Technical Documentation

Integrating Sound Level Meter Type 2239 A

Brüel & Kjær

English BB 1219 – 11

Integrating Sound Level Meter
Type 2239 A

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Brüel & Kjær

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Contents

Chapter 1

Introduction

1.1 About this Manual

1.1.1 Summary of Contents

- **Chapter 1 – Introduction**: provides a general overview of the instrument and its functions.
- **Chapter 2 – Getting Started**: provides basic information including: replacing batteries, using the buttons, reading the screen, and setting the language.
- **Chapter 3 – Taking Measurements**: gives instructions for calibrating and measuring with Type 2239 A.
- **Chapter 4 – Data Functions**: contains information and instructions about using the data functions and AC output, including: saving, viewing, and erasing records; downloading records; printing measurements; recording to DAT; and monitoring with headphones.
- **Chapter 5 – Maintenance and Troubleshooting**: gives care, cleaning and storage instructions, and a table of error messages together with their causes and solutions.

- **Chapter 6 – Specifications**: a comprehensive listing of technical specifications of type 2239 A.
- **Chapter 7 – Quick Reference**: contains several flowcharts and some brief descriptions to help you find the settings you need when working with the instrument.
- **Chapter 8 – Index**

1.1.2 Conventions Used in this Manual

All references to buttons on Type 2239 A are shown with the button's pictogram as it appears on the instrument. See section 2.2 for a complete list of button pictograms and their functions.

Text which refers directly to text on the instrument's screen or printouts is indicated using a `Courier` type face.

For example, "Press  until `MaxP` is visible on the screen."

1.2 Features

Type 2239 A contains several features that enable you to take and save sound level measurements under a variety of conditions. Features include:

- Ease of use
- Three measurement ranges
- Seven measured parameters (see section 1.3)
- A- or C-weighted RMS measurements in parallel with C-weighted peak
- Fast, Slow, and Impulse time weightings
- Easy to read display with backlight
- Preset measurement time up to eight hours
- Storage of up to 40 records (see section 1.5.3)

- Serial port for printing or downloading records to a computer
- Downloading records in a standard spreadsheet format
- AC output for headphone monitoring or DAT recording
- Five built-in languages

1.3 Parameters

The following parameters are monitored during measurement and can be viewed selectively:

- L_{eq} (L_{lm})
- MaxP
- Peak
- MaxL
- MinL
- SPL
- Inst

You can change the displayed parameters during measurement by pressing . L_{lm} is displayed instead of L_{eq} when an Impulse time weighting is used. For more information about selecting and reading the parameters, see section 3.3.

1.4 Settings

The following settings are available:

- Measurement range
- Frequency weighting for the RMS detector
- Time weighting
- Preset time
- Time and date

You can change the measurement range by pressing . You can change the other settings through windows that are displayed when you press . Settings cannot be changed while the instrument is measuring. For more information about setting up the sound level meter for measurement, see section 3.4.

1.5 Memory

The sound level meter has three kinds of memory

- Set-up
- Buffer
- Records

1.5.1 Set-up Memory

The set-up memory is used to store the date and time, last settings used, and the language selection. This memory is maintained by the backup battery, so it is saved when you turn off the instrument. The date and time are stored directly in the real-time clock, which is also powered by the backup battery.

1.5.2 Buffer

The buffer holds all the measurement results from the last measurement period. It is cleared each time you start a measurement or turn off the sound level meter. Results in the buffer can be output to a printer or copied into a record.

1.5.3 Records

Up to 40 records of measurement results can be stored in memory. Records are copied from the buffer. They can be stored automatically (after a measurement over a preset time interval) or manually (at any time after a measurement is stopped).

The records are stored in non-volatile memory, which is powered by the backup battery. All records are preserved when you turn off the instrument.

The following parameters are stored in each record:

- L_{eq} (L_{lm})
- MaxP
- MaxL
- MinL
- Time and frequency weightings
- Time and date of measurement
- Measurement duration
- Overload status

The following data functions are available via windows that are displayed when you press 📖:

- Save the buffer to a record
- Recall a record to the screen
- Print results of the last measurement
- Download spreadsheet data of records
- Erase last record
- Erase all records

For more *information about records, see section 4.1.*

1.5.4 Backlight

Type 2239A includes a backlight, which makes the display easier to read in low light situations. Press 💡 to turn it on or off. To save batteries, the light will switch off automatically after 30 seconds.

Chapter 2

Getting Started

2.1 Fitting Batteries

2.1.1 Checking the Battery Level

The battery symbol in the upper right-hand corner of the Measurement Window indicates the current battery level.

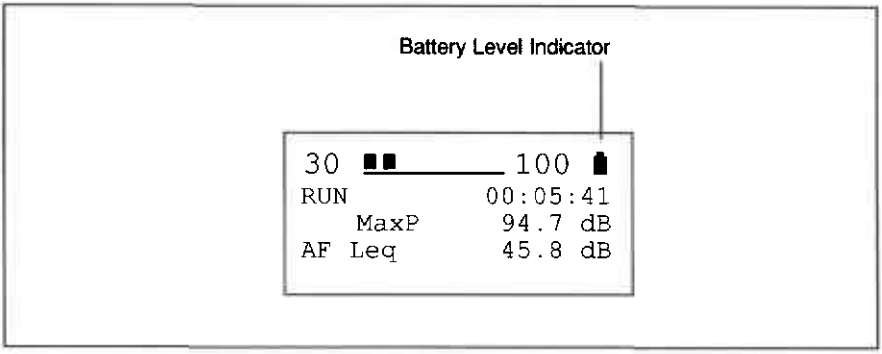


Fig. 2.1 Location of the battery level indicator

When the battery is full, the battery level indicator is fully black. As the batteries are used, the level will fall until the indicator is completely empty. When it is time to replace the batteries, the indicator will be empty and blinking.

The battery level indicator has five rows of pixels in it (including the tip). Each line represents approximately 2.5 hours of remaining battery time (at room temperature). When the indicator is blinking, there is less than one hour left. In extremely cold or hot environments, the remaining time may be less.

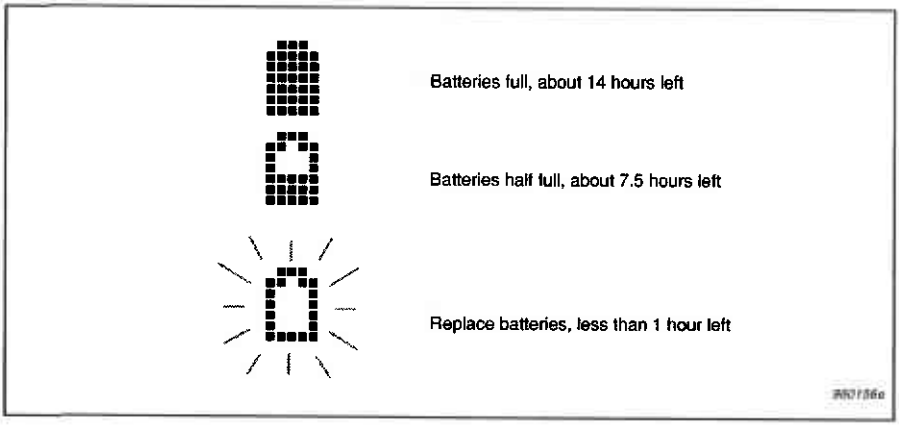


Fig. 2.2 Interpreting the battery level indicator

Caution

It is possible for batteries to explode or leak if they are handled incorrectly, so:

- For long-term storage, remove the batteries and keep the sound level meter in a dry place.
- Never mix different makes or types of battery.
- Never mix charged and discharged batteries.

2.1.2 Replacing Batteries

To replace the batteries:

1. Make sure the sound level meter is switched off by pressing ⏻ (you will need to stop any measurement first).

2. The battery compartment is located in the centre of the back of the instrument. Press the two tabs on the upper edge of the battery compartment and remove the lid.

Fig. 2.3 Type 2239A with the battery lid removed

3. Remove all of the old batteries.

4. Insert new batteries (four 1.5 V LR6/AA size alkaline batteries) following the +/- orientation shown in the bottom of the battery compartment.

5. Press the compartment lid back into place.

Note: If you cannot switch the sound level meter on after replacing the batteries, check that you have inserted them correctly. The sound level meter is designed so that it will not work if the batteries are inserted incorrectly in the battery compartment.

2.1.3 The Back-up Battery

The sound level meter has a back-up battery for running the clock and maintaining the records and settings, even when it is switched off or the main batteries are removed.

The back-up battery is recharged automatically when there are standard batteries in the sound level meter. It is fully charged after about 24 hours. Fully charged, the back-up battery runs the clock and retains records and settings for about 6 months.

These charge times are typical for a sound level meter at room temperature.

Important:

If the back-up battery is flat, then you will see the Set-up Language Window when the instrument starts-up (see section 2.4). The measurement settings, date and time will also be reset to factory-set values.

If this happens, then your instrument's calibration may no longer be valid. Contact your Brüel & Kjær dealer to have your sound level meter recalibrated.

2.2 Button Definitions

To control the sound level meter, you must use the buttons on the instrument's front panel. Each button is marked with a pictogram. This section gives a brief explanation of each button.

Power	⏻	Press this button to switch the instrument on or off. The instrument will begin measuring as soon as it starts up. Power cannot be switched *off while measuring.*
Calibrate		Press this button to calibrate your instrument. See section 3.1 for calibration instructions.
Settings		Press this button to step through the measurement settings windows. With these windows you can adjust the measurement time, frequency weighting, time weighting, and current date and time.
Up Arrow	▲	Press this button to make changes in the settings, data, or calibration windows. When recalling records, use this button to step through the displayed records. It increments the available numbers and choices.
Down Arrow	▼	Press this button to make changes in the settings, data, or calibration windows. When recalling records, use this button to step through the displayed records. It decrements the available numbers and choices.

Data Records		Press this button to step through the data windows. With these windows you can store, recall, erase, print and/or download records of your measurements.
Range		Press this button to step through the available measurement ranges.
Measure / Cancel		While viewing the Measurement Window or saved records, press this button to step through the available measurement parameters. While viewing any of the calibration, data, or settings windows, press this button to exit to the Measurement Window without changing any settings.
Start / Stop / OK		While viewing the Measurement Window, press this button to start or stop a measurement. While viewing any of the calibration, data, or setting windows, press this button to perform the displayed action (e.g., Erase All Records) or apply all new settings you have made. While viewing saved records, press this button to return to the Measurement Window.
Backlight		Switches the display's backlight on or off. To save batteries, the backlight switches off automatically after 30 seconds.

2.3 The Measurement Window

During normal operation, you will use the Measurement Window to view your measured data. It provides several kinds of information about your settings and measurements.

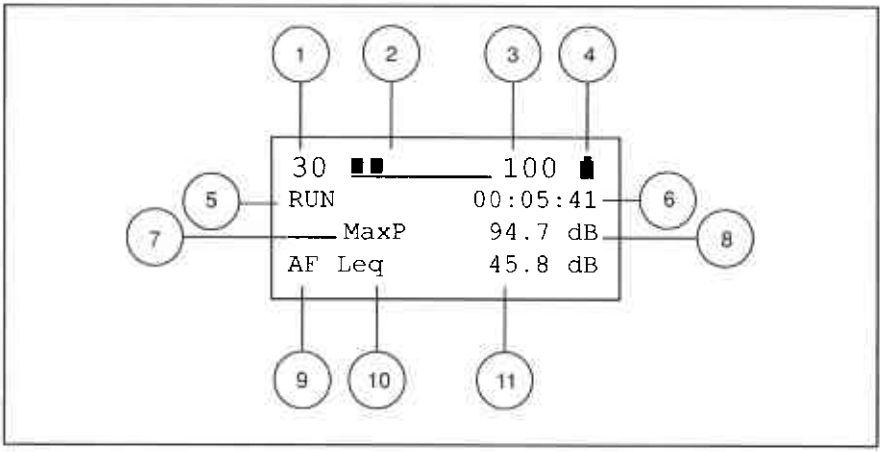


Fig. 2.4 The Measurement Window

1. *The bottom end of the measurement range (in dB)*: All sound below this level will register as under range. To change the measurement range, press while measurement is stopped.

2. *Quasi-analog display*: Shows a graphical representation of the current sound pressure level. It is updated 15 times a second.

3. *The upper end of the measurement range (in dB) and overload indicator*: Peaks above this level will trigger an overload warning. If an overload has occurred in the last second, this number will change to read "OVL" for the duration of the next second. If an overload has occurred at any time during a measurement in progress, then this number will blink (this is called a "latched overload"). To

change the measurement range, press while measurement is stopped.

4. *Battery level*: When the batteries are new, this indicator is completely black. As the batteries are used, the level falls. Replace the batteries when this indicator is empty and blinking.

5. *Run/Stop indicator*: Displays the current status of measurement. Press to start or stop a measurement.

6. *Elapsed time*: Displays the amount of time that has passed since measurement began.

7. *Peak parameter*: Shows the type of peak reading displayed (MaxP or Peak). Press to select the displayed parameters.

8. Value of the peak parameter

9. *Weightings used for the RMS parameter can be:*
   - AF ("A" frequency weighted and Fast time weighted)
   - AS ("A" frequency weighted and Slow time weighted)
   - AI ("A" frequency weighted and Impulse time weighted)
   - CF ("C" frequency weighted and Fast time weighted)
   - CS ("C" frequency weighted and Slow time weighted)
   - CI ("C" frequency weighted and Impulse time weighted)

10. *RMS parameter*: Shows the type of RMS sound level reading displayed (L_{eq} (L_{lm}), MinL, MaxL, SPL, or Inst). Press to select the displayed parameters.

11. Value of the RMS parameter.

2.4 Choosing the Language

Type 2239 A is fluent in five languages. Use the procedure below to choose the language used in the instrument's display screen.

1. If the sound level meter is on, then stop any measurement and press ⏻ to switch it off.
2. While the instrument is off, press 📖 and hold it down.
3. While holding 📖, press ⏻.
4. Release both buttons. The instrument does a self-test and then displays the Set-up Language window.

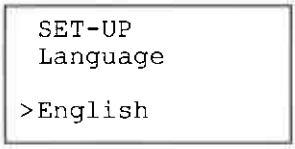


Fig. 2.5 The Set-up Language Window

5. Press the ▲ and/or ▼ keys until your preferred language appears in the window. The choices are (in order):
   - English
   - Francais
   - Deutsch
   - Italiano
   - Espanol
6. Press ▶/■ or 🔭 to choose the language and proceed to the Measurement Window.

Important

If the Set-up Language window appears unexpectedly when you start up your instrument (i.e., when you have not pressed 🖳) and the clock and measurement settings have been reset, then the back-up battery is probably flat. This means that your calibration may no longer be valid. Contact your Brüel & Kjær dealer to have your sound level meter recalibrated.

The backup battery is charged by the main batteries.

Chapter 3

Taking Measurements

3.1 Calibration

3.1.1 When to Calibrate

Most national standards recommend that you calibrate your sound level meter before each set of measurements and check the calibration after each set.

3.1.2 Principle of Calibration

The sound level meter uses a calibration factor to correct for drift. It compares a signal of known volume and frequency, which is emitted by a certified calibrator, against the sound level meter's reading of that signal.

When calibrating, you enter the calibration level into the sound level meter and then take a measurement from the calibrator. The sound level meter then computes a calibration factor that will correct its response to match the known value.

3.1.3 Free- and Diffuse-Field Measurements

The sound level meter is calibrated in the same way for free-field measurements (according to IEC) and diffuse-field measurements (according to ANSI). However, the calibration levels for some calibrators may be different, depending on which measurements are to be made. See your calibrator's user manual for details.

Always remove the Random Incidence Corrector DZ 9566 (if fitted) from the microphone when calibrating or checking the calibration.

3.1.4 Which Calibrators Can I Use?

The sound level meter can be calibrated using Brüel & Kjær Sound Level Calibrator Type 4231 or any other certified sound level meter calibrator that emits a 1 kHz signal at 94 dB.

Each individual calibrator is slightly different. The actual calibration level is not necessarily equal to the nominal calibration level. Therefore, it is important to check the level listed on the chart included with your calibrator and set your sound level meter accordingly.

3.1.5 Calibrating Type 2239 A

1. Stand away from loud noise sources.
2. If fitted, remove Random Incidence Corrector DZ 9566.
3. Fit the calibrator carefully onto the sound level meter and rest the assembly on a table or other flat surface as shown in Fig. 3.1. Ensure that the calibrator fits snugly on the microphone.
4. Press ⏻ to switch on the sound level meter.
5. Press ▶/■ to stop the sound level meter from measuring.

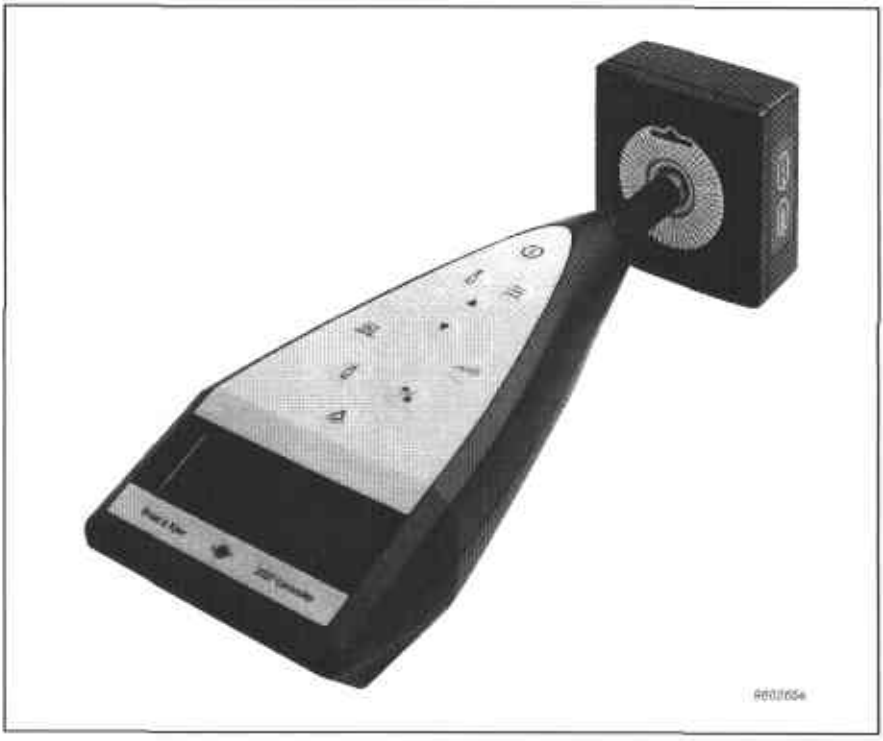


Fig. 3.1 Sound Level Calibrator Type 4231 fitted onto a sound level meter

6. Set the calibrator to emit a 1 kHz signal at 94 dB (see the calibrator's user manual for instructions). Type 4231 does this automatically.

7. Press on the sound level meter to display the Calibration Window, as shown in Fig. 3.2.

8. Check your calibrator's documentation for the correct calibration level. Different values are usually listed for free-field (IEC standard – usually 93.85 dB) and diffuse-field (ANSI standard – usually 94 dB) calibrations. Pressure-field calibrations are the same for both standards (usually 94 dB). In some cases, you may need to round to the nearest tenth of a dB. For example, if your calibrator's

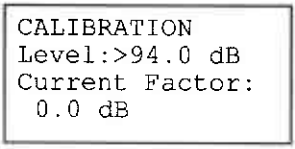


Fig. 3.2 The Calibration Window

chart reads "93.85 dB" then set your sound level meter to 93.9 dB. Use ▲ and ▼ on the sound level meter to set the Level to the correct value.

9. Switch on the calibrator. Wait a few seconds for it to warm up.

10. Press ▶/■ to calibrate your instrument. (Press 🔦 if you want to abort the calibration procedure.)

11. Your instrument is now calibrated.

Note:

If an error message appears after you press ▶/■, make sure that:

- the calibrator is switched on
- the calibrator is securely attached to the top of your sound level meter
- the calibrator's batteries are fully charged
- the surrounding sounds are not loud enough to interfere with the calibration

Then press ▶/■ again. If the error message is repeated, then note the text and contact your Brüel & Kjær representative. Also, see section 5.3.

3.2 Taking Measurements

There are two ways to take a basic measurement. One is to start and stop the instrument manually, the other is to use a preset measurement period. In both cases, the sound level meter must be correctly configured before you start the measurement. See section 3.4 for more information about configuring the range and measurement settings.

3.2.1 Manually Timed Measurements

To take a manually timed measurement, the preset time must be set to "Off". See section 3.4.4 for more information about making this setting.

1. Press ⏻ to switch on the instrument. (If the instrument is already switched on but not measuring, then press ▶/■ and skip to step 4.)

2. Wait for the sound level meter to start up (about 8 seconds).

3. Measurement begins automatically.

4. Wait an appropriate amount of time. In some situations, the measurement time will be prescribed by regulations. Otherwise, watch the Measurement Window until the Leq reading has stabilized (if necessary, press 🔦 until Leq is visible).

5. Press ▶/■ to stop measuring.

6. Check the upper limit of the measurement range, if it is blinking (see Fig. 3.3), then an overload has occurred and the measurement may be invalid. If an overload has occurred, then increase the measurement range by pressing ▭ (check the measurement range on the screen as shown in Fig. 3.3). Begin a new measurement by pressing ▶/■ and repeat from step 4.

7. Step through the displayed measurement parameters by pressing 🔦. If some of them show no value (---.- dB),

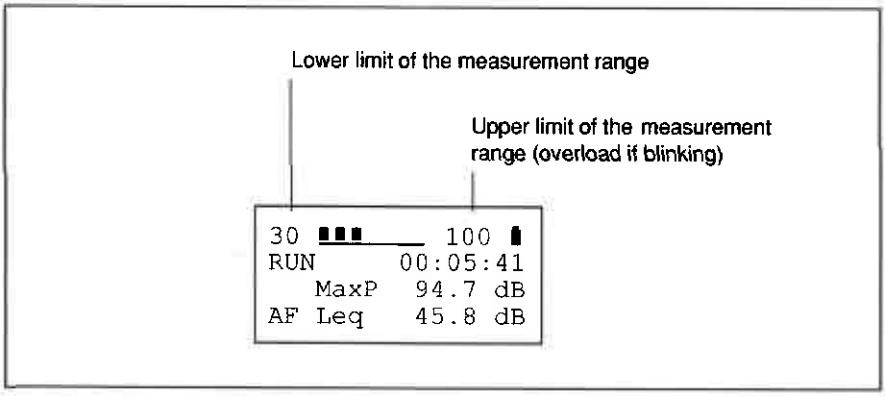


Fig.3.3 The measurement range limits

then input levels were too low for the measurement range (under range). Decrease the measurement range by pressing (check the measurement range on the screen as shown in Fig. 3.3).

8. If you are keeping manual records, then press to step through the displayed parameters until the ones you need are visible. note your readings.

9. If you want to print using a portable printer, then see section 4.2 for connecting and printing instructions.

10. If you want to download your results later to a computer, then save your measurements in a record (see section 4.1 for instructions). Take note of the record number. See section 4.3 for instructions on connecting to a computer and downloading records. If no more records are available, then you will see a warning on your screen (see section 4.1.2 for more information).

3.2.2 Taking Preset-Period Measurements

To take a preset-period measurement, the preset time intervalmust be set to a specific interval (not "Off"). See section 3.4.4 for more information about making this setting.

1. Press ⏻ to switch on the instrument. (If the instrument is already switched on but not measuring, then press ▶/■ and skip to step 4.)

2. Wait for the sound level meter to start up (about 8 seconds). This gives you time to step away from the instrument if required.

3. Measurement begins automatically.

4. Measurement will stop automatically after the preset time interval has expired. All measured parameters will be saved in the next available record (see section 4.1 for more information). If no more records are available, then you will see a warning on your screen (see section 4.1.2).

5. Check the upper limit of the measurement range, if it is blinking, then an overload has occurred and the measurement may be invalid (see Fig. 3.3). If an overload has occurred, then increase the measurement range by pressing ▲▮▮. You may want to erase the record of the overloaded measurement as described in section 4.1.4. Begin a new measurement by pressing ▶/■ and repeat from step 4.

6. Step through the displayed measurement parameters by pressing 🔦. If some of them show no value (---.- dB), then input levels were too low for the measurement range (under range). If necessary, decrease the measurement range by pressing ▼▮▮ once or twice (check the measurement range on the screen as shown in Fig. 3.3). You may want to erase the record of the under-ranged measurement as described in section 4.1.4. Begin a new measurement by pressing ▶/■ and repeat from step 4.

7. If you are keeping manual records, then press 🔦 to step through the displayed parameters until the ones you need are visible. Note your readings.

8. If you want to print using a portable printer, then see section 4.2 for connecting and printing instructions.

9. If you want to download your results to a computer, then see section 4.3.

3.2.3 Overload Conditions

If you measure sound with peak values higher than the upper limit of the measurement range, then the sound level meter will register an overload. This may invalidate your measurement because the instrument is not capable of reading how loud the overload was, only that an overload occurred. Overloads are indicated in two ways:

1. *Instantaneous Overload*: If an overload has occurred within the last second, then the upper limit of the measurement range value will change to read "OVL", as shown in Fig. 3.4, until the overload stops.

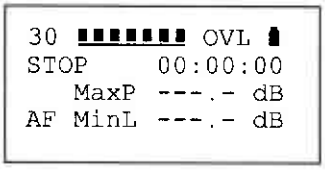


Fig. 3.4 Instantaneous overload

2. *Latched Overload*: If the instrument is measuring when the overload occurs, it will show OVL until the overload stops (as described above). Thereafter, the upper limit of the measurement range will blink until a new measurement is started.

If an overload has occurred, then stop measuring (if necessary), increase the measurement range by pressing and retake the measurement.

Overloads are also indicated in printouts and in records.

- In recalled records, all parameter values will blink if an overload occurred in that record (see section 4.1.3)

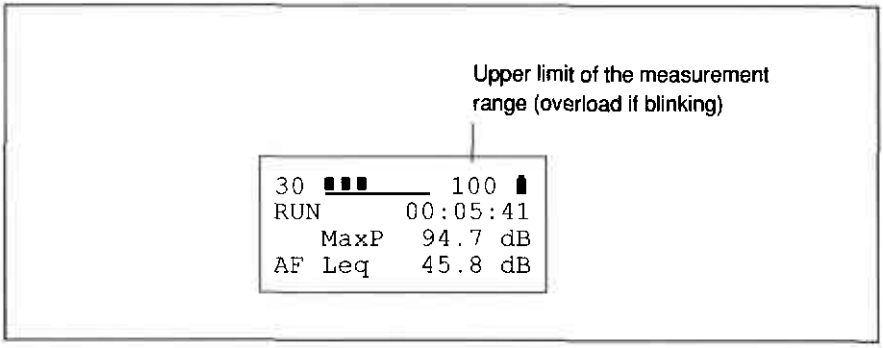


Fig.3.5 Latched overload

- Printed results indicate an overload by showing "Overload" on the printout (see section 4.2.2)
- Spreadsheet results have a special overload column in which overloads are indicated with "Y".

3.3 Reading the Parameters

Seven parameters are monitored by the sound level meter. Two parameters are displayed at a time; one in each of the bottom two lines of the Measurement Window. To change the parameters displayed on the screen, press .

The displayed parameters have the following meanings:

L_{eq} (L_{lm}) Equivalent continuous sound level over the elapsed measurement time. This is the most useful parameter for giving an impression of the average sound pressure level. Limits to L_{eq} are normally prominent in sound regulations. Note that when an Impulse time weighting is used, then this parameter is called "L_{lm}". Because of the characteristics of the Impulse time weighting, L_{lm} is generally higher than L_{eq} for non-stationary signals.

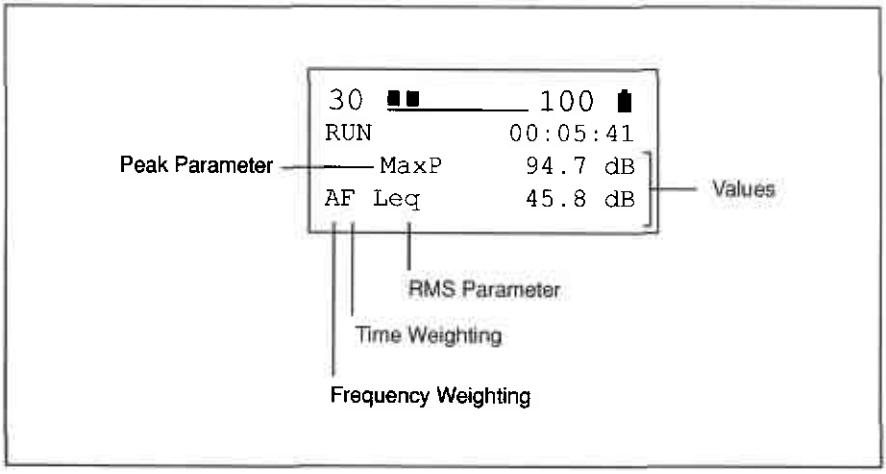


Fig. 3.6 Parameters in the Measurement Window

MaxP — Maximum peak level over the elapsed measurement time. This parameter is normally important for occupational health readings.

Peak — The maximum peak level within the last one second interval.

MaxL — Maximum sound pressure level (SPL) over the elapsed measurement time.

MinL — Minimum sound pressure level (SPL) over the elapsed measurement time.

SPL — The maximum sound pressure level within the last one second interval. This parameter is the numerical equivalent of the level indicated by the quasi-analog display. It differs from the peak value because SPL is an RMS (root mean square) measurement.

Inst — A randomly sampled instantaneous sound level within the last one second. Generally, its value is smaller than SPL.

The values of the RMS value parameters (SPL, MaxL, MinL, L_{eq} and Inst) are affected by the frequency and time weighting settings (see section 3.4.3). The settings are shown next to the relevant parameters on the display .

Consult your local authorities for regulations concerning which parameters you need to monitor and which time weighting you should use. In general, L_{eq} and MaxP measured with a Fast time weighting are required.

The peak value parameters (Peak and MaxP) are not affected by the time weighting.

The following codes are displayed to indicate the applied frequency and time weightings:

- AF ("A" frequency weighted and Fast time weighted),
- AS ("A" frequency weighted and Slow time weighted),
- AI ("A" frequency weighted and Impulse time weighted),
- CF ("C" frequency weighted and Fast time weighted),
- CS ("C" frequency weighted and Slow time weighted), or
- CI ("C" frequency weighted and Impulse time weighted).

Regardless of the parameters that are displayed, the following parameters are always saved when you store a record:

- L_{eq}
- MaxP
- MaxL
- MinL
- Time and frequency weightings
- Time and date or measurement
- Measurement duration
- Overload status

For more information about records, see section 4.1.

For a complete listing of the available parameter combinations, see the section 7.3.

3.4 Measurement Settings

Before you begin measuring, your sound level meter must be set up correctly. Settings that affect measurements and records are:

- Measurement Range
- Frequency Weighting
- Time Weighting
- Preset Time
- Date and Time
- Calibration (see section 3.1)

This section explains how to make each of the above settings (except calibration, which is described in section 3.1) and how they will affect your measurements.

3.4.1 Setting the Measurement Range

The sound level meter is capable of measuring in any one of three different ranges:

- 30 to 100 dB
- 50 to 120 dB
- 70 to 140 dB

The range you choose will depend on the environment in which you are measuring. It is important to select the measurement range so that the instrument is sensitive enough to measure all relevant sound, but not so sensitive that it overloads. Your measurement will not be accurate if an overload occurs. See section 3.2.3 for more information about overloads.

To set the measurement range:

1. If the instrument is measuring, then press ▶/■ to stop it. The Measurement Window must read STOP (as shown below), not RUN.

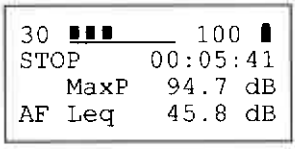


Fig. 3.7 The display when measurement is stopped

2. Check the current measurement range. It is shown at the top of the Measurement Window. (In the example above, the range is 30 to 100 dB.)

3. To select a new range, press repeatedly until the range you need is displayed in the Measurement Window.

4. Use the quasi-analog display to decide if you have set the range correctly. If the display is blank most of the time, then sound levels are too low; select a lower measurement range. If the display ever becomes full and the value for the upper limit of the measurement range changes to read "OVL", then sound levels are overloading the instrument; select a higher range.

3.4.2 Setting the Frequency Weighting

The frequency weighting adjusts how the sound level meter responds to different sound frequencies. Type 2239 A supports the "A" and "C" time weightings as they are defined in the IEC and ANSI standards (see Chapter 6).

The frequency weighting you choose will usually depend on the regulations according to which your are measuring. If no frequency weighting is specified, then use A-weighting.

The current frequency weighting is displayed in the bottom left-hand corner of the Measurement Window (see Fig. 3.8).

To Change the Frequency Weighting:

1. Make sure measurement has stopped (as shown in Fig. 3.8). If the instrument is measuring, then press ▶/■ to stop it.

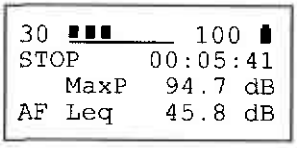


Fig. 3.8 The Measurement window with a fast time weighting selected and with measurement stopped

2. Press ⚙ until the Frequency Weighting Set-up Window is visible on the screen, as shown below.

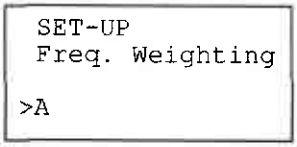


Fig. 3.9 The Frequency Weighting Set-up Window

3. Press ▲ or ▼ to step through the frequency weighting settings (A, C).

4. To store the new frequency weighting, press ▶/■. You will then return to the Measurement Window. (If you prefer to cancel your changes and return to the old frequency weighting, press ⏻).

3.4.3 Setting the Time Weighting

The time weighting adjusts how quickly the sound level meter reacts to sudden changes in sound pressure level. Three time weightings are available, each of which is defined in the IEC and ANSI standards.

- *F (Fast)*: uses a 125 ms time constant. This setting is used in most situations
- *S (Slow)*: uses a 1 s time constant, which smooths out fluctuating levels
- *I (Impulse)*: uses a 35 ms time constant with a slow decay, which allows readings of short-duration sound events.

The time weighting you choose will usually depend on the regulations according to which you are measuring. If no time weighting is specified, then use Fast weighting.

The current time weighting setting is displayed in the Measurement Window. It appears in the bottom left-hand corner. It will show one of six values:

- AF ("A" frequency weighted and Fast time weighted),
- AS ("A" frequency weighted and Slow time weighted),
- AI ("A" frequency weighted and Impulse time weighted),
- CF ("C" frequency weighted and Fast time weighted),
- CS ("C" frequency weighted and Slow time weighted), or
- CI ("C" frequency weighted and Impulse time weighted).

In Fig. 3.8, the current setting is shown to be AF, so a fast time weighting has been set.

To Change the Time Weighting:

1. Make sure measurement has stopped (as shown in Fig. 3.8). If the instrument is measuring, then press ▶/■ to stop it.

2. Press ±+ until the Time Weighting Set-up Window is visible on the screen, as shown below.

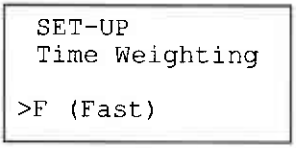


Fig. 3.10 The Time Weighting Set-up Window

3. Press ▲ or ▼ to step through the time weighting settings (`F (Fast), S (Slow), I (Impulse)`).

4. Store the new time weighting, press ▶/■. You will then return to the Measurement Window. (If you psee cancel your changes and return to the old time weighting, press).

3.4.4 Setting the Measurement Time

Type 2239 A can be set to measure for a fixed amount of time. When the set time has elapsed, measurement is stopped automatically and the results are stored in the next available record (except when the off (manual) setting is used).

10 preset time settings are available:

- Off (manual)
- 10 s
- 30 s
- 1 min
- 5 min
- 8 min
- 10 min
- 30 min
- 1 h
- 8 h

If the preset time is set to Off (manual), then the instrument will continue measuring *until you press* ▶/■. Also, results will not be saved automatically. For instructions on how to save results from a manually timed measurement, see section 4.1.1.

To begin a measurement, regardless of the preset time setting, simply switch on the instrument by pressing ⏻. If the instrument is already switched on but not measuring, then press ▶/■ to begin measuring.

To interrupt a preset-timed measurement in progress, press ▶/■. Note that the results will not be saved to a record in this case. For instructions on how to save results from a manually stopped measurement, see section 4.1.1.

To set the Preset Time Interval:

1. If the instrument is measuring, then press ▶/■ to stop it. The Measurement Window must read STOP (as shown below), not RUN.

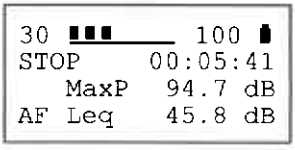


Fig. 3.11 The display when measurement is stopped

2. Press ⚙ until the Preset Time Set-up Window is visible on the screen, as shown below.

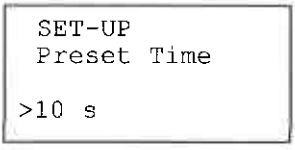


Fig. 3.12 The Preset Time Set-up Window

3. Press ▲ to increase the preset time interval or press ▼ to decrease it. The setting will wrap around between Off and 8 h. Stop when the required setting appears on the screen.

4. To store the new preset time interval, press ▶/■. (If you prefer to cancel your changes and return to the old preset time interval, press .) You will then return to the Measurement Window.

3.4.5 Setting the Time and Date

Date and time information is stored with each record you save. Therefore, it is important to make sure this information is correct.

To set the date and time:

1. If the instrument is measuring, then press ▶/■ to stop it. The Measurement Window must read STOP (as shown in Fig. 3.13), not RUN.

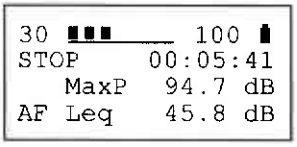


Fig. 3.13 The display when measurement is stopped

2. Press ⚙ until the Date/Time Set-up Window is visible on the screen, as shown in Fig. 3.14.

3. A blinking cursor indicates the currently selected parameter. In Fig. 3.14, the cursor points to the number "04", which is the day. To increment the day, press ▲. To decrement the day, press ▼. Continue to use these cursors until the correct day is shown.

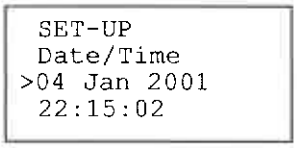


Fig. 3.14 The Date/Time Set-up Window

4. Press ⇆ to move the next parameter (the month). Use ▲ and ▼ to set the current month.

5. Repeat step 4 until you have set the current year, hour, minute, and second. If you want to adjust a previous parameter (for example, to set the day after you have set the year), then press ⇆ repeatedly to cycle back through the set-up windows.

6. To store the new date and time, press ▶/■ or ⏻. It is not possible to cancel Date/Time changes. You will then return to the Measurement Window.

3.5 Influence of Instrument and Operator

When measuring noise with a sound level meter, precautions should be taken to minimise the influence of the instrument body and the operator. The instrument's influence is documented in Fig. 6.3. Type 2239 A is designed to have minimal influence on the measurement.

The operator's influence cannot be documented in the same way, but the human body does act as a reflector of sound. Experiments have shown that, at frequencies of around 400 Hz, errors of up to 6 dB can be caused by reflections from a body. It is obvious that a body blocks sound coming from behind.

The operator's influence is often minimised by using a microphone extension cable and by mounting the microphone and preamplifier (or the sound level meter) on a tripod (see Fig. 6.4). However, in most cases, it is sufficient to hold the

instrument at arm's length while making a measurement. A simple way of checking your influence on the reading is to let the sound level meter remain fixed while you step from side to side.

Chapter 4

Data Operations

4.1 Working with Records

Type 2239 A can store up to 40 records of measured results. This enables you to take several readings at different locations or at different times of day and store them all for future reference. All records can be recalled to the screen and/or downloaded to a computer in a standard spreadsheet format.

4.1.1 Saving Records

A record is saved automatically after each measurement over a preset time interval (see section 3.4.4). Results from a manually timed measurement or an interrupted measurement over a preset time interval must be saved manually. Records are numbered from 1 to 40 and are filled sequentially.

Each record holds the following information:

- L_{eq}
- MaxP
- MaxL

- MinL
- Time and frequency weightings
- Time and date or measurement
- Measurement duration
- Overload Status

Once all 40 records have been filled, no further records can be stored until some or all of the stored records are erased. You are able to erase the last record taken or all records at once (see section 4.1.4).

To save a record manually:

1. Take a manually timed measurement as described in section 3.2.1.

2. Press 🖭 until the Store Results Window appears on the screen, as shown below.

```
STORE
Current
Measurement
in Record No. 4
```

Fig. 4.1 The Store Results Window

3. Press ▶/■ to store the results in the displayed record number (in the example shown in the figure above, results will be stored in record number 4). You will then return to the Measurement Window. If you wish to cancel the operation rather than store the record, press 🧹 to return to the Measurement Window.

4.1.2 When All Records are Full

If you attempt to store a record (either manually, or after a preset interval) after all 40 records have been filled, you will see the following message:

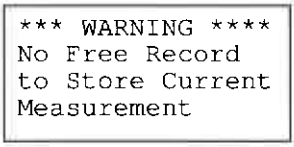


Fig.4.2 The No Free Records warning

If you see this message, then you must erase some or all of your records (see section 4.1.4) or take written records of your measurements.

To prevent problems:

- Always erase all records after you have downloaded and saved them to your computer's hard disk.
- Erase records of invalid measurements (e.g., overloads) right away by using the Erase Last Record command (see section 4.1.4).

4.1.3 Recalling a Stored Record

To view the results of any of your stored measurements, follow the procedure below.

1. If the instrument is measuring, then press ▶/■ to stop it. The Measurement Window must read STOP (as shown in Fig.4.3), not RUN.

2. Press 🖹 until the Recall Records to Display Window is visible on the screen (as shown in Fig.4.4).

3. Press ▶/■ to display the most recently stored record, which will resemble the example shown in Fig.4.5. Note

that if an overload occurred during the measurement, then the value for each parameter will blink.

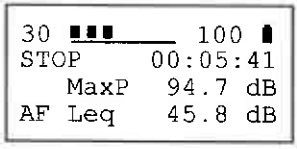


Fig. 4.3 The display when measurement is stopped

Fig. 4.4 The Recall Records to Display Window

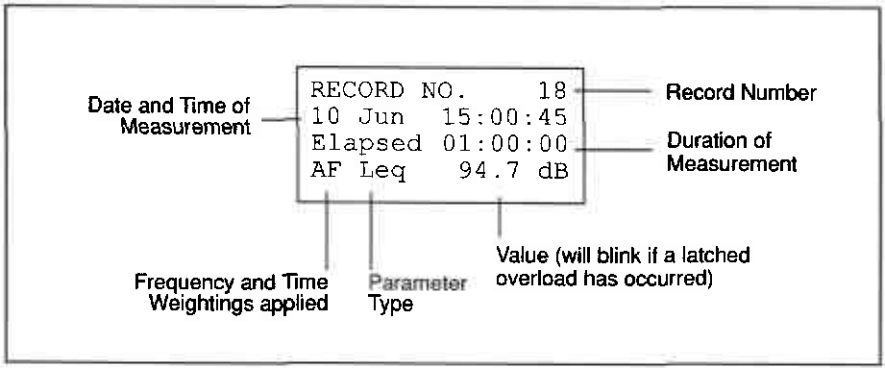


Fig. 4.5 An example of a recalled record

4. To step through the parameters stored in the record, press . They are displayed in the following order:
   - L_{eq} (default)

- MaxP (no displayed weightings)
- MaxL
- MinL

For more information about the meanings of the parameters and weightings, see section 3.3.

5. To view earlier records, press ▲ . To view later records, or to wrap back around to the first record, press ▼ .

6. When you have finished viewing your records, press ▶/■ to return to the Measurement Window.

4.1.4 Erasing Records

In some cases, you may want to erase the last record you saved. For example, if you took a preset interval measurement that was overloaded and therefore invalid, then you should erase the record and retake the measurement. (Note that this is not necessary with an interrupted or manually timed measurement, since the record is not saved automatically.)

After you have downloaded your records to a computer, then you no longer need to store your record on the instrument. You should erase all records on the sound level meter so that the memory will be free for storing future measurements.

To erase the last record taken:

1. If the instrument is measuring, then press ▶/■ to stop it. The Measurement Window must read STOP (as shown in Fig.4.6), not RUN.

2. Press 🖹 until the Erase Last Record Window is visible on the screen, as shown in Fig. 4.7. The number of the last recorded record is displayed. In the example shown, record no. 6 will be erased.

3. To erase the record shown, press ▶/■ . To cancel, press 🧹 . If you press ▶/■ , then a warning like the one shown

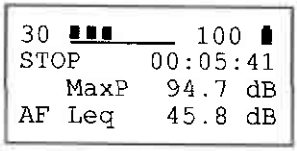


Fig. 4.6 The display when measurement is stopped

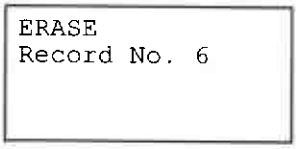


Fig. 4.7 The Erase Last Record Window

in Fig. 4.8 will appear to make sure you have not made a mistake.

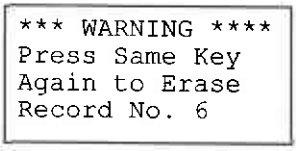


Fig. 4.8 The Erase Last Record Warning

4. If you mean to erase the record, press ▶/■ again. Otherwise, press ⏻ to keep the record and return to the Measurement Window.

To erase all records:

1. If the instrument is measuring, then press ▶/■ to stop it. The Measurement Window must read STOP (as shown Fig. 4.9), not RUN.

2. Press 🖩 until the Erase All Records Window is visible on the screen, as shown in Fig. 4.10 .

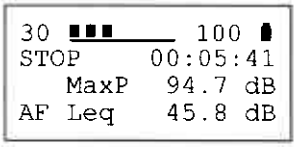


Fig. 4.9 The display when measurement is stopped

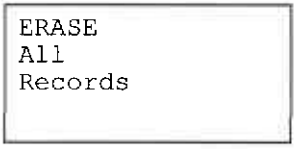


Fig. 4.10 The Erase All Records Window

3. To erase all records, press ▶/■. To cancel, press . If you press ▶/■, then a warning like the one shown in Fig. 4.11 will appear to make sure you have not made a mistake.

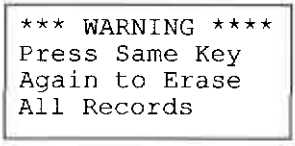


Fig. 4.11 The Erase All Records Warning

4. If you mean to erase all records, press ▶/■ again. Otherwise, press to leave all records stored and return to the Measurement Window.

4.2 Using a Portable Printer

Type 2239A includes a standard serial port interface. It is designed to work with portable serial printers. Contact your

Brüel & Kjær dealer for more information about printers recommended for use with Type 2239 A.

4.2.1 To Make a Print

If you are using a portable printer, you will get the best results by printing each set of measurements immediately after you have taken them. If you want to save your measurements as records, then it is best to download the records to a computer and print from a spreadsheet program. Otherwise they may not be printed correctly.

To connect the sound level meter to a serial printer, you must use Brüel & Kjær cable AO 1442. Contact your Brüel & Kjær representative if you do not have one.

To print measurement results:

1. If you have already taken the measurement you wish to print, do not turn off the sound level meter. If you do, your results will be erased.

2. Connect one end of a Cable AO 1442 to the serial port on the back of the sound level meter, using the screws to secure it.

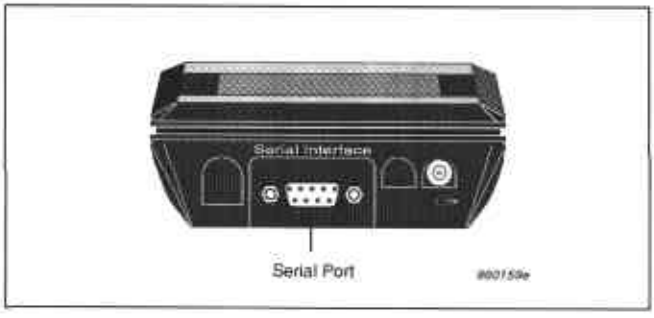


Fig. 4.12 Location of the serial port

3. Connect the other end of the cable to your printer as described in your printer manual.

4. If necessary, switch on the printer as described in your printer manual.

5. Configure your printer to use the communication setup listed below. See your printer manual for instructions.
   - 9600 Baud
   - 8 data bits
   - 1 stop bit
   - Parity: none
   - Handshake: XON/XOFF

6. If you have not taken a measurement, then take a complete measurement as described in section 3.2. Make sure measurement has stopped before proceeding.

7. Press 🖷 until the Print Measurement Window is visible on the screen, as shown below.

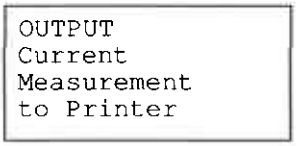


Fig. 4.13 The Print Measurement Window

8. Press ▶/■ to begin printing. Press 🚫 to cancel the operation.

4.2.2 Reading the Printout

Type 2239 A generates a printout that supplies the following information:

- Time weighting

- Frequency weighting
- Measurement range
- Date and time
- Elapsed measurement time
- MaxP
- MaxL
- MinL
- L_{eq}
- Overload status

Sample printouts are shown in Fig. 4.14.

4.3 Transferring Records to a Computer

Type 2239 A can store up to 40 records of measured results. For more information about saving records, see section 4.1. All records can be downloaded to a computer in a standard spreadsheet format. This enables you to read, print, and present your test results in any standard spreadsheet program (such as Microsoft® Excel).

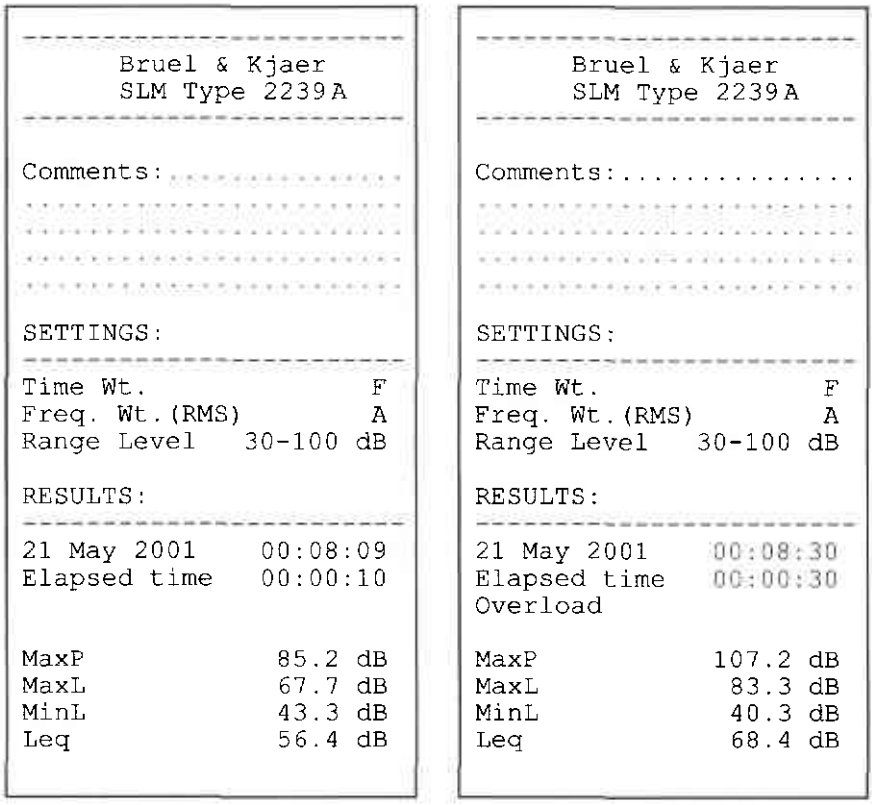
4.3.1 Connecting to a Computer

1. Take a set of measurements and save each to a record. See section 3.2 and section 4.1 for instructions.

2. Switch off the sound level meter and take it to your computer.

3. Switch off your computer.

4. Connect one end of a Cable AO 1442 to the serial port on the back of the sound level meter, using the screws to secure it.



```
------------------------
      Bruel & Kjaer
      SLM Type 2239A
------------------------

Comments:.............
.........................
.........................
.........................
.........................

SETTINGS:
------------------------
Time Wt.                F
Freq. Wt.(RMS)          A
Range Level    30-100 dB

RESULTS:
------------------------
21 May 2001     00:08:09
Elapsed time    00:00:10


MaxP              85.2 dB
MaxL              67.7 dB
MinL              43.3 dB
Leq               56.4 dB
```

```
------------------------
      Bruel & Kjaer
      SLM Type 2239A
------------------------

Comments:.............
.........................
.........................
.........................
.........................

SETTINGS:
------------------------
Time Wt.                F
Freq. Wt.(RMS)          A
Range Level    30-100 dB

RESULTS:
------------------------
21 May 2001     00:08:30
Elapsed time    00:00:30
Overload

MaxP             107.2 dB
MaxL              83.3 dB
MinL              40.3 dB
Leq               68.4 dB
```

Fig. 4.14 Print examples. In the example on the right an overload has occurred, which is indicated by the "Overload" label on the sixth line from the bottom

5. Connect the other end of the serial cable to your computer as described in your computer manual.

6. Switch on the sound level meter by pressing ⏻.

7. Switch on your computer.

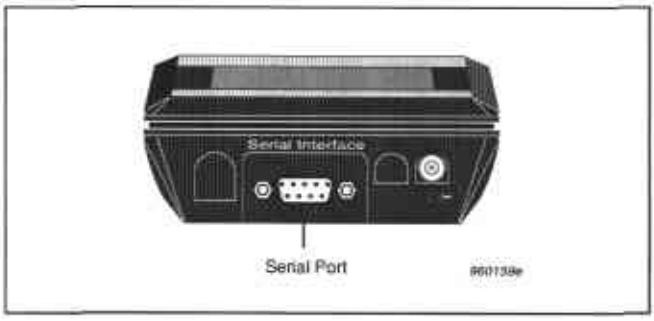


Fig. 4.15 Location of the serial port

4.3.2 Transferring Results with Third Party Software

In some situations (e.g., if you are using a Macintosh™ or DOS-only machine), you may want to use communications software other than that included with your instrument. If so, follow the instructions below.

1. Connect Type 2239 A to your computer as described in section 4.3.1.

2. Start your communications software.

3. Set your software's communication parameters as follows:
   - 9600 Baud
   - 8 data bits
   - 1 stop bit
   - Parity: none
   - Handshake: XON/XOFF

4. Your communications software will probably ask you for a name and location to which to save the data. Make the appropriate selections. All records will be saved in a single spreadsheet format file (tab separated) with the name and location you choose.

5. On the sound level meter, press ▤ until the Output Stored Results Window is visible on the screen, as shown in Fig.4.16 .

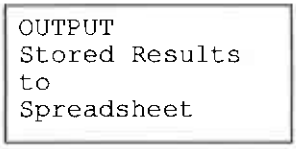


Fig.4.16 The Output Stored Results Window

6. Press ▶/■ to begin downloading the results. (Press ⏻ to cancel the operation.)

7. To view the data, start a spreadsheet program and open the file from there. See your program's user manual for instructions.

4.4 Using the AC Output

Type 2239A includes an unweighted AC output port. This is useful, for example, for recording sounds on a DAT recorder so that you can take samples back to a laboratory for further analysis. You may also want to use a set of headphones connected to the AC port to monitor the measurement.

The AC output port is easy to use. All you need is the appropriate cabling to get the signal from the sound level meter into your DAT recorder or headphones. See section 6.2 or contact your Brüel&Kjær dealer for information about ordering the required cables and adaptors.

4.4.1 To Record Measured Sound to a DAT

1. Set up measurement range and other settings as described in section 3.4.

2. Check the AC output specifications given in section 6.1. Set your DAT recorder appropriately, as described in its user manual.

3. Switch off the sound level meter and your DAT recorder.

4. Connect the LEMO end of a Brüel & Kjær AO 0403 LEMO to BNC cable to the AC output socket on the back of the sound level meter. Contact your Brüel & Kjær dealer if you

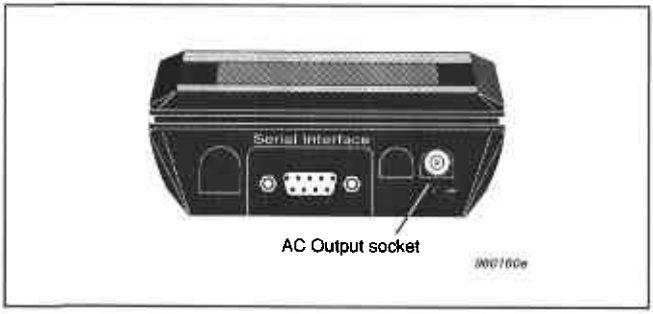


Fig. 4.17 Location of the AC output socket

do not have this cable.

5. Connect the BNC end of the cable (using an adaptor if required) to your DAT recorder.

6. Switch on the sound level meter, calibrator, and DAT recorder.

7. Set the record levels on your DAT recorder appropriately.

8. If you intend to use a sound analyzer on the recording, then connect a calibrator as described in section 3.1. Switch on the calibrator and record a few seconds of the calibration signal on the DAT. Take note of the calibration level shown on the sound level meter. Remove the calibrator when you are done.

9. Begin recording on the DAT and use your sound level meter as usual.

10. If you intend to use a sound analyzer on the recording, then repeat step 8 when you have taken all your measurements.

4.4.2 To Monitor the Measurement with Headphones

1. Switch off the sound level meter and your DAT recorder.

2. Connect a headphones adaptor to the AC output socket on the sound level meter (see Fig. 4.17).

3. Plug your headphones cable into the adaptor.

4. Use your sound level meter as usual.

Chapter 5

Introduction

5.1 Service and Repair

Type 2239 A 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 batteries to prevent risk of further damage.

For more information about preventing or identifying faults or damage to your sound level meter, please read the other sections of this chapter.

For repair, contact your local Brüel & Kjær dealer.

5.2 Care, Cleaning and Storage

Type 2239 A is a delicate precision instrument. When handling, storing, or cleaning your instrument, please take the following precautions.

5.2.1 Storing the Instrument

- Keep the sound level meter in a dry place.
- For long-term storage, remove the batteries.
- Do not exceed storage temperature limits of –25 to +60°C (–13 to +140°F).

5.2.2 Cleaning the Instrument

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

5.2.3 Handling the instrument

- Do not try to remove the microphone grid, 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, then please contact your Brüel & Kjær representative.
- Do not allow the instrument to get wet.
- Never mix different makes or types of battery.
- Never mix fresh and partially discharged batteries.
- Do not allow fully discharged batteries to remain inside the instrument.
- Protect the instrument from impact. Do not drop it. Transport it in the shoulder bag supplied.

5.3 Warnings and Error messages

If you get an error message while using or calibrating your Type 2239 A, then see the chart below.

Message	Occurs	Solution
`*** Warning **** Function Not Available While Measuring`	If you press ⏻,  ,  ,  , or  while the instrument is in the middle of a measurement.	Wait for measurement to finish or press  to stop measurement and then make your settings.
`***** Error **** Calibration Stopped due to Input Error`	During calibration, if foreign sounds have corrupted the calibration signal or if the calibrator is not switched on.	Make sure you have turned on and connected the calibrator correctly[a], check the calibrator's batteries, and/or move to a quieter location. If the error persists, then contact your Brüel & Kjær representative.
`***** Error **** New Initial Calibration Needed`	During calibration, if the instrument has discovered that the required calibration factor is more than ±1.5 dB from the factory calibration.	Check the conditions listed above. Make sure you have selected the correct calibration level on your calibrator and sound level meter[a]. If the error persists, then you may need a new factory calibration. Contact your Brüel & Kjær representative for assistance.

a. See section 3.1 for more information.

Message	Occurs	Solution
*** WARNING **** No Free Records to Store Overall Results	When you try to save a record and all 40 records are full.	Erase records or take manual records. See section 4.1.2 for more suggestions.
SET-UP Language >English	Normally, as described in section 2.4 (not an error). However, if it appears unexpectedly on start up, then your backup battery is probably flat. In this case, the clock and all settings will also be reset. This means that the instrument requires a new factory calibration.	Contact your Brüel & Kjær representative to arrange for a new factory calibration.
*** WARNING **** No Data Available	If you press 📖 when there are no records saved and the buffer is empty.	Make and store measurements before using this function.

Chapter 6

Specifications

6.1 Specifications

STANDARDS
Conforms with the following:
- IEC 60651 Type 1 (1979) and amendment 1 (1993) and Amendment 2 (2000)
- IEC 60804 Type 1 (2000)
- IEC/EN 61672 – Draft July 2000 Class 1
- EN 60651 Type 1 and Amendment 1 (2000)
- EN 60804 Type 1 and Amendment 1 (2000)
- ANSI S1.4–1983 Type S1
- ANSI S1.43–1997 Type 1

MEASURING RANGES

Range (dB)	Max. Peak level (dB)	Upper Limit (RMS) for Signals with Crest Factor 10 (dB)
30 – 100	103	83
50 – 120	123	103
70 – 140	143	123

NOISE FLOOR
Below measurement range – less than 30 dB

DETECTORS
Simultaneous RMS and Peak with independent frequency weightings
Linearity Range: 70 dB
Pulse Range: 73 dB
Non-linear Distortion: Too small to affect accuracy
Peak Detector Rise Time: < 100 µs

FREQUENCY WEIGHTINGS
RMS: A and C
Peak: C

TIME WEIGHTINGS
Fast, Slow, and Impulse (F, S, I)

DISPLAY
4 line LCD showing:
- Input signal level – indicated with a quasi-analog bar (updated 15 times per second)
- Selected parameters with level
- Warnings for: battery low and overload
- Measuring range
- Time weighting setting
- Elapsed measurement time
- Menus for displaying and editing settings
- Recalled records

Features a back-light for easy viewing, which can be turned on and off and includes an auto time-out to save batteries. Displayed parameters updated once per second.

PARAMETERS
Types: L_{eq} (L_{lm}), MaxP, Peak, MaxL, MinL, SPL, Inst
Resolution: 0.1 dB

EXCHANGE RATE
3 dB

MEMORY
40 Records of measurement results

MICROPHONE
Type 4188 Prepolarized Free-field 1/2" Condenser Microphone
Sensitivity: –30 dB re 1 V/Pa ±2 dB
Frequency Range: 8 Hz to 16 kHz ±2 dB
Capacitance: 12 pF

SERIAL INTERFACE
Compatible with:
EIA–574
EIA–232–E with 25-pole adaptor
Baud Rate: 9600
Data Bits: 8
Stop Bit: 1
Parity: None
Handshake: XON/XOFF
Result Output Formats:
Buffer (printer format) or all records (spreadsheet format)

AC OUTPUT
Short-circuit protected coaxial LEMO series 00 socket
***Max.* Output:** 0.5 V RMS corresponding to the top of the selected measurement range ±3 dB depending on the microphone's sensitivity
Output Impedance: 100 Ω
Output: Output signal from preamplifier (unweighted)

CLOCK
Real-time (calendar) and measurement duration
Factory set to Central European Time

START-UP TIME
Less than 10 s

EFFECT OF MAGNETIC FIELD
80 A/m (1 ørsted) at 50 Hz gives <30 dB (A)

CALIBRATION CONDITIONS
Reference Frequency: 1000 Hz
Reference SPL: 94 dB
Reference Temperature: 20°C (68°F)
Reference RH: 65%
Reference Range: 50 – 120 dB (set automatically during calibration sequence)
Reference Direction of Incidence: Frontal

ENVIRONMENTAL EFFECTS
Storage Temperature: –25 to +60°C (–13 to +140°F)
Operating Temperature: –10 to +50°C (14 to 122°F)
Effect of Temperature: <0.5 dB (–10 to +50°C) (14 to 122°F)
Effect of Humidity: <0.5 dB for 30%<RH<90% (at 40°C (104°F)

EMC
Classification Group: X
Reference Direction for Testing Radio Frequency Susceptibility: Microphone facing antenna

EMC IMMUNITY
Maximum sensitivity is achieved with Interface Cable AO 1422 and Output Cable AO 0403

EMC EMISSION
For all settings and configurations, the emission is much lower than specified by IEC 60651 Amendment 2 (2000), Draft IEC 61672

VIBRATION SENSITIVITY
<80 dB at 1 m/s^2 horizontally
<85 dB at 1 m/s^2 vertically

BATTERIES
Four 1.5 V LR6/AA size alkaline cells
***Lifetime (at room temperature):* Typically** >12 h
Internal back-up battery:
Keeps clock and memories operating for at least 6 months (typically) if fully charged. Fully charged in about 24 hours when main batteries are inserted

PHYSICAL CHARACTERISTICS
Size: 257×97×41 mm (10.1×3.8×1.6 in)
Weight: 460 g (incl. batteries) (1.0 lb)

CE Certification

CE C-Tick	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive. C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand
Safety	EN 61010–1 and IEC 61010–1: Safety requirements for electrical equipment for measurement, control and laboratory use. UL 3111–1: Standard for Safety – Electrical measuring and test equipment
EMC Emission	EN 50081–1: Generic emission standard. Part 1: Residential, commercial and light industry. EN 50081–2: Generic emission standard. Part 2: Industrial environment. 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.
EMC Immunity	EN 50082-1: Generic immunity standard. Part 1: Residential, commercial and light industry. RF immunity implies that sound level indications of 45 dB or greater will be affected by no more than 0.5 dB. EN 50082-2: Generic immunity standard. Part 2: Industrial environment. RF immunity implies that sound level indications of 60 dB or greater will be affected by no more than 0.5 dB. These levels of immunity are 14 dB better than required by IEC/EN 61672 (Draft). **Note:** The above conformance is guaranteed only when using accessories listed in this manual.

Frequency Weighting

Nominal Frequency* in Hz	Exact Frequency* in Hz	A-weighting	C-weighting
10	10.00	– 70.4	– 14.3
12.5	12.59	– 63.4	– 11.2
16	15.85	– 56.7	– 8.5
20	19.95	– 50.5	– 6.2
25	25.12	– 44.7	– 4.4
31.5	31.62	– 39.4	– 3.0
40	39.81	– 34.6	– 2.0
50	50.12	– 30.2	– 1.3
63	63.10	– 26.2	– 0.8
80	79.43	– 22.5	– 0.5
100	100.0	– 19.1	– 0.3
125	125.9	– 16.1	– 0.2
160	158.5	– 13.4	– 0.1
200	199.5	– 10.9	– 0.0
250	251.2	– 8.6	– 0.0
315	316.2	– 6.6	– 0.0
400	398.1	– 4.8	– 0.0
500	501.2	– 3.2	– 0.0
630	631.0	– 1.9	– 0.0
800	794.3	– 0.8	– 0.0
1000	1 000	0	0
1250	1 259	+ 0.6	– 0.0
1600	1 585	+ 1.0	– 0.1
2000	1 995	+ 1.2	– 0.2
2500	2 512	+ 1.3	– 0.3
3150	3 162	+ 1.2	– 0.5
4000	3 981	+ 1.0	– 0.8
5000	5012	+ 0.5	– 1.3
6300	6 310	– 0.1	– 2.0
8000	7 943	– 1.1	– 3.0
10 000	10 000	– 2.5	– 4.4
12 500	12 590	– 4.3	– 6.2
16 000	15 850	– 6.6	– 8.5
20 000	19 950	– 9.3	– 11.2

* Nominal frequencies are as specified in ISO Standard 266. Exact frequencies are given above to four significant figures and are equal to $1000 \times 10^{n/10}$, where n is a positive or negative integer.

Frequency Response

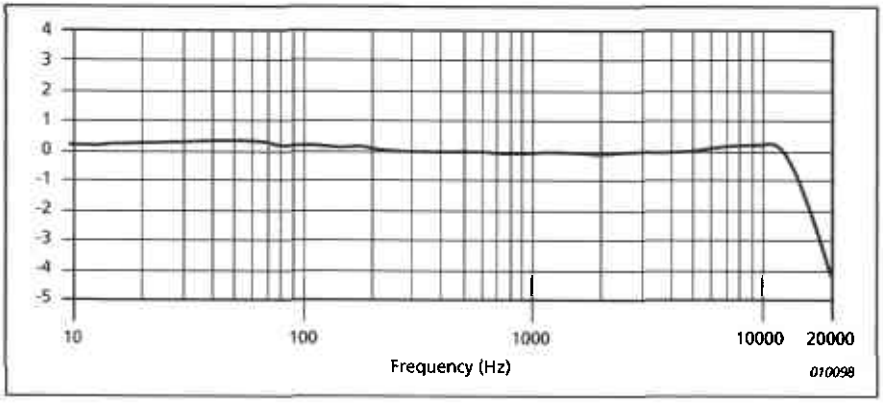


Fig. 6.1 *Typical free-field response of Type 2239A fitted with Microphone Type 4188 for 0° incidence*

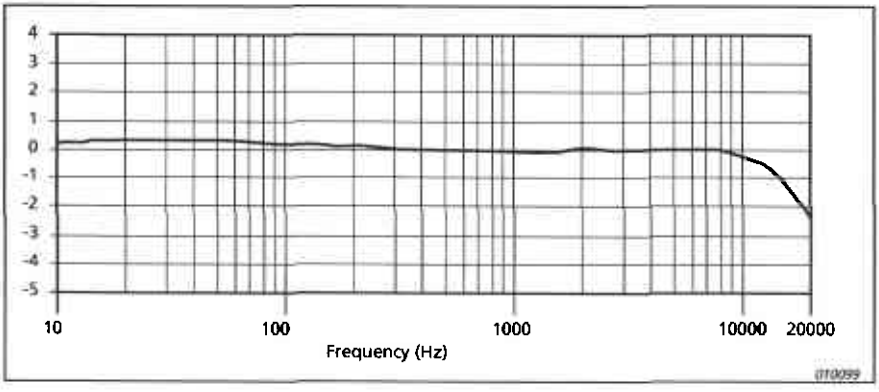


Fig. 6.2 *Typical diffuse-field response of Type 2239A fitted with Microphone Type 4188 with random incidence corrector*

Directional Characteristics

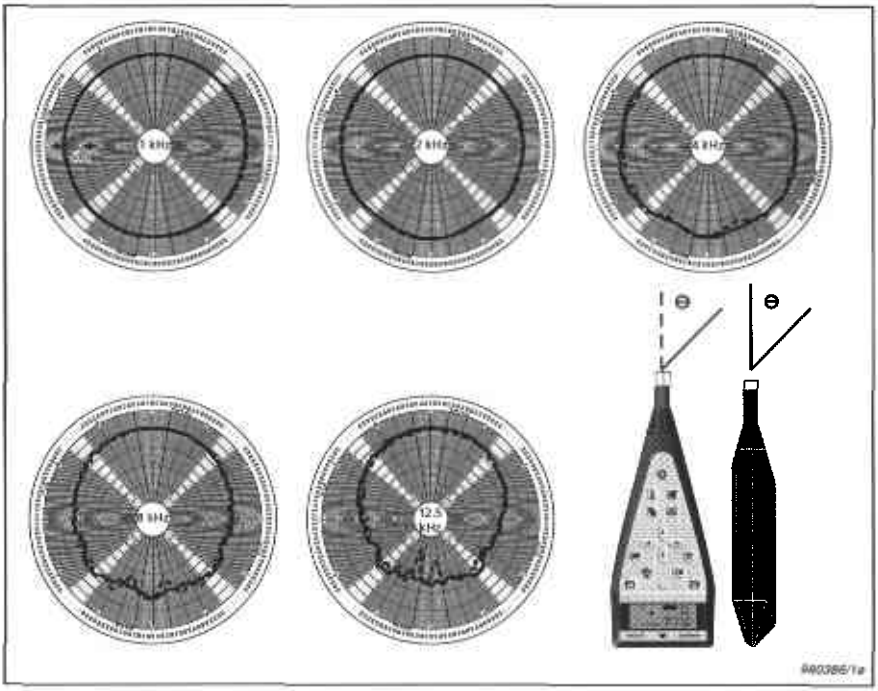


Fig. 6.3 *Directional characteristics of Type 2239 A fitted with the supplied microphone Type 4188. Characteristics measured at 1, 2, 4, 8 and 12.5 kHz*

Effect of Accessories

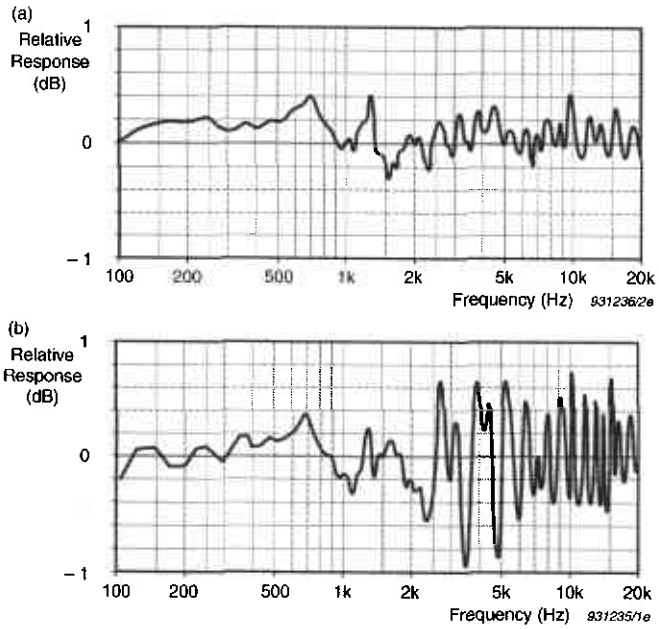


Fig. 6.4 *(a) Effect of the sound level meter's casing on its frequency response (for reference) compared to (b) the effect of Tripod UA 0801 on the sound level meter's frequency response*

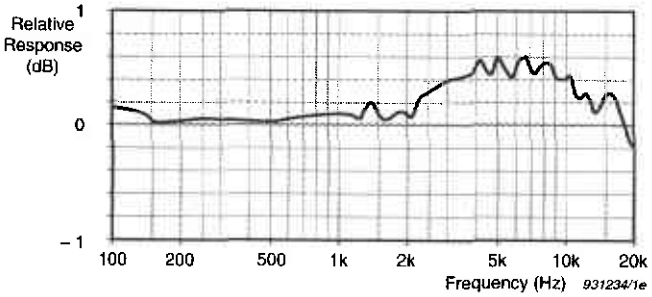


Fig. 6.5 *Effect of Protective Cover UA 1236 on the sound level meter's frequency response*

6.2 Ordering Information

Type 2239 A Integrating Sound Level Meter
Type 2239 B Integrating Sound Level Meter and Hand-Arm Vibration Meter

Included Accessories

4×QB 0013 Four 1.5 V LR6/AA alkaline cells
Type 4188 Prepolarized Condenser Microphone Cartridge
KE 0323 *Shoulder Bag*
UA 1236 Protective Cover

Optional Accessories

Type 4231 Sound Level Calibrator (Type 1)
UA 1251 Tripod
UA 0801 Lightweight Tripod
UA 0237 Windscreen (Ø 90 mm)
UA 0459 Windscreen (Ø 65 mm)
AO 0403 LEMO to BNC Cable
AO 1442 9-pole Cable with 25-pole Adaptor (for serial printer)

Carrying Cases

KE 0325 Carrying Case with insert for sound level meter, Sound Level Calibrator Type 4231 and Lightweight Tripod UA 1251

Brüel & Kjær reserves the right to change specifications and accessories without notice.

Chapter 7

Quick Reference

7.1 The Measurement Window

During normal operation, you will use the Measurement Window to view your measured data. It provides several kinds of information about your settings and measurements (see section 2.3 for a more detailed description):

1. The bottom end of the measurement range (in dB)
2. Quasi-analog display
3. The upper end of the measurement range (in dB) and overload indicator (when showing "OVL" or blinking, see section 3.2.3 for more information about overloads)
4. Battery level (see section 2.1.1)
5. Run/Stop indicator
6. Elapsed time
7. Peak parameter

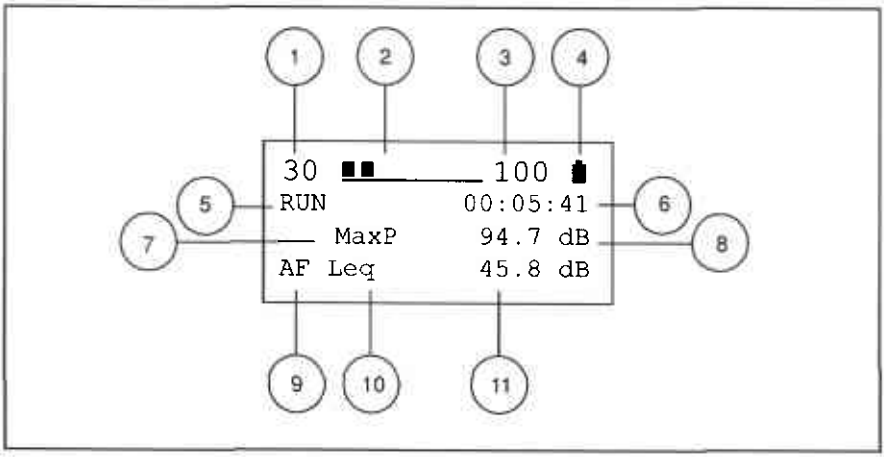


Fig. 7.1 The Measurement Window

8. Value of the peak parameter
9. RMS parameter weightings and type (see section 7.3)
10. Value of the RMS parameter

7.2 Measurement Range Flowchart

Three measurement ranges exist. It is important to select a measurement range that is appropriate to your measuring environment; the instrument must be sensitive enough to measure the quietest relevant sounds, yet should never be overloaded. You are only able to change the measurement range while the instrument is not measuring. To set the measurement range, press to step through the available options as detailed in the flowchart below (the measurement range is shown at the top of each screen). See section 3.4.1 for more information.

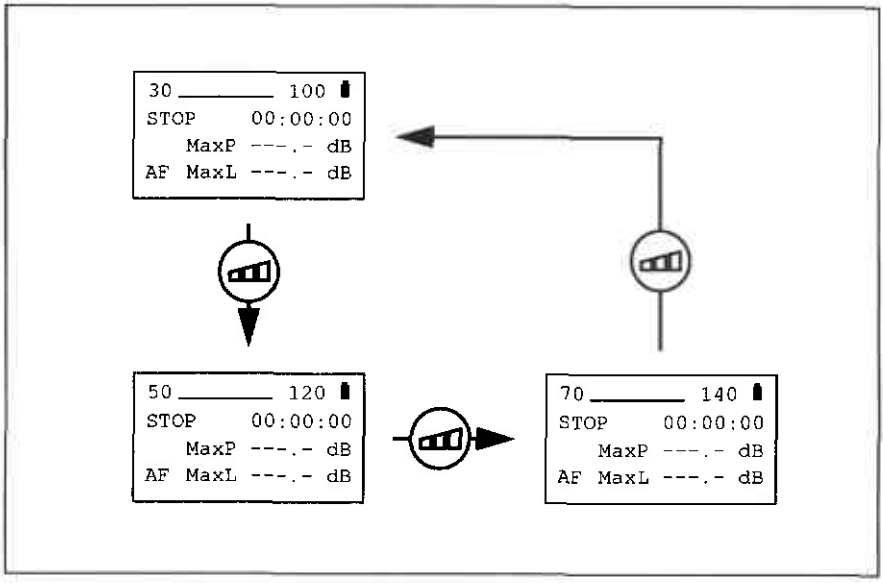


Fig. 7.2 Measurement Range flowchart

7.3 Displayed Parameters

The Measurement Window displays two parameters at a time on the bottom two lines of the screen, though seven parameters are monitored by the instrument at all times. Press to step through the readings. You can change the displayed parameters both during and after measurement. The flowchart below details the available paired choices. Note that the weightings shown in the screens below (AF) may differ from your own, depending on your settings. For more information, see section 3.3.

7.3.1 Parameter Definitions

L_{eq} (L_{lm}) Equivalent continuous sound level since the last reset. L_{lm} is shown instead of L_{eq} when the instrument is set to an Impulse time weighting.

MaxP	Maximum Peak since last reset
Peak	Maximum peak in the last one second interval
MaxL	Maximum SPL since last reset
MinL	Minimum SPL since last reset
SPL	Maximum sound level in the last one second interval.
Inst	A randomly sampled instantaneous sound level from within the last one second.

7.3.2 Possible Weightings

- AF ("A" frequency weighted and Fast time weighted)
- AS ("A" frequency weighted and Slow time weighted)
- AI ("A" frequency weighted and Impulse time weighted)
- CF ("C" frequency weighted and Fast time weighted)
- CS ("C" frequency weighted and Slow time weighted)
- CI ("C" frequency weighted and Impulse time weighted)

7.3.3 Displayed Parameter Flowchart

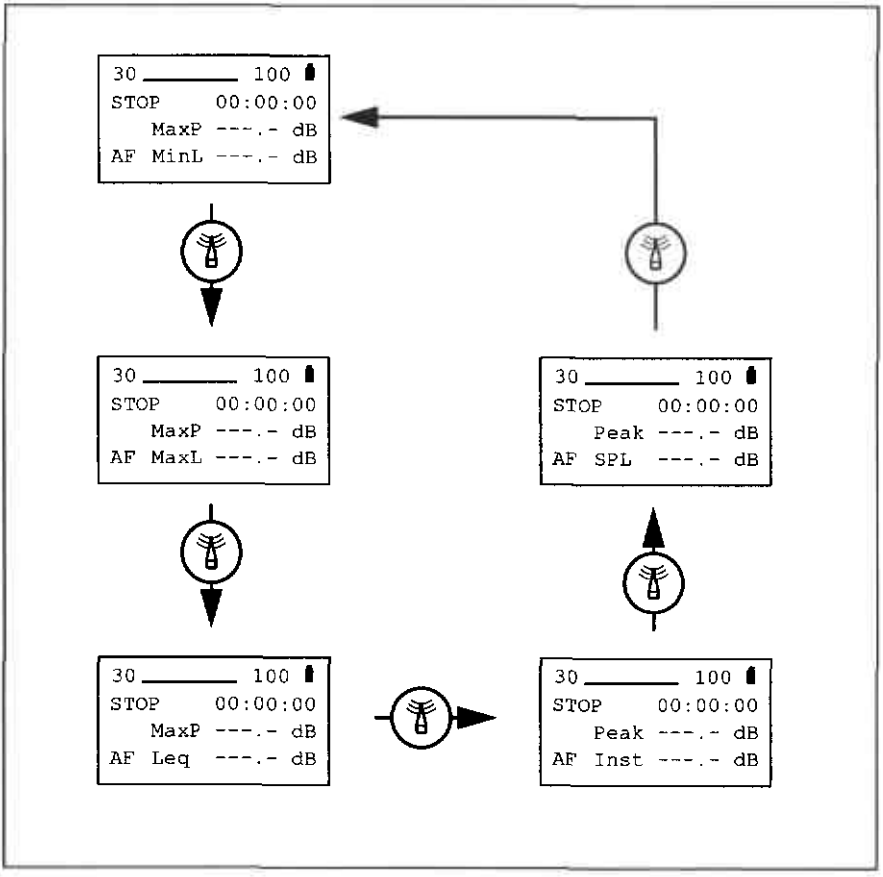


Fig. 7.3 Displayed parameter flowchart

7.4 Set-up Functions Flowchart

The ⇆ button gives you access to the measurement settings (time weighting, preset time, current date and time). You are only able to do this while the instrument is not measuring.

Press ⇆ to step through the available settings, as detailed in the flowchart below. The arrow on the screen (>) indicates the selected parameter. Use ▲ to increment the selected parameter and ▼ to decrement it. See section 3.4 for more information.

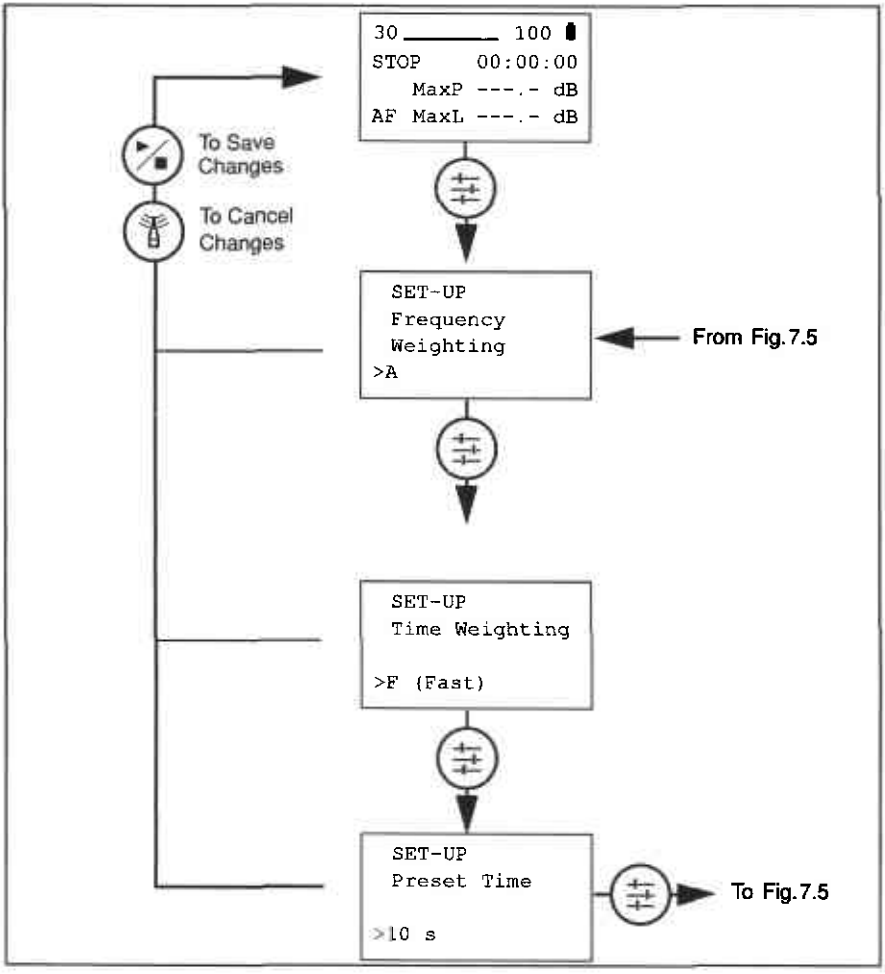


Fig. 7.4 Set-up functions flowchart, part 1

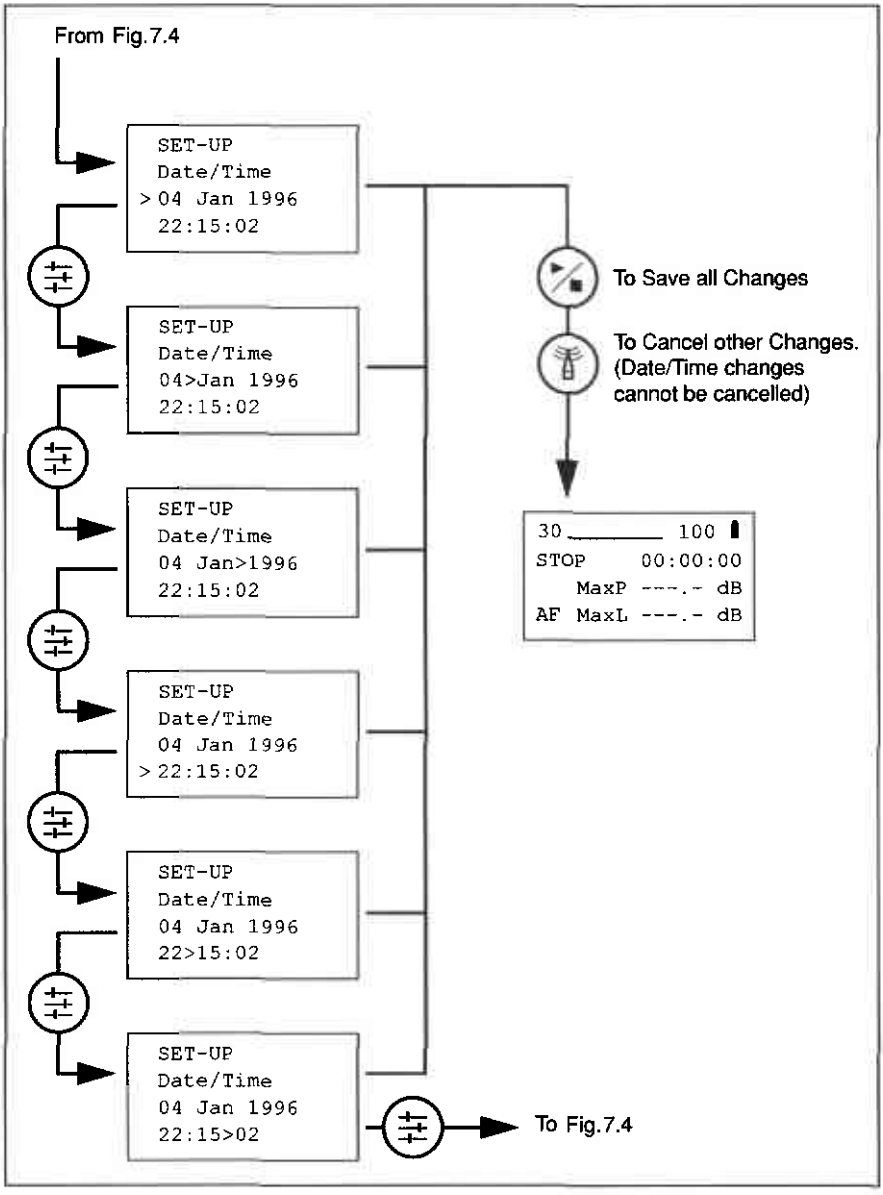


Fig. 7.5 Set-up functions flowchart, part 2

7.5 Data Functions Flowchart

The button gives you access to the sound level meter's data functions. These are used to store, print, download, and/or erase records of sound measurements.You are only able to do this while the instrument is not measuring. Press to step through the available settings, as detailed in the flowchart below. See section 3.4.4, section 4.2 and section 4.3 for more information.

Note:

The flowchart shown in Fig. 7.7 and Fig. 7.8 shows all possible choices. The following exceptions apply:

- If the buffer is empty (elapsed measurement time = 0), then the Store Results window will not appear.
- If there are no stored records, then none of the recall, output, or erase windows will appear.
- If there are no stored records and the buffer is empty, then the following warning message will appear when you press .

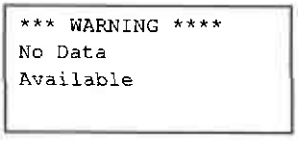


Fig. 7.6 The no data available warning

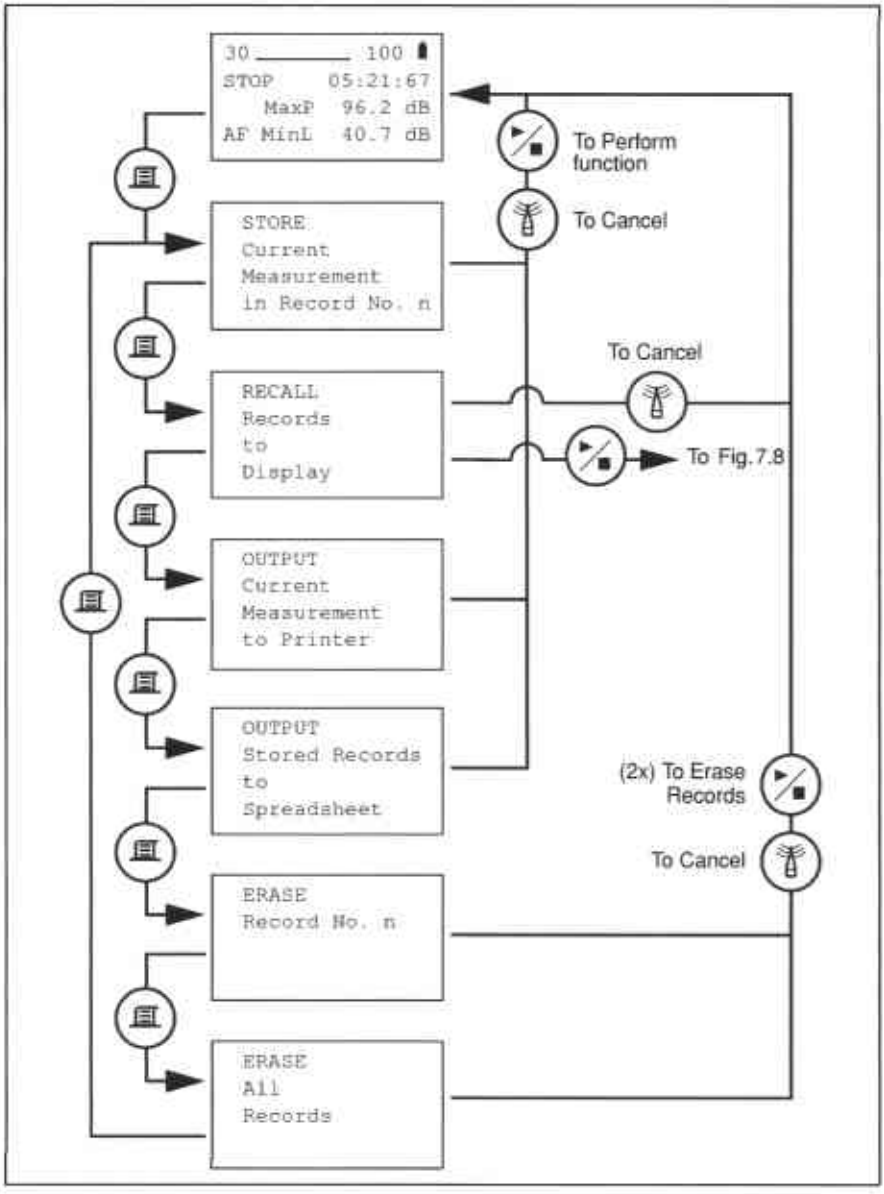


Fig. 7.7 Data functions flowchart, part 1

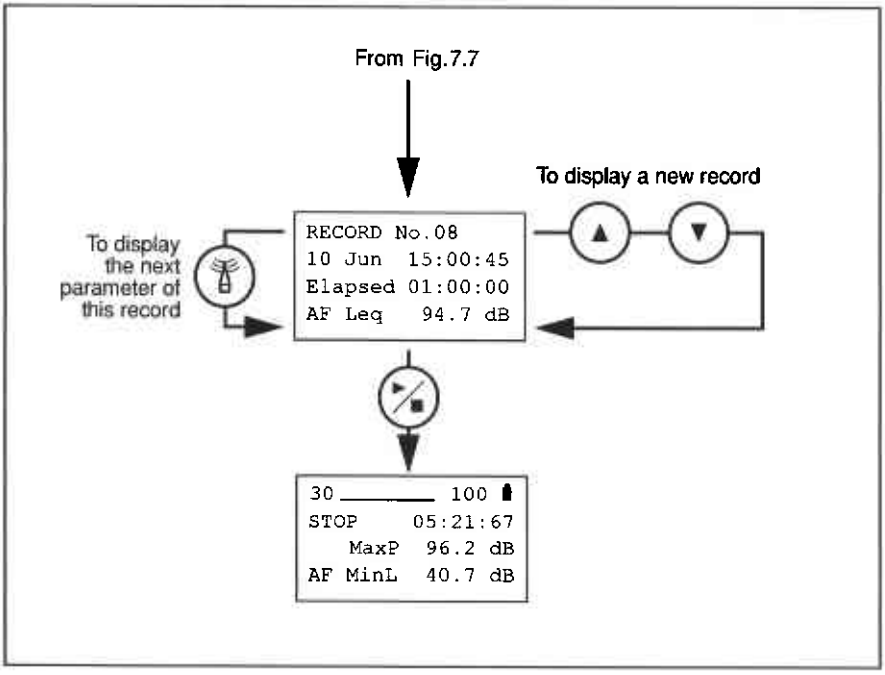


Fig. 7.8 Data functions flowchart, part 2

Chapter 8

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