '2250', the project template is set to **SOUND LEVEL METER** and *No Transducer* selected. The existing **SOUND LEVEL METER** project template will be overwritten, as will the preferences for user '2250'. To reset the instrument to the default state, do as follows:
  - Power off the instrument (press and hold the power-on pushbutton for at least 5 seconds)
  - Press and hold down the **Commentary** and **Save** pushbuttons while switching on the instrument. The display will show:

Fig. 9.1
Maintenance Mode – initial screen



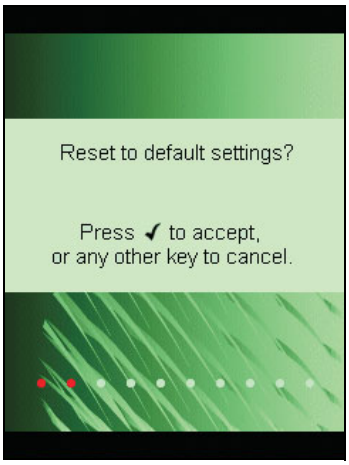
Within a few seconds the display will show:

Fig. 9.2
Update 2250 software screen



Press any other pushbutton than the **Accept** pushbutton ✓ to continue:

Fig. 9.3
Reset to default settings screen



Press the **Accept** pushbutton ✓ to reset to default settings.

If the instrument now functions normally, you should select the correct transducer again in the **Transducers** menu, make your preferred settings in the **Preferences** menu, adjust the touch screen again and make necessary changes to **Setup** (all accessed via the Main Menu).

If you experience problems selecting the correct transducer again, or selecting another template or you login as another user, then note which step causes the problem. You might need to delete a transducer, or delete/reconfigure templates or users.

⚠ **WARNING:** If you delete a transducer, the calibration history will be lost.

You can delete a transducer from the transducer database by tapping the Delete Transducer icon (see “Transducer Database” on page 44).

To delete/reconfigure templates or users you can use Utility Software for Hand-held Analyzers BZ-5503, with the instrument connected to the PC using the USB interface cable (AO-1476) or a modem connection. Please consult the on-line help included with the BZ-5503 software for instructions on how to configure Type 2250.

Re-installing Software

If the instrument still does not work normally after performing the ‘Reset to Default Settings’ procedure, then the software might need to be re-installed. This can be done in two ways:

1) If the connection to Utility Software for Hand-held Analyzers BZ-5503 works with the instrument connected to the PC using a USB cable, then the software can be re-installed and re-configured through the USB cable. Please consult the on-line help included with the BZ-5503 software for instructions on how to re-install software on Type 2250.

2) If the connection to the PC does not work, then you need a Compact Flash card (size at least 64 Mbytes) and a Compact Flash card reader for the PC. You can then use Utility Software for Hand-held Analyzers BZ-5503 to update the Compact Flash card with the

necessary files. Please consult the on-line help included with the BZ-5503 software for instructions on how to update a Compact Flash card with installation files for Type 2250.

Power off Type 2250 and insert the compact flash card in the CF slot on the instrument. Then press and hold down the **Commentary** and **Save** pushbuttons while switching on the instrument. The Maintenance Mode initial screen will be displayed, and then within a few seconds the screen shown in Fig. 9.2 will appear.

Press the **Accept** pushbutton to update the software. This will take approx. 5 minutes.

⚠ **WARNING:** Do not remove the CF-card while updating the Type 2250 software!

When the Type 2250 software has been updated, you will get the option of resetting to the default settings.

If the problem still persists, then you should contact your local Brüel & Kjær representative.

Service and Repair

Type 2250 is designed and constructed to provide many years of reliable operation. However, if a fault occurs that impairs the sound level meter's correct function, then remove the battery pack and disconnect any external power supply to prevent risk of further damage.

For more information about preventing faults or damage to your sound level meter, please read the "Care, Cleaning and Storage" section that follows.

For repair, contact your local Brüel & Kjær representative. Brüel & Kjær provides a high level of support and after-sales service to assist customers in the handling and operation of their instruments.

Care, Cleaning and Storage

Type 2250 is a delicate precision instrument. When handling, storing or cleaning your instrument, please take the following precautions.

Handling the Instrument

- Do not try to remove the microphone grid as you can easily damage the microphone in this way
- Do not attempt to open the instrument. There are no user-serviceable parts inside. If you think your instrument requires service, please contact your Brüel & Kjær representative
- Do not allow the instrument to get wet
- Protect the instrument from impact. Do not drop it. Transport it in the supplied carrying pouch

Cleaning the Instrument

If the instrument casing becomes dirty, then wipe it with a lightly dampened cloth. Do not use abrasive cleansers or solvents. Do not allow moisture to enter the microphone, connectors or casing.

Storing the Instrument

- Keep the sound level meter in a dry place, preferably within its carrying pouch
- For long-term storage, remove the battery pack
- Do not exceed storage temperature limits of –25 to +70°C (–13 to +158°F)

Chapter 10

1/1- or 1/3-octave Frequency Analysis (Optional Module)

2250 Frequency Analysis Software BZ-7223 enables you to make 1/1-octave or 1/3-octave measurements and broadband sound level measurements simultaneously.

Check the About Menu to see whether you have the license to run the frequency analyzer. The About Menu is accessed from the built-in help – tap ? on the shortcut bar, then select **About**. See Chapter 9 for instructions on installing the license for the frequency analyzer.

Setting up the Instrument

The frequency analyzer measures the following spectrum parameters together with full spectral statistics during timed measurements:

- L_{Xeq}
- L_{XFmax}
- L_{XSmax}
- L_{XFmin}
- L_{XSmin}

where X is the frequency weighting A, B, C or Z.

These spectra and the spectral statistics are saved in the project together with the measured sound level meter (broadband) parameters.

The spectral statistics can be viewed as L_{XYN} percentile spectra, where Y is the time weighting F or S and N can be one of 7 defined percentiles.

In addition, the instantaneous spectra L_{XF} and L_{XS} are always available.

1) Select the **FREQUENCY ANALYZER** Project Template. (See “What is a Project Template?” on page 16 for more details on templates.) The Project Template is displayed at the top of the screen, if it does not display **FREQUENCY ANALYZER**, tap on the black bar

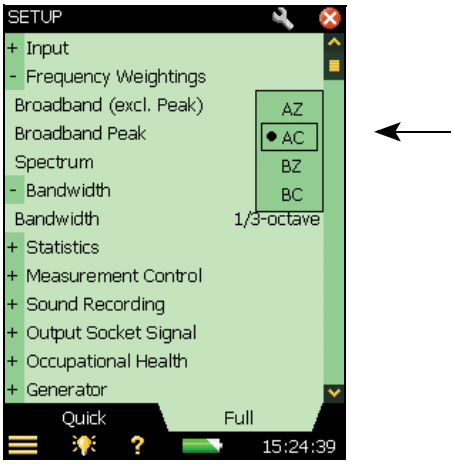
at the top of the screen and select **FREQUENCY ANALYZER** from the drop-down that appears.

2) Tap the Main Menu icon and select **Setup** from the list of options. Set the *Broadband* and *Spectrum* parameter to A, B, C or Z, as required. (A/B-weighting is determined by setting the parameter in *Setup*, *Frequency Weightings*, *Broadband (excl. Peak)*).

   Then, under *Bandwidth*, set the *Bandwidth* parameter to 1/1-octave or 1/3-octave before making the measurement.

   To exit the screen, tap on the icon.

Fig. 10.1
Setting the frequency weighting and bandwidth parameters



Controlling the Measurement

The measurement is controlled in the same way you would control a normal sound level meter measurement, using **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons, see Chapter 3 for more details.

The measurement can control a generator connected to the Output Socket on the Connector Panel (see Fig. 2.2). Enable the generator by setting the *Source* parameter to *Generator* in *Setup*, *Output Socket Signal*, then set up the generator settings in *Setup*, *Generator*. The generator will be controlled using Escape Time and Build-up Time, as described in Fig. 14.3.

Displaying the Results

The frequency analyzer measurement screen includes three tabs at the bottom: *Spectrum*, *Broadband* and *XL View* (Extra Large View). The tabs allow you to choose different ways of displaying the measurement results. All but the *Spectrum* tab have been covered in Chapter 3. However, a quick recap is provided below.

The *Broadband* view shows an instantaneous L_{AF} readout, with associated bar graph and four measurement parameters, followed by two measurement setup parameters. (The first measurement parameter is displayed in a larger font size for better readability.)

The *XL View* increases the size of the first parameter readout to a 4 digit, full-screen display (including decimal point).

The *Spectrum* view, (which only appears as a tab if Frequency Analysis Software BZ-7223 is enabled), shows two different spectra parameters being measured simultaneously. In the example in Fig. 10.2, L_{ZFmax} and L_{ZF} are being viewed at the same time.

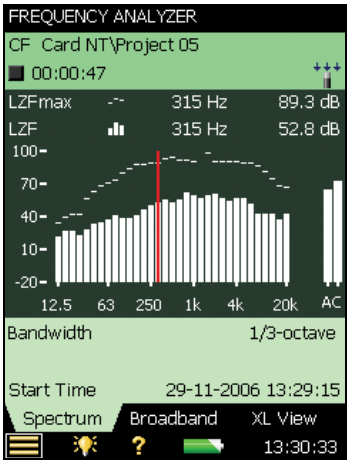
Note the Reference Spectrum and Main Spectrum icons, indicating which spectrum belongs to which parameter.

1) Select which spectra to view by tapping the parameter fields in the two lines above the spectrum display.

   These lines also include readouts of the spectrum values highlighted by the spectrum cursor. Tap on the spectrum at the frequency of interest - or just tap anywhere in the spectrum area and then move the cursor to the position of interest using the left ◄ and right ► arrow pushbuttons.

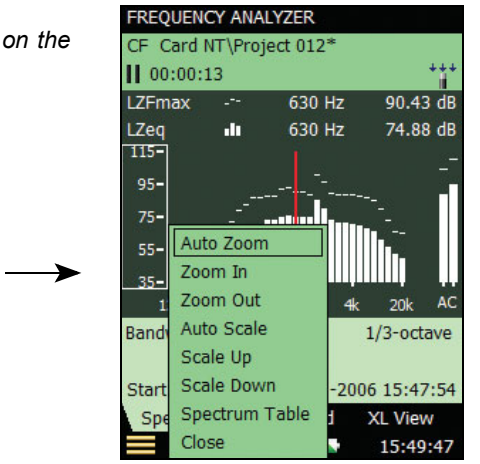
   To the right of the spectrum, two broadband bars (of the same parameters) are also displayed.

Fig. 10.2
Displaying the results – spectrum screen



2) Scale the Y-axis (left-hand vertical scale of the graphical display) by tapping on the scale and accessing the drop-down menu, see Fig. 10.3. (You can also select the spectrum cursor and press the **Accept** ✓ pushbutton.)

Fig. 10.3
Scaling the Y-axis on the Spectrum display



Select *Auto Zoom* to adjust the range of the Y-axis for best fit of the measured spectrum.

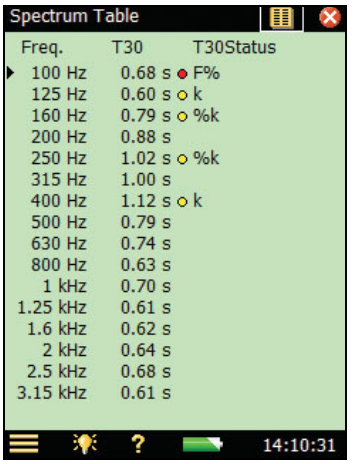
Select *Zoom In*/*Zoom Out* to adjust the zoom.

Select *Scale Up/Scale Down* to adjust the full scale value on the Y-axis – or select *Auto Scale* to select the best scaling for viewing the spectra – without adjusting the zoom.

Spectrum Table displays the spectrum in tabular form – as in Fig. 10.4. Press the Table Format icon at the top of the screen to select between three different viewing formats:

- *Two Parameters*: for displaying values from both spectra
- *One Parameter*: for displaying values from the main spectrum only (available for Reverberation Time Software only)
- *One Parameter (wrap)*: for displaying values from the main spectrum only, but with the columns wrapped on the display to allow as many values as possible on the screen

Fig. 10.4
Spectrum table



To exit the Spectrum Table, tap on the icon.

Auto Zoom and *Auto Scale* automatically close the drop-down menu, otherwise, select *Close,* tap outside the dropdown list or use the left arrow ◄ pushbutton to close the menu.

Hint: a quick way of auto zooming is to tap anywhere in the spectrum and then press the **Accept** ✓ pushbutton twice.

Saving Results

Measurements are saved and can be viewed later, in the same way as described for the Sound Level Meter Project in Chapter 3.

Chapter 11

Logging (Optional Module)

2250 Logging Software BZ-7224 enables you to measure and save data periodically on SD- or CF-Cards. The module is optimised for attended use, which means that while measuring you can annotate any sound on-line, as well as ‘mark’ up to five different sound categories on-line.

The main benefit is that data is documented on-site and is therefore ready for post-processing and reporting back at the office using Utility Software for Hand-held Analyzers BZ-5503 or other post-processing software such as Noise Explorer Type 7815, Evaluator Type 7820, Protector Type 7825 or Microsoft® Excel.

In addition to measuring broadband parameters (see Chapter 3) and spectra[a] (see Chapter 10), the logging module allows you to simultaneously log the following parameters:

- Broadband Parameters (including broadband statistics)
- Spectra[a] (including spectral statistics)
- Broadband Parameters every 100 ms
- Record the measured signal[b]

An overview showing the options available during a typical logging task has been provided in Table 11.1.

a. Requires Frequency Analysis Software BZ-7223
b. Requires Sound Recording Option BZ-7226

Table 11.1 *Overview of options available during a typical logging task*

Selection	Period	Broadband Parameters	Broadband Statistics	Spectral Parameters	Spectral Statistics
Logged	1 s – 24 h	1 to 10 or All (32)	None or Full	0 – 3 or All (5)	None or Full
Logged (100 ms)	100 ms	None, L_{Aeq} and/or L_{AF}	None available	None available	None available
Total	Elapsed Time	All (45)	Full	All (5)	Full

Check the **About** Menu to see whether you have the right license to run the Logging module. (The **About** Menu is accessed from built-in help – tap ? on the shortcut bar, then select **About**.) See Chapter 9 for instructions on installing the license for the Logging Module.

Setting up the Instrument

1) Select the **LOGGING** Project Template. (See "What is a Project Template?" on page 16 for more details on templates.) The Project Template is displayed on the black banner at the top of the screen. If this banner does not display **LOGGING**, tap on the banner and select **LOGGING** from the drop-down that appears.

   Note: The Logging Project Template assumes you have a license for the Frequency Analysis Software. If not, then select the **LOGGING SLM** Project template instead.

2) Insert an SD or CF memory card in the slot for SD or CF cards (see items 9 and 10 in Fig. 2.2). You will be notified that a memory card has been inserted – select *Yes* to change the default measurement path to the memory card.

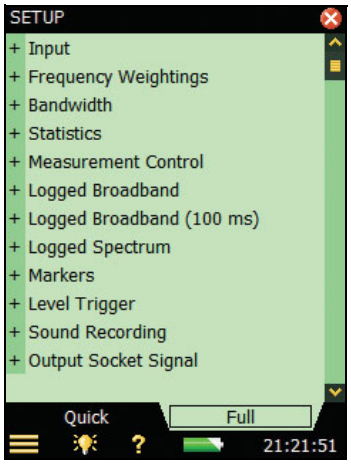
3) Tap the Main Menu icon and select **Explorer** from the list of options. Create a job folder for the measurements and set the default measurement job/path as described in Chapter 6.

   Note: You cannot log data on the internal disk.

4) Tap the Main Menu icon and select **Setup** from the list of options. The Setup screen will appear, see Fig. 11.1. Set the *Input*, *Frequency Weightings*, *Bandwidth*[a] and *Statistics* parameters as required for the Sound Level Meter and Frequency Analyzer[1] measurement, see Chapter 3 and Chapter 10 respectively. These settings are common to both the logging and the total measurement.

a. Requires Frequency Analysis Software BZ-7223

Fig. 11.1
The Setup screen



5) Under the *Measurement Control* parameters, set the *Measurement Time* and *Logging Period* as required. Set *Synchronize with clock* to *Yes* if you want the logging to synchronise with whole minutes or hours. For example, if *Logging Period* is set to 1 minute and you start the measurement at 8:12:33, then the first logging interval will be from 8:12:33 to 8:12:59 (27 seconds), the second will be from 8:13:00 to 8:13:59 (60 seconds), etc. Set *Synchronize with clock* to *No* if you want every logging interval to be the specified Logging Period exactly.

6) Under the *Logged Broadband* parameters, choose which broadband parameters you want to log in accordance with the *Measurement Control* parameters. You can choose to log *Full Statistics* per *Logging Period* or not. You can also choose to log *all* the measured *Broadband Parameters* or a *Selected* number of parameters. If you choose *Selected* then you can specify up to 10 parameters.

7) The *Logged Broadband (100 ms)* parameter allows you to log L_{Aeq}, with an elapsed time of 100 ms and a logging period of 100 ms, and/or L_{AF}, with a logging period of 100 ms, irrespective of the other logging parameters.

8) The *Logged Spectrum*[a] parameter allows you to choose which spectra to log. You can specify to log *All*, *None* or up to 3 *Selected* spectra. You can also choose to log *Full Spectral Statistics* per *Logging Period* or not.

9) Under *Markers* you can specify the names of the five available markers. The markers are predefined as follows:

   - Marker 1: ‘Exclude’ – can be controlled by pressing the **Back-erase** pushbutton
   - Marker 2: ‘Manual’ – can be controlled by pressing the **Manual Event** pushbutton
   - Marker 3: ‘Level’ – can be controlled by the Level Trigger detection
   - Marker 4: ‘Marker 4’
   - Marker 5: ‘Marker 5’

a. Requires Frequency Analysis Software BZ-7223

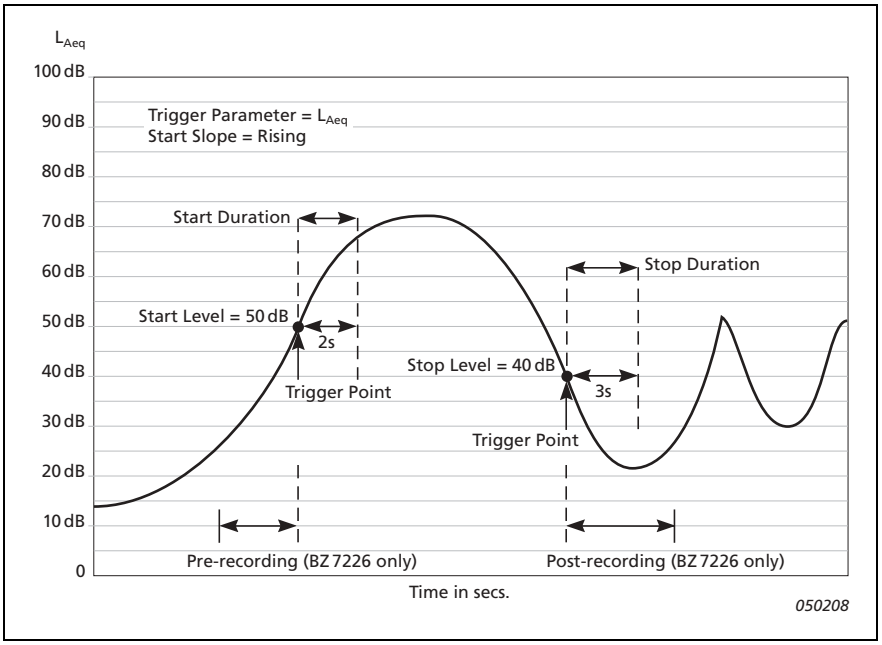
- Marker 6: ‘Sound’ – is set when recording sound (requires Sound Recording Software BZ-7226)

All markers can be controlled by the stylus in the Profile display.

You can set a *Pre-marker Time* between 0 and 5 seconds. This will start markers 1, 2 or 3 the set number of pre-marker seconds before the point where the **Back-erase** pushbutton, the **Manual Event** pushbutton, or the Level Trigger, respectively, are pressed. See “Marking Sound Categories” on page 86.

10) Under the *Level Trigger* parameters, choose the settings for triggering the number 3 marker ‘Level’ and for starting a sound recording – see Chapter 12.
    - Set *Level Trigger Control* to *On* to enable the level trigger facility, or *Off* to disable the facility
    - Set *Trigger Parameter* to the parameter you want to monitor, e.g., L_{Aeq} – see Appendix A for the total list of parameters
    - Set *Start Slope* to *Rising* if you want to start when the *Trigger Parameter* exceeds *Start Level* (and stop when it goes below *Stop Level*) or to *Falling* if you want to start when the *Trigger Parameter* goes below *Start Level* (and stop when it exceeds *Stop Level*)
    - Set *Start Duration* for the number of seconds the *Trigger Parameter* must fulfill the trigger condition before the trigger point is acknowledged
    - Set *Stop Duration* for the number of seconds the *Trigger Parameter* doesn’t fulfill the trigger condition anymore to acknowledge the end point of the trigger. (See the relationship between the trigger parameters in Fig. 11.2)

Fig. 11.2 *Relationship between trigger parameters*



11) Under the *Sound Recording* parameters, choose the settings for recording sound while making a logging – see Chapter 12.

12) Under *Input* specify *Trigger Input* if you want to start the sound recording using an external trigger signal. See details in Appendix A.

To exit the screen, tap on the  icon.

Controlling the Measurement

The measurement is controlled in the same way you would control a normal sound level meter measurement, using **Start/Pause**, **Continue**, **Reset** and **Save** pushbuttons, see Chapter 3 for more details.

Annotating a Project

While using the logging software you can annotate measurements using the normal method of adding annotations to a project, before or after a measurement, or while the measurement is paused. The annotations can then be viewed by tapping on the paperclip icon or tapping the Main Menu and selecting **Explorer** from the list of options. See “Document your Measurement” on page 22.

However, if you choose to annotate the profile during the measurement, the annotation icon will appear below the profile, not as a paperclip icon in the status field or attached to a project in **Explorer**, as described previously. In this case, you view the annotation using the method described under “The Profile” on page 85.

Recording Sound

You can record sound during the measurement[a] by pressing the **Manual Event** pushbutton (Manual Event marker), the **Back-erase** pushbutton (Exclude Marker) or when the level of a specific parameter exceeds a certain level – or you can record sound through the whole measurement – depending on the Sound Recording setting in the Setup – see details in Chapter 12.

Displaying the Results

The Logging measurement screen (or Profile View) includes three tabs at the bottom: *Profile*, *Spectrum* and *Broadband* View (the Logging SLM includes the tabs: *Profile*, *Broadband* and *XL View*). The tabs allow you to choose different ways of displaying the measurement results. All but the *Profile* tab have been covered previously in Chapters 3 and 10, however a quick recap is provided below.

The *Broadband* view shows an instantaneous L_{AF} readout, with associated bar graph and a number of measurement parameters. (The first measurement parameter is displayed in a larger font size for better readability.)

a. Requires License for Sound Recording Software BZ-7226

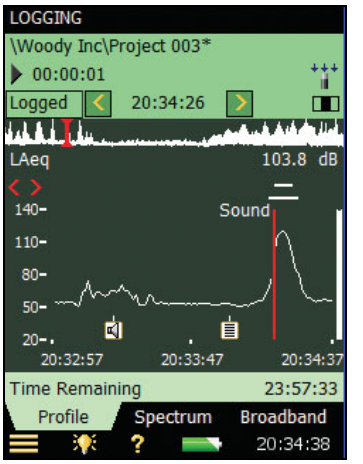
The *XL View* increases the size of the first parameter readout to a 4 digit, full-screen display (including decimal point).

The *Spectrum* view shows two different spectra parameters being measured simultaneously.

The Profile View

The *Profile* view displays a profile of a logged broadband parameter (dB versus time). This is very convenient when marking sound categories on-line or annotating the measurement. See Fig. 11.3.

Fig. 11.3
Profile View (showing extended status field)



Status Field

The Status Field has been extended to include an extra line of information below the two existing lines of information covered previously in the Sound Level Meter and Frequency Analyzer (see Fig. 11.3).

This extra line of information allows you to:

- Select whether the results of the *Total* measurement from the *Logged* measurement, or from the *Logged(100 ms)* measurement are displayed. Select *Total* to display the measurement parameters of the Total measurement in all the views – the Broadband and Spectrum views will then display parameters or spectra similar to the Sound Level Meter or Frequency Analyzer. (The Profile View will be empty, because the Total measurement contains only a single set of parameters). Select *Logged* to display the measurement parameters from the logging intervals. The cursor in the profile selects which logging interval is displayed in all the views. Select *Logged(100 ms)* to display the L_{Aeq} or L_{AF} in the profile from the 100 ms logging intervals. This setting does not display spectra or parameters in other views
- View the start time of the measurement (for *Total*) or the start time of the current logging interval (for *Logged* or *Logged(100 ms)* if measuring and the profile is not frozen) or the start time of the logging interval pointed out by the cursor. Tap on the start time in any of the views to select data from another logging interval

- View whether the display of the profile during the measurement is frozen or not. When the icon is "animated" the display is being updated with new logged data during the measurement. You can freeze the display update by tapping on the icon. This also freezes the icon. Tap on the icon again to unfreeze the display
- Step forwards or backwards through the logging intervals on all displays, using the and icons. (The icons are also connected to the profile cursor, so that any corresponding movement backwards or forwards through the intervals in one display will be reproduced in the other)

Some interaction with the display will automatically freeze and unfreeze the display (only while measuring):

- Tap the stylus on the profile. This will set the profile cursor and freeze the display update of the profile. You can move the cursor to any point in the profile by using the left and right arrow pushbuttons. The profile will be scrolled automatically, if necessary. Unfreeze by tapping on the icon
- Tap and hold the stylus on the profile display and drag it to the left or right. This will freeze the display and show two cursors. Next, remove the stylus from the display and a dropdown menu appears with the possibility of setting or editing a marker or annotation (see below). Select the required function from the dropdown menu. When the function has been carried out, the profile unfreezes automatically and progresses as it did before you tapped on the screen

The logged data are displayed as two profiles. The Profile Overview with the entire profile and the Profile with 100 logging samples.

The Profile Overview

An overview of the entire profile is displayed across the screen on the topmost part of the graph area.

The overview is based on $L_{Xeq,1s}$ (X = A or B depending on the *Broadband (excl. Peak)* Frequency Weightings parameter). The Y-axis is auto-zoomed.

When you have logged for more than 4 minutes, then each pixel on the X-axis will cover more than 1 s. The overview will then display from the minimum $L_{Xeq,1s}$ to the maximum $L_{Xeq,1s}$ within the interval covered by the pixels on the X-axis.

Tap in the Profile Overview to select the part of the entire profile to display in the Profile below.

The Profile

The Profile displays a hundred samples of the logged data.

Select which parameter to view by tapping the parameter field in the line above the profile.

Markers are displayed between the profile and the profile parameter. Marker 1 (Exclude) is the topmost positioned marker. The name of the marker is displayed if the marker overlaps the cursor position. If a sound has been recorded, then a Sound Marker (Marker 6) is displayed above the profile – the marker covers exactly the time of the sound recording.

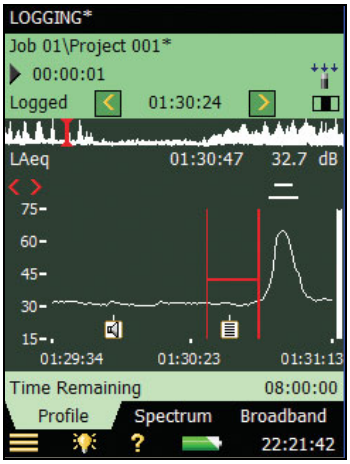
You can browse through markers using the buttons in the profile.

The whole, or any part of the sound recording can be played back, once or repetitively – see Chapter 12 for details.

To the right of the profile, the broadband parameter L_{AF} is displayed and updated regardless of the measurement status and the display freeze status.

Annotations are displayed below the profile as icons. To select an annotation, tap and hold the stylus at one side of the icon, just above it, then drag the stylus to the opposite side of the icon (so it looks like the example in Fig.11.4) and remove the stylus from the display.

Fig.11.4
Selecting Annotations



A dropdown menu appears, select the required function:

- Open note or play commentary
- Delete annotation
- Move annotation (to the position on the display where the stylus was removed from the display)

Scale the Y-axis (left-hand vertical scale of the graphical display) by tapping on the scale and accessing the drop-down menu (as in the Spectrum display):

- Select *Auto Zoom* to adjust the range of the Y-axis for best fit of the measured spectrum
- Select *Zoom In/Zoom Out* to adjust the zoom
- Select *Scale Up/Scale Down* to adjust the full scale value on the Y-axis - or select *Auto Scale* to select the best scaling for viewing the spectra - without adjusting the zoom
- *Auto Zoom* and *Auto Scale* automatically close the drop-down menu, otherwise, select *Close*, tap outside the dropdown list or use the left arrow pushbutton to close the menu

Marking Sound Categories

Use this facility to categorise the sound while you are measuring, or while you are observing the different kinds of sound on the display. This will make it much easier to do the post-processing and reporting back in the office.

You can mark up to five sound categories on-line. The markers are displayed as horizontal lines above the sound profile, see Fig.11.3. There are two main types of marker:

- An Exclude Marker – this allows you to mark a sound you want to exclude from your measurement later during post-processing or reporting. (It does not remove any data from your measurement)
- An Event Marker – this allows you to mark a particular sound of interest during your measurement

On Type 2250, Marker 1 is used as an Exclude Marker, while Markers 2 to 5 are used as Event Markers. All four event markers can be user-defined. You can define a marker by tapping on the Main Menu icon and selecting **Setup**, followed by *Markers*.

Marker 2 is set to a Manual Event marker by default – it can be controlled by the **Manual Event** pushbutton and the stylus.

Marker 3 is set to a Level Event marker by default – it can be controlled by the level trigger facility and the stylus.

Marker 6 is used as a Sound Marker and shows the size of the sound recording.

Type 2250 allows you to view the markers at a later date by recalling the data and viewing the desired profile. (This can also be done if you have transferred the data to Type 7815 Noise Explorer).

If required, Type 7820 Evaluator and Type 7825 Protector can use the markers in their calculations. Marker number 1 (the Exclude Marker) will always be used as an Exclude Marker, while markers 2 to 5 will be used as defined in Type 7820 Evaluator/Type 7825 Protector software. The marker names, however, will be transferred from Type 2250. Marker 6 will be used as sound marker.

Marking During the Measurement:

The measurement parameter is displayed as a progressing profile.

Use of pushbuttons:

Press the **Back-erase** pushbutton to start an Exclude Marker (marker number 1). The marker is displayed above the profile. Press the button once more to stop the Exclude Marker.

Press the **Manual Event** pushbutton to start a Manual Event Marker (marker number 2). The marker is displayed above the profile. Press the button once more to stop the Manual Event Marker.

Use of stylus:

Tap and hold the stylus on the profile display at the position where you want the marker to start. This will freeze the display and show a cursor at the position of the stylus. Then drag the stylus left or right to the position where you want the marker to end. This will display a second cursor. Next, remove the stylus from the display and a dropdown menu appears showing the five markers you have specified in the setup. Select the marker you require. The marker is displayed above the profile, the cursors disappear and the profile unfreezes and progresses as it did before you tapped on the screen.

Note: If you select Sound Marker, then the sound for this part will be recorded – see Chapter 12 for details.

Marking Measurement While it is Paused:

The measurement parameter is displayed as a profile while the measurement is paused.

You can use the stylus to mark the sound categories:

Tap and hold the stylus in the profile display at the position where you want the marker to start. This will display a cursor at the position of the stylus. Then drag the stylus left or right to the position where you want the marker to end. This will display a second cursor. Next, remove the stylus from the display and a dropdown menu appears showing the five markers you have specified in the setup. Select the marker you require. The marker is displayed above the profile and the cursors disappear.

Editing Markers on Profiles

To widen a marker:

1) Tap and hold the stylus on the profile display at a position within the marker range.
2) Drag the stylus left or right to the position where you want the marker to end.
3) Remove the stylus from the display and a dropdown menu appears.
4) Select the marker you want to widen from the dropdown menu.

To narrow a marker:

1) Tap and hold the stylus on the profile display at the position inside the marker range where you want it to stop.
2) Drag the stylus left or right to a position outside the marker range.
3) Remove the stylus from the display and a dropdown menu appears.
4) Select *Delete* for the marker you want to narrow from the dropdown menu. The part where the marker overlaps the gap between the two cursors will be deleted.

To delete a marker:

1) Tap and hold the stylus in the profile display at a position to the left of the marker you want to delete.
2) Drag the stylus to a position to the right of the marker.
3) Remove the stylus from the display and a dropdown menu appears.
4) Select *Delete* for the marker you want to delete from the dropdown menu.

   Note: Sound markers cannot be edited. Marking the whole sound marker (or part of it) and selecting *Delete* will delete the whole sound marker and sound recording.

Annotate Sound Categories

You can annotate the measurement on-line with a spoken comment or a written note. The annotation is displayed as an icon below the sound profile.

Annotating During the Measurement:

The measurement parameter is displayed as a progressing profile.

Use of pushbuttons:

Press and hold down the **Commentary** pushbutton and talk to the instrument to make your comment. Release the button when finished. This will insert a comment annotation in the profile at the time when the button was pressed.

Use of stylus:

Tap and hold the stylus in the profile display at the position where you want the annotation to start. This will freeze the display and display a cursor at the position of the stylus. Then drag the stylus a little to the left or right and raise it again. A dropdown menu appears and below the five markers you can select *Add Comment* or *Add Note* to add a spoken comment or write a note. When finished, the Comment or Note is inserted in the profile, the cursors disappear and the profile unfreezes and progresses as before tapping on the screen.

Annotating While the Measurement is Paused:

The measurement parameter is displayed as a profile while the measurement is paused.

Use of stylus to annotate the sound:

Tap and hold the stylus in the profile display at the position where you want the marker to start. This will display a cursor at the position of the stylus. Next, drag the stylus a little to the left or right and remove the stylus from the display. A dropdown menu appears and below the five markers you can select *Add Comment* or *Add Note* to add a spoken comment or write a note. When finished the Comment or Note is inserted in the profile and the cursors disappear.

Use of pushbuttons:

Using the **Commentary** pushbutton during a pause means that the comment annotation will be added to the project instead of the profile. (The annotations can be viewed by tapping on the paperclip icon or tapping the Main Menu and selecting **Explorer** from the list of options. See “Document your Measurement” on page 22.)

Editing Annotations on Profiles

To move an annotation:

1) Tap and hold the stylus on the profile display at a position on one side of the annotation icon.

2) Drag the stylus through the annotation icon to the position where you want the annotation moved to.

3) Remove the stylus from the display and a dropdown menu appears.

4) Select *Move Comment* (or *Move Note*) from the dropdown menu.

To delete an annotation:

1) Tap and hold the stylus on the profile display at a position to the left of the annotation icon you want to delete.
2) Drag the stylus to a position to the right of the annotation.
3) Remove the stylus from the display and a dropdown menu appears.
4) Select *Delete* for the annotation you want to delete from the dropdown menu.

Saving and Recalling Results

Measurements are saved and can be viewed later, in the same way as described for the Sound Level Meter Project in Chapters 3 and 6.

Note: The viewer only displays the results as one set of data per logging interval (you can browse through all data). To display the data as a profile and see or hear annotations – or even edit the markers or insert new markers and annotations – you must Open the saved project instead of Viewing it.

Chapter 12

Enhanced Logging (Optional Module)

2250 Enhanced Logging Software BZ-7225 enables you to measure and save data periodically on SD or CF cards. The module is optimised for unattended use, which means that the module will measure and save data in an efficient way, without the requirement for an operator to be present.

In addition to measuring broadband parameters (see Chapter 3) and spectra[a] (see Chapter 10), it simultaneously logs the following parameters (see Chapter 11):

- Broadband Parameters (including broadband statistics)
- Broadband Parameters every 100 ms
- Spectra[a] (including spectral statistics)
- Record the measured signal[b]

Finally, the Enhanced Logging module can also log with a different period (periodic reports – for example, every hour) for reporting:

- Broadband Parameters (including broadband statistics)
- Spectra[a] (including spectral statistics)

The Enhanced Logging module can measure continuously, limited only by data memory and power supply. An overview showing the options available during a typical enhanced logging task has been provided in Table 12.1.

a. Requires Frequency Analysis Software BZ-7223
b. Requires Sound Recording Option BZ-7226

Table 12.1 *Overview of options available during a typical enhanced logging task*

Selection	Period	Broadband Parameters	Broadband Statistics	Spectral Parameters	Spectral Statistics
Logged	1 s – 24 h	1 to 10 or All (32)	None or Full	0 – 3 or All (5)	None or Full
Logged (100 ms)	100 ms	None, L_{Aeq} and/or L_{AF}	None available	None available	None available
Periodic Reports	1 m – 24 h	All (45)	Full	All (5)	None or Full
Total	Elapsed Time	All (50)	Full	All (5)	Full

Check the **About** Menu to see whether you have the right license to run the Enhanced Logging module. (The **About** Menu is accessed from built-in help – tap ? on the shortcut bar, then select **About**.)

See Chapter 9 for instructions on installing the license for the Enhanced Logging Module.

Note: Remember you need a license for 2250 Frequency Analysis Software BZ-7223 as well as the license for 2250 Enhanced Logging Software BZ-7225.

Setting up the Instrument

1) Select the **ENHANCED LOGGING** Project Template. (See "What is a Project Template?" on page 16 for more details on templates.) The Project Template is displayed on the black banner at the top of the screen. If this banner does not display **ENHANCED LOGGING**, tap on the banner and select **ENHANCED LOGGING** from the drop-down that appears.

2) Insert an SD or CF memory card in the slot for SD or CF cards (see items 9 and 10 in Fig.2.2). You will be notified that a memory card has been inserted – select *Yes* to change the default measurement path to the memory card.

3) Tap the Main Menu icon and select **Explorer** from the list of options. Create a job folder for the measurements and set the default measurement job/path as described in Chapter 6.

   Note: You cannot log data on the internal disk.

4) Tap the Main Menu icon and select **Setup** from the list of options. Set up the measurement as described for Logging in Chapter 11, steps 4 to 12.

5) Under the *Measurement Control* parameters, set the *Save Project Data at*, *Continuous Logging* and *Report Period* as required.

6) Under the *Logged Spectrum* parameters, you can choose to log *Full Spectral Statistics* per *Logging Period* or not.

Note: Logging the full spectral statistics at a short logging period (e.g., every second) takes up a lot of space on the memory card.

7) Under the *Periodic Reports* parameters, you can choose to log *Full Spectral Statistics* per report period.

   Note: all other measured broadband and spectral parameters are logged automatically per report period.

8) Under L_{den} *Periods* parameters you can set up the day, evening and night periods and the penalties in accordance with your local legislation.

To exit the screen, tap on the  icon.

Controlling the Measurement

The measurement is controlled in the same way you would control a normal sound level meter measurement, using **Start/Pause**, **Continue**, **Reset** and **Save** pushbuttons, see Chapter 3 for more details.

However, during the measurement, data are automatically saved in projects, one per day. The projects are automatically saved at the time specified in the *Save Project Data at* parameter in the **Setup**, **Measurement Control** menu. The next project is (automatically) started immediately after the first one, without any data loss.

Note: When *Preset Logging Time* has elapsed, or you pause the measurement, then the project will not be saved automatically. This has to be done manually.

In case of power failure, or other failures, the software is rebooted automatically. This means that the measurement data collected up until the time of the reboot is saved in a project and a new measurement is started. The new measurement is started in a new project.

The projects are named as specified in the *Preferences*, *Storage Settings*.

Example: If you select *Auto-naming of Projects*, and start the measurement on the 13th of November, then your projects for measuring 48 hours (assuming you have started in the middle of the day, and have set *Save Project Data at* parameter to *00:00:00*) will be:

051113 001 (containing data from the middle of the day November 13th until midnight)

051114 001 (containing data for a whole day – November 14th)

051115 001 (containing data from midnight to the middle of the day on November 15th)

If you didn't select *Auto-naming of Projects* then you would have the following projects (assuming the *Project Name Prefix* parameter was set to *Project* and no projects had been saved before in the directory):

Project 001

Project 002

Project 003

Annotating a Project

Measurements can be annotated in the same way as you annotate Logging measurements. See "Annotating a Project" on page 83.

Recording Sound

Sound Recording can be done in the same way as described under Logging measurements. See "Recording Sound" on page 83.

Displaying the Results

The Enhanced Logging measurement screen includes three tabs at the bottom: *Profile*, *Spectrum* and *Broadband* View – as the Logging measurement screen does. You view the data in the same way as in the Logging module. You mark and annotate sound categories and edit markers and annotations in the same way as in the Logging module – please see Chapter 11.

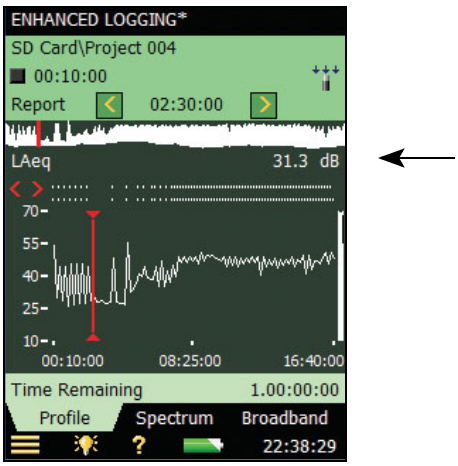
The Result Selector (first item in the third line of the status field) determines whether results from the *Total*, *Logged*, *Logged (100 ms)* or *Report* measurement are displayed.

If you need to display data from another day of the measurement, then use Explorer to select and open the project from that day.

The Profile View

The *Profile* view displays a profile of a logged broadband parameter (dB versus time). See Fig. 12.1.

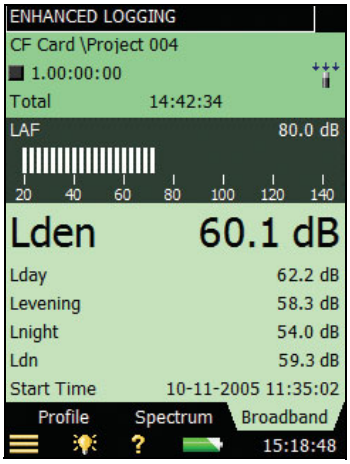
Fig. 12.1
Profile View in Enhanced Logging



Displaying Noise Indicators

The L_{den} and L_{dn} parameters are displayed in the *Broadband* View when selecting *Total* in the Result Selector. Then select the Noise Indicators from the L_{eq} parameter group. See Fig. 12.2.

Fig. 12.2
Noise Indicators



Saving and Recalling Results

Measurements are saved and can be viewed later, in the same way as described for the Sound Level Meter Project in Chapter 3 and Chapter 6.

Note: The viewer only displays the results as one set of data per logging interval (you can browse through all data). To display the data as a Profile and see or hear annotations – or even edit the markers or insert new markers and annotations – you must Open the saved project instead of Viewing it.

Chapter 13

Sound Recording (Optional Module)

2250 Sound Recording Option BZ-7226 allows you to record sound during measurement using one of the software modules BZ-7222, BZ-7223, BZ-7224, BZ-7225 or BZ-7227. The sound recording can be controlled manually or by using an external trigger signal. The recording can also be triggered when a measured parameter exceeds a preset level (BZ-7224 and BZ-7225 only). The recorded sound can be played back and listened to using the supplied earphones, HT-0015. Sound is recorded directly to CF or SD memory cards.

The main benefit is that data is documented on-site and is therefore ready for post-processing and reporting back at the office using Utility Software for Hand-held Analyzers BZ-5503 or other post-processing software such as Noise Explorer Type 7815, Evaluator Type 7820, Protector Type 7825 or Microsoft® Excel.

Check the **About** Menu to see whether you have the right license to run the Sound Recording module. (The **About** Menu is accessed from built-in help – tap ? on the shortcut bar, then select **About**.) See Chapter 9 for instructions on installing the license for the Sound Recording Module.

Sound Level Meter and Frequency Analysis Software

You can use the Sound Recording facility together with the Sound Level Meter Software and the Frequency Analysis Software. You can record the sound for the whole measurement period or you can record sound for controlled parts of the measurement. The recordings are attached to the project as annotations, named “Soundrec N”, where N is the number of the recording for the project. (See “Document your Measurement” on page 22 and “Viewing or Listening to Annotations” on page 51 for a description of how to use annotations.)

Note 1: Sound recordings can only be done during measurements.

Note 2: Sound recordings can only be done on projects saved on SD or CF cards.

Setting up the Instrument

1) Select a Sound Level Meter Project Template or a Frequency Analyzer Project Template. (See “What is a Project Template?” on page 16 for more details on templates.)

2) Insert an SD or CF memory card in the slot for SD or CF cards (see items 9 and 10 in Fig. 2.2).

3) Tap the Main Menu icon and select **Explorer** from the list of options. Navigate to the memory card, create a job folder for the measurements and set the default measurement job/path as described in Chapter 6.

Note: You cannot record sound on the internal disk.

4) Tap the Main Menu icon and select **Setup** from the list of options. Set all the parameters as required for the Sound Level Meter or Frequency Analyzer measurement, see Chapter 3 and Chapter 10 respectively.

5) Under *Sound Recording* you can specify the *Recording Control* parameters as follows:
   - *Automatic*, if you want to start the recording when you start the measurement and stop when you pause the measurement, and to limit the recording to *Maximum Duration*, if *Duration Limit* is set to *On*
   - *Manual Event*, if you want to start and stop the recording using the **Manual Event** push-button during the measurement and to limit the duration of the recording, if *Duration Limit* is set to *On*. In this case the recording will be at least *Minimum Duration* long, but no longer than the *Maximum Duration*. Use *Pre-recording Time* and *Post-recording Time* to specify how much extra you want to be recorded before and after the event
   - *External Event*, if you want to start and stop the recording using an external trigger signal, connected to the Trigger Input. See details in Appendix A
   - *Off*, if you don't want to record sound

6) Set *Recording Quality* to *High*, *Medium*, *Fair* or *Low* in accordance with your needs. Note, however, that high quality requires more disk space than low quality – see details in Appendix A.

7) Set *Recorded Signal* to either *Input A/B-weighted*, *Input C-weighted* or *Input Z-weighted* (A/B-weighting is determined by setting the parameter in *Setup*, *Frequency Weightings*, *Broadband (excl. Peak)*). Input C-weighted is suitable for recordings used afterwards to identify the sound source – it contains all the audible content of the signal, but reduces the low-frequency noise from wind, etc.

8) Set *Automatic Gain Control* to *On* – if you don't know the dynamic of the signal beforehand, or the dynamic is very high, then the 120 dB dynamic range (from max. input level and down) will be converted to 40 dB. Otherwise, set it to *Off* and specify the *Peak Recording Level*.

9) Under *Input* you specify *Trigger Input* if you want to start the sound recording using an external trigger signal. See details in Appendix A.

To exit the screen, tap on the icon.

Controlling the Recording

The measurement is controlled in the same way you would control a normal sound level meter measurement, using **Start/Pause**, **Continue**, **Reset** and **Save** pushbuttons, see Chapter 3 for more details.

When the measurement signal is being recorded, the recording icon is displayed in the status field. The recording is attached to the project as an annotation. The paperclip icon is then displayed to indicate that the project has been annotated.

When *Recording Control* is set to *Automatic*, the recording will start when the measurement is started and last for the *Maximum Duration* or the *Elapsed Time*, whichever is smallest. If you continue a paused measurement, then a new recording is started.

When *Recording Control* is set to *Manual Event*, the recording will start the first time you press the **Manual Event** pushbutton during the measurement, and stop the second time you press it; if you press it a second time before the *Minimum Duration* has elapsed, then the recording will continue until *Minimum Duration* has elapsed; if you press it a second time after *Maximum Duration* has elapsed, then the recording has already been stopped when *Maximum Duration* elapsed and the pushbutton will initiate a new recording instead.

When *Recording Control* is set to *External Event*, and *Trigger Input* is set to *Voltage Level*, then recording is started when the voltage level is 'high' and stopped when voltage level is 'low' (see details in Appendix A). *Duration Limit* has no effect on this setting.

If *Pre-recording Time* has been set, then the recording will start this time before you hit the **Manual Event** pushbutton. This is possible because the recording is done continuously in an internal buffer, ready to be saved as a wave file. The *Pre-recording Time* is limited by this buffer size and the Recording Quality – see details in appendix A.

Note: Very long sound recordings will be split into wave files containing maximum 10 minutes, i.e., a 35 minute sound recording will consist of 4 wave files, three with 10 minutes sound and one with 5 minutes sound.

Playing the Recording

Sound recordings are attached to the measurement project as annotations. The paperclip icon is displayed in the status field to indicate this. Tap on the paperclip to open the list of annotations. Tap on the annotation to play it back – see details in Chapter 3 and Chapter 6.

Logging and Enhanced Logging Software

You can use the Sound Recording facility together with the Logging and Enhanced Logging Software. You can record the sound for the whole measurement period or you can record sound for controlled parts of the measurement. The recordings are attached to the profile as sound markers. The sound recordings can be controlled by the **Manual Event** pushbutton, the **Back-erase** pushbutton, an external trigger signal, or by the level of the measured signal. You can also control the sound recording using the stylus to mark the interesting part on the profile.

Note 1: Sound recordings can only be done during measurements.

Note 2: Sound recordings can only be done on projects saved on SD or CF cards.

Setting up the Instrument

1) Select a Logging, Logging SLM or Enhanced Logging Project Template. (See "What is a Project Template?" on page 16 for more details on templates.)

2) Insert an SD or CF memory card in the slot for SD or CF cards (see items 9 and 10 in Fig. 2.2).

3) Tap the Main Menu icon and select **Explorer** from the list of options. Navigate to the memory card, create a job folder for the measurements and set the default measurement job/path as described in Chapter 6.

Note: You cannot record sound on the internal disk.

4) Tap the Main Menu icon and select **Setup** from the list of options. Set all the parameters as required for the Logging or Enhanced Logging measurement, see Chapter 11 or Chapter 12, resp.

5) Under *Sound Recording* you can specify the *Recording Control* parameters as follows:
   - *Automatic*, if you want to start the recording when you start the measurement and stop when you pause the measurement, and to limit the recording to *Maximum Duration*, if *Duration Limit* is set to *On*
   - *Manual Event*, if you want to start and stop the recording using the **Manual Event** push-button during the measurement
   - *Exclude Event*, if you want to start and stop the recording using the **Back-erase** pushbutton during the measurement
   - *External Event*, if you want to start and stop the recording using an external trigger signal, connected to the Trigger Input
   - *Level Event*, if you want to start and stop the recording based on the level trigger settings during the measurement
   - *All Events*, if you want to start and stop the recording based on any of the events

     Note: When *Recording Control* set to any of the events, you can limit the duration of the recording, if *Duration Limit* is set to *On*. In this case the recording will be at least *Minimum Duration* long, but no longer than the *Maximum Duration*. Use *Pre-recording Time* and *Post-recording Time* to specify how much extra you want to be recorded before and after the event
   - *Off*, if you don't want to record sound

6) Set *Recording Quality* to *High*, *Medium*, *Fair* or *Low* in accordance with your needs, note, however, that the high quality requires more disk space than low quality – see details in Appendix A.

7) Set *Recorded Signal* to either *Input A/B-weighted*, *Input C-weighted* or *Input Z-weighted* (A/B-weighting is determined by setting the parameter in *Setup*, *Frequency Weightings*, *Broadband (excl. Peak)*). Input C-weighted is suitable for recordings used afterwards to identify the sound source – it contains all the audible content of the signal, but reduces the low-frequency noise from wind, etc.

8) Set *Automatic Gain Control* to *On* – if you don't know the dynamic of the signal beforehand, or the dynamic is very high, then the 120 dB dynamic range (from max. input level and down) will be converted to 40 dB. Otherwise, set it to *Off* and specify the *Peak Recording Level*.

Under *Input* you specify *Trigger Input* if you want to start the recording using an external trigger signal. See details in Appendix A.

To exit the screen, tap on the  icon.

Controlling the Recording

The measurement is controlled in the same way you would control a normal logging measurement, using **Start/Pause**, **Continue**, **Reset** and **Save** pushbuttons, see Chapter 11 for more details.

When the measurement signal is being recorded, then the recording icon  is displayed in the status field. The recording is attached to the profile as a Marker 6 (Sound).

If you set *Recording Control* to *Automatic*, the recording will start when the measurement is started and last for *Maximum Duration* or *Elapsed Time*, whichever is smallest. If you continue a paused measurement, then a new recording is started.

If you set *Recording Control* to *Manual Event*, the recording will start the first time you press the **Manual Event** pushbutton during the measurement (this starts a Manual Event marker and a Sound marker), and stop the second time you press it; if you press it a second time before *Minimum Duration* has elapsed, then the recording will continue until *Minimum Duration* has elapsed; if you press it a second time after *Maximum Duration* has elapsed, then the recording has already stopped when *Maximum Duration* elapsed, and the pressing the button will have no effect on the sound recording (the Manual Event marker, however, is stopped).

If you set *Recording Control* to *Exclude Event*, the recording will start the first time you press the **Back-Erase** pushbutton during the measurement (this starts an Exclude Event marker and a Sound marker), and stop the second time you press it – the behaviour will be similar to control by the **Manual Event** pushbutton.

When *Recording Control* is set to *External Event*, and *Trigger Input* is set to *Voltage Level*, then recording is started when the voltage level is 'high' and stopped when voltage level is 'low' (see details in Appendix A). *Duration Limit* has no effect on this setting.

If you set *Recording Control* to *Level Event*, the recording will start, controlled by the level trigger – see Chapter 11 for details.

If you set *Recording Control* to *All Events*, the recording will start when any of the events above become active, and stop when all events are inactive again.

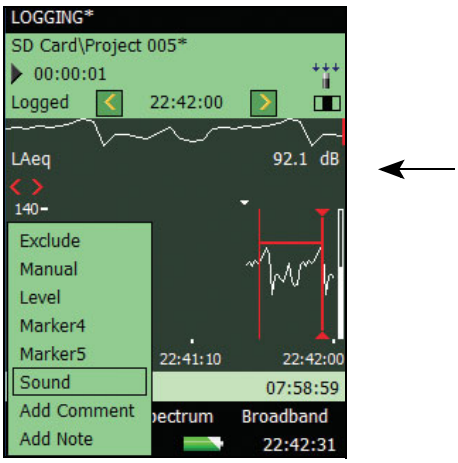
If *Pre-recording Time* has been set, then the recording will start this time before the Event appears. This is possible because the recording is done continuously in an internal buffer, ready to be saved as a wave file. The Pre-recording Time is limited by this buffer size and the Recording Quality – see details in Appendix A.

Note: Very long sound recordings will be split into wave files containing maximum 10 minutes, i.e., a 35 minute sound recording will consist of 4 wave files, three with 10 minutes sound and one with 5 minutes sound.

Control Recording using the Stylus

If *Recording Control* is set to any of the events, or to *All Events*, the recording can also be controlled using the stylus directly on the profile, in the same way as you mark sound categories – see details in Chapter 11.

Fig. 13.1
Example Logging display (showing internal buffer marker)



The small triangle above the profile indicates the amount of sound you have in the internal buffer – ready for storage in a wave-file. You will have sound from this triangle to the right-hand side of the profile. The triangle is updated every second.

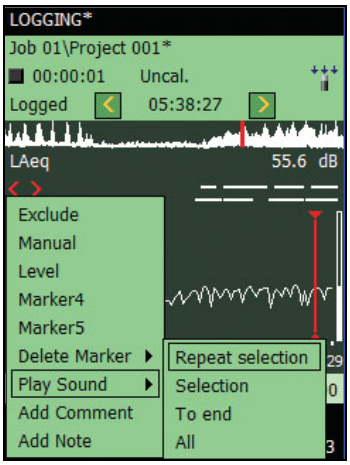
To make a sound recording using the stylus, you tap and hold the stylus on the profile display and drag it to the position where the sound recording should end, then you remove the stylus and get a dropdown menu with the possibility of setting one of the six markers. If you select *Sound*, then a sound marker is made and the sound for the marked interval is stored in a wave file. Only the portion of the sound available in the internal buffer (to the right of the small triangle) will be stored and the sound marker will only indicate this part.

Note: when selecting an interval for storing (or setting a marker), the profile display freezes, but the sound recording is still updated in the internal buffer. The part of the buffer available on the screen will decrease and you will see the small triangle move to the right. Be sure not to wait too long in selecting the Sound marker from the dropdown menu – otherwise the sound recording will disappear from the internal buffer.

Playing the Recording

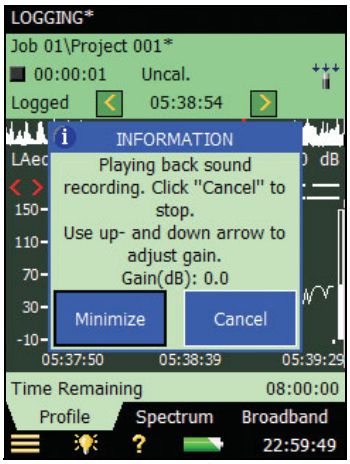
You play-back the sound simply by selecting part of the marker – as described in "Editing Markers on Profiles" on page 88 – and choose *Play Sound* from the resulting dropdown menu. The following dropdown menu will then appear, see Fig. 13.2.

Fig. 13.2
Playing the recording – the dropdown menu



Select one of the four ways of playing a sound: *Selection* will play the part you have selected; *Repeat Selection* will play the selected part until you press *Cancel* on the pop-up menu; *To End* will play the sound from the position you selected the sound marker to the end; and finally *All* will play the entire sound recording, regardless of your selection point.

Fig. 13.3
Playing the recording – output level pop-up



When you have selected the method of play-back, a pop-up appears explaining how to adjust the output level in the headphone and how to stop the play-back.

Tap on the *Minimize* button to reduce this to a small blue bar at the top of the screen – allowing you to watch the profile underneath – you will notice that the profile cursor is updated every second to the position of the sound that is currently being played.

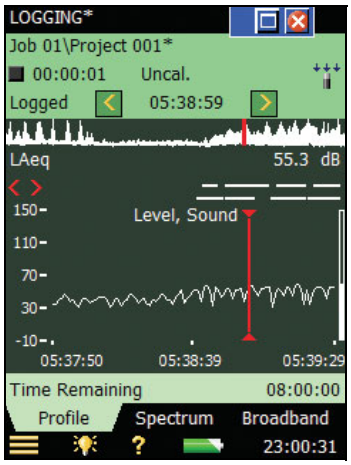


Fig. 13.4
Playing the recording – minimizing the pop-up

The small blue button bar at the top can be maximized again by tapping the icon, or you can close it and stop playing back by tapping the icon.

Sound Recordings on the PC

When projects including sound recording have been transferred into an Archive on a PC using Utility Software BZ-5503, then sound recordings on Sound Level Meter projects or Frequency Analysis Projects can be played back directly from BZ-5503.

Sound recordings on profiles can be played back when the Logging or Enhanced Logging projects have been transferred to Noise Explorer, Evaluator or Protector – the sound recording will appear in the profiles as Sound markers.

Sound Recordings can be input to the Brüel & Kjær PULSE Analyzer Platform for further analysis – please contact your local Brüel & Kjær representative for further information.

Note: When recording sound for further analysis in PULSE, be sure to record the Z-weighted signal and select *Automatic Gain Control* to *Off* under the *Sound Recording* parameters and select the *Recording Quality* to match your needs for frequency content – see details on sampling frequency in Appendix A.

When *Automatic Gain Control* is set to *Off*, then the calibration information is stored in the wave files – allowing PULSE to analyse the sound recordings, taking the calibration into account.

Chapter 14

Reverberation Time Software (Optional Module)

Introduction

2250 Reverberation Time Software BZ-7227 enables you to measure reverberation time in 1/1-octave or 1/3-octave.

Check the **About** Menu to see whether you have the license to run the reverberation time software. (The **About** Menu is accessed from built-in help – tap ? on the shortcut bar, then select **About**.) See Chapter 9 for instructions on installing the license for the Sound Recording Module.

Definition

Reverberation Time (RT) is the most 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 addition, it is used to correct for the effects of RT on building acoustics and sound power measurements.

RT 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 evaluated over a 10, 20 or 30 dB drop, using the measurements within these ranges to make a regression line, which is then extrapolated to the 60 dB range, see Fig. 14.1.

RT may be labelled EDT, T20 and T30 respectively for those three evaluation ranges. EDT is used in room acoustics only, while T20 and T30 may be used for Building Acoustics, Sound Power and Absorption Coefficient measurements as well.

RT is measured in 1/1- or 1/3-octave frequency bands, some of which may be averaged to provide a single-number result for the most significant bands.

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

Fig. 14.1 *Definition of Reverberation Time (RT). Evaluation range of 30 dB for calculation of T30 indicated*

RT varies between positions in a room, so it is usually measured at several positions. The spatial average (Room average) for all positions gives an overall assessment, and the position results may be used to indicate the acoustic quality as a function of location.

The Room average can either be made as an average of the RT spectra, or calculated for the averaged decays (ensemble average), that is: the decays for each frequency band are averaged over all positions and the RT spectrum is then calculated for the averaged decays.

How Do We Measure Reverberation Time?

RT can be measured using either Interrupted Noise, with the built-in noise generator, or by using Impulsive Excitation (Schroeder Method), such as from a pistol or balloon burst.

Interrupted Noise Method

When using a power amplifier and loudspeaker sound source, see Fig. 14.2, Type 2250-F/BZ-7227 will turn its noise generator on and off, then measure and display the RT spectrum and decays.

Fig. 14.2 *Typical RT measurement setup using a loudspeaker source*

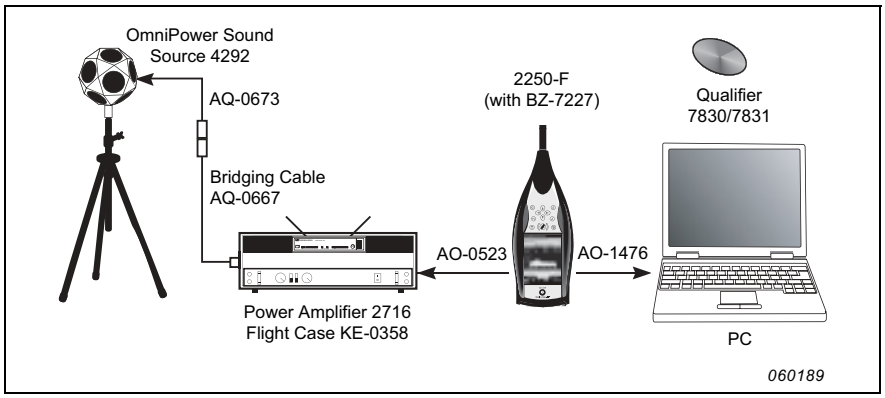


Fig. 14.3 *Typical RT measurement cycle for the interrupted noise method*

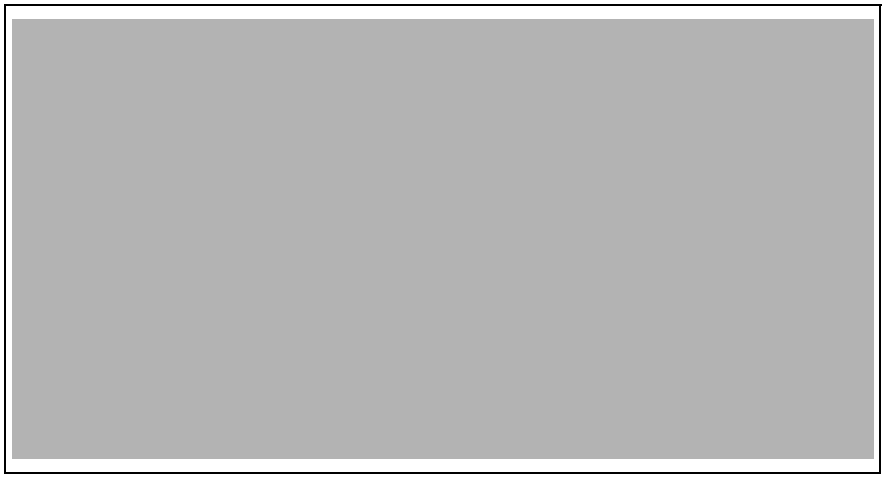


Fig. 14.3 shows a typical RT measurement cycle automatically performed by the Analyzer, where the different steps are described as follows:

1) After 'Start', there is a chosen 'Escape Time' which allows for vacating the measurement site.

2) The noise generator is then switched on and waits for the chosen 'Build-up' time to allow for a steady state to be reached.

3) The decay measurement starts. The level for the first second, or so, (labelled 'About 1s' on Fig. 14.3) is used to identify the excitation sound level as the 0 dB reference level.

4) The noise generator is switched off and the 'Decay time' starts.

5) The decay measurement ends when only the background noise level is measured (automatically detected by Type 2250).

6) Steps 2) to 5) are automatically repeated a chosen number of times and the measured decays are averaged together to reduce the uncertainty of the measurement.

7) The reverberation time spectra EDT, T20 and T30 are calculated and displayed on the screen.

The measurement can be in octaves or 1/3-octaves in parallel over a selectable frequency range, allowing you to focus sound power on the relevant range. In each frequency band, the decay is sampled 200 times each second, for reverberation times as long as 20 seconds.

Impulsive Excitation Method

With Impulsive Excitation, all you need to carry is Type 2250-F, a tripod and a balloon (or other impulsive source, such as a starting pistol). After you start Type 2250-F and pop the balloon, Type 2250-F will start measuring, analyse the decay and display the RT spectrum and decay.

The single input range means that trial measurements are not necessary when using the impulsive excitation method.

Fig. 14.4 *Typical RT measurement cycle for the interrupted noise method*

Fig. 14.4 shows a typical RT measurement cycle performed by the analyzer, where the different steps are described as follows:

1) After ‘Start’, the analyzer waits for the level to exceed the ‘Trigger Level’ (indicated on Type 2250 by the Traffic Light giving a short green flash every second).

2) The impulse excitation is made, e.g., a pistol is fired or a balloon is burst.

   Caution: the use of hearing protection is highly recommended.

3) The impulse measurement is started 1 s before the level exceeds the ‘Trigger Level’.

4) The impulse measurement stops after Type 2250 detects the background noise level again (automatically measured by Type 2250).

5) The analyzer performs backward integration of the impulse measurement

6) The reverberation time spectra EDT, T20 and T30 are calculated and displayed on the screen.

The measurement can be in octaves or 1/3-octaves in parallel over a selectable frequency range. In each frequency band, the decay is sampled 200 times each second.

The impulse response is backward integrated (according to the Schroeder method). In theory, the resulting decay will be equivalent to the average of a large number of decays made with the interrupted noise method. Therefore, the decays will be smooth using just one single shot.

Setting up the Instrument

1) Select the **REVERBERATION TIME** Project Template. (See "What is a Project Template?" on page 16 for more details on templates.) The Project Template is displayed at the top of the screen, if it does not display **REVERBERATION TIME**, tap on the black bar at the top of the screen and select **REVERBERATION TIME** from the drop-down menu that appears.

2) Tap the Main Menu icon  and select **Setup** from the list of options. Set the *Bandwidth* and *Bottom* and *Top Frequency* of the measurement as required.

3) Set *Map Based Measurement = No* in the **Measurement Control** setup – the reverberation decays will then be numbered from Pos. 1 to N – see how to measure with position management in next section.

4) Set *Automatic Save = No*, if you want to inspect the reverberation time and decays before manually saving the measurement – otherwise select *Yes* to automatically save the decays after each measurement.

5) The analyzer automatically detects the decay time and stops the measurement at the end of the decay – however, under special conditions (for example, when measuring with high background noise) the decay time cannot be detected and the measurement will run up to 20 s. To minimize the measurement time and memory requirement for the measurement, you can limit the measurement by setting the *Max Decay Time*. 3 s is adequate for most ordinary rooms, but should be increased for larger halls or reverberation rooms.

6) Set *Excitation to Impulse* if you want to measure using the impulse method (go to step 14) – otherwise select *Interrupted Noise*.

Interrupted Noise Method

7) Set the number of decays you want to measure per position – the analyzer automatically controls the generator, measurement of the decays and averaging the decays.

8) Set the Generator as required – set *Generator Type = External* if you want to control an external generator (see details in Appendix A) – otherwise leave it at *Internal* to use the internal generator.

9) Select Noise Type for the internal generator. *Pink* noise is typically used.

10) Adjust the level of the internal generator output to match the input of the power amplifier used by setting *Level [re. 1 V]*.
Note: You can manually turn the generator on and off by tapping on the loudspeaker icon in the status field.

11) Set the *Escape Time* allowing you to leave the room before the generator is turned on during the measurement – see Fig. 14.3.

12) Set *Build-up Time* to allow the excitation noise to reach a steady level before the measurement starts. 1 s is adequate in most ordinary rooms, but should be increased for larger halls or reverberation rooms.

13) Select the *Sound Source* used, to optimise the frequency response of the internal generator output for either a flat power response or optimum power difference between adjacent 1/1- or 1/3-octave bands – thereby eliminating the need for an equalizer to smooth the response in most cases. Select a type matching your sound source – select *Unknown* if you are using a non Brüel & Kjær sound source, or don't want to make a correction to the frequency response. Go to step 16).

Impulsive Method

14) Set *Trigger Level* low enough to be sure the impulse will be triggered, but high enough to avoid triggering on the background noise. A level between 80 and 100 dB is normally adequate.

15) If you have selected *Automatic Save = yes*, then *Trigger Repeat* can be set to *yes* to automatically start a new measurement when a measurement has been saved. This allows you to go to another position and make a new impulse, without the need for controlling Type 2250 between the measurements. Observe how the Traffic Light indicates the status of the measurement (see Table 4.2 and Fig. 14.4) making it easy for you to change position and generate the impulse synchronised with the measurement procedure. Press the **Start**/**Pause** pushbutton to stop the measurement when the last measurement has been saved.

Sound Recording

16) Set *Recording Control = Automatic* if you want to record the sound during the measurement. The recordings can be played back afterwards for identifying the cause of measurements differing from each other – or (if *Excitation = Impulse*) for further analysis of the measured impulse response by post-processing software like DIRAC Room Acoustics Software Type 7841.

The recordings will contain the signal from when you press the **Start** pushbutton until the measurement stops. The recording will be attached to the measurement as an annotation.

Note: Sound Recording requires a license for the Sound Recording Option BZ-7226.

To exit the setup screen, tap on the icon.

Controlling the Measurement

The measurement is controlled in the same way you would control a normal sound level meter measurement, using **Start**/**Pause**, **Continue**, **Reset** and **Save** pushbuttons, see Chapter 3 for more details.

Note the following exceptions:

- Pressing **Start** initiates a measurement cycle slightly more complex than a standard SLM measurement – see Fig. 14.3 and Fig. 14.4 for details. The results are the same, however, a set of measurement data – in this case the reverberation decays at one position

Creating a new Reverberation Time Project

- The measured data is stored at a position – and you can have several positions in one project. Therefore, starting a complete new project cannot be done by pressing **Reset** and then **Start** (as when measuring using the SLM template), because this will measure the decays at a single position within the Project – a new project is initiated by selecting a new project template (or the same again). This will create a new project

Annotating Projects and Positions

While using the reverberation time software you can annotate the reverberation time project using the normal method of adding annotations to a project. The annotations can then be viewed by tapping on the paperclip icon or tapping the Main Menu icon and selecting **Explorer** from the list of options. See “Document your Measurement” on page 22.

However, your project can contain a lot of measurements, one per position, so you can annotate any position in the project. Sound recordings are automatically attached as annotations to the positions. Annotations at positions are managed in the *Overview* display – described in the next section.

Displaying the Results

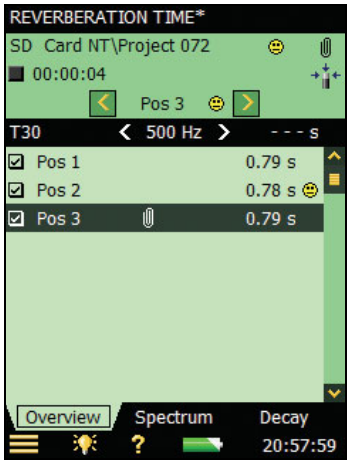
The Reverberation Time measurement screen includes three tabs at the bottom: *Overview*, *Spectrum* and *Decay*. The tabs allow you to choose different ways of displaying the measurement results:

- *Overview*: Shows the measurement positions in a table – one position per row. Use this to get an overview of your measurements, to include/exclude positions from the spatial average of all positions in the room, and to manage annotations/sound recordings at the positions
- *Spectrum*: Shows the reverberation spectra graphically, or as a table, for one position, or for the room average. Alternatively, it can show the instantaneous sound pressure level while measuring
- *Decay*: Shows the reverberation decay at a single frequency, for one position, or for the room average

Overview

The *Overview* tab shows the measurement positions in a table – one position per row.

Fig. 14.5
Overview tab



Status Field

The Status Field consists of three lines (see Fig. 14.5) – the first two lines of information are common to the status lines in the Sound Level Meter and Frequency Analyzer (see Chapter 4, page 32).

Note: The first line of the status field might also contain a smiley, indicating the quality of the Room (the spatial average of all positions), see the description of smiley's in the following paragraph and at the end of this chapter.

The third line of information allows you to:

- Select the measured position. The selected position is the one highlighted in the table. The selected position will be the one displayed when selecting the *Spectrum* or *Decay* view
- Step forwards or backwards through the positions on all displays, using the and icons
- Get information on the quality of the measurement through a Quality Indicator (Smiley) displayed as an icon:

  : means results should be used with caution

  : means results may be suspect or missing

  No icon means Type 2250 found no measurement quality issues

Tap on the Smiley to get more detailed information about the quality indication. (See the description of smiley's at the end of this chapter.)

Table

The header row of the table contains (from left to right):

- The RT selector (EDT, T20 or T30), which determines which RT to display in the table rows below. It is also linked to the main *Spectrum* selector and main *Decay* selector
- The Frequency selector (which includes decrement and increment buttons), determines the frequency of the readouts in the table rows below. The frequency selector is linked to the *Spectrum* cursor and the frequency of the selected decay
- Readout of the RT value for the current measurement, before it is saved to a position

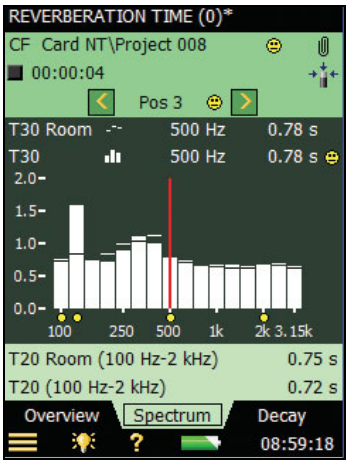
Each row of the table contains (from left to right):

- A checkmark controlling whether the position is included or excluded from the Room average. Tap on it to include (check) or exclude (uncheck) the position. All positions are by default included in the Room average
- The position. Tap on it to get a drop-down with two options, *Select* and *View Annotations*. Use *Select* to select the position and *View Annotations* to view the list of annotations for the position. You can add annotations on the position from this view – as described in Chapter 6
- Possible annotation indicated by . Tap on it to view the list of annotations for the position
- The readout of the RT parameter at the frequency determined by the RT selector and Frequency selector in the table header row. There might be a smiley to the right of the readout warning about the quality of the readout. Tap on the smiley to get more detailed information about the warning

Spectrum

The *Spectrum* tab shows the reverberation time spectrum from a position, or the Room average reverberation time, or both. The sound level is displayed during measurements.

Fig. 14.6
Spectrum tab



Status Field

The Status field on the *Spectrum* tab is the same as on the *Overview* tab.

Spectrum Graph

The Spectrum Graph is the same as in the Frequency Analysis software: Two 1/1-octave, or 1/3-octave spectra, superimposed with cursor readouts. The displayed frequency range is automatically adjusted for the measured frequency range.

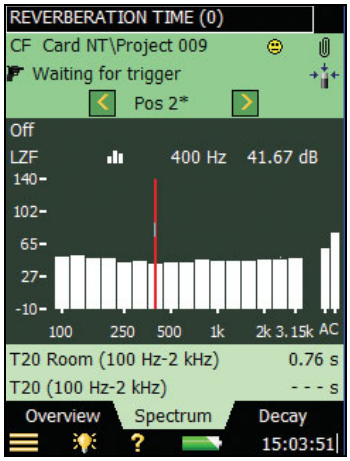
Small Smiley's are set below each frequency band with a potential problem. The Smiley's are also available at the cursor readouts. Tap on the Smiley at the cursor readout to get detailed information about the warning.

The Spectrum Parameter Selectors above the graph selects which spectra to display. You can choose to display: *T20*, *T30*, *EDT*, *T20 Room*, *T30 Room* or *EDT Room*. If you only want one graph you can set the other to *Off*.

In addition to choosing which parameter to display, you can choose to Display Sound Level – this will display the Z-weighted spectrum LZF together with the A- and C-weighted broadband levels – see Fig. 14.7. When displaying LZF you can tap on the LZF selector and select *Display Reverberation Time* to display the reverberation time spectra.

When starting a measurement the graph will automatically display the sound level spectrum, when finished it will display the reverberation time spectrum.

Fig. 14.7
Spectrum view when measuring



The Main Spectrum Graph on the display (the one with bars) is selected using the parameter selector on the second line of the two shown above the graph (LZF in Fig. 14.7). The Smiley's below the spectra (if there are any) belong to the main spectrum. The parameter selector for the main spectrum is linked to the selector on the *Overview* tab and the parameter selector for the main decay on the *Decay* tab.

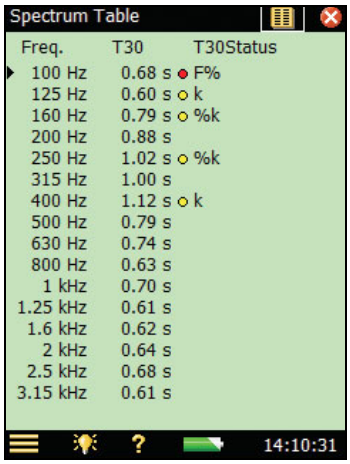
The Reference Spectrum on the display (the one displayed as small lines above the bars in Fig. 14.6) is selected using the parameter selector on the first line of the two shown above the graph (*T30 Room* in Fig. 14.6). The parameter selector for the reference spectrum is linked to the parameter selector for the reference decay curve in the *Decay* view.

The cursor is linked to the frequency selectors on the *Overview* and *Decay* tabs.

Tap on the Y-axis to select:

- *Auto Zoom* to adjust the range of the Y-axis for best fit of the measured spectrum.
- *Zoom In/Zoom Out* to adjust the zoom.
- *Spectrum Table* to display the spectrum in a table, see an example in Fig. 14.8

Fig. 14.8
Spectrum table



Auxiliary Parameters

Below the graphics are two lines containing parameters for displaying the Wide Band Reverberation Times for the current position, or the Room Average. You are also able to display the L_{CF} and L_{AF} broadband values.

Decay

The *Decay* tab shows the reverberation time decay from a position or the Room average – or both, see Fig. 14.9.

Status Field

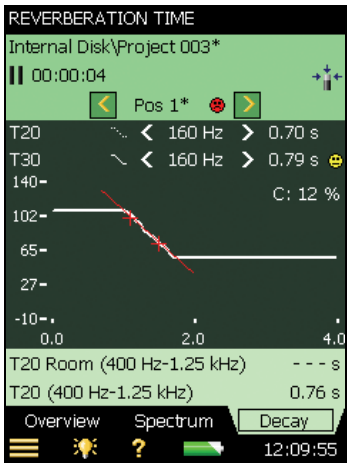
The Status field on the *Decay* tab is the same as on the *Overview* and *Spectrum* tabs.

Decay Graph

The Decay Graph shows the decay of one frequency band for the selected position and/or the decay of the same frequency band for the Room Average (requires Ensemble Averaging).

The Decay Parameter Selectors above the graph select which decay to display: *T20*, *T30* or *EDT*. Each of these selections show the decay for the measurement at the selected position together with the readout of T20, T30 and EDT resp. *T20 Room*, *T30 Room* and *EDT Room* show the decay for the Room Average together with the readout of T20 Room, T30 Room and EDT Room resp. If you only want one graph you can set the other selector to *Off*.

Fig. 14.9
Decay view



The Main Decay on the display (displayed as a continuous line) is selected using the parameter selector in the second line of the two shown above the display (*T30* in Fig. 14.9). The parameter selector for the main decay is linked to the selector on the *Overview* tab and the parameter selector for the main spectrum on the *Spectrum* tab.

The Reference Decay on the display (displayed as a dashed line) is selected using the parameter selector in the first line of the two shown above the display (*T20* in Fig. 14.9). The parameter selector for the reference decay is linked to the parameter selector for the reference spectrum on the *Spectrum* tab.

The Frequency selector (with decrement and increment buttons as well), determines the frequency of the decay curves. The frequency selector is linked to the spectrum cursor and the frequency selector on the *Overview* tab.

In the upper right corner of the view area, the value of a single quality indicator is displayed:

- C: xx%. The Curvature indicator – if above 10%, then the quality indicator '%', meaning 'Decay is bent', is set

For more details of the quality indicators, see "Quality Indicators" on page 121.

Tap on the Y-axis to select:

- *Auto Zoom* to adjust the range of the Y-axis for best fit of the measured spectrum
- *Zoom In/Zoom Out* to adjust the zoom
- *Auto Scale* to select the best scaling for viewing the spectra – without adjusting the zoom
- *Scale Up/Scale Down* to adjust the full scale value on the Y-axis

- *Show/Hide Regression Line* to show/hide the regression line and the evaluation range for the main decay, together with the two quality indicators C and ξ

Measurements with Graphical Position Management

Type 2250 can keep track of the source and receiver positions in a graphical way together with the measurements. To do this, make the following settings in the Setup:

1) Set *Map Based Measurement = Yes* in the **Measurement Control** setup – the reverberation decays will then be placed graphically on the 'map' shown on the *Overview* tab, and numbered as source-receiver relations (for example, S1R2 means the decay measurement with noise from Source 1 and measured at Receiver position 2).

2) Set *Meas. All Pos. for Each Source = Yes* for measuring all combinations of source and receiver positions. Set to *No*, if you want to measure at a specific number of receiver positions per source.

3) Set *No. of Positions per Source* to the number of receiver positions you want to measure per source.

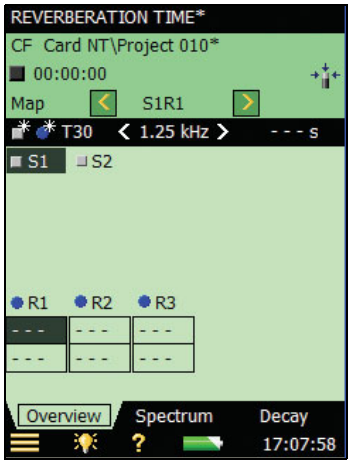
4) Set *Increment* to *Sources First*, *Receivers First* or *Manual*. Typically *Sources First* is best for Impulsive excitation (you can then walk between the source positions and generate the impulses while Type 2250 is placed on a tripod at one receiver position); *Receivers First* is best for Interrupted Noise excitation (you can move Type 2250 between the receiver positions, while the sound source remains in the same place).

The *Overview* tab will then look like Fig. 14.10:

Fig. 14.10
Overview tab showing one source and one receiver position

Note the Add Source and Add Receiver icons on the headline for the map. Tap on to add new sources, and tap on to add new receivers on the map.

Fig. 14.11
Overview tab showing two sources and three receiver positions



You can move the sources or receivers on the map by tapping on the source/receiver (see Fig. 14.12), select *Move* from the dropdown menu that appears, then tap at the position where you want the source/receiver (see Fig. 14.13).

Fig. 14.12
Tap on a source to get a dropdown with options

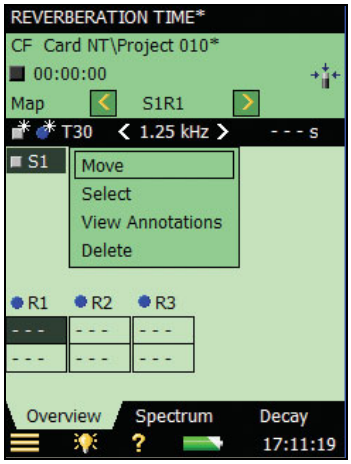
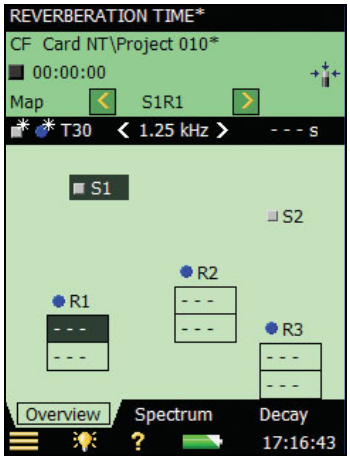


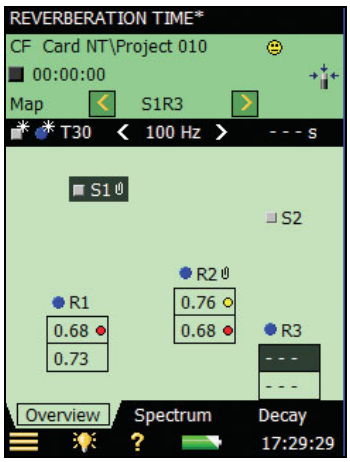
Fig. 14.13
Sources and receivers moved to places on the map in accordance with their physical position in a room



The dark-green fields on the map indicate the selected Source-Receiver relation. The next measurement will be saved at this position.

Results from the measurements at the receiver positions are displayed in the boxes at the receiver positions – determined by the parameter and frequency selector in the headline of the map.

Fig. 14.14
Example display showing a measurement in progress



The example in Fig. 14.14 shows the state when four measurements have been made and saved and the position at S1R3 is selected, ready for the next measurement. Note the small smileys at some of the receiver positions – you can tap on them and get more detailed information.

You can attach text or commentaries at source or receiver positions by selecting *View Annotations* (see Fig. 14.12) and add new annotations as described in Chapter 6. Note the two small paperclips at S1 and R2 – they indicate annotations at these positions.

Tap on *Map* just above the Add Source and Add Receiver icons, and select *Table* to display the measurements in a table (see Fig. 14.15). The table contains the same information as the table described in the previous section when measuring without position management (Fig. 14.5).

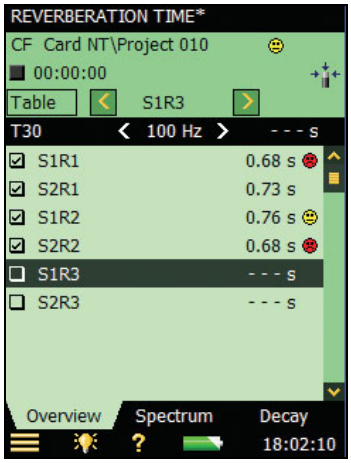


Fig. 14.15
Map-based measurements displayed in a table

Note: You can move the data from one position to another: Tap on a position you want to move and select *Cut* from the dropdown, then tap on the position where you want to paste it and select *Paste*. This can be done on the map as well as in the table.

If you want to measure at a specific number of receiver positions per source, then the map for one receiver position per source, for example, will look like Fig. 14.16.

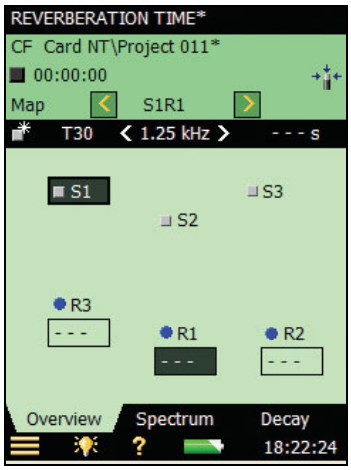


Fig. 14.16
Map-based measurement showing one receiver per source

Note: there is only an Add Source icon because the specified number of receivers is added automatically when adding a source.

The *Spectrum* and *Decay* views function in the same way as when measuring without position managing. The only difference is the indication of the position in the status field – this is now a Source-Receiver selector instead of a position number selector.

Quality Indicators

There are Quality Indicators for each frequency band in each reverberation time spectrum and for each reverberation time spectrum. (These include letters, symbols or smileys, see Table 14.1 for an overview). One of the quality indicators are recommended in ISO 3382-2 annex B, as a measure of how good the slope of the decay can be approximated to a straight line:

- C: xx%. The Curvature indicator – if above 10%, then the quality indicator '%', meaning 'Decay is bent', is set

Table 14.1 *Overview of Quality Indicators and Smileys*

Quality Indicator	Smiley	Explanation	Description
N		No decay end found	The end of the decay cannot be determined because it doesn't end in the background noise
y		Background noise too high	Background noise is above the upper evaluation point
t		No decay start found	No decay start found
Y		Background noise too high	Background noise is above the upper evaluation point
T		Max. Decay Time too short	The lower evaluation point is beyond the decay time
Z		No decay found	The slope of the decay is positive, i.e., the reverberation time is negative
P		Reverberation time too short	Less than 2 points in Evaluation Range
O		Excitation sound level too high	Overload
F		Reverberation time too short	B×T below 16 (B = filter bandwidth and T = reverberation time of detector) – required by ISO 3382
R		T20 used (T30 unavailable)	T20 used (T30 unavailable)
n		High background noise	Background noise too close to level at lower evaluation point
p		Short reverberation time	Less than 4 points in Evaluation Range

Quality Indicator	Smiley	Explanation	Description
%		Decay is bent	The difference between T20 and T30 is greater than 10%. (Recommended quality indicator from ISO 3382-2 annex B)
k		Decay is non-linear	Correlation coefficient in linear regression is too low

The Quality Indicators (first column) are shown in the spectrum table only.

The Smileys are shown on:

- all readouts of reverberation time results
- on the position selector as the 'sum' of all quality indicators from each frequency band
- on the Room (Project) as the 'sum' of all quality indicators from each frequency band in the Room reverberation time spectrum

The explanation is shown if you tap on a smiley (except on the small smileys below the frequency bands in the spectrum – select the frequency band with the cursor and tap on the smiley in the cursor readout).

Saving and Recalling Results

Measurements are saved at position numbers (for example, *Pos. 1*) or Source-Receiver relations (for example, *S1R1*) within the Project. This means there are more measurements stored in the Reverberation Time Projects than the Sound Level Meter, Frequency Analyzer or Logging Projects, which all contain only one measurement within each project.

The saved project can be opened using *Open* in **Explorer**, then you can view all the measured data, and even continue measuring at new positions.

If you view the data using *View* in **Explorer**, then you can only view the Room Average of the project.

Chapter 15

Specifications

This chapter comprises the specifications that are needed for evaluation of instrument performance characteristics and proper use of the instrument. Some of the applicable sound level meter standards require additional technical documentation, in particular for pattern evaluation (type approval) purposes, but have no bearing on normal use. The additional technical documentation is given in a separate Brüel & Kjær instruction manual (BE 1712).

Type 2250 Platform

Specifications apply to Type 2250 fitted with Microphone Type 4189 and Microphone Preamplifier ZC-0032

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, 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 1 s to turn on; press 1 s to enter standby; press for more than 5 s to switch off

STATUS INDICATORS
LEDs: Red, amber 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

INPUT SOCKET
Connector: Triaxial LEMO
Input Impedance: ≥ 1 MΩ
Direct Input: Max. input voltage: ± 14.14 V_{peak}
CCLD Input: Max. input voltage: ± 7.07 V_{peak}
CCLD Current/voltage: 4 mA/25 V

TRIGGER SOCKET
Connector: Triaxial LEMO
Max. Input Voltage: ± 20 V_{peak}
Input Impedance: > 47 kΩ

OUTPUT SOCKET
Connector: Triaxial LEMO
Max. Peak Output Level: ± 4.46 V
Output Impedance: 50 Ω

HEADPHONE SOCKET
Connector: 3.5 mm Minijack stereo socket
Max. Peak Output Level: ± 1.4 V
Output Impedance: 32 Ω in each channel

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

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, 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 Catalan, English, French, German, Italian, Japanese, Polish, Portuguese, Romanian, Serbian, Slovenian and Spanish

Software Specifications – 2250 Sound Level Meter Software BZ-7222

Conforms with the following National and International Standards:
- IEC 61672 – 1 (2002 – 05) Class 1
- IEC 60651 (1979) plus Amendment 1 (1993 – 02) and Amendment 2 (2000 – 10), Type 1
- IEC 60804 (2000 – 10), Type 1
- DIN 45657 (1997 – 07)
- ANSI S1.4 – 1983 plus ANSI S1.4A – 1985 Amendment, Type 1
- ANSI S1.43 – 1997, Type 1

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 also conforms to these EN Standards

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, 4191, 4193, 4950 and 4952, BZ-7222 is able to correct the frequency response to compensate for sound field and accessories:
Sound Field: Free-field or Diffuse-field (for Type 4952 only: 0° (Top) reference direction and 90° (Side) reference direction)
Accessories (Type 4189 only): None, Windscreen UA-1650 or Outdoor Microphone Kit UA-1404
Accessories (Types 4191 and 4193 only): None or Windscreen UA-1650
Accessories (Type 4950 only): None or Windscreen UA-0237

DETECTORS
Parallel Detectors on every measurement:

A- or B-weighted (switchable) broadband detector channel with three exponential time weightings (Fast, Slow, Impulse), one linearly averaging detector and one peak detector
C- or Z-weighted (switchable) as for A- or B-weighted
Overload Detector: Monitors the overload outputs of all the frequency weighted channels

MEASUREMENTS
X = frequency weightings A or B
Y = frequency weightings C or Z
V = frequency weightings A, B, C or Z
U = time weightings F or S
Q = exchange rate 4, 5 or 6 dB
N = number between 0.1 and 99.9
For Storage
Full statistics
For Display and Storage

Start Time	Stop Time	Overload %
Elapsed Time	L_{Xeq}	L_{Yeq}
L_{XE}	L_{YE}	L_{Ceq}-L_{Aeqk}
L_{XSmax}	L_{XFmax}	L_{XImax}
L_{YSmax}	L_{YFmax}	L_{YImax}
L_{XSmin}	L_{XFmin}	L_{XImin}
L_{YSmin}	L_{YFmin}	L_{YImin}
L_{XIeq}	L_{YIeq}	L_{AIeq}-L_{Aeq}
L_{AFTeq}	L_{AFTeq}-L_{Aeq}	Time Remaining
$L_{ep,d}$	$L_{ep,dv}$	E
Dose	Proj. Dose	L_{vpeak}
#VPeaks (>NNNdB)	#VPeaks (>137dB)	#VPeaks (>135dB)
T_{Vpeak}	L_{avUQ}	TWA
TWAv	DoseUQ	Proj. DoseUQ

Only for Display as Numbers or Quasi-analogue Bars

L_{XS}	L_{XF}	L_{XI}
L_{YS}	L_{YF}	L_{YI}
$L_{XS(SPL)}$	$L_{XF(SPL)}$	$L_{XI(SPL)}$
$L_{YS(SPL)}$	$L_{YF(SPL)}$	$L_{YI(SPL)}$
L_{XN1} or L_{XUN1}	L_{XN2} or L_{XUN2}	L_{XN3} or L_{XUN3}
L_{XN4} or L_{XUN4}	L_{XN5} or L_{XUN5}	L_{XN6} or L_{XUN6}
L_{XN7} or L_{XUN7}	$L_{Vpeak,1s}$	

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: 16.6 to 140 dB
Primary Indicator Range: In accordance with IEC 60651, A-weighted: 23.5 dB to 123 dB
Linearity Range: In accordance with IEC 60804, A-weighted: 21.4 dB to 140 dB
Linear Operating Range: In accordance with IEC 61672, A-weighted: 1 kHz: 24.8 dB to 140 dB
Peak C Range: In accordance with IEC 61672: 29.5 dB to 143 dB

SAMPLING FOR STATISTICS
The Statistics can be based on either L_{XF}, L_{XS} or L_{Xeq}:
- Statistics L_{XFN1-7} or L_{XSN1-7} are based on sampling L_{XF} or L_{XS}, resp., every 10 ms into 0.2 dB wide classes over 130 dB
- Statistics L_{XN1-7} are based on sampling L_{Xeq} every second into 0.2 dB wide classes over 130 dB

Full distribution saved with measurement

MEASUREMENT DISPLAYS
SLM: Measurement data displayed as numbers of various sizes and one quasi-analogue bar
Measured data are displayed as dB values, housekeeping data as numbers in relevant format. Instantaneous measurement L_{XF} is displayed as a quasi-analogue bar

MEASUREMENT CONTROL
Manual: Manually controlled single measurement
Automatic: Pre-set measurement time from 1 s to 24 hours in 1 s steps
Manual Controls: Reset, Start, Pause, Back-erase, Continue and Store the measurement manually
Auto-start: A total of 10 timers allow set up of measurement start times up to a month in advance. Each timer can be repeated. Measurements are automatically stored when completed

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

MEASUREMENT STATUS
On Screen: Information such as overload 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 flash every 5 s = stopped, ready to measure
- Green LED flashing slowly = awaiting 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
The input signal can be monitored using an earphone/ headphones connected to the headphone socket, or it can be fed to the output socket
Output Signal: Input conditioned; A-, B-, C- or Z-weighted
Gain Adjustment: –60 dB to 60 dB
L_{XF} output (every ms) as a DC voltage between 0 V and 4 V.
DC output for calibration purposes: 0 dB ~ 0 V and 200 dB ~ 4 V
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 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 0 dB

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

DATA MANAGEMENT
Project Template: Defines the display and measurement setups
Project: Measurement data stored with the Project Template
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)

Software Specifications – 2250 Frequency Analysis Software BZ-7223

The specifications for BZ-7223 include the specifications for 2250 Sound Level Meter Software BZ-7222. BZ-7223 adds:

STANDARDS
Conforms with the following National and International Standards:
- 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

CENTRE FREQUENCIES
1/1-octave Band Centre Frequencies: 8 Hz to 16 kHz
1/3-octave Band Centre Frequencies: 6.3 Hz to 20 kHz

MEASUREMENTS
X = frequency weightings A, B, C or Z , Y = time weightings F or S
Data for Storage
Full Spectral Statistics

Spectra for Display and Storage

L_{Xeq}	L_{XSmax}	L_{XFmax}
L_{XSmin}	L_{XFmin}	

Spectra for Display Only

L_{XS}	L_{XF}	L_{XYN1}
L_{XYN2}	L_{XYN3}	L_{XYN4}
L_{XYN5}	L_{XYN6}	L_{XYN7}
SIL	PSIL	SIL3

$L_{Aeq\ (20\text{-}200\,Hz)}$

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: 1.7 to 140 dB
Linear Operating Range: In accordance with IEC 61260: $\leq$ 20.5 dB to 140 dB

SAMPLING FOR OCTAVE OR 1/3-OCTAVE STATISTICS
X = frequency weightings A or B
The Statistics can be based on either L_{XF} or L_{XS}:
- Statistics L_{XFN1-7} or L_{XSN1-7} are based on sampling L_{XF} or L_{XS}, respectively, every T ms into 1 dB wide classes over 150 dB;

T = 100 for frequency range set to 12.5 – 20 kHz
T = 200 for frequency range set to 6.3 – 20 kHz
Full distribution can be saved with measurement

MEASUREMENT DISPLAYS
Spectrum: One or two spectra superimposed + A/B and C/Z broadband bars
Table: One or two spectra in tabular form

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

INTERNAL GENERATOR
Built-in pseudo-random noise generator
Spectrum: Selectable between Pink and White
Crest Factor:
Pink Noise: 4.4 (13 dB)
White Noise: 3.6 (11 dB)
Bandwidth: Selectable:
- **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:** –60 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
Repetition Period: 175 s
Output Connector: Output Socket

EXTERNAL GENERATOR
Selectable as alternative to Internal Generator
To control external noise generator, set:
- **Levels:** 0 V (Generator off), 4.5 V (Generator on)
- **Rise-time and Fall-time:** 10 µs

The noise generator is turned on and off automatically during the measurement
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

Software Specifications – 2250 Logging Software BZ-7224

The specifications for BZ-7224 include the specifications for 2250 Sound Level Meter Software BZ-7222. BZ-7224 adds:

MEASUREMENTS
Logging: Measurement data logged at pre-set periods into files on external SD- or CF-cards
Logging Period: From 1 s to 24 hours with 1 s resolution
Fast Logging: L_{AF} and L_{Aeq} can be logged every 100 ms, irrespective of logging period
Broadband Data Stored at each Logging Interval: All, or up to 10 selectable broadband data
Broadband Statistics Stored at each Logging Interval: Full distribution, or none
Spectrum Data Stored at each Logging Interval: All, or up to 3 selectable spectra (license for BZ-7223 required)
Spectral Statistics Stored at each Logging Interval: Full distribution, or none (license for BZ-7223 required)
Logging Time: From 1 second to 31 days with 1 s resolution
Measurement Total: For the logging time, in parallel with logging: All broadband data, statistics and spectra (license for BZ-7223 required)

MARKERS
One data exclusion marker and four user-definable markers for on-line marking of sound categories heard during the measurement
Events can be set manually

TRIGGERS
Markers can be set when a broadband level is above or below a specified level

ANNOTATIONS
On-line annotations with spoken comments or written notes

MEASUREMENT DISPLAYS
Profile: Graphical display of selectable measurement data versus time. Fast display of next or previous marker, Profile Overview of entire measurement
Y-axis: Range: 5, 10, 20, 40, 60, 80, 100, 120, 140 or 160 dB. Auto zoom or auto scale available
X-axis: Scroll facilities
Cursor: Readout of measurement data at selected time

Software Specifications – 2250 Enhanced Logging Software BZ-7225

The specifications for BZ-7225 include the specifications for 2250 Logging Software BZ-7224 and for 2250 Frequency Analysis Software BZ-7223 (with the exception of the generator). Licenses for BZ-7223 and BZ-7225 are required to run BZ-7225. BZ-7225 adds:

MEASUREMENTS
For Display and Storage
L_{dn}, L_{den}, L_{day}, $L_{evening}$ and L_{night}
Selectable Day, Evening and Night periods and penalties
Periodic Reports: Measurement data logged at a pre-set report period into files on external SD- or CF-cards
Report Period: From 1 min to 24 hours with 1 min resolution
Broadband Data and Statistics Stored at each Reporting Interval: All
Spectrum Data Stored at each Reporting Interval: All
Spectral Statistics Stored at each Reporting Interval: Full distribution, or none
Logging Time: From 1 second to 31 days with 1 s resolution or Continuous
Data are saved in separate projects for every 24 hrs of logging – at a user-defined time of day
Automatic reboot and resume of operation in case of power failure

Software Specifications – Sound Recording Option BZ-7226

Sound Recording Option BZ-7226 is enabled with a separate license. It works with all the software for Type 2250: Sound Level Meter, Frequency Analysis, Logging Software, Enhanced Logging Software and Reverberation Time Software
Sound Recording requires a CF- or SD-Card for data storage

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
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.

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

FUNCTIONS WITH BZ-7222 AND BZ-7223
Manual Control of Recording: Recording can be manually started and stopped during a measurement using a pushbutton or an external signal
Automatic Control of Recording: Start of recording when measurement is started. Minimum and Maximum recording time can be preset

FUNCTIONS WITH BZ-7224 AND BZ-7225
Manual Control of Recording (using Manual Event or Back-erase pushbutton, or an external signal): Recording during all of the event, or for preset minimum and maximum duration. A Sound marker is set while recording. Selectable pre- and post-recording time
Manual Control of Recording (using touch screen): Recording for the selected time period (subject to the limitations of the pre-recording buffer). A Sound marker is set for the selected time period
Automatic Control of Recording: An event can be triggered when a broadband level is above or below a specified level. Recording during all of the event or for preset minimum and maximum duration. Selectable pre- and post-recording time

FUNCTIONS WITH BZ-7227
Automatic Control of Recording: Start of recording when measurement is started

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 (extension .wav) attached to the data in the project, easily played-back afterwards on a PC using Type 7815, 7820 or 7825. Calibration information is stored in the wav file, allowing PULSE to analyse the recordings

Software Specifications – 2250 Reverberation Time Software BZ-7227

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 140
- ISO 3382
- ISO 354

CORRECTION FILTERS
For Microphone Types 4189, 4191, 4193, 4950 and 4952, BZ-7227 is able to correct the frequency response to compensate for sound field and accessories

Broadband Measurements

DETECTORS
A- and C-weighted broadband detectors with F exponential time weighting
Overload Detector: Monitors the overload outputs of all the frequency weighted channels

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: 16.6 to 140 dB
Primary Indicator Range: In accordance with IEC 60651,
A-weighted: 23.5 dB to 123 dB
Linear Operating Range: In accordance with IEC 61672,
A-weighted: 1 kHz: 24.8 dB to 140 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

MEASUREMENTS
L_{ZF} spectrum for display only
L_{Zeq} spectra sampled at 5 ms intervals

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: 1.7 to 140 dB
Linear Operating Range: In accordance with IEC 61260: $\leq$ 20.5 dB to 140 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.: $1V_{rms}$ (0 dB)
Gain Adjustment: –60 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), 4.5 V (Generator on)
Rise-time and Fall-time: 10 µs
Control: See Measurement Control

Reverberation Time

EDT, T20 and T30 in octave or 1/3-octave bands
Decays: Measured and stored using averaging time of 5 ms
Evaluation Range: –5 to –15 dB for EDT, –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: EDT, T20 and T30 measurements can be averaged (arithmetic averaging or ensemble averaging)
EDT, 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 total project (room)
Reverberation Time Range: Max. 20 s, min. 0.1 – 0.7 s, depending on bandwidth and centre frequency
Wide Band Reverberation Time: The arithmetic average of the Reverberation Time within a selectable frequency range is calculated

Measurement Displays

OVERVIEW MAP
Map of Source and Receiver positions with reverberation time readout for a selectable frequency band on each measurement position together with quality indicator.
Organisation of Source and Receiver Positions: measure at all receiver positions for each source or measure in a number of positions (1 to 10) for each source
Source and Receiver positions can be added, moved or deleted.

OVERVIEW TABLE
Table of measurement positions with reverberation time readout for selectable frequency band on each position together with quality indicator.
Positions can be included/excluded from Room average

SOUND LEVEL SPECTRUM
LZF spectrum plus A and C broadband bars
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

REVERBERATION TIME 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
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

MEASUREMENT CONTROL
Measurement Sequence: Supports measuring:
- at all receiver positions before using another source
- at a receiver position for all sources before measuring at a new position
- at subsequent receiver positions without source information, or
- at manually selected source and receiver positions

During measurement, the instantaneous sound level spectrum is displayed. After measurement, the reverberation time is displayed
Interrupted Noise Excitation: Measurements are started manually and can be automatically stored on completion of measurement.
The noise generator is turned on and off automatically
Escape Time: 0 to 60 s
Build-up Time: 1 to 10 s
Number of Decays per Measurement: 1 to 100, ensemble averaged into one decay
The generator can be turned on and off manually for checking equipment and sound levels
Impulse Excitation: 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

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 Reverberation Time Project, to Sources, to Receivers 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 Annotations

Text annotations can be attached to the Reverberation Time Project, to Sources, to Receivers and to measurements at each Position

Data Management

Project Template: Defines the display and measurement setups
Project: Measurement data for all positions defined in a room are stored with the Project Template
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 Type 7831 and Type 7830, please refer to Product Data BP 1691

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

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

ON-LINE DISPLAY OF TYPE 2250 DATA
Measurements on Type 2250 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

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 (content 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

USERS
Users of Type 2250 can be created or deleted

EXPORT FACILITIES
Excel: Projects (or user specified parts) can be exported to Microsoft® Excel
Type 7810/12/15/16/20/25/30/31: Projects can be exported to Predictor Type 7810, Lima Type 7812, Noise Explorer Type 7815, Acoustic Determinator Type 7816, Evaluator Type 7820, Protector Type 7825 or Qualifier (Light) Type 7830 (7831)

TYPE 2250 SOFTWARE UPGRADES AND LICENSES
The utility software controls Type 2250 software upgrades and licensing of the Type 2250 applications

INTERFACE TO TYPE 2250
USB ver. 1.1 or Hayes compatible GSM or standard analogue modem

PC REQUIREMENT
Operating System: Windows® 2000/Windows® XP, Microsoft®.NET

Recommended PC: Pentium® III (or equivalent) processor, 128 Mbyte RAM, SVGA graphics display/ adaptor, sound card, CD ROM drive, mouse, USB, Windows® XP

Ordering Information

PACKAGES

Type 2250-A	Hand-held Analyzer with Sound Level Meter Software
Type 2250-B	Hand-held Analyzer with Sound Level Meter and Frequency Analysis Software
Type 2250-C	Hand-held Analyzer with Sound Level Meter and Logging Software
Type 2250-D	Hand-held Analyzer with Sound Level Meter, Frequency Analysis and Logging Software
Type 2250-E	Hand-held Analyzer with Sound Level Meter, Frequency Analysis, Enhanced Logging Software and Sound Recording Software
Type 2250-F	Hand-held Analyzer with Sound Level Meter and Reverberation Time Software

SOFTWARE MODULES AVAILABLE SEPARATELY

BZ-7223	2250 Frequency Analysis Software
BZ-7224	2250 Logging Software
BZ-7225	2250 Enhanced Logging Software
BZ-7225-UPG	Upgrade from 2250 Logging Software BZ-7224 to 2250 Enhanced Logging Software BZ-7225 (does not include memory card)
BZ-7226	2250 Sound Recording Option
BZ-7227	2250 Reverberation Time Software

COMPONENTS INCLUDED WITH TYPE 2250 HAND-HELD ANALYZER

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 for Type 2250
FB-0679	Hinged Cover for Hand-held Analyzer
HT-0015	Earphones
UA-1654	5 Extra Styli
QB-0061	Battery Pack
ZG-0426	Mains Power Supply

COMPONENTS INCLUDED WITH 2250 LOGGING SOFTWARE BZ-7224 AND ENHANCED LOGGING SOFTWARE BZ-7225

	Memory Card for Hand-held Analyzers **Note:** the upgrade from Logging Software BZ-7224 to Enhanced Logging Software BZ-7225 (BZ-7225-UPG) does not include memory card

ACCESSORIES AND COMPONENTS AVAILABLE SEPARATELY

ANALYZER

ZG-0444	Charger for QB-0061 Battery Pack

CALIBRATION

Type 4231	Sound Calibrator (fits in KE-0440)
Type 4226	Multifunction Acoustic Calibrator
Type 4228	Pistonphone
2250 CAI	Accredited Initial Calibration of Type 2250
2250 CAF	Accredited Calibration of Type 2250
2250 CTF	Traceable Calibration of Type 2250
2250 TCF	Conformance Test of Type 2250, with certificate

MEASURING

Type 3592	Outdoor Measuring Gear (see Product Data BP 1744)
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-0441-D-030	Microphone Extension Cable, 10-pin LEMO, 3 m (10 ft)
AO-0441-D-100	Microphone Extension Cable, 10-pin LEMO, 10 m (33 ft)
UA-0587	Tripod
UA-0801	Small Tripod
UA-1317	Microphone Holder

UA-1404	Outdoor Microphone Kit
UA-1672	AutoDetect Insert for UA-1650
UL-1009	SD Memory Card for Hand-held Analyzers
UL-1013	CF Memory Card for Hand-held Analyzers

MEASURING WITH REVERBERATION TIME SOFTWARE BZ-7227

Type 2716	Power Amplifier
Type 4292	OmniPower Sound Source
KE-0449	Flight Case for Type 4292
KE-0364	Carrying Case for Type 4292s Tripod
Type 4224	Sound Source
Type 4295	Omnidirectional Sound Source
KE-0392	Carrying Case for Type 4295
KE-0538	Flight Case
AO-0523	10 m Cable from Type 2250 to Type 2716
AO-0524	10 m Cable from Type 2250 to Type 4224
AQ-0667	Bridging Cable for Type 2716/4292
AQ-0673	10 m Cable from Type 2716 to sound source
UA-1476	Wireless Transmission Kit
Type 7831	Qualifier Light
Type 7830	Qualifier

Note: For sound sources, please see separate Product Data BP 1689

INTERFACING

Type 7815	Noise Explorer – data viewing software
Type 7820	Evaluator – data viewing and calculation software
Type 7825	Protector – software for calculation of Personal Noise Exposure

SERVICE PRODUCTS

2250-EW1	Extended Warranty, one year extension
2250-MW1	5 Years Warranty including yearly Accredited Calibration – annual payment
2250-MW5	5 Years Warranty including yearly Accredited Calibration

Compliance with Standards

CE C-Tick	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: Safety requirements for electrical equipment for measurement, control and laboratory use. UL 61010B – 1: Standard for Safety – Electrical measuring and test equipment.
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
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

Appendix A

Setup Parameters

This appendix describes all the setup parameters included in a template.

Input

Table A.1 *Input parameters*

Parameter	Values	Comment
Input	*Top Socket* *Rear Socket*	Determines whether the input is taken from the top socket or the rear socket ('Input' on connector panel). Connect your transducer to this socket **Note:** *Sound Field* and *Windscreen* corrections can be added to both the *Top Socket* and the *Rear Socket* (*Input* parameters). However, be careful that you don't add a 'double' correction - for instance, if you have recorded the signal from the Output socket on a tape recorder, and later want to re-analyse the recording via the Rear Input. In this case you should set *Microphone Type* to *Unknown* on the **Transducer** menu for the used transducer, when using Rear Input
Sound Field Correction	*Free-field* *Diffuse-field*	Select a correction matching the sound field of your measurements. i.e., you can make correct measurements in a diffuse-field using a Type 4189 free-field microphone, by selecting *Diffuse-field* correction. Even free-field correction of a free-field microphone will enhance the overall frequency response of the system. Generally, ISO requires free-field conditions and ANSI requires diffuse-field conditions.Check your local standards for the setting you require. No correction is made for unknown transducers

For outdoor measurements, it is often necessary to mount a windscreen on the microphone to reduce the measured wind noise. This has, however, a small impact on the overall frequency response of the analyzer. To compensate for this, use the built-in windscreen correction.

Table A.2 *Input parameters, with windscreen correction*

Parameter	Values	Comment
Windscreen Auto Detect	*On* *Off*	Automatic detection of UA-1650 windscreen when mounted on the ZC-0032 microphone preamplifier. The preamplifier should be connected to the top socket, if necessary using a microphone extension cable. This parameter is available for microphone types using ZC-0032 only
Windscreen Correction	*None* *UA-1650* *UA-1404*	If *Windscreen Auto Detect* is set to *Off*, you can manually select a windscreen correction suitable for the windscreen in use. Correction is automatically made for the windscreen on Type 4952. No correction is made for unknown transducers
Extended Low Frequency[a]	*On* *Off*	Use this parameter to extend the low frequency of the broadband measurements and the frequency analysis. However, be aware that the measurements will be more sensitive to very low frequency noise such as wind noise. **Extended Low Frequency Off:** Broadband Z-weighting: 6.3 Hz to 22.4 kHz (–2 dB limits) Frequency analysis[b]: 1/1-octave: 16 Hz – 16 kHz 1/3-octave: 12.5 Hz – 20 kHz **Extended Low Frequency On:** Broadband Z-weighting (using a Type 4189 microphone): 4.2 Hz to 22.4 kHz (–2 dB limits) Broadband Z-weighting (without microphone): approx. 1 Hz to 22.4 kHz (–2 dB limits) Frequency analysis[b]: 1/1-octave: 8 Hz – 16 kHz 1/3-octave: 6.3 Hz – 20 kHz

Table A.2 *(Cont.) Input parameters, with windscreen correction*

Parameter	Values	Comment
Trigger Input[a]	*None*	This parameter should be set to match the equipment connected to the Trigger Input Socket on the connector panel of Type 2250. Set it to *None*, if not used.
	MATRON Handswitch	Set *Trigger Input* to *MATRON Handswitch* if Type 2250 is being used in the MATRON system. (MATRON is a dedicated neighbour complaint system. For UK customers only). Please contact your local Brüel & Kjær representative for further information.
	Voltage Level	Set Trigger input to *Voltage Level* if you want to control sound recording by a voltage level generated by external equipment. The Voltage Level should generate at least 2 V for On and less than 1 V for Off. The duration of the steady level should be at least 1 s, so it can be recognised by Type 2250

a. Not available in Reverberation Time Software BZ-7227.
b. Requires Frequency Analysis Software BZ-7223.

Frequency Weightings

Table A.3 *Frequency weighting parameters*[a]

Parameter	Values	Comment
Broadband (excl. Peak)	*AC* *AZ* *BC* *BZ*	All broadband parameters (except L_{peak}) are measured simultaneously with two different frequency weightings – select the weightings here
Broadband Peak	*X* *C* *Z*	One broadband peak parameter L_{peak} is measured, select the frequency weighting here. **Note:** X = frequency weighting A or B. 'A' requires that the *Broadband (excl. Peak)* parameter is set to *AC or AZ.* 'B' requires that the *Broadband (excl. Peak)* parameter is set to *BC or BZ*
Spectrum[b]	*X* *C* *Z*	The frequency analysis (1/1-octave or 1/3-octave) will be frequency weighted in accordance with this parameter **Note:** X = frequency weighting A or B. 'A' requires that the *Broadband (excl. Peak)* parameter is set to *AC or AZ.* 'B' requires that the *Broadband (excl. Peak)* parameter is set to *BC or BZ*

a. Not available in Reverberation Time Software BZ-7227.
b. Requires Frequency Analysis Software BZ-7223.

Bandwidth

Table A.4 *Bandwidth parameters*

Parameter	Values	Comment
Bandwidth[a]	*1/1-octave* *1/3-octave*	Bandwidth of frequency analysis
Bottom Frequency[b]	*50 Hz to Top Frequency*	1/1-octave: 63 Hz – 8 kHz 1/3-octave: 50 Hz – 10 kHz **Note:** The settings of Bottom and Top Frequency control the frequency range of the frequency analysis and the internal noise generator.
Top Frequency[b]	*Bottom Frequency to 10 kHz*	1/1-octave: 63 Hz – 8 kHz 1/3-octave: 50 Hz – 10 kHz

a. Requires Frequency Analysis Software BZ-7223 or Reverberation Time Software BZ-7227.
b. For Reverberation Time Software BZ-7227 only.

Statistics

Table A.5 *Statistics parameters*[a]

Parameter	Values	Comment
Broadband Statistics based on	L_{Xeq} L_{XF} L_{XS}	The broadband statistics are based on sampling the broadband parameter L_{XF} or L_{XS} each 10 ms or L_{Xeq} each second. **Note:** X = frequency weighting A or B. 'A' requires that the *Broadband (excl. Peak)* parameter is set to *AC or AZ.* 'B' requires that the *Broadband (excl. Peak)* parameter is set to *BC or BZ*
Spectral Statistics based on[b]	*LXF* *LXS*	The statistics are based on sampling the instantaneous spectrum every 100 ms (200 ms for *Extended Low Frequency* set to *On*). The time weighting for the spectrum is either F or S. The frequency weighting X is determined by the *Frequency Weighting*, *Spectrum* parameter
Percentile N1	*0.1 to 99.9*	User-defined percentile level where the value of L_{XN1} is exceeded for N1% of the elapsed time
Percentile N2	*0.1 to 99.9*	User-defined percentile level where the value of L_{XN2} is exceeded for N2% of the elapsed time
Percentile N3	*0.1 to 99.9*	User-defined percentile level where the value of L_{XN3} is exceeded for N3% of the elapsed time
Percentile N4	*0.1 to 99.9*	User-defined percentile level where the value of L_{XN4} is exceeded for N4% of the elapsed time

Table A.5 *(Cont.) Statistics parameters*[a]

Parameter	Values	Comment
Percentile N5	*0.1 to 99.9*	User-defined percentile level where the value of L_{XN5} is exceeded for N5% of the elapsed time
Percentile N6	*0.1 to 99.9*	User-defined percentile level where the value of L_{XN6} is exceeded for N6% of the elapsed time
Percentile N7	*0.1 to 99.9*	User-defined percentile level where the value of L_{XN7} is exceeded for N7% of the elapsed time

a. Not available for Reverberation Time Software BZ-7227.
b. Requires Frequency Analysis Software BZ-7223.

The percentile levels N1 to N7 are common to broadband and spectral statistics, and can be changed after the measurement has been done.

Measurement Control – for BZ-7222 to BZ-7225

Table A.6 *Measurement Control parameters – for BZ-7222 to BZ-7225*

Parameter	Values	Comment
Measurement Mode[a]	*Manual* *Automatic*	Determines whether the measurement is under *Manual* control (fully controlled by the **Reset** and **Start/Pause** pushbuttons), or *Automatic* control (start of measurement controlled by the **Reset** and **Start/Pause** pushbuttons, end of measurement automatically controlled by the instrument when preset time has elapsed)
Preset Time[a]	*00:00:01 to 24:00:00*	Fixes the duration of a measurement from start to automatic stop (in hours, minutes and seconds). Any pauses made during the measurement via the **Start/Pause** pushbutton are not counted in the preset time
Save Project Data at[b]	*00:00:00 to 23:59:59*	Determines the time for automatic save of the project and start of a new project.
Continuous Logging[b]	*On* *Off*	Determines whether the logging will run continuously, or for a time set by *Preset Logging Time*
Preset Logging Time[c]	*0.00:00:01 to 31.00:00:00*	Fixes the duration of a measurement from start to automatic stop (in days, hours, minutes and seconds)
Logging Period[c]	*00:00:01 to 24:00:00*	Sets the period of the logging (in hours, minutes and seconds)
Report Period[b]	*00:01:00 to 24:00:00*	Sets the period of the reports (in hours and minutes)

Table A.6 *(Cont.) Measurement Control parameters – for BZ-7222 to BZ-7225*

Parameter	Values	Comment
Synchronize with Clock[c]	*Yes* *No*	Select *Yes* to synchronise the logging and reporting intervals with whole minutes or hours, e.g., if Logging Period is set to 00:01:00 (1 minute) and Report Period is set to 01:00:00 and you start the measurement at 8:12:33, then the first logging interval will be from 8:12:33 to 8:12:59 (27 seconds), the second will be from 8:13:00 to 8:13:59 (60 seconds), etc., and the first Report interval will be from 8:12:33 to 8:59:59 (48 min and 27 seconds), the second will be from 9:00:00 to 9:59:59 (1 hour), etc. Select *No* if you want every logging and reporting interval to be exactly the specified Logging Period

a. For Sound Level Meter (BZ-7222) and Frequency Analyzer (BZ-7223) templates only.
b. For Enhanced Logging (BZ-7225) templates only.
c. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only.

Measurement Control – for Reverberation Time Software BZ-7227

Table A.7 *Measurement Control parameters – for Reverberation Time Software BZ-7227*

Parameter	Values	Comment
Map Based Measurement	*No* *Yes*	If *Map Based Measurement* = *Yes* you can define the source positions and receiver positions graphically on a map – otherwise the measurements are just numbered from position number one (*Pos. 1*) onwards
Meas. All Pos. for Each Source	*No* *Yes*	Parameter only available if *Map Based Measurement* = *Yes.* Set to *Yes* for measuring all positions for each source position. Set to *No* for measuring a specific number of receiver positions per source position
No. of Positions per Source	*1 to 10*	Parameter only available if *Meas. All Pos. for Each Source* = *No* Set number of receiver positions you want to measure per source
Increment	*Sources First* *Receivers First* *Manual*	Parameter only available if *Map Based Measurement* = *Yes.* Allows you to select the quickest method of measurement, when positioning your Type 2250 in relation to source and receiver positions. (Typically, *Sources First* is best for Impulsive Excitation and *Receivers First* is best for Interrupted Noise excitation)

Table A.7 *(Cont.) Measurement Control parameters – for Reverberation Time Software BZ-7227*

Parameter	Values	Comment
Automatic Save	*No* *Yes*	Set to *Yes* to automatically save the decay after each measurement
Max. Decay Time	*1 to 20 s*	Sets the maximum duration of the decay measurement. If the decay finishes in a shorter time, decay measurement stops automatically
Excitation	*Impulsive* *Interrupted Noise*	Select *Impulsive* to excite the room with an impulse. Type 2250 triggers on the impulse, measures the impulse as a sequence of spectra with 5 ms intervals, and finally backwardly integrates the measurements to decay curves. Select *Interrupted Noise* to excite the room with noise, interrupt the noise and measure the decays – all controlled by Type 2250
Number of Decays	*1 to 99*	Parameter only available if *Excitation* = *Interrupted Noise.* Specify the number of decays to be measured automatically and averaged together per position

Impulse Trigger

Table A.8 *Impulse Trigger*[a]

Parameter	Values	Comment
Trigger Level	*0 to 200 dB*	Parameter only available if *Excitation* = *Impulsive.* Specify the trigger level for the sound level in any frequency band – the measurement starts as soon as this level is exceeded. The measurement has a pre-trigger of 1 s
Trigger Repeat	*Off* *On*	Set to *On* to start a new measurement automatically, after saving the previous measurement (and after fulfilling the trigger conditions). Parameter only available if *Excitation* = *Impulsive* and *Automatic Save* = *Yes*

a. Requires Reverberation Time Software BZ-7227.

Logged Broadband

Table A.9 *Logged Broadband parameters*[a]

Parameter	Values	Comment
Full Statistics	*Yes* *No*	Determines whether the full broadband statistics are logged or not
Broadband Parameters	*All* *Selected*	Determines whether all broadband parameters are logged or a selected part is logged (up to 10 parameters)
Parameter 1 to Parameter 10	L_{Xeq} L_{Yeq} L_{Ceq}-L_{Aeq} L_{AE} L_{Vpeak} L_{XFmax} L_{XSmax} L_{XImax} L_{YFmax} L_{YSmax} L_{YImax} L_{XFmin} L_{XSmin} L_{XImin} L_{YFmin} L_{YSmin} L_{YImin} L_{XIeq} L_{YIeq} L_{AIeq}-L_{Aeq} L_{AFTeq} L_{AFTeq}-L_{Aeq} L_{avUQ}	This parameter can be set if Broadband Parameters = *Selected*. X = frequency weightings A or B (controlled by **Setup** – *Frequency Weightings – Broadband (excl. Peak)* parameter). Y = frequency weightings C or Z (controlled by **Setup** – *Frequency Weightings – Broadband (excl. Peak)* parameter). V = frequency weightings A, B, C or Z (controlled by **Setup** – *Frequency Weightings – Broadband Peak* parameter) U = time weightings F or S (controlled by **Setup** – *Occupational Health – Time Weighting for Lav* parameter) Q = exchange rate 4, 5 or 6 dB (controlled by **Setup** – *Occupational Health – Exchange Rate for Lav* parameter)

a. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only.

Logged Broadband (100 ms)

Table A.10 *Logged Broadband (100 ms) parameters*[a]

Parameter	Values	Comment
L_{Aeq}	*On* *Off*	Select *On* to log L_{Aeq} (with an elapsed time of 100 ms and a logging period of 100 ms) **Note:** Logging L_{Aeq} every 100 ms requires *Broadband (excl. Peak)* parameter set to *AC* or *AZ*

Table A.10 *(Cont.) Logged Broadband (100 ms) parameters*[a]

Parameter	Values	Comment
L_{AF}	*On* *Off*	Select *On* for logging of L_{AF} every 100 ms **Note:** Logging L_{AF} every 100 ms requires *Broadband (excl. Peak)* parameter set to *AC* or *AZ*

a. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only.

Logged Spectrum

Table A.11 *Logged Spectrum parameters*[a]

Parameter	Values	Comment
Full Spectral Statistics	*Yes* *No*	Determines whether the full spectral statistics are logged or not
Spectrum Parameters	*All* *Selected* *None*	Determines whether all Spectrum parameters are logged, a selected part of the parameters are logged (up to 3 parameters) or none are logged
Spectrum 1 to Spectrum 3	L_{Xeq} L_{XFmax} L_{XSmax} L_{XFmin} L_{XSmin} *Off*	These parameters can be set if Spectrum Parameters = Selected. X = frequency weightings A, B, C or Z (controlled by **Setup** – *Frequency Weightings* – *Spectrum* parameter)

a. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only, requires Frequency Analysis Software BZ-7223.

Periodic Reports

Table A.12 *Periodic Reports parameters*[a]

Parameter	Values	Comment
Full Spectral Statistics	*Yes* *No*	Determines whether the full spectral statistics are logged in the report or not

a. For Enhanced Logging (BZ-7225) templates only, requires Frequency Analysis Software BZ-7223.

Markers

Table A.13 *Markers*[a]

Parameter	Values	Comment
Marker 1	*Text string*	Default set to 'Exclude'. This marker can be set using the stylus in the profile or the **Back-erase** pushbutton during a measurement
Marker 2	*Text string*	Default set to 'Manual'. This marker can be set using the stylus in the profile or the **Manual Event** pushbutton during a measurement
Marker 3	*Text string*	Default set to 'Level'. This marker can be set using the stylus in the profile, or if the conditions for the Level Trigger are met during a measurement
Marker 4 and Marker 5	*Text string*	These markers can be set using the stylus in the profile display
Marker 6	*Text String*	Default set to 'Sound'. This marker is set if a sound recording is made during a measurement
Pre-marker Time	*0 to 5 s*	Specifies number of seconds marker 1, marker 2 or marker 3 will be set ahead of the point where the **Back-erase** or the **Manual Event** pushbuttons are pressed or the level trigger conditions are fulfilled

a. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only..

Level Trigger

Table A.14 *Level Trigger parameters*[a]

Parameter	Values	Comment
Level Trigger Control	*On* *Off*	Set to *On* for setting Marker 3 (Level) when the *Trigger Parameter* fulfils the Level Trigger conditions (see below). The conditions are checked every second. Sound Recording[b] can also be controlled by these settings, see **Setup** – *Sound Recording* – *Recording Control*

Table A.14 *(Cont.) Level Trigger parameters*[a]

Parameter	Values	Comment
Start Slope	*Rising* *Falling*	Set to *Rising* to start when level goes above *Start Level* (and then stop when level goes below *Stop Level*). Set to *Falling* to start when level goes below *Start Level* (and stop when level goes above *Stop Level*)
Start Level	*–100 to 200 dB*	Start trigger conditions are fulfilled, when level crosses *Start Level* (in accordance with *Start Slope*) for at least *Start Duration* seconds – set *Start Level here*
Start Duration	*0 to 15 s*	Start trigger conditions are fulfilled, when level crosses *Start Level* (in accordance with *Start Slope*) for at least *Start Duration* seconds – set *Start Duration here*
Stop Level	*–100 to 200 dB*	Stop trigger conditions are fulfilled, when level crosses *Stop Level* (in accordance with *Start Slope*) for at least *Stop Duration* seconds – set *Stop Level here*
Stop Duration	*0 to 15 s*	Stop trigger conditions are fulfilled, when level crosses *Stop Level* (in accordance with *Start Slope*) for at least *Stop Duration* seconds – set *Stop Duration here*

Table A.14 *(Cont.) Level Trigger parameters*[a]

Parameter	Values	Comment
Trigger Parameter	L_{Xeq} L_{Yeq} L_{Vpeak} L_{XFmax} L_{XSmax} L_{XImax} L_{YFmax} L_{YSmax} L_{YImax} L_{XFmin} L_{XSmin} L_{XImin} L_{YFmin} L_{YSmin} L_{YImin} $L_{XF(SPL)}$ $L_{XS(SPL)}$ $L_{XI(SPL)}$ $L_{YF(SPL)}$ $L_{YS(SPL)}$ $L_{YI(SPL)}$ L_{avUQ}	Select which parameter to monitor for the level trigger. The parameter is based on 1 second measurements and checked every second regardless of the logging period and logged parameters. X = frequency weightings A or B (controlled by **Setup** – *Frequency Weightings – Broadband (excl. Peak)* parameter). Y = frequency weightings C or Z (controlled by **Setup** – *Frequency Weightings – Broadband (excl. Peak)* parameter). V = frequency weightings A, B, C or Z (controlled by **Setup** – *Frequency Weightings – Broadband Peak* parameter) U = time weightings F or S (controlled by **Setup** – *Occupational Health – Time Weighting for Lav* parameter) Q = exchange rate 4, 5 or 6 dB (controlled by **Setup** – *Occupational Health – Exchange Rate for Lav* parameter)

a. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only.
b. Requires license for Sound recording BZ-7226

Sound Recording

Table A.15 *Sound Recording parameters*[a]

Parameter	Values	Comment
Recording Control	*Off*	Determines how recording of the measured signal is controlled.
	Automatic	Set to *Automatic* to start the recording when the measurement is started and record throughout the measurement, only limited by the *Maximum Duration.*
	Manual Event	Set to *Manual Event* to start recording manually while measuring when the **Manual Event** pushbutton is pressed, and record until pressing the pushbutton again, however, take *Maximum* and *Minimum Duration* into account.
	Exclude Event[b]	Set to *Exclude Event* to start recording manually while measuring when the **Back-erase** pushbutton is pressed, and record until pressing the pushbutton again, however, take *Maximum* and *Minimum Duration* into account.
	External Event	Set to *External Event* to start recording using external equipment connected to the Trigger Input Socket.
	Level Trigger Event[b]	Set to *Level Trigger Event* to record while the level trigger conditions are fulfilled, however, take *Maximum* and *Minimum Duration* into account.
	All Events[b]	Set to *All Events* to record while any of the events above are active, however, take *Maximum* and *Minimum Duration* into account. If you don't want to record the input signal, then set *Recording Control* to *Off*, to economise on power. For Reverberation Time Software BZ-7227 the values are limited to *Off* and *Automatic*. Set to *Automatic* to make sound recordings during the measurements

Table A.15 *(Cont.) Sound Recording parameters*[a]

Parameter	Values	Comment
Recording Quality	*Low* *Fair* *Medium* *High*	This setup determines the quality of the recording by adjusting the sampling rate. The amount of space required for the recording on the memory card will depend on the selected quality: Quality / Sampling freq. / Upper freq. / Memory Low 8 kHz 3 kHz 16 KB/s Fair 16 kHz 6 kHz 32 KB/s Medium 24 kHz 10 kHz 48 KB/s High 48 kHz 20 kHz 96 KB/s
Recorded Signal[c]	*Input X-weighted* *Input C-weighted* *Input Z-weighted*	Use this parameter to select the frequency weighting of the recorded signal. **Note 1:** The frequency weighting of the recorded signal can be selected independently of the frequency weighting of the measurement, the signal at the output socket and the signal at the earphone socket **Note 2:** X = frequency weighting A or B. 'A' requires that the *Broadband (excl. Peak)* parameter is set to *AC or AZ.* 'B' requires that the *Broadband (excl. Peak)* parameter is set to *BC or BZ*
Automatic Gain Control[c]	*On* *Off*	To ease identification of sound sources, the gain can be automatically adjusted to keep the average level within a 40 dB range. When playing back the recorded signal, you will then hear clearly the whole signal content, whether the level has been 20 dB or 140 dB. Set *Automatic Gain Control* to *On* to convert the recorded signal. Set *Automatic Gain Control* to *Off* for recording the signal with a fixed gain – then set *Peak Recording Level* to fit the signal **Note:** If the sound contains very high levels at low frequency, then a fixed gain is recommended

Table A.15 *(Cont.) Sound Recording parameters*[a]

Parameter	Values	Comment
Peak Recording Level	*140 dB* *130 dB* *120 dB* *110 dB* *100 dB* *90 dB* *80 dB* *70 dB*	The recorded signal is stored as a 16-bit wave file, which has a dynamic range of up to 96 dB. When playing back on Type 2250 the dynamic range of the output is approx. 75 dB. When playing back on a PC it might be even lower. Set *Peak Recording Level* to fit the signal. The values for *Peak Recording Level* take the sensitivity of the attached transducer into account. The values shown in the list here are nominal values for a Type 4189 microphone. **Hint:** Monitor the L_{peak} value during a trial measurement before selecting the *Peak Recording Level*
Pre-recording Time[b,c]	*0 to 110 s*	Recording is started the *Pre-recording Time* before the trigger conditions are fulfilled (e.g., 5 s means the recording will be started 5 s before you hit the **Manual Event** pushbutton). This is possible because the recording is done continuously in an internal buffer, ready to be saved as a wave file. The *Pre-recording Time* is limited by this buffer size and the *Recording Quality*: Quality — Pre-recording Time limit Low — 110 s Fair — 50 s Medium — 30 s High — 10 s
Post-recording Time[b,c]	*0 to 300 s*	Use this parameter to specify how much extra you want to be recorded after the trigger conditions are no longer fulfilled
Duration Limit[c]	*On* *Off*	Use this parameter to enable the *Minimum Duration* and *Maximum Duration* parameters for overruling the duration of the sound recording determined by the trigger condition parameters
Minimum Duration[c]	*00:00:00 to 01:00:00*	When *Duration Limit* is *On*, then *Minimum Duration* will determine the minimum recording time regardless of the trigger conditions. The total record length will then (as a minimum) be the sum of *Minimum Duration*, *Pre-recording Time* and *Post-recording Time*

Table A.15 *(Cont.) Sound Recording parameters*[a]

Parameter	Values	Comment
Maximum Duration[c]	*00:00:00 to 01:00:00*	When *Duration Limit* is *On*, then *Maximum Duration* will determine the maximum recording time regardless of the trigger conditions. The total record length will then (as a maximum) be the sum of *Maximum Duration*, *Pre-recording Time* and *Post-recording Time.* **Note:** If *Maximum Duration* = *00:00:00*, then it is disabled and doesn't limit the duration

a. Requires license for Sound Recording Option BZ-7226.
b. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only.
c. Not available for Reverberation Time Software BZ-7227.

Output Socket Signal

Table A.16 *Output Socket Signal parameters*[a]

Parameter	Values	Comment
Source	*Off* *Input X-weighted* *Input C-weighted* *Input Z-weighted* L_{XF} *DC Voltage* *Generator*	Output to the Output socket on the connector panel. Select between *Off* and the input signal for monitoring purposes. The L_{AF} setting will output the X-weighted sound level as a voltage between 0 V and 4 V. Use the *DC Voltage* parameter to calibrate the connected equipment by setting the *DC Output*. Use *Generator* parameter to output the signal specified by the Generator settings. **Note 1:** If you do not want to output the signal, then select *Off* to economise the power. **Note 2:** X = frequency weighting A or B. 'A' requires that the *Broadband (excl. Peak)* parameter is set to *AC or AZ.* 'B' requires that the *Broadband (excl. Peak)* parameter is set to *BC or BZ.* **Note 3:** The *Generator* setting is only available for Frequency Analysis templates
DC Output (20 mV/dB)	*0.0 to 200.0 dB*	*Source = DC Voltage* will output: 0 V for *DC Output = 0 dB* and 4 V for *DC Output = 200 dB*

Table A.16 *(Cont.) Output Socket Signal parameters*[a]

Parameter	Values	Comment
Output Gain Input	*–60.0 dB to 60.0 dB*	Output gain of the input signal. Key in a gain value (0.1 dB resolution) for the input signal. Use '@' to assign the new value for immediate response at the output – or use the up/down navigation keys to increment/ decrement the value in steps of 1 dB. **Note:** 0 dB means 1 V output for 1 V input.

a. Not available for Reverberation Time Software BZ-7227.

L_{den} Periods

Table A.17 *L_{den} Periods parameters*[a]

Parameter	Values	Comment
Day Start	*00:00:00 to 23:59:59*	Determines the start of the day period for the L_{day} calculation
Evening Start	*00:00:00 to 23:59:59*	Determines the start of the evening period for the $L_{evening}$ calculation
Night Start	*00:00:00 to 23:59:59*	Determines the start of the night period for the L_{night} calculation
Evening Penalty	*0 to 20 dB*	The Evening Penalty will be added to $L_{evening}$ when calculating L_{den}
Night Penalty	*0 to 20 dB*	The Night Penalty will be added to L_{night} when calculating L_{den}

a. For Enhanced Logging (BZ-7225) templates only.

Note: If *Evening Start* is set between *Night Start* and *Day Start*, then the $L_{evening}$ parameter will be undefined.

Occupational Health

Table A.18 *Occupational Health Parameters*[a]

Parameter	Values	Comment
Exposure Time	*00:01:00 to 1.00:00:00*	Set the *Exposure Time* to the actual time that you are exposed to noise during a workday. Used for calculation of $L_{ep,d}$ and $L_{ep,d,v}$. **Note:** *Exposure Time* can be changed after the measurement has been done

Table A.18 *(Cont.) Occupational Health Parameters*[a]

Parameter	Values	Comment
Reference Time	*00:01:00 to 5.00:00:00*	Set the *Reference Time* as required for calculation of Sound Exposure Level or Time Weighed Average with a reference time other than 8 hours. Used for calculation of $L_{ep,d,v}$ and TWA_v
Threshold Level	*0 to 140 dB*	Any sound levels below the threshold value do not contribute to the Dose measurement data. The time resolution for this calculation is 1 s for calculation of Dose and ProjDose – and 10 ms for calculation of TWA, TWA_v, DoseUQ and ProjDoseUQ. Used for calculation of Dose, ProjDose, TWA, TWAv, DoseUQ, ProjDoseUQ. U = *Time Weighting for Lav*: F or S Q = *Exchange Rate for Lav*: 4, 5 or 6 dB
Criterion Level	*0 to 140 dB*	*Criterion Level* is the sound level allowed for an 8-hour period and would yield a 100% dose. The criterion level must be set according to the legislation with which you will have to comply. Used for calculation of Dose, ProjDose, DoseUQ, ProjDoseUQ. U = *Time Weighting for Lav*: F or S Q = *Exchange Rate for Lav*: 4, 5 or 6 dB

PeaksOver Level	*0 to 200 dB*	Any peak levels that exceed the level set here will be counted.
		Used for calculation of #XPeaks(>NNNdB)
		X = A, B, C or Z, set by **Setup** – *Input* – *Broadband Peak*, NNN is the *PeaksOver Level*
		Note: Two other peak counters are preset to count peaks over 135 dB and 137 dB, respectively

Exchange Rate for Lav	*4 dB* *5 dB* *6 dB*	The increase in noise level that corresponds to a doubling of the noise level is determined by *Exchange Rate for Lav*. Set *Exchange Rate for Lav* as required by your local standards. Used for calculation of LavUQ, TWA, TWA_v DoseUQ, ProjDoseUQ. U = *Time Weighting for Lav*: F or S Q = *Exchange Rate for Lav*: 4, 5 or 6 dB **Note:** TWA and TWA_v requires U = S and Q = 5

Table A.18 *(Cont.) Occupational Health Parameters*[a]

Parameter	Values	Comment
Time Weighting for Lav	*F* *S*	Lav will be time weighted in accordance with this parameter. Used for calculation of LavUQ, TWA, TWA_v DoseUQ, ProjDoseUQ. U = *Time Weighting for Lav*: F or S Q = *Exchange Rate for Lav*: 4, 5 or 6 dB **Note:** TWA and TWA_v requires U = S and Q = 5

a. Not available for Reverberation Time Software BZ-7227

Generator

Table A.19 *Generator Parameters*[a]

Parameter	Values	Comment
Generator Type	*Internal* *External*	Set to *Internal* to use the internal noise generator as specified below. Set to *External* to switch an external generator on/off using a logic signal: On = 4.5 V; Off = 0 V. The generator signal appears at the Output Socket. **Note 1:** For Reverberation Time Software BZ-7227, set *Measurement Control*, *Excitation* = *Interrupted Noise* to enable the generator parameters. **Note 2**: For Frequency Analysis Software BZ-7223, set *Output Socket Signal*, *Source* = *Generator* to enable the generator parameters
Noise Type	*Pink* *White*	The type of noise from the internal generator. The bandwidth of the noise will be adjusted to the frequency range from *Bottom Frequency* to *Top Frequency*
Level [re. 1 V]	*–60.0 to 0.0 dB*	This sets the internal noise generator attenuation in dB, referenced to 1 V. This level stays at the set level irrespective of the frequency range

Table A.19 *(Cont.) Generator Parameters*[a]

Parameter	Values	Comment
Sound Source	*Unknown* *Type 4292 Optimum* *Type 4295 Optimum* *Type 4296 Optimum* *Type 4292 Flat* *Type 4295 Flat* *Type 4296 Flat*	This setting optimises the frequency response of the internal generator output to the connected sound source. The 'Flat' setting optimises the output for a flat power response, the 'Optimum' setting optimises the power difference between adjacent 1/1- or 1/3-octave bands, while maintaining a 'boost' at low frequencies. Select a type matching your sound source: Type 4292 or 4296 OmniPower Sound Source, or Type 4295 OmniSource Sound Source. Select *Unknown* if you are using another sound source, or don't want to correct the frequency response
Escape Time	*0 to 60 s*	Set the *Escape Time* to allow the operator to leave the room before the generator is turned on and the measurement starts
Build-up Time	*1 to 20 s*	Set the *Build-up Time* to allow the sound pressure in the room to settle after the sound source is switched on
Bottom Frequency[b]	*50 Hz to Top Frequency*	1/1-octave: 63 Hz – 8 kHz 1/3-octave: 50 Hz – 10 kHz **Note:** The settings of *Bottom* and *Top Frequency* control the bandwidth of the noise from the internal noise generator
Top Frequency[b]	*Bottom Frequency to 10 kHz*	1/1-octave: 63 Hz – 8 kHz 1/3-octave: 50 Hz – 10 kHz

a. Available for Frequency Analysis Software BZ-7223 and Reverberation Time Software BZ-7227 only.
b. Available for Frequency Analysis Software BZ-7223 only.

Post-processing

Table A.20 *Post-processing Parameters*[a]

Parameter	Values	Comment
Ensemble Averaging	*No* *Yes*	Set to *Yes* to average each of the position[b] decays into an average decay (called the ensemble average or Room average). The averaged decays of the room can then be displayed in the Decay View. T30 Room, T20 Room and EDT Room will be calculated from the Room average. Set to *No* for no ensemble averaging. There will be no decays available for the room. T30 Room, T20 Room and EDT Room will be calculated as averages of the T30, T20 and EDT resp. for all the positions[b]
Wide Band RT Bottom	*50 Hz to Wide Band RT Top*	1/1-octave: 63 Hz – 8 kHz 1/3-octave: 50 Hz – 10 kHz The settings of *Wide Band RT Bottom* and *Wide Band RT Top* control the range of frequency bands used in the averaging of the wide band parameters available below the Spectrum and Decay graphs. **Example:** Set *Wide Band RT Bottom* to *100 Hz* and *Top* to *2 kHz*, then the average of the frequency bands from 100 Hz to 2 kHz will be calculated for the current position as: • T30 (100 Hz – 2 kHz) • T20 (100 Hz – 2 kHz) • EDT (100 Hz – 2 kHz) and for the Room as: • T30 Room (100 Hz – 2 kHz) • T20 Room (100 Hz – 2 kHz) • EDT Room (100 Hz – 2 kHz)
Wide Band RT Top	*Wide Band RT Bottom to 10 kHz*	1/1-octave: 63 Hz – 8 kHz 1/3-octave: 50 Hz – 10 kHz

a. Requires Reverberation Time Software BZ-7227.
b. The positions ‘checked’ in the Table Overview will be used in the Room calculations.

Appendix B

Measurement Parameters

This appendix describes the measurement parameters. They are measured in accordance with the setup parameters.

Please refer to the Glossary in Appendix E for a description of the parameters.

The following letters are substituted in the parameters that follow to represent the wide range of frequency weightings, time weightings and percentile levels available:

V = frequency weightings A, B, C or Z (controlled by **Setup** – *Frequency Weightings – Broadband Peak* parameter)

X = frequency weightings A or B (controlled by **Setup** – *Frequency Weightings – Broadband (excl. Peak)* parameter)

Y = frequency weightings C or Z (controlled by **Setup** – *Frequency Weightings – Broadband (excl. Peak)* parameter)

W = frequency weightings A, B, C or Z (controlled by **Setup** – *Frequency Weightings – Spectrum* parameter)

U = time weightings F or S (controlled by **Setup** – *Statistics – Spectral Statistics based on* parameter)

R = time weightings F or S (controlled by **Setup** – *Occupational Health – Time Weighting for Lav* parameter)

Q = exchange rate 4, 5 or 6 dB (controlled by **Setup** – *Occupational Health – Exchange Rate* parameter)

N = number between 0.1 and 99.9 (controlled by **Setup** – *Statistics – Percentile N parameter*)

Total Measurement

For 2250 Sound Level Meter Software BZ-7222, 2250 Frequency Analysis Software BZ-7223, 2250 Logging Software BZ-7224 and 2250 Enhanced Logging Software BZ-7225

The following parameters are measured within the Elapsed Time:

Equivalent Continuous Sound Levels

- L_{Xeq}
- L_{Yeq}
- L_{Ceq}-L_{Aeq}

Sound Exposure Level

- L_{XE}
- L_{YE}

Peak Sound Level

- L_{Vpeak}
- T_{Vpeak}

Maximum Time-weighted Sound Levels

- L_{XFmax}
- L_{XSmax}
- L_{XImax}
- L_{YFmax}
- L_{YSmax}
- L_{YImax}

Minimum Time-weighted Sound Levels

- L_{XFmin}
- L_{XSmin}
- L_{XImin}
- L_{YFmin}
- L_{YSmin}
- L_{YImin}

ISO/EU Occupational Health Parameters

- $L_{ep,d}$
- $L_{ep,d,v}$
- E
- Dose
- ProjDose

- #VPeaks (>xxx dB)
- #VPeaks (>137 dB)
- #VPeaks (>135 dB)

US Occupational Health Parameters

- L_{avRQ}
- TWA
- TWA_v
- DoseRQ
- ProjDoseRQ

General Parameters

- Overload in %
- Start time
- Stop Time
- Elapsed Time (excl. pauses)
- Time Remaining (for the current measurement, taking available diskspace into account)

Special Parameters

- L_{XIeq} (also called L_{XIm})
- L_{YIeq}
- L_{AIeq}-L_{Aeq}
- L_{AFTeq} (also called L_{AFTm5})
- L_{AFTeq}-L_{Aeq}
- SIL (average of L_{Zeq} octave band levels: 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz)[a]
- PSIL (average of L_{Zeq} octave band levels: 500 Hz, 1000 Hz and 2000 Hz)[a]
- SIL3 (average of L_{Zeq} octave band levels: 1000 Hz, 2000 Hz and 4000 Hz)[a]
- L_{Aeq}(20–200 Hz) (average of power values for L_{Aeq} 1/3-octave bands from 20 Hz to 200 Hz)[a]

Noise Indicators[b]

- L_{day}
- $L_{evening}$
- L_{night}
- L_{den}
- L_{dn}

Statistics to Calculate Percentile Levels

- L_{XN1} or L_{XFN1}
- L_{XN2} or L_{XFN2}
- L_{XN3} or L_{XFN3}

a. These parameters require license for BZ-7223 and measurement of spectra.
b. These parameters are available for Enhanced Logging BZ-7225 only.

- L_{XN4} or L_{XFN4}
- L_{XN5} or L_{XFN5}
- L_{XN6} or L_{XFN6}
- L_{XN7} or L_{XFN7}

Spectrum Parameters[a]

- L_{Weq}
- L_{WFmax}
- L_{WSmax}
- L_{WFmin}
- L_{WSmin}

Statistics to Calculate Percentile Levels as spectra[b]

- L_{WUN1}
- L_{WUN2}
- L_{WUN3}
- L_{WUN4}
- L_{WUN5}
- L_{WUN6}
- L_{WUN7}

Periodic Reports

For Enhanced Logging Software BZ-7225

Parameters measured within a Periodic Report interval:

Equivalent Continuous Sound Levels

- L_{Xeq}
- L_{Yeq}
- L_{Ceq}-L_{Aeq}

Sound Exposure Level

- L_{XE}
- L_{YE}

Peak Sound Level

- L_{Vpeak}
- T_{Vpeak}

a. These parameters require license for BZ-7223 and measurement of spectra.

Maximum Time-weighted Sound Levels

- L_{XFmax}
- L_{XSmax}
- L_{XImax}
- L_{YFmax}
- L_{YSmax}
- L_{YImax}

Minimum Time-weighted Sound Levels

- L_{XFmin}
- L_{XSmin}
- L_{XImin}
- L_{YFmin}
- L_{YSmin}
- L_{YImin}

ISO/EU Occupational Health Parameters

- $L_{ep,d}$
- $L_{ep,d,v}$
- E
- Dose
- ProjDose
- #VPeaks (>xxx dB)
- #VPeaks (>137 dB)
- #VPeaks (>135 dB)

US Occupational Health Parameters

- L_{avRQ}
- TWA
- TWA_v
- DoseRQ
- ProjDoseRQ

General Parameters

- Overload in %
- Start time
- Stop Time
- Elapsed Time (excl. pauses)

Special Parameters

- L_{XIeq} (also called L_{XIm})
- L_{YIeq}

- L_{AIeq}-L_{Aeq}
- L_{AFTeq} (also called L_{AFTm5})
- L_{AFTeq}-L_{Aeq}
- SIL (average of L_{Zeq} octave band levels: 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz)[a]
- PSIL (average of L_{Zeq} octave band levels: 500 Hz, 1000 Hz and 2000 Hz)[a]
- SIL3 (average of L_{Zeq} octave band levels: 1000 Hz, 2000 Hz and 4000 Hz)[a]
- L_{Aeq}(20–200 Hz) (average of power values for L_{Aeq} 1/3-octave bands from 20 Hz to 200 Hz)[a]

Statistics to Calculate Percentile Levels

- L_{XN1} or L_{XFN1}
- L_{XN2} or L_{XFN2}
- L_{XN3} or L_{XFN3}
- L_{XN4} or L_{XFN4}
- L_{XN5} or L_{XFN5}
- L_{XN6} or L_{XFN6}
- L_{XN7} or L_{XFN7}

Spectrum Parameters[a]

- L_{Weq}
- L_{WFmax}
- L_{WSmax}
- L_{WFmin}
- L_{WSmin}

The Statistics can be logged in Periodic Reports to Calculate Percentile Levels as spectra[a]

- L_{WUN1}
- L_{WUN2}
- L_{WUN3}
- L_{WUN4}
- L_{WUN5}
- L_{WUN6}
- L_{WUN7}

a. These parameters require license for BZ-7223 and measurement of spectra

Logged Measurement

For 2250 Logging Software BZ-7224 and 2250 Enhanced Logging Software BZ-7225

Parameters measured within a logging interval – up to ten (or all) of the following parameters can be logged:

Equivalent Continuous Sound Levels

- L_{Xeq}
- L_{Yeq}
- L_{Ceq}-L_{Aeq}

Sound Exposure Level

- L_{XE}
- L_{YE}

Peak Sound Level:

- L_{Vpeak}

Maximum Time-weighted Sound Levels

- L_{XFmax}
- L_{XSmax}
- L_{XImax}
- L_{YFmax}
- L_{YSmax}
- L_{YImax}

Minimum Time-weighted Sound Levels

- L_{XFmin}
- L_{XSmin}
- L_{XImin}
- L_{YFmin}
- L_{YSmin}
- L_{YImin}

US Occupational Health Parameters

- L_{avRQ}

Special Parameters

- L_{XIeq} (also called L_{XIm})
- L_{YIeq}
- L_{AIeq}-L_{Aeq}
- L_{AFTeq} (also called L_{AFTm5})

- L_{AFTeq}-L_{Aeq}
- SIL (average of L_{Zeq} octave band levels: 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz)[a]
- PSIL (average of L_{Zeq} octave band levels: 500 Hz, 1000 Hz and 2000 Hz)[a]
- SIL3 (average of L_{Zeq} octave band levels: 1000 Hz, 2000 Hz and 4000 Hz)[a]
- L_{Aeq}(20–200 Hz) (average of power values for L_{Aeq} 1/3-octave bands from 20 Hz to 200 Hz)[a]

The following parameters are available per set of logged parameters

- Overload in %
- Start time
- Stop Time
- Elapsed Time (excl. pauses)

The Statistics can be logged to calculate Percentile Levels per logging interval

- L_{XN1} or L_{XFN1}
- L_{XN2} or L_{XFN2}
- L_{XN3} or L_{XFN3}
- L_{XN4} or L_{XFN4}
- L_{XN5} or L_{XFN5}
- L_{XN6} or L_{XFN6}
- L_{XN7} or L_{XFN7}

Up to three (or all) of the following Spectrum parameters can be logged and displayed on the spectrum display[b]

- L_{Weq}
- L_{WFmax}
- L_{WSmax}
- L_{WFmin}
- L_{WSmin}

The Statistics can be logged to calculate Percentile Levels as spectra[a]

- L_{WUN1}
- L_{WUN2}
- L_{WUN3}
- L_{WUN4}
- L_{WUN5}
- L_{WUN6}
- L_{WUN7}

a. These parameters require license for BZ-7223 and measurement of spectra.
b. These parameters require license for BZ-7223 and measurement of spectra.

Logged (100 ms) Measurement

For 2250 Logging Software BZ-7224 and 2250 Enhanced Logging Software BZ-7225

The following Broadband parameters can be logged every 100 ms

- L_{Aeq}
- L_{AF}

Instantaneous Measured Parameters (available at any time)

Instantaneous Time-weighted Sound Levels

- L_{XF}
- L_{XS}
- L_{XI}
- L_{YF}
- L_{YS}
- L_{YI}

Sound Pressure Levels (maximum time-weighted sound levels once per second)

- $L_{XF(SPL)}$
- $L_{XS(SPL)}$
- $L_{XI(SPL)}$
- $L_{YF(SPL)}$
- $L_{YS(SPL)}$
- $L_{YI(SPL)}$

Peak Sound Levels (maximum peak sound level once per second)

- $L_{Vpeak,1s}$

Instantaneous Measured Spectra:[a]

- L_{WF}
- L_{WS}

a. These parameters require license for BZ-7223 and measurement of spectra.

Relationship Between Setup and Measurement Parameters

The measurement parameters are measured in accordance with the setup parameters. The following tables describe the relationship between the setup and measurement parameters:

Table B.1 *General Parameters*

Parameter	LXeq	LXE	LXleq	LAFTeq	LVpeak	TVpeak	LXYmax	LXYmin
Sound Field Correction	●	●	●	●	●	●	●	●
Windscreen Correction	●	●	●	●	●	●	●	●
Extended Low Frequency	●	●	●	●	●	●	●	●
Broadband (excl. Peak)	●	●	●	A			●	●
Broadband Peak					●	●		

Table B.2 *Noise Indicators and Statistics*

Parameter	L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{dn}	LXYN
Sound Field Correction	●	●	●	●	●	●
Windscreen Correction	●	●	●	●	●	●
Extended Low Frequency	●	●	●	●	●	●
Broadband (excl. Peak)	A	A	A	A	A	●
Broadband Statistics based on						●
Percentile N%						●
Day Start	●		●	●		
Evening Start	●	●		●		
Night Start		●	●	●		
Evening Penalty				●		

Table B.2 *(Cont.) Noise Indicators and Statistics*

Parameter	L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{dn}	LXYN
Night Penalty				●		

Table B.3 *Occupational Health Parameters*

Parameter	$L_{ep,d}$	$L_{ep,d,v}$	E	Dose	ProjDose	#VPeaks (>NNNdB)	LavRQ	TWA	TWA_v	Dose-RQ	Proj-DoseRQ
Sound Field Correction	●	●	●	●	●	●	●	●	●	●	●
Wind-screen Correction	●	●	●	●	●	●	●	●	●	●	●
Extended Low Frequency	●	●	●	●	●	●	●	●	●	●	●
Broadband (excl. Peak)	A	A	A	A	A		A	A	A	A	A
Broadband Peak						●					
Exposure Time	●	●									
Reference Time		●							●		
Threshold Level				●	●			●	●	●	●
Criterion Level				●	●					●	●
Peaks-Over Level						●					
Exchange Rate for Lav							●	5	5	●	●
Time Weighting for Lav							●	S	S	●	●

Reverberation Time Measurement

For 2250 Reverberation Time Software BZ-7227

The following parameters are measured or calculated at each position:

Decays

- Reverberation Decays (for each frequency band from *Bottom Frequency* to *Top Frequency*) based on sampling L_{Zeq} spectra at 5 ms intervals

Spectra

- T30 Spectrum
- T20 Spectrum
- EDT Spectrum

Single Number Values

- T30 (*Wide Band RT Bottom – Wide Band RT Top*)
- T20 (*Wide Band RT Bottom – Wide Band RT Top*)
- EDT (*Wide Band RT Bottom – Wide Band RT Top*)

The following parameters are calculated for the room as an average of all positions:

Decays

- Ensemble Averaged Reverberation Decays (for each frequency band from *Bottom Frequency* to *Top Frequency*)

Spectra

- T30 Room Spectrum
- T20 Room Spectrum
- EDT Room Spectrum

Single Number Values

- T30 Room (*Wide Band RT Bottom – Wide Band RT Top*)
- T20 Room (*Wide Band RT Bottom – Wide Band RT Top*)
- EDT Room (*Wide Band RT Bottom – Wide Band RT Top*)

Quality Indicators are given for each frequency band, in each reverberation time spectrum, and for each reverberation time spectrum.

Instantaneous Measured Parameters (available at any time)

Instantaneous Time-weighted Sound Levels:

- L_{AF}
- L_{CF}

Instantaneous Measured Spectra:

- L_{ZF}

Appendix C

Instrument Parameters

This appendix describes the parameters that are common to all users of the instrument.

Current Transducer

Table C.1 *Current Transducer parameters*

Parameter	Values	Comment
Transducer Used (i.e., connected to *Top Socket*)	Name and serial number of transducer	This parameter selects which transducer is connected to the *Top Socket* (displayed in **Setup** – *Input* and at the top of **Transducers** database)
Transducer Used (i.e., connected to *Rear Socket*)	Name and serial number of transducer	This parameter selects which transducer is used at *Rear Socket* (displayed in **Setup** – *Input* and at the top of **Transducers** database)
Input (no text is displayed)	*Top Socket* *Rear Socket*	Determines whether the input is taken from the top socket, or the rear socket ('Input' on connector panel). Connect your transducer to this socket. This parameter is displayed in **Setup** – *Input* and on the second line of the **Transducers** database

Transducer Database

The Transducer Database consists of a Transducer Setup and a Calibration History – one set per transducer.

Transducer Setup

Table C.2 *Transducer Setup parameters*

Parameter	Values	Comment
Serial No.	Text string	Insert unique ID for transducer
Name	Text string	Insert name of transducer to display together with serial number
Description	Text string	Insert description of transducer
Preamplifier ID No.	Text string	Document the preamplifier here
(Transducer) *Family*	*Microphone*	(Transducer) *Family* is set to *Microphone* in this version of the software
Microphone Type	*4189* *4191* *4193* *4950* *4952 0°* *4952 90°* *Unknown*	If microphone is a known type, then the rest of the parameters of the transducer are set automatically. *Sound Field Correction* and *Windscreen Correction* are possible for known microphone types only. **Note:** Microphone Type 4952 can be used with 0° reference direction or 90° reference direction. For unknown microphone types, set the rest of the parameters – no corrections can be made for unknown types **Note:** If you are unsure which microphone to use, please refer to Table C.5, which gives an overview of Type 2250 microphones, where they can be used and their specifications
Nominal Sensitivity	Double	Set automatically for known type, otherwise set the nominal sensitivity of the microphone in mV/Pa
Sensitivity Unit	*mV/Pa*	Can only be mV/Pa
Polarization Voltage	*Yes* *No*	Set to *No* if microphone is prepolarized, otherwise set to *Yes* for polarization voltage of 200 V (*Top Socket* only). Set automatically for known *Microphone Type*
Free-field Type	*Yes* *No*	Set to *Yes* for Free-field types, otherwise set to *No*. Set automatically for known *Microphone* type

Table C.2 *(Cont.) Transducer Setup parameters*

Parameter	Values	Comment
Capacitance	Double	Insert capacitance of microphone in pF. Set automatically for known *Microphone* type
CCLD	*Yes* *No*	Set to *Yes* for CCLD (Constant Current Line Drive) transducers, otherwise set to *No*. Set automatically for known *Microphone* Type. **Note:** Set Input to *Rear Socket*. The CCLD input at the Rear socket will automatically be enabled when selecting a transducer requiring CCLD input

Calibration History

Table C.3 *Calibration History parameters*

Parameter	Values	Comment
1. Calibration date & Time	*YYYY-MM-DD hh:mm:ss*	Initial
1. *Sensitivity*	Double	Initial mV/Pa
1. *Preamplifier ID No.*	Text string	Initial
1. *User*	Text string	Initial
1. *Input*	*Top Socket*, *Rear Socket*	Initial
1. *Calibration Type*	External,Internal	Initial
1. *Calibrator Serial No.*	Text string	Initial
1. *Comment*	Text string	Initial
1. 2250 Serial No.	Text string	Initial
2. Calibration date & Time	*YYYY-MM-DD hh:mm:ss*	
2. *Sensitivity*	Double	
2. *Preamplifier ID No.*	Text string	
2. *User*	Text string	
2. *Input*	*Top Socket*, *Rear Socket*	
2. *Calibration Type*	External,Internal	
2. *Calibrator Serial No.*	Text string	
2. *Comment*	Text string	
2. 2250 Serial No.	Text string	
:	:	:

Table C.3 *(Cont.) Calibration History parameters*

Parameter	Values	Comment
N. Calibration date & Time	*YYYY-MM-DD hh:mm:ss*	Current
N. *Sensitivity*	Double	Current
N. *Preamplifier ID No.*	Text string	Current
N. *User*	Text string	Current
N. *Input*	*Top Socket*, *Rear Socket*	Current
N. *Calibration Type*	External,Internal	Current
N. *Calibrator Serial No.*	Text string	Current
N. *Comment*	Text string	Current
N. 2250 Serial No.	Text string	Current

Calibration Setup

Table C.4 *Calibration Setup parameters*

Parameter	Values	Comment
(Sound Level) *Calibrator*	*4231* *Custom*	Select which calibrator to use
Calibration Level (for Sound Calibrator Type 4231)	*0.00* to *200.00 dB* re 20 µPa	The *Calibration Level* will be automatically calculated for *Input* = *Top Socket*.The *Calibration Level* can be set manually in all other cases
Calibration Level (for Custom Sound Level Calibrator)	*0.00* to *200.00 dB* re 20 µPa	Set calibration level for custom calibrator
Serial No. for 4231	Text string	Serial number will be documented in calibration history
Serial No. for Custom Sound Level Calibrator	Text string	Serial number will be documented in calibration history

Type 2250 Microphones

Table C.5 *Overview of Type 2250 Microphones*

Micro-phone	Application	Optimised For	Dynamic Range[a]	Free-field ±1 dB Frequency Range	Free-field ±2 dB Frequency Range
4189	Standard	Free-field and Diffuse-field	16.6 – 140 dB(A)	6.8 Hz – 22.4 kHz[b] 7.8 Hz – 22.4 kHz	4.2 Hz – 22.4 kHz[b] 6.3 Hz – 22.4 kHz
4191	High Levels	Free-field and Diffuse-field	25.6 – 152 dB(A)	3.6 Hz – 22.4 kHz[b] 6.6 Hz – 22.4 kHz	2.5 Hz – 22.4 kHz[b] 5.6 Hz – 22.4 kHz
4193	Low Frequencies	Low Frequencies	23.2 – 152 dB(A) 44.6 – 152 dB(Z)[b]	0.56 Hz – 22.4 kHz[b] 6.3 Hz – 22.4 kHz	0.45 Hz – 22.4 kHz[b] 5.5 Hz – 22.4 kHz
4952	Outdoor	Free-field 0° or 90° and Diffuse-field	20.0 – 144 dB(A)	4.3 Hz – 14.0 kHz[b] 6.3 Hz – 14.0 kHz	3.2 Hz – 14.5 kHz[b] 5.6 Hz – 14.5 kHz

a. From the typical total inherent noise level for the microphone and Type 2250, to the overload limit for a sinusoidal signal at 1 kHz.
b. Type 2250 *Extended Low Frequency* set to *On.*

Detailed specifications for Type 2250 together with the different microphones are available, please contact your local Brüel & Kjær representative if you need more information.

Type 2250 has correction filters to optimise the frequency response of each microphone. The relevant filter is automatically applied when you select the microphone for input, be it via the top socket, or the rear input socket.

Note for Microphone Type 4193:

Microphone Type 4193 is delivered with the UC-0211 Adaptor. Do not use UC-0211 together with Type 2250. The adaptor can be used together with other equipment to extend the low frequency range, but when using Microphone Type 4193 together with Type 2250 the correction filters are used to do the job. This results in a better dynamic range specification. Using the Adaptor together with Type 2250 results in a corrupted low-frequency response and a reduced sensitivity of approximately 16 dB

Appendix D

Preferences

This appendix describes the unique set of parameters that can be set for each user on the instrument.

Display Settings

Table D.1 *Colour Scheme parameters*

Parameter	Values	Comment
Colour Scheme	*Arcade* *Alhambra* *Indoor* *Outdoor* *Night*	Select between five colour schemes, one optimised for outdoor use in bright conditions and one optimised for very dark conditions

For each colour scheme select the optimum choice of brightness for the traffic light and whether the backlight for the pushbuttons should be on or off. In addition, you can also change the number of decimal places on your dB results readout.

Table D.2 *Traffic Light, Backlight and Decimal Place parameters*

Parameter	Values	Comment
Traffic Light Brightness	*Off* *Low* *Normal* *High*	
Key Backlight	*Off* *On*	

Table D.2 *Traffic Light, Backlight and Decimal Place parameters*

Parameter	Values	Comment
Backlight Brightness	*Minimum* *Level 2* *Level 3* *Level 4* *Level 5* *Maximum*	Select backlight brightness using the backlight icon at the bottom of the screen. Maximum level uses the most power
Number of Decimal Places	*1* *2*	Select how many decimal places you want in the dB results readout, 1 or 2. **Note:** The setting is for display only and has no effect on the measurement precision or resolution

Power Settings

Table D.3 *Power Settings parameters*

Parameter	Values	Comment
Turn off Backlight	*After 10 sec.* *After 30 sec.* *After 1 min.* *After 2 min.* *After 5 min.* *Never*	Select optimum value for full backlight on (brightness determined by Backlight Brightness)
Turn off Backlight Dim	*After 1 min.* *After 2 min.* *After 5 min.* *After 10 min.* *After 30 min.* *Never*	Select optimum value for *Backlight Dim* period running after the *Backlight On* period has elapsed. The Backlight Brightness will be at Minimum in the dim period. When *Backlight Dim* period has elapsed, the backlight is switched off
Standby	*After 1 min.* *After 2 min.* *After 5 min.* *After 10 min.* *After 30 min.* *Never*	Select optimum value for ‘on’ period before the instrument is set automatically to standby

Note: If the instrument is externally powered, then the settings will be ignored.

Regional Settings

Table D.4 *Regional Settings parameters*

Parameter	Values	Comment
Decimal Point	. ,	Select your preferred decimal point
Date separator	- / .	Select your preferred date separator
Date Format	*yyyy-MM-dd HH:mm:ss* *dd-MM-yyyy HH:mm:ss* *MM-dd-yyyy HH:mm:ss* *yy-MM-dd hh:mm:ss XX* *dd-MM-yy hh:mm:ss XX* *MM-dd-yy hh:mm:ss XX*	Select your preferred date format: HH = 24 hour, hh = 12 hour, XX = AM or PM
Time Zone	*GMT-12* *GMT* *GMT+13*	Select the time zone of your region
Language	*English*, ...	A number of different languages are available for your Type 2250. Select your preferred language – if it is not in the list, then it might be available for installation using BZ-5503
Keyboard	*United Kingdom*, ...	33 different keyboards. Select your preferred keyboard

Storage Settings

Table D.5 *Storage Settings parameter*

Parameter	Values	Comment
Auto-naming of Projects	*Yes* *No*	Select *Yes* for automatically naming projects from the start date of the project as Year, Month, Date in the format YYMMDD, (e.g., 051112 as 2005, November 12th) or *No* for using the name defined in the *Project Name Prefix* parameter
Project Name Prefix	Text string	Prefix for automatically generated project name. Maximum 8 characters

Headphone Settings

Table D.6 *Headphone Settings parameters*

Parameter	Values	Comment
Listen to signal	*No* *Input X-weighted* *Input C-weighted* *Input Z-weighted*	In addition to the commentary annotations, you can listen to the input signal for monitoring purposes. Select one of the A-weighted, B-weighted, C-weighted or Z-weighted signals. **Note 1:** The frequency weighting of the signal you listen to can be selected independently of the frequency weighting of the measurement, the signal at the output socket and the signal used for sound recording **Note 2:** X = frequency weighting A or B. 'A' requires that the *Broadband (excl. Peak)* parameter is set to *AC or AZ.* 'B' requires that the *Broadband (excl. Peak)* parameter is set to *BC or BZ*
Automatic Gain Control	*On* *Off*	To ease identification of sound sources, the gain can be automatically adjusted to keep the average level within a 40 dB range. When playing back the recorded signal, you will then hear clearly the whole signal content, whether the level has been 20 dB or 140 dB. Set *Automatic Gain Control* to *On* to convert the signal at the headphone output. Set *Automatic Gain Control* to *Off* for listening to the signal with a fixed gain

Table D.6 *(Cont.) Headphone Settings parameters*

Parameter	Values	Comment
Gain for Meas.Signal	*– 80.0 dB to 60.0 dB for Automatic Gain Control set to Off* *– 60.0 dB to 0.0 dB for Automatic Gain Control set to On*	Key in a gain value (0.1 dB resolution) for the measurement input signal. Use '@' to assign the new value for immediate response at the output – or use the up/down navigation keys to increment/decrement the value in steps of 1 dB. **Note:** 0 dB means 1 V output for 1 V input (*Automatic Gain Control* set to *Off*)
Gain for Annotations	*– 94.5 dB to 0.0 dB*	Key in a gain value (1.5 dB resolution) for the commentary annotations. Use '@' to assign the new value for immediate response at the output – or use the up/down navigation keys to increment/decrement the value in steps of 1.5 dB

Note 1: While playing back an annotation, you can use the up/down navigations keys to increase/decrease the gain of the annotation.

Note 2: If you don't want to listen to the input signal, then set 'Listen to Signal' = *No*, to economise on power.

Users

Table D.7 *Users parameter*

Parameter	Values	Comment
Multi User	*Disabled* *Enabled*	Set to *Enabled* to enable the Multi-user facility, set to *Disabled* if you are the only user

Printer Settings

Table D.8 *Printer Settings parameters*

Parameter	Values	Comment
Printer Used	*None* *MPS* *PCL* *PCL Inkjet* *PCL Laser*	Select *None* if you don't have a printer connected to Type 2250. Select *MPS* for a Mobile Pro Spectrum thermal printer from AM-TECH. Select *PCL* for a printer accepting PCL printer language. Select *PCL Inkjet* for an inkjet printer accepting PCL language. Select *PCL Laser* for a laser printer accepting PCL language. See Chapter 8 for more details
Top Margin	*0.0 to 20.0 cm*	Use *Top Margin* to position the print on the paper
Left Margin	*0.0 to 20.0 cm*	Use *Left Margin* to position the print on the paper
Width	*1.0 to 15.0 cm*	Use *Width* to set the size of the print
Height	*1.4 to 20.0 cm*	Use *Height* to set the size of the print

Modem Settings

Table D.9 *Modem Settings parameter*

Parameter	Values	Comment
Modem	*Enabled* *Disabled*	Set to *Enabled* if you have a modem connected to the Compact Flash socket. Set to *Disabled* if you don't have a modem connected – or when you physically connect or disconnect the modem. See Chapter 8 for more details

Appendix E

Glossary

A-weighting filter: Frequency weighting corresponding approximately to the 40 dB equal loudness curve, that is to say, the human ear's response at low to medium sound levels. It is by far the most commonly applied frequency weighting and is used for all levels of sound.

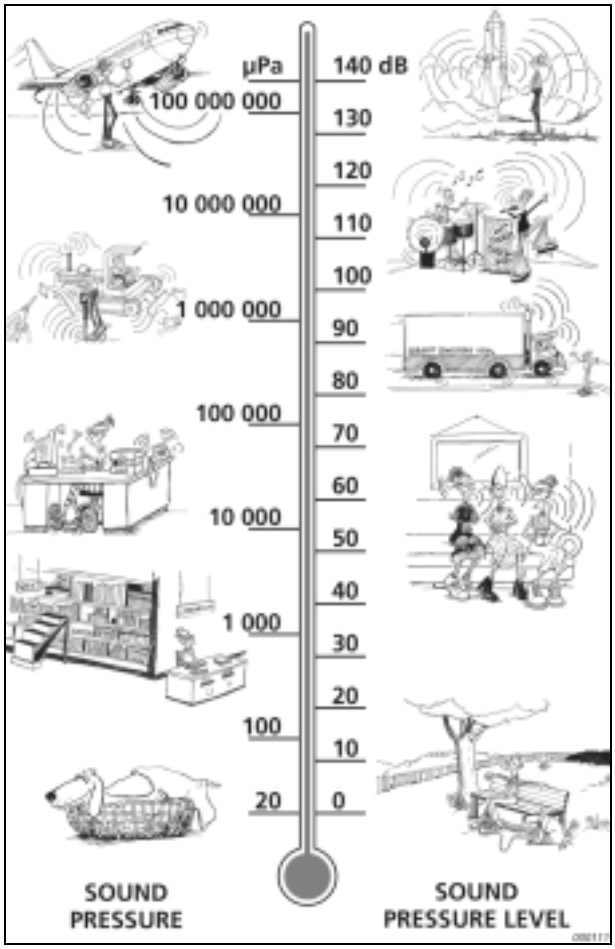
B-weighting filter: Frequency weighting corresponding approximately to the 70 dB equal loudness curve, that is to say, the human ear's response at medium sound levels.

C-weighting filter: Frequency weighting corresponding to the 100 dB equal loudness curve, that is to say, the human ear's response at fairly high sound levels. Mainly used when assessing peak values of high sound pressure levels.

Criterion Level: Criterion Level is the maximum averaged sound level allowed for an 8-hour period. Used for calculation of Dose, ProjDose, DoseUQ and ProjDoseUQ, where U = F or S and Q = 4, 5 or 6 dB.

Decibel (dB): The measurement unit for expressing the relative intensity of sound. A direct application of linear scales (in Pa) to the measurement of sound pressure leads to large and unwieldy numbers. As the ear responds logarithmically rather than linearly to stimuli, it is more practical to express acoustic parameters as a logarithmic ratio of the measured value to a reference value. This logarithmic ratio is called a decibel or dB. The advantage of using dB can be clearly seen in the below illustration. Here, the linear scale with its large numbers is converted into a manageable scale from 0 dB at the threshold of hearing (20 μPa) to 130 dB at the threshold of pain (~100 Pa).

Our hearing covers a surprisingly wide range of sound pressures – a ratio of over a million to one. The dB scale makes the numbers manageable



Dose, ProjDose: The Noise Dose is the equivalent averaged A-weighted Noise Level (taking the Threshold Level into account) using Exchange Rate = 3 for an 8 hour period (reference duration) relative to the maximum allowed (the Criterion Level) – expressed in percentage.

Example: If the Criterion Level is 85 dB and a person is exposed to a constant sound pressure level of 85 dB for 8 hours, then the Dose is 100%. A constant level 88 dB results in a Dose of 200% and a constant level of 82 dB results in a dose of 50%.

The Projected Dose is the Noise Dose based on measurement duration less than 8 hours, assuming the sound level for the remaining time stays the same.

DoseUQ, ProjDoseUQ: The Noise Dose is the averaged A-weighted Noise Level (taking the Threshold Level into account) with Time Weighting U = F or S and Exchange Rate Q = 4, 5 or 6 for an 8 hour period (reference duration) relative to the maximum allowed (the Criterion Level) – expressed in percentage.
Example: If the Criterion Level is 90 dB and a person is exposed to a constant average sound level of 90 dB for 8 hours with Time Weighting S and Exchange Rate 5, then the DoseS5 is 100%. A constant level 95 dB results in a DoseS5 of 200% and a constant level of 85 dB results in a doseS5 of 50%.
The Projected DoseS5 is the Noise DoseS5 based on measurement duration less than 8 hours, assuming the sound level for the remaining time stays the same.

E: Sound Exposure is the energy of the A-weighted sound calculated over the measurement time. The unit is Pa^2h.

Exchange Rate: Exchange Rate is the increase in noise level that corresponds to a doubling of the noise level. The Exchange Rate is used for calculation of L_{avUQ}, TWA, TWA_v, DoseUQ and ProjDoseUQ, where U = F or S and Q = Exchange Rate: 4, 5 or 6 dB.
Note: L_{Aeq} is always based on an Exchange Rate = 3.

Exposure Time: Exposure Time is the actual time that a person is exposed to noise during a workday. Used for calculation of $L_{ep,d}$ and $L_{ep,d,v}$

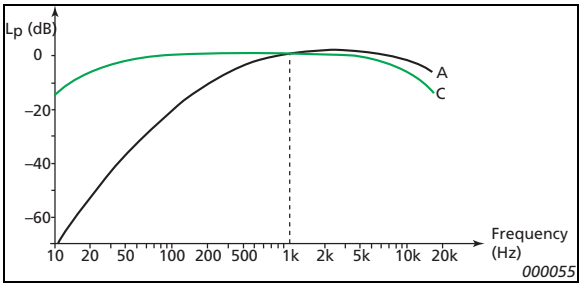
'F', 'S' or 'I' time weighting: A time weighting (sometimes called a 'time constant') defines how the exponential averaging in root-mean-square (RMS) measurement is done. It defines how the heavily fluctuating sound pressure variations are smoothed or averaged to allow useful readings. The standards define three time weightings: F (Fast), S (Slow) and I (Impulse). Most measurements are carried out using the 'F' time weighting, which uses a 125 ms time constant.

Frequency: The number of pressure variations per second. Frequency is measured in hertz (Hz). The normal hearing for a healthy young person ranges from approximately 20 Hz to 20000 Hz (20 kHz).

Frequency weighting: Our hearing is less sensitive at very low and very high frequencies. In order to account for this, weighting filters can be applied when measuring sound. The most commonly used weighting is the 'A-weighting', which approximates the human ear's response to low – medium noise levels.

Frequency weighting (cont.):

A 'C-weighting' curve is also used, particularly when evaluating very loud or low-frequency sounds.



L_{AE}:

Sound Exposure Level – sometimes abbreviated SEL and sometimes called Single Event Level, is the Sound Exposure expressed as a level. The letter 'A' denotes that the A-weighting has been included.

L_{Aeq}:

A widely used noise parameter that calculates a constant level of noise with the same energy content as the varying acoustic noise signal being measured. The letter 'A' denotes that the A-weighting has been included and 'eq' indicates that an equivalent level has been calculated. Hence, L_{Aeq} is the A-weighted equivalent continuous noise level.

L_{AF}:

The instantaneous time-weighted sound level, Lp, is available at any time. 'A' denotes that the A-frequency weighting is used. 'F' denotes that the Fast time-weighting is used.

L_{AFmax}:

Maximum time-weighted sound level measured with A-frequency weighting and Fast time weighting. It is the highest level of environmental noise occurring during the measurement time. It is often used in conjunction with another noise parameter (for example L_{Aeq}) to ensure a single noise event does not exceed a limit.

L_{AFmin}:

Minimum time-weighted sound level measured with A-frequency weighting and Fast time weighting. It is the lowest level of environmental noise occurring during the measurement time (time resolution is 1 s).

$L_{AF90.0}$:

The noise level exceeded for 90% of the measurement period with A-frequency weighting and Fast time weighting. The level is based on statistical analysis of a parameter (LAF or LAS) sampled at 10 ms intervals into 0.2 dB wide classes. The percentage is user-definable.
An analysis of the statistical distributions of sound levels is a useful tool when assessing noise. The analysis not only provides useful information about the variability of noise levels, but is also prominent in many standards as the basis for assessing background noise. For example, L_{AF90} is used as an indicator of background noise levels while L_{AF10} or L_{AF5} are sometimes used to indicate the level of noise events.

$L_{A90.0}$: The noise level exceeded for 90% of the measurement period with A-frequency weighting. The level is based on statistical analysis of L_{Aeq} sampled at 1 s intervals into 0.2 dB wide classes. The percentage is user-definable.

$L_{AF(SPL)}$: The Sound Pressure Level (maximum time-weighted sound level during the latest second) is available at any time. 'A' denotes that the A frequency weighting is used. 'F' denotes that the Fast time-weighting is used.

L_{AFTeq}: Taktmaximal Mittelungspegel as defined by DIN 45641. L_{AFTeq} has also been called L_{AFTm5} or L_{ATm5F}.

L_{avUQ}: Average Sound Level with Time Weighting U = F or S and Exchange Rate Q = 4, 5 or 6. This is a widely used occupational health noise parameter in the USA, corresponding to the L_{Aeq} used otherwise.

L_{Cpeak}: Maximum peak sound level during a measurement. 'C' denotes that the C frequency weighting is used. Used for assessing possible damages to human hearing caused by very high short-duration noise levels.

$L_{Cpeak,1s}$: Maximum peak sound level during the latest second – is available at any time. 'C' denotes that the C frequency weighting is used. Used for monitoring the peak levels.

L_{den}, L_{day}, $L_{evening}$, L_{night}, L_n: Noise Indicators for describing the annoyance due to exposure to environmental noise.
L_{den} (day-evening-night noise indicator), L_{day} (day-noise indicator), $L_{evening}$ (evening-noise indicator) and L_{night} (night-noise indicator) are defined by the European Union. They are based on L_{Aeq} over different periods: L_{day} over the day period from 7:00 to 19:00, $L_{evening}$ over the evening period from 19:00 to 23:00, L_{night} over the night period from 23:00 to 7:00 and L_{den} over the whole day with a penalty of 5 dB(A) for the evening period and a penalty of 10 dB(A) for the night period.
L_{dn} (day-night level) is defined by the Environmental Protection Agency (EPA) in the USA as a descriptor of noise level based on L_{Aeq} over the whole day with a penalty of 10 dB(A) for night time noise (from 22:00 to 7.00).

$L_{ep,d}$: The Daily Noise Exposure Level is the average A-weighted noise exposure level for a nominal 8-hour working day. $L_{ep,d}$ is also known as $L_{EX,8h}$. $L_{ep,d}$ is calculated from the measured L_{AE}, the setting of Exposure Time and a Reference time of 8 h. Used for assessing the noise exposed to a worker during a working day – in accordance with ISO standards.
The European Noise at Work Directive 2003/10/EC defines the following limit and action values:
Exposure Limit Value: 87 dB
Upper Exposure Action Value: 85 dB
Lower Exposure Action Value: 80 dB.

$L_{ep,d,v}$: The Daily Noise Exposure Level for a user-defined reference period. $L_{ep,d,v}$ is calculated from the measured L_{AE} and the settings of Exposure Time and Reference Time. Used, for example, for calculating a Weekly Noise Exposure Level, by setting the Reference Time to 40 h.

#CPeaks(>140dB): The number of 1 s peak sound levels over 140 dB. 'C' denotes that the C frequency weighting is used.
Three peak counters are available – one with a user-definable value (set to 140 dB by default), one with 137 dB and one with 135 dB value. Used for assessing possible damage to human hearing caused by very high, short-duration, noise levels.
The European Noise at Work Directive 2003/10/EC defines the following limit and action values:
Limit Value: 140 dB corresponding to 200 Pa
Upper Action Value: 137 dB corresponding to 140 Pa
Lower Action Value: 135 dB corresponding to 112 Pa.

Occupational Health Standards: Typical Setup Parameter settings for Occupational Health measurements in accordance with various standards:

- OSHA (Occupational Safety and Health Administration) – 29 CFR 1910.95
- MSHA (Mine Safety and Health Administration) – 30 CFR 62.0 UMHRPEL
- DOD (Department of Defence) – DoD Instruction 6055.12
- ACGIH (American Conference of Government Industrial Hygienists) – DHHS Pub 98-126
- ISO – UK Noise at Work Regulations SI 1989/1790 amended by SI 1992/2966 and SI 1996/341

See the table below, but please also check your local legislation.

Table E.1 *Occupational Health Setup Parameters and Associated Standards*

Setup Parameters	OSHA	MSHA	DOD	ACGIH	ISO
Broadband (excl. Peak)	A	A	A	A	A
Broadband Peak	Z	Z	Z	Z	C
Exposure Time	N/A	N/A	N/A	8:00:00	8:00:00
Reference Time (Preset)	8:00:00	8:00:00	8:00:00	8:00:00	8:00:00
Reference Time (user-definable)	40:00:00	40:00:00	40:00:00	40:00:00	40:00:00
Threshold Level	80	80	80	80	70
Criterion Level	90	90	85	85	85, 90
PeaksOver Level[a]	140	140	140	140	140
Exchange Rate for Lav	5	5	4	N/A	N/A
Weighting for Lav	S	S	S	N/A	N/A

a. This is user-definable – the two other 'PeaksOver Level' parameters are preset to 137 and 135 dB resp.

Reference Time: Reference Time is used for calculation of Sound Exposure Level $L_{ep,d,v}$ or Time Weighed Average TWA_v with a reference time other than 8 hours.

SIL, PSIL, SIL3: SIL (Speech Interference Level) is the arithmetic average of the 500 Hz, 1 kHz, 2 kHz and 4 kHz octave band levels.
PSIL (Preferred Speech Interference Level) is the arithmetic average of the 500 Hz, 1 kHz and 2 kHz octave band levels.
Used for evaluating the interference of noise upon speech communication.
SIL3 (Speech Interference Level based on highest 3 octaves) is the arithmetic average of the 1 kHz, 2 kHz and 4 kHz octave band levels.
Note: Though SIL, PSIL and SIL3 are defined for octave band levels they are also calculated for 1/3-octave band levels by summing the power values in the three bands within each octave before doing the averaging.

Sound: Any pressure variation that the human ear can detect. Just like dominoes, a wave motion is set off when an element sets the nearest particle of air into motion. This motion gradually spreads to adjacent air particles further away from the source. Depending on the medium, sound extends and affects a greater area (propagates) at different speeds. In air, sound propagates at a speed of approximately 340 m/s. In liquids and solids, the propagation velocity is greater – 1500 m/s in water and 5000 m/s in steel.

Sound level or sound pressure level: The level in decibels of the pressure variation of a sound. See also **decibel**.

T_{Cpeak}: The time when the peak sound level occurred. 'C' denotes that the C frequency weighting is used.

Threshold Level: Any sound levels below the threshold level do not contribute to the Dose measurement data. For example, if you set the threshold level to 80, any sound levels below 80 dB are not taking into consideration by the instrument, when it calculates doses and time weighted averages.
Used for calculation of Dose, ProjDose, TWA, TWA_v DoseSQ, ProjDoseSQ.

TWA: The Time Weighted Average is the average A-weighted sound level for a nominal 8-hour working day with Time Weighting S and Exchange Rate 5. TWA is calculated from the measured LavS5 (taking Threshold Level into account) and a Reference time of 8 h. Mainly used in the USA for assessing the noise exposure for a worker during a working day.

TWA_v: The Time Weighted Average for a user-defined reference period. TWA_v is calculated from the measured LavS5 (taking Threshold Level into account) and the Reference Time. Used, for example, for calculating a Weekly Time Averaged Level by setting the Reference Time to 40 h.

Z-weighting: 'Zero' frequency weighting is without any frequency weighting, that is, equivalent to Linear, LIN or FLAT.

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

Australia (+61) 2 9889-8888 · Austria (+43) 1 865 74 00 · Brazil (+55) 11 5188-8161 · Canada (+1) 514 695-8225
China (+86) 10 680 29906 · Czech Republic (+420) 2 6702 1100 · Finland (+358) 9-521 300 · France (+33) 1 69 90 71 00
Germany (+49) 421 17 87 0 · Hong Kong (+852) 2548 7486 · Hungary (+36) 1 215 83 05 · Ireland (+353) 1 807 4083
Italy (+39) 0257 68061 · Japan (+81) 3 5715 1612 · Netherlands (+31) 318 55 9290 · Norway (+47) 66 77 11 55
Poland (+48) 22 816 75 56 · Portugal (+351) 21 41 69 040 · Republic of Korea (+82) 2 3473 0605 · Singapore (+65) 6377 4512
Slovak Republic (+421) 2 5 443 0701 · Spain (+34) 91 659 0820 · Sweden (+46) 33 225 622 · Switzerland (+41) 44 880 7035
Taiwan (+886) 2 2502 7255 · United Kingdom (+44) 14 38 739 000 · USA (+1) 800 332 2040

Local representatives and service organisations worldwide