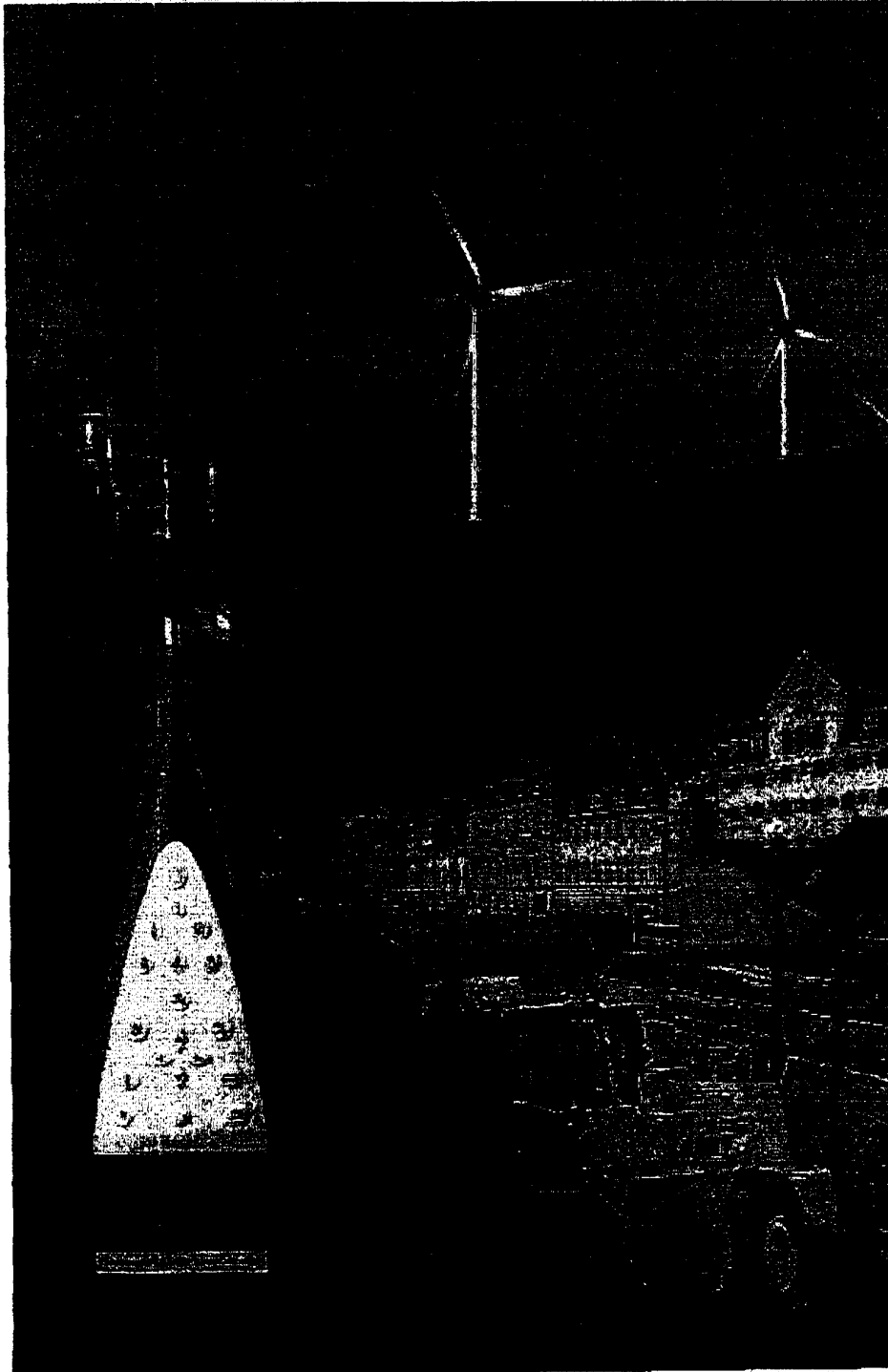# PRODUCT DATA

Modular Precision Sound Analyzer— 2260 Observer™
Including BZ7219 Sound Analysis Software
and BZ7220 Room Acoustics Software

2260 Observer is a state-of-the-art sound level meter and sound analyzer. It's a hand-held instrument capable of doing all the measurements and analyses that are typically used when assessing community noise and noise at the work place. 2260 Observer complies with the new sound level meter standard IEC 61672 as well as the previous IEC standards (60651 and 60804), and the latest ANSI standards.

All broadband parameters and statistical values are measured in parallel, so you will never miss a beat: all parameters are there – you just choose what you want to examine, now or later. Additionally, and simultaneously, real-time analysis in 1/1- or 1/3-octave bands is carried out. Broadband and spectral data can all be logged to obtain a time history (profile) for later analyses.

As an option to these standard facilities, you can add measurements of reverberation time. Using this option, acceptance test of rooms, noise reduction in workplaces and similar tasks are carried out conveniently. Reverberation time can be measured using impulsive noise (e.g., using a starting pistol), or you can use the built-in generator and a sound source.

2260 Observer can be upgraded to include the full range of advanced applications from the 2260 Investigator range of products, for example sound intensity, two-channel building acoustics, and FFT analysis.

2260 Observer

Brüel & Kjær

|	
USES	○ Environmental noise assessment
	○ Octave or 1/3-octave band analyses
	○ Noise monitoring
	○ Appraisal of sound reduction efforts
	○ Gathering field data for further analyses
	○ Research and development
	○ Reveration time measurement (BZ 7220 only)

FEATURES	○ IEC and ANSI Type 1 /Class 1 sound level meter
	○ 6.3 Hz – 20 kHz frequency range in 1/3-octave band analysis
	○ On-line annotation and data exclusion
	○ Control of sound recording on a PC
	○ Remote operation via modem link
	○ Measures reverberation time with impulse or interrupted noise excitation (BZ 7220 only)
	○ Displays reverberation time and decay curves (BZ 7220 only)
	○ Calculates broadband average reverberation time (BZ 7220 only)

Introduction

Fig. 1
Typical 2260
spectrum display
using BZ 7219
software
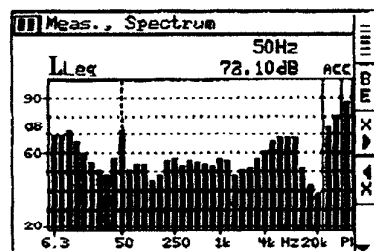
2260 Observer is based on a versatile hand-held analyzer platform. As standard, the analyzer is delivered with software that makes the instrument very well suited for most of the tasks relevant to assessment of environmental noise. This software is also useful in any other contexts where broadband level measurements or 1/1- or 1/3-octave band analyses of sound is needed. The frequency range covered in 1/3-octaves is 6.3 Hz to 20 kHz.

2260 Observer can be extended to allow measurements of reverberation time in 1/1- or 1/3-octaves. Additionally, as described later, it is even possible to upgrade the instrument to cover advanced two-channel applications such as intensity measurements and building acoustics.

Making Measurements

Basically, making measurements is a simple matter of starting, pausing, stopping and storing. However, with the plethora of parameters and setup options offered by 2260 Observer, you will enjoy the ability to define setups and store them under a name of your choice. This is useful for recurring tasks as well as special assignments. 2260 Observer also lets you define your own displays, that is, you define which of the many parameters you want to see on-screen and which you will only need for later analyses. Whenever a measurement is stored, all parameters are stored, except those you have explicitly deselected.

Many measurements are made with an operator on-site. Documenting measurement conditions and acquiring representative samples, requires an operator in most cases, as does the visual identification of sound sources. With 2260 Observer you can make on-line annotations of your measurement by attaching named markers to a profile. Furthermore, the actual sound can be recorded on a PC for identification and attached to the profile, when the profile is transferred to a PC.

Markers and Sound Recording

Fig. 2
2260 Observer
screen showing
three of the
markers
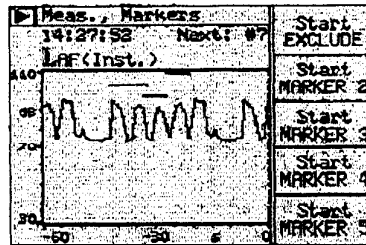
Markers are set on the fly. There are four markers that can be named, for example to identify sound sources, and an additional "exclude" marker to mark unwanted sound and exclude it from later processing. Markers can be selected in any order and for any duration. You can set all the markers to finish automatically after a predefined time or set to continue until you stop each one. The markers are saved with the measurement and are transferred with the measurement to post-processing software on a PC.

If sound recording is activated, using 7820 Evaluator™, 7825 Protector™ or 7815 Noise Explorer™, a .wav file can be recorded on the PCs hard disk at the same time as a marker is set. The recording is controlled from 2260 Observer.

When, at a later stage, the measurement is transferred to the PC, the recordings are merged with the profile. The sound recordings are then marked in the profile display and can be replayed. You use the cursor position in the profile display to decide which part of the recording you want to hear. See Fig. 8.

# Remote Access

Fig. 3
Outdoor Gear Type
3592

Noise monitoring in out-of-the-way places no longer needs to be a problem. Outdoor Gear Type 3592 offers security and weather protection for 2260 Observer. Safe and dry in its robust, heat reflecting, bright yellow case, the analyzer will operate unattended for more than 3 days. For longer periods, the battery can be changed without interrupting measurements. You can also save yourself a site visit by using the modem dial-up facility to collect your results. The system consists of a weatherproof case, outdoor microphone kit, microphone extension cable, microphone tripod or mast, sealed lead-acid battery, and battery charger. The Outdoor Gear Type 3592 system is modular, allowing you to assemble a monitoring system that meets your exact requirements. Evaluator Type 7820 software on your PC controls the communication process and allows measurement files to be downloaded directly to your PC's hard disk, thus freeing space for more results. The modem

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interface is standard RS-232. You can connect either a land-line modem or a mobile phone with a digital interface. The Type 3592 case has a space for the modem/mobile phone, and is transparent to radio waves.

Measurement Parameters

*Fig. 4
Screen showing real-time simultaneous display of broadband parameters and Elapsed Time*
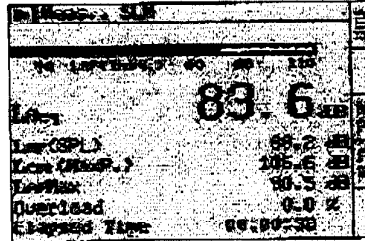
However many sound parameters (discrete, spectral and statistical) you select to measure with 2260 Observer, they will all be measured concurrently. Serial measurements, which are expensive and time consuming, are not necessary. While viewing a spectrum, you can switch over to see how any of the other parameters are developing, for example, the current values of L_N or L_{Ceq}– L_{Aeq}. Such analysis techniques are advantageous when the sound source is complex and you need on-the-spot tonal information, for example, when choosing hearing protection aids.

*Fig. 5
Statistics screen showing a level distribution curve. The cursor is at the 69 dB to 70 dB interval, showing there are 1.9% of the samples in the interval*
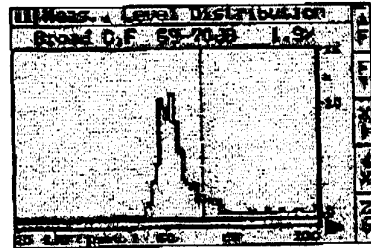
When you've made your measurements, you can store the final results in a file to view or analyse later. Measurements can be started manually or automatically. The automatic mode uses Observer's nine timers, clock and calendar.

You simply select how often the analyzer is to be "woken up" to make and store the required measurement data and the analyzer does the rest. You can see from the specifications that 2260 Observer can measure an impressive array of parameters based on various combinations of time and frequency weightings, filtering, and detection of peaks, etc. During measurements, the A-weighted, and C- or L-weighted sound signals are sampled and processed by the real-time DSP. The DSP continuously calculates the current values for the whole array of selected sound parameters, which you can display immediately and store later when the measurement is completed.

Reverberation Time Measurements

Measurements of reverberation time are often used for noise reduction in the workplace and determination of room corrections. 2260 Observer's optional reverberation time module BZ 7220 is an ideal solution for these applications.

*Fig. 6
Decay curve as shown on 2260 Observer's display*
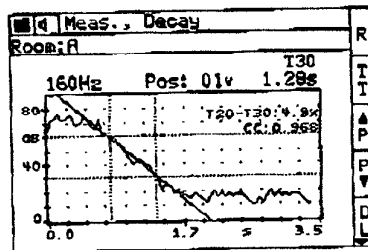
The reverberation time can be measured using the impulsive noise method. In this case you need only to carry the 2260 Observer and a starting pistol to, for example, a factory hall. Impulse decays are computed in all frequency bands simultaneously by backwards integration (Schroeder method). Alternatively, the built-in generator can be used in combination with a power amplifier and a loudspeaker source, thus allowing measure-

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ments using the interrupted noise method. In conditions of high background noise, serial measurements are supported.

A broadband average reverberation time can be computed from the bands you select and viewed on-screen.

Post-processing Software

With its 32 MB internal memory, 2260 Observer can store a large amount of data. To make it easy and efficient for you to examine the results of the measurements, and to make further analyses such as rating level or exposure calculations, Brüel & Kjær offers a number of Windows®-based software application packages. Each of the software packages is described in a separate product data sheet.

fig. 7
Spectrum graphs
from different
measurement files
*displayed by Noise*
Explorer Type 7815
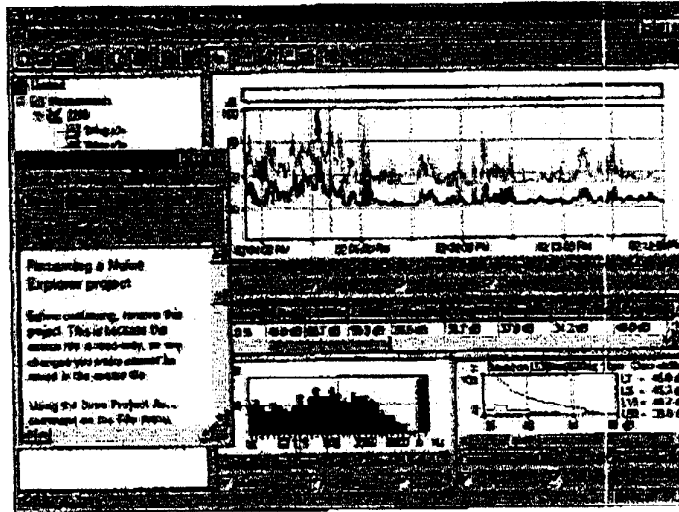
Noise Explorer™ Type 7815

Noise Explorer is software for displaying and reporting noise measurements made with a number of Bruel & Kjær hand-held instruments, including 2260 Observer. As well as displaying the data as graphs, spectra or statistics curves, Noise Explorer has a range of export features allowing you to export your measurement data to other programs or send to a printer. Noise Explorer has the facility to let the operator record and replay sound events to aid post-processing.

Evaluator™ Type 7820

Evaluator has similar display options to Noise Explorer. It is specifically designed to calculate Rating Levels (a single figure evaluation of environmental noise normally based on the L_{Aeq} with various penalties) according to the standards and legislation you follow. Using Evaluator with measurement data produced by 2260 Observer, you can quickly arrive at Rating Level figures. For noise reduction analysis, noise levels can be edited to give you on-screen indications of "what if" situations. The facility to record sound events is also available with this software.

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Fig. 8
Evaluator Type
7820 calculating
the rating level
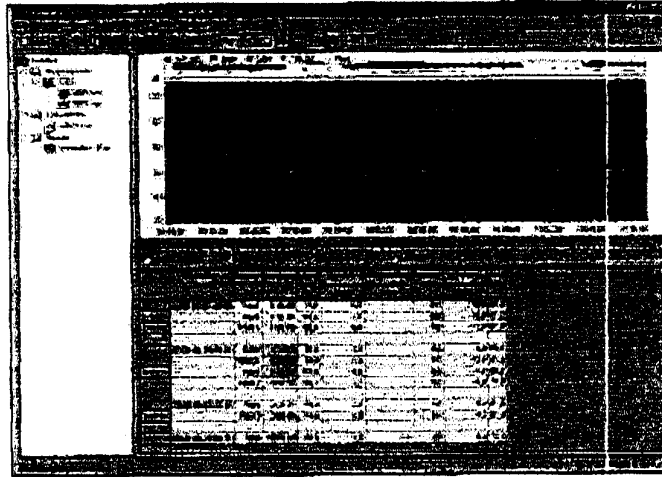
Fig. 9
Protector Type
7825 can show the
noise exposure
from an entire
plant
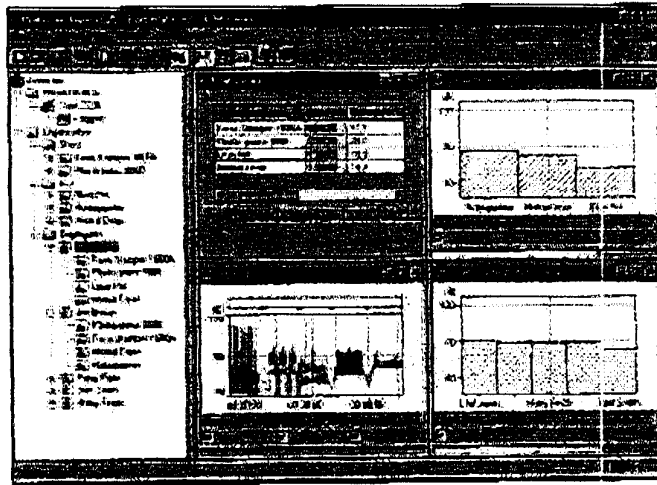
Protector™ Type 7825

Protector is software for post-processing, simulating and archiving noise exposure data. Protector works with the family of Brüel & Kjær dose meters, sound level meters and analyzers including 2260 Observer. Protector allows you to quickly download sample noise profiles for specific locations or persons, which Protector can then use to calculate noise exposure for people or positions under investigation. Protector calculates noise exposure according to ISO 9612.2. For situations where only work point noise measurements are available, and workers move about, Protector can combine workpoint measurements with a profile of the persons movements, to simulate their personal noise exposure.

Qualifier™ Type 7830/31

Qualifier Type 7831 is for post-processing of reverberation time data. When data are transferred from 2260 Observer you see the same results as in the instrument, including selected standard and the setup parameters. Reverberation times can be modified by drawing a new slope line across a displayed decay curve. Reverberation-time measurements can be averaged in two ways:

○ Averaging of reverberation times (T20 and T30) or
○ Averaging of decay curves (multispectra), also called ensemble averaging. This
   method produces an average decay curve (multispectrum) for each frequency band

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Fig. 10
Qualifier Type 7830
documenting
reverberation time
measurements
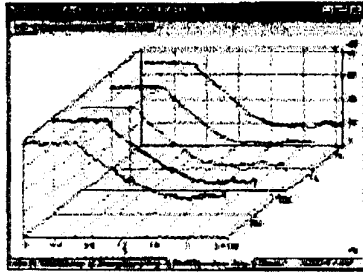
Upgrade Path

2260 Observer always comes with Sound Analysis Software BZ 7219 pre-installed. The Room Acoustics Software BZ 7220 is an option that can be installed on the Observer at a later time by the user.

In addition, 2260 Observer can be upgraded to a 2260 Investigator (described in separate data sheets). Investigator is a 2-channel platform for which a range of additional applications is available:

o Enhanced Sound Analysis, including event detection and event logging (100 ms intervals) as well 10 ms logging of L_{AF}
o Building Acoustics, including measurements of airborne and impact sound insulation in one or two channels
o Sound Intensity measurements for sound power measurements and noise source location
o Narrow-band analyses (Fast Fourier Transform (FFT)) of sound and vibration with built-in pure tone detection according to several standards
o Noise Profile Software for logging noise parameters within a 110 dB dynamic range

Compliance with Standards

CE ⓒ	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. CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Class B Limits. Note: the above is only guaranteed using accessories listed in this Product Data Sheet.
EMC Immunity	EN 50082–1: Residential, commercial and light industry. RF immunity implies that sound level indications of 40 dB or greater will be affected by no more than ±0.5 dB. EN 50082–2 (1995): Industrial environment. RF immunity implies that sound level indications of 55 dB or greater will be affected by no more than ±0.5 dB. Note: the above is only guaranteed using accessories listed in this Product Data Sheet.
Temperature	IEC 60068–2–1 & IEC 60068–2–2: Environmental Testing. Cold and Dry Heat. Operating Temperature: <0.5 dB –10°C to +50°C (+14°F to +122°F) Storage Temperature: –25°C to +70°C (–13°F to +158°F)
Humidity	IEC 60068–2–3: Damp Heat: 90% RH (non-condensing at 40°C (104°F)) Effect of Humidity: <0.5 dB for 30% < RH < 90% (at 40°C (104°F) and 1 kHz)
Mechanical	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: 1000 bumps at 250 m/s^2
Calibration	Initial factory calibration traceable in conjunction with ISO 9001

Specifications – Type 2260 Observer with BZ 7219 Software

Specifications apply to 2260 Observer fitted with the supplied microphone and input stage, and running BZ 7219 software

STANDARDS
Conforms with the following:
- IEC 60651 (1979) Type 1 plus Amendments 1 and 2
- IEC 60804 (2000) Type 1
- IEC 61672 (Draft March 2001) Class 1
- IEC 61260 (1995) Octave Bands and 1/3-octave Bands Class 0
- ANSI S1.4-1983 Type 1 plus ANSI S1.4A– 1985 Amendment
- ANSI S1.43-1997 Type 1
- ANSI S1.11-1986 Octave Bands and 1/3-octave Bands, Order 3, Type 0-C, Optional Range

SUPPLIED MICROPHONE
Type 4189: Prepolarized Free-field 1/2" Microphone
Nominal Sensitivity: –26 dB ± 1.5 dB re 1 V/Pa
Capacitance: 14 pF (at 250 Hz)

INPUT STAGE
ZC 0026
Extension Cables: Up to 100 m between the input stage and the Type 2260 can be driven by the input stage

CALIBRATION
Initial calibration is stored for comparison with later calibrations.
Acoustic: Using Sound Level Calibrator Type 4231, Multifunction Acoustic Calibrator Type 4226 or Pistonphone Type 4228
Electrical (internal): Uses internally generated electrical signal combined with a keyed-in value of microphone sensitivity

MEASURING RANGES
Linear Operating Range: 80 dB adjustable to give full-scale readings from 80 dB to 130 dB in 10 dB steps
Max. Peak Level: 3 dB above full scale reading
Upper Limit (RMS) for Crest Factor = 10: 17 dB below full scale reading

Passive Attenuation: Microphone attenuator ZF 0023 (included) effectively increases all full-scale readings by 20 dB

OCTAVE and 1/3-OCTAVE BAND FILTERS
Octave Band Centre Frequencies: 8 Hz to 16 kHz
1/3-octave Band Centre Frequencies: 6.3 Hz to 20 kHz

DETECTORS
Overload detector which monitors the overload outputs of all the frequency weighted channels
Parallel detectors on every measurement:
A-weighted broadband detector channel with three exponential time weightings (Fast, Slow, Impulse), one linearly averaging detector and one peak detector
C- or L-weighted (switchable) as above for A-weighted
Octave band filters, pre-weighted either A-, C- or L-, each with a detector channel containing one linearly averaging detector and one exponentially averaging detector switchable between Slow or Fast

INHERENT NOISE LEVEL
(Combination of electrical noise and microphone thermal noise at 20°C). Typical values with supplied microphone or nominal sensitivity:

Weighting	Electrical Noise (2260)	Thermal Noise (4189)	Combined Noise
"A"	12.3 dB	14.6 dB	16.6 dB
"C"	14.0 dB	15.3 dB	17.7 dB
Lin. 5 Hz–20 kHz	19.2 dB	15.3 dB	20.7 dB
Lin. 3 Hz–20 kHz	26.4 dB	15.3 dB	26.7 dB

CORRECTION FILTERS
Sound Incidence: Built-in filters for correction of frontal/random sound incidence

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Windscreens: Built-in filters for correcting the influence of Protective Cover UA 1236, Windscreen UA 0459 (65 mm) and UA 0237 (90 mm)

MEASUREMENTS

V = frequency weightings C or L
X = frequency weightings A, C or L
Y = time weightings S, F
N = number

For Display and Storage (Broadband)

Start Date	Start Time	Measurem. No.
Stop Date	Stop Time	Overload %
Elapsed Time	No. of Pauses	Underrange %
Level Distribution	Cumulative Distribution	
	$L_{Apk(MaxP)}$	$L_{Vpk(MaxP)}$
#Peaks A>L	#PeaksV>L	$L_{AE(ASEL)}$
L_{Aeq}	L_{Veq}	L_{AIm}
L_{VIm}	$L_{Veq-Aeq}$	L_{AIm}, L_{Aeq}
L_{ASTm3}	L_{AFTm3}	L_{AITm3}
L_{VSTm3}	L_{VFTm3}	L_{VITm3}
L_{ASTm5}	L_{AFTm5}	L_{AITm5}
L_{VSTm5}	L_{VFTm5}	L_{VITm5}
L_{ASMax}	L_{AFMax}	L_{AIMax}
L_{ASMin}	L_{AFMin}	L_{AIMin}
L_{VSMax}	L_{VFMax}	L_{VIMax}
L_{VSMin}	L_{VFMin}	L_{VIMin}
L_{XYN1}	L_{XYN2}	L_{XYN3}
L_{XYN4}	L_{XYN5}	$L_{AEP.d}$

For Display and Storage (Spectrum)

L_{Xeq}	L_{XYMax}	L_{XYMin}

Only for Display as Numbers or Bargraphs (Broadband)

$L_{AS(SPL)}$	$L_{AF(SPL)}$	$L_{AI(SPL)}$
$L_{VS(SPL)}$	$L_{VF(SPL)}$	$L_{VI(SPL)}$
$L_{AS(Inst)}$	$L_{AF(Inst)}$	$L_{AI(Inst)}$
$L_{VS(Inst)}$	$L_{VF(Inst)}$	$L_{VI(Inst)}$
L_{AST3}	L_{AFT3}	L_{AIT3}
L_{VST3}	L_{VFT3}	L_{VIT3}
L_{AST5}	L_{AFT5}	L_{AIT5}
L_{VST5}	L_{VFT5}	L_{VIT5}
$L_{Apk(Peak)}$	$L_{Vpk(Peak)}$	

For Storage During Logging (Broadband)

Nothing or
All parameters or
All parameters without statistics or
6 Major Parameters:

L_{Aeq}	$L_{Cpk(MaxP)}$ (or $L_{Lpk(MaxP)}$ if L is selected)
L_{AFMax}	L_{Ceq} (or L_{Leq} if L is selected)
L_{AFMin}	L_{AIm}

For Storage during Logging (Spectrum)

Nothing or
All Parameters or
L_{eq} (pre-weighting A,C, or L as selected)

Only for Display as Numbers or Spectra (Spectrum Bands)

$L_{XY(SPL)}$	$L_{XY(Inst)}$

The Broadband Level Distribution, Cumulative Distribution and Statistics L_{XYN1-5} are based upon sampling $L_{XY(Inst)}$ every 10 ms into 0.2 dB wide classes over 80 dB

MEASUREMENT CONTROL

Measurement Types:
- Manual – manually controlled single measurement
- Automatic – with preset measurement time
- Logging – a single measurement with a selectable duration of 1 s to 100 days in 1 s steps. Logging duration divided into logging intervals of 1 s to 100 hours in 1 s steps

Elapsed Time: When not in Logging mode, elapsed time resets/starts and pauses/continues according to the respective command. In Logging Mode, elapsed time continues in real-time, regardless of pauses in a measurement

GPS DATA

A position can be attached to a measurement job by inputting data from a GPS (Global Positioning System) receiver via the Serial Interface

Receiver Standards Supported: NMEA 0183 ver. 2.20, optional corrected to Differential GPS using RTCM 104 ver. 2.1
Baud Rate: 4800 bps

TIMERS

Up to nine independent timers can be specified. Each timer "wakes-up" the analyzer at a specified date and time and initiates a measurement in accordance with predefined setups. Timed measurement can be repeated up to 999 times. Timers from different software applications can be mixed

BACK ERASE

Up to the last 15 s of data can be erased, except when logging

MARKERS

One data exclusion marker and four user-definable markers for on-line annotation of sound categories heard during the measurement (logging only)

CONTROL OF SOUND RECORDING

Sound recording (.wav files on a PC using Type 7815, 7820 or 7825) can be controlled from 2260 via RS-232 interface and Aux output connected to the sound card on the PC

MEASUREMENT DISPLAYS

SLM: One main and five secondary parameters can be specified plus one analog bar with zoom facilities
Cumulative Distribution: Broadband plus one analogue bar
Level Distribution: Broadband. Class width can be specified. Also with one analogue bar. Zoom facilities provided
Profile: The last 15 s of $L_{AF(Inst)}$ plus one analog bar for manual measurement or the last 60 s with markers for logging measurements
Spectrum: Spectrum + two broadband bars plus one peak bar. Zoom facilities provided.
The four graphical displays also have cursor read-out facilities

STORAGE SYSTEM

Internal Hard Disk: Up to 32 MB for application software, user setups and data
External Memory Card for store/recall of measurement data (SRAM or SanDisk ATA Flash Cards)
MS-DOS® compatible file system (from ver. 3.3)

SERIAL PRINTER/OUTPUT

Set-ups and measurement data can be printed on an IBM® Proprinter® (or compatible), Portable Printer Type 2322 or 2318. The formats can be screen dumps, tables or graphs
Measurement data can be output in spreadsheet format or as a binary file for post-processing on a PC

HELP AND USER LANGUAGES

Concise context-sensitive help throughout in English, German, French, Italian, Spanish or Czech

CLOCK

Back-up battery powered clock. Accuracy better than 1 minute per month

INPUT STAGE CONNECTION

Connector: 10-pin LEMO

AUX OUTPUTS (2 independent)

Can be set to:
$L_{AF(Inst)}$: 0 to 4 V DC signal updated every 100 ms
Reference: 4 V square-wave for output calibration
Meas. Status for triggering external devices
Signal from amplified frequency weighted signal (A, C/L)

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AC INPUTS/OUTPUTS (2)
As Output: Buffered, unweighted microphone signal
Output Impedance: $2 \times 200\,\Omega$
Maximum Load: $47\,k\Omega \parallel 200\,pF$ (short-circuit protected)
As Input: Alternative to microphone input
Connector: 3-pin LEMO (balanced input)

SERIAL INPUT/OUTPUT
Conforms to EIA ITIA 574 (RS–232), coupled as data terminal equipment (DTE)
Connector: 9-pin D-type male
Baud Rates: 1200, 2400, 4800, 9600, 19200, 38400, 115200
Word Length: 8 bits, no parity or stop bits
Handshake: None, XON/XOFF, RTS/CTS

PCMCIA INPUT/OUTPUT
Computer with PCMCIA/JEIDA standards release 1.0

SETTLING TIME
From Power On: approximately 35 s

BATTERIES
Type: $6 \times LR14/C$-size 1.5 V alkaline
Lifetime (at 20°C): 5 to 9 hours continuous operation

EXTERNAL DC POWER SUPPLY
Voltage: regulated or smoothed 10 to 14 V, max. ripple 100 mV
Power: 3.5 W, current: 300 mA, inrush current: 1000 mA
Socket: Ø 5.5 mm with Ø 2 mm pin (positive)

WEIGHT AND DIMENSIONS
1.2 kg (2.6 lb.) with batteries
$375 \times 120 \times 52$ mm ($14.8 \times 4.7 \times 2.0$")

Specifications – Type 2260 Observer with BZ 7220 Software

Specifications apply to 2260 Observer fitted with the supplied microphone and input stage, and running BZ7220 software

SOUND LEVEL METER STANDARDS
Conforms with the following:
• IEC 60651 (1979) Type 1 plus Amendments 1 and 2
• IEC 61260 (1995) Octave Bands and 1/3-octave Bands Class 0
• ANSI S1.4-1983 Type 1 plus ANSI S1.4A– 1985 Amendment
• ANSI S1.11-1986 Octave Bands and 1/3-octave Bands, Order 3, Type 0-C, Optional Range

MEASUREMENT AND CALCULATION STANDARDS
Measurement and calculations can be made according to the following standards: ISO (3382, 354), DIN (52212), BS, NBE, SS, Sia, ÖNORM, NF, UNI, ASTM and NEN (5077)

UNDERRANGE INDICATION
Octave and 1/3-octave: 90dB below upper limit for each range setting, corresponding to less than 0.5 dB error

FREQUENCY WEIGHTING
Lin frequency weighting
A-weighting Instantaneous Fast (displayed, not stored)

OCTAVE AND 1/3-OCTAVE BAND FILTERS
Octave Band Centre Frequencies: 63 Hz to 8 kHz
1/3-Octave Band Centre Frequencies: 50 Hz to 10 kHz
Real-time Frequency Range: 50 Hz to 10 kHz centre frequencies

INHERENT NOISE LEVEL
(Inherent noise is the combination of the electrical noise and the thermal noise from the microphone at 20°C.) Typical values using a microphone Type 4189 with a nominal sensitivity:
1/3-octaves: 2 dB at 1 kHz, 8 dB at 10 kHz
1/1-octaves: 6 dB at 1 kHz, 12 dB at 8 kHz

DETECTORS
The analyzer contains several detectors working in parallel on every measurement:
Octave Band Filters (8) or 1/3-octave Band Filters (24): Pre-weighted by Lin., each with a detector channel containing one linear averaging detector
Overload Detector: Monitors the overload condition
A-weighted: Broadband detector channel with Fast exponential time weighting

INTERNAL GENERATOR
Built-in pseudo-random noise generator
Spectrum: Selectable between Pink and White
Crest Factor:
Pink noise: 4.4 (13 dB)
White noise: 3.5 (11 dB)

Bandwidth: Follows measurement bandwidth
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)
May be set in 1 dB steps 0–60 dB
When bandwidth is changed, the level for all bands is automatically adjusted to comply with the set output level
Turn-on time and Turn-off time: Equivalent to RT – 70 ms
Repetition Period: 175 s
Output Connector: Auxiliary 1 output
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.

MEASUREMENTS
Instantaneous: For display, no storage
"Live" spectrum – L_{eq} with a short averaging time
Range: Follows setting in Levels and Reverberation Time
Generator: Turned on and off manually
Reverberation Time: T20 and T30 in octave or 1/3-octave bands
Decays are measured and stored, using averaging times between 8 and 96 ms, depending on bandwidth and decay time

Manual entry: After measurement, the value in each band, for each position, may be changed by user entry

Broadband average: The arithmetic average of the Reverberation Time for selected bands is calculated and displayed (not stored)

Impulse excitation: When level (say from starter pistol) exceeds user selected trigger level, the decay is recorded and backwards integration performed (Schroeder method)

Generator: Controlled automatically

Repetition: Decays can be repeated automatically up to 99 times (ensemble averaging)

Averaging: up to 25 T20 and T30 measurements can be averaged (arithmetic averaging)
T20 and T30 calculation: From slope in evaluation range
Slope estimation: Least squares approximation

10

Status Indications: Overload, underrange, start time, T20–T30% Correlation Coefficient; extensive list of Status codes
RT range: Max. 30.00 s, min. 0.1–0.7 s, depending on bandwidth

MEASUREMENT CONTROL
Manual or semi-automatic. Measurements are started manually and can be automatically stored on completion of measurement. The noise generator is turned on and off automatically
With Inst. spectrum on display, the generator can be turned on and off manually for checking
Selected frequency bands can be measured serially, i.e., one by one in automatic sequence

MEASUREMENT DISPLAYS
T2: Shows the spectrum of reverberation times (T20 or T30) measured in the receiving room. Also, decay curve can be shown for each centre frequency
Spectrum: Octave or 1/3-octave band spectrum. Y-axis can be zoomed

dB(A): Instantaneous level is shown as a column next to the spectrum, with cursor readout. The graphical displays have cursor read-out facilities

DISPLAY RESOLUTION
Levels: 0.1 dB
Reverberation Time: 0.01 s

DISPLAY
Update Rate: Instantaneous – typically 5 times per second

AUXILIARY OUTPUTS
Aux. 1: noise generator output
Aux. 2: 'Input' signal monitor output
can be set to either monitor 'Input' signal with variable attenuation from 0 to –80 dB in 1 dB steps, or can be switched Off to reduce power consumption

HELP AND USER LANGUAGES
Concise context-sensitive Help throughout in English, German, French, Italian, Spanish or Czech

Ordering Information

Note: for upgrades and kit options, contact your Brüel & Kjær representative

Type 2260 I	Modular Precision Sound Analyzer with Sound Analysis Software BZ 7219
Type 2260 J	Modular Precision Sound Analyzer with Sound Analysis Software BZ 7219 and Reverberation Time Software BZ 7220
BZ 7220	Reverberation Time Software

Accessories Included with Type 2260 I

BZ 7219	Sound Analysis Software
Type 4189	Prepolarized Free-field ½" Microphone
ZC 0026	Input Stage
ZF 0023	20 dB Capacitive Attenuator
UA 1236	Protective Cover
DH 0696	Wrist Strap
KE 0342	Shoulder Bag (with room for 2260 and 4231)
6 x QB 0009	1.5 V LR 14/C size alkaline cells
UA 0237	Large Round Windscreen
AO 1442	9-pin to 25-pin PC or Serial Interface Cable

Optional Accessories

CALIBRATION

Type 4226	Multifunction Acoustic Calibrator
Type 4228	Pistonphone
Type 4231	Sound Level Calibrator
2260 CAI	Accredited Initial Calibration of Type 2260
2260 CAF	Accredited calibration of Type 2260
2260 CAP	Accredited calibration with pre-calibration of Type 2260

INTERFACING

Type 7815	Noise Explorer – data viewing software

TRADEMARKS
Windows® and MS-DOS® are registered trademarks of Microsoft Corporation in the United States and/or other countries
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Type 7820	Evaluator – data viewing and calculation software
Type 7825	Protector – software for calculation of Personal Noise Exposure
Type 7830	Qualifier – Reverberation Time Viewing and Calculation Software
Type 2322	Portable Printer
AO 1442	9-pin to 25-pin PC or serial printer interface cable
UL 1006	32 MB ATA Flash Memory Card

MAINS POWER SUPPLIES

ZG 0386	EU Version
ZG 0387	UK Version
ZG 0388	US Version

MEASURING

Type 3592	Outdoor Measuring Gear (see Product Data BP 1744)
AO 0440	AC input/output cable
AO 0441	3 m Microphone Ext. Cable
AO 0442	10 m Microphone Ext. Cable
AO 0543	2260 to Jack Cable
AO 0586	Cable from 2260 to Audio input on a PC
KE 0371	Carrying Case for 2260 and accessories
UA 0237	Large Round Windscreen
UA 0459	Small Round Windscreen
UA 1317	Microphone Holder
UA 1404	Outdoor Microphone Kit
UA 0522	Headphones Adaptor
UA 0587	Tripod
UA 0801	Small Tripod
Type 4295	Omnisource
Type 4296	OmniPower Sound Source with Tripod
Type 2716	Power Amplifier
KE 0358	Flight Case
AO 0523	10 m Cable from 2260 to 2716
AQ 0621	Bridging Cable for 2716 output
AQ 0622	10 m Cable from 2716 to 4296

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

Brüel & Kjær

PRODUCT DATA

Modular Precision Sound Analyzer — 2260 Investigator™ including BZ7206 and BZ7210 Sound Analysis Software

2260 Investigator™ is a battery-operated, hand-held, programmable sound analyzer. Its embedded operating system, based on a PC architecture, is closely integrated with a digital signal processor (DSP) and two-channel microphone conditioning electronics, all together creating a versatile platform for high-quality real-time sound analyses.

Like a personal computer, 2260 Investigator is driven by application software for various tasks. Every 2260 Investigator is shipped with Basic Sound Analysis Software BZ7210 that makes the instrument into a precision sound level analyzer. Other applications available for 2260 Investigator include:

- Noise Profiles (BZ7203)
- Building Acoustics (BZ7204)
- Sound Intensity (BZ7205)
- Enhanced Sound Analysis (BZ7206)
- Room Acoustics (BZ7207)
- FFT Analysis (BZ7208)

The potent combination of quality hardware and unique application software ensures that 2260 Investigator remains the world's most advanced hand-held sound analyzer.

2260/BZ7206/BZ7210

Brüel & Kjær

USES   ○ Comprehensive sound measurements

○ Detailed octave and 1/3-octave band analyses

○ Noise monitoring

○ Appraisal of noise reduction efforts

○ Gathering field-data for further analyses

○ Research and development

FEATURES   ○ IEC and ANSI Type 1 sound level meter

○ 6.3 Hz – 20 kHz frequency range in real-time 1/3-octave bands

○ Broadband statistics

○ On-line annotation and data exclusion

○ Control of sound recording on a PC

○ Logging rates down to 1 s

○ Remote operation via modem link

○ Automatic Charge Injection Calibration (CIC) check

○ Spectral statistics*

○ Automatic event logging*

○ Logging rates down to 100 ms*

Introduction and Overview

2260 Investigator™ is a precision sound analyzer based on a unique platform concept. The platform has generous hardware and software specifications (see the specifications pages) creating an extremely flexible instrument to cover all your current and future sound analysis needs. This Product Data describes 2260 Investigator with Basic Sound Analysis Software BZ 7210 (always included with the instrument) and Enhanced Sound Analysis Software BZ 7206 (optional).

Fig. 1
Real-time 1/3-octave spectrum display
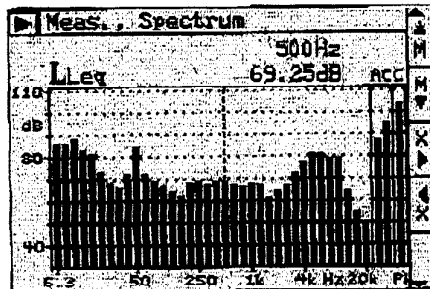
With Sound Analysis Software BZ 7210 or BZ 7206 running, the analyzer becomes a Type 1 sound level meter capable of real-time 1/3-octave frequency analysis with broadband and spectral* statistical distributions. Also included are facilities for sound recording to a PC and automatic Charge Injection Calibration (CIC) for checking the microphone condition. Measurements may be programmed using automatic sequences or timers.

Styling

The slim shape of 2260 Investigator has a purpose beyond good looks: the effect on the sound field is minimised, assuring accurate sound measurements when mounted on a tripod. Fig. 2 shows the effect of the analyzer's casing on frequency response.
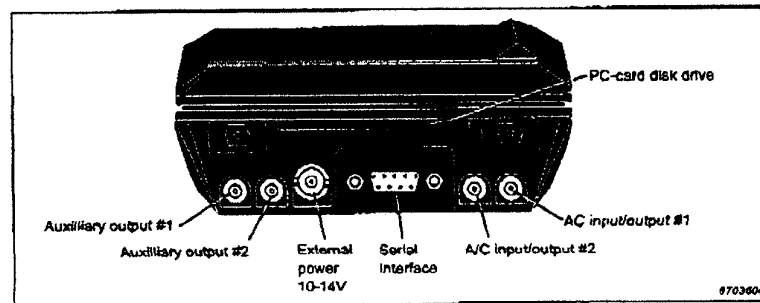
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* BZ 7206 only

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together with IEC Type 1 tolerances (shown as a mask). Notice how well the actual response lies within the maximum allowed for Type 1.

Fig. 2 Effect of the analyzer's casing on frequency response. Mask shows IEC Type 1 tolerances
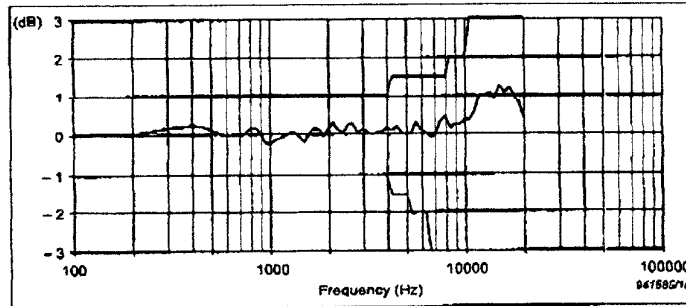
Inputs and Outputs Available

Fig. 3 The inputs and outputs of 2260 Investigator

Microphone/Input Stage – 2260 Investigator is supplied with a Falcon™ Range ½″ microphone and input stage that conform to IEC and ANSI Type 1 standards. The input stage is able to drive an extension cable of up to 100 m, a valuable feature when a measurement requires remote location of the microphone, for example when using Outdoor Microphone Kit UA 1404.

AC Input/Output – This can act as either an analogue input or output, for example when sending DAT recorded signals into 2260 Investigator for further analysis.

Aux. Outputs – There are two of these, one for each channel. These can be set up independently for use with level recorders, triggering DAT recorders, sound recording in combination with Brüel & Kjær PC-software, or monitoring the microphone signal.

PC-card Disk Drive – By saving measurement files on Flash Memory Card UL 1008 inserted into 2260 Investigator you are able to rapidly transfer your data to a PC fitted with a standard PC-card (PCMCIA) slot.

Serial Interface – 2260 Investigator has an RS–232 standard serial interface that allows data transfer and remote control of the instrument, typically using one of the Type 78xx programs in the PC software suite available from Brüel & Kjær.

3

Calibration Features Available

Whenever measuring sound, calibration of the system before and after measurement is an essential part of the process. Basic Sound Analysis Software BZ 7210 has several features to ensure your measurements are reliable.

○ **Internal Calibration** – The internal calibration method uses a stable, internal electrical reference signal to directly excite the preamplifier output. The whole measurement chain, except the microphone and preamplifier, is calibrated in this way. By entering the microphone's sensitivity, a very quick and reliable calibration is possible.

○ **External Calibration** – The external method requires the microphone to be coupled to a stable reference acoustic sound source, such as Brüel & Kjær's Sound Level Calibrator Type 4231, Pistonphone Type 4228, or the Multifunction Acoustic Calibrator Type 4226. This method calibrates everything in the measurement chain and is recommended for routine calibration in the field.

○ **Initial and Accredited Calibration** – Each analyzer "remembers" its initial calibration together with the serial number of its microphone and will report any deviation from this Initial Calibration. An Accredited Initial Calibration is done only at the factory. If you need one, or need to renew the one in your analyzer, contact your Brüel & Kjær representative.

○ **Manual or Automatic Charge Injection Check (CIC)** – CIC allows the analyzer to monitor the measurement chain right from the microphone diaphragm (see Fig. 4). When you perform an Internal or External Calibration, a reference CIC is also automatically made and the result stored as a reference. Later you may manually initiate a CIC and compare it to the reference. A stable CIC ratio assures stable operation of microphone, cable, preamplifier and the remaining measurement system.

Fig. 4
Charge Injection Check. Capacitor C_c is fed with voltage e_i. The ratio e_o/e_i is constant when g, C_c, C_m and C_i are constant. Changes to any of them will change e_o/e_i, and hence indicate probable changes in calibration
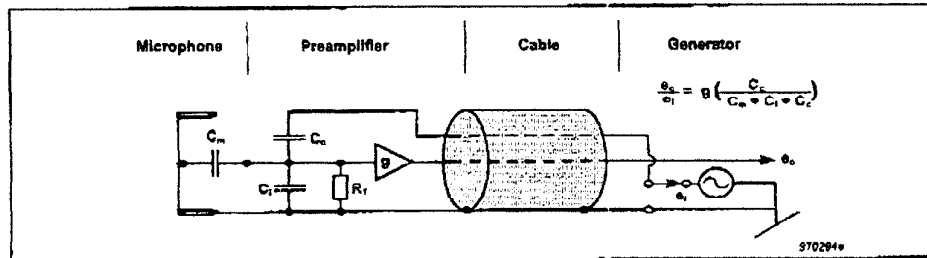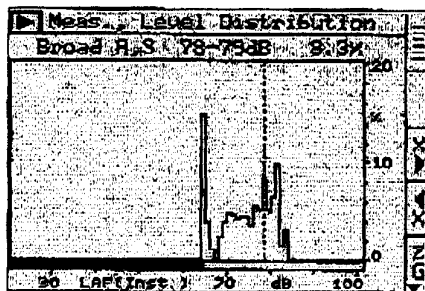

Making Measurements

You can see from the specifications pages that 2260 Investigator can measure an impressive array of discrete, spectral and statistical parameters based on various combinations of time and frequency weightings, filtering, detection of peaks, and so forth. However many parameters you select to measure with 2260 Investigator, they will all be measured concurrently. Serial measurements that are expensive and time-consuming (or downright impossible!) are simply not necessary.

Each parameter can be regarded as a position in a multi-point array continuously being updated. While viewing a spectrum, you can easily see how any of the other parameters are developing, for example, the values of L_N, (broad-band) or $L_{Ceq}-L_{Aeq}$ (an indication of low frequency content). Such analysis techniques are advantageous when the sound source is complex and you need on-the-spot tonal information, for example when choosing hearing-protection aids.

4

Viewing and Display

Fig. 5
*A level distribution display snapshot showing the current statistics during a measurement*

2260 Investigator's real-time digital signal processor (DSP) allows you viewing access at any time to all the parameters measurable. During measurement, or when a set of measurements are in the memory, you can view the data in a number of ways. Spectral data (in octave or 1/3-octave bands) and statistical data (level and cumulative distributions) can be displayed graphically, complete with display zoom and cursor facilities.

When you've made your measurements, you can store the final results in a file to view them later on the analyzer, or examine them further using one of the 2260 platform's extensive range of PC-based software packages.

Markers

Fig. 6
2260 Investigator screen showing three of the markers
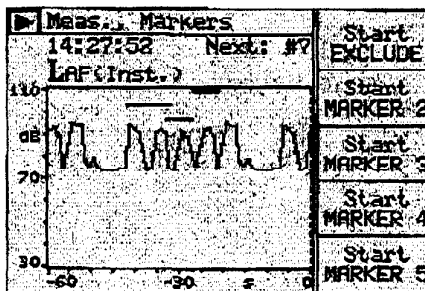
Marker "soft" keys allow you to identify specific measurement conditions. There are four markers plus an "EXCLUDE" marker. You can name these marker keys to aid in identifying what type of condition is present. For BZ 7206, the marker duration can be edited on-screen up to one minute after the occurrence has taken place. The markers are saved at the same time as your measurement data and, if sound recording is activated, a .wav file is saved on your PC (see below).

The markers can be seen on a PC when the data has been transferred to Noise Explorer Type 7815, Evaluator Type 7820 or Protector Type 7825. Markers can be selected in any order and for any duration. You can set all the markers to finish automatically after a pre-defined time or set to continue until you stop each one.

PC Sound Recording

Fig. 7
The "CAR" and "TRUCK" markers have been tagged to start sound recording when they are active

To be sure of what had caused a marked event, you can record sound directly onto your PC's hard drive using Noise Explorer Type 7815, Evaluator Type 7820 or Protector Type 7825. These allow 2260 Investigator to control sound recording on the hard disk while making measurements. The only limit to duration is the size of the hard disk. There is a 60 s sound buffer in the PC to permit editing of markers up to 1 minute after the occurrence has taken place (BZ 7206 only).

Sound recording can be tagged to one or more markers (see Fig. 7). Recordings are time stamped and stored as .wav files. After transferring the measurement data from 2260 Investigator to Type 7815/20, the data are automatically merged with the sound recordings. The sound recordings are then marked in the profile display of Type 7815/20/25 and can be replayed.

5

DAT Recording

You can also use the DAT recording facility offered by 2260 Investigator, where the microphone's signal is fed directly to tape. 2260 Investigator can remotely trigger the DAT to start and stop recording. From stand-by mode, the DAT recorder starts recording within 1–2 s.

DAT recording can be set to occur only during an event or during the entire measurement.

Logging

You can start single measurements manually or automatically repeat sequences of a single measurement. You can also select "Logging" or "Event Logging" (BZ 7206 only) Logging allows 2260 Investigator to measure background sound levels using a set of defined parameters. For BZ 7206, if triggered by an event, another set of parameters can be defined for the duration of the event (event logging). In this way you can have a higher resolution record of the noise levels during the event.
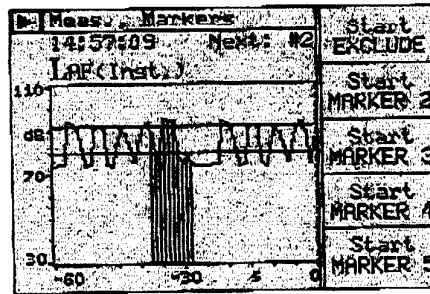
Event Threshold in BZ 7206

To prevent transients causing a large number of events, a time limit (in 1 s intervals) can also be imposed on the threshold. For an event to be "logged" it must exceed the threshold for more than the time limit. To ensure that the start of the event is not missed, measurement data is also delayed. Events can also be triggered remotely via the RS–232 interface (by sending the appropriate start/stop command), by using a remote control connected to 2260 Investigator, or by pressing a "soft" key.

Unattended Monitoring and Remote Access

For noise monitoring in out-of-the-way places, Outdoor Gear Type 3592 offers security and weather-protection for 2260 Investigator. The modular system consists of a weatherproof case, outdoor microphone kit, microphone extension cable, microphone tripod or mast, sealed lead-acid battery, charger for battery, DAT recorder (not supplied by Brüel & Kjær), and cables for interconnection.
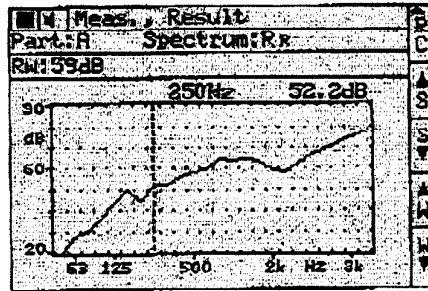
Safe and dry in its robust, heat reflecting, bright yellow case, the analyzer will operate unattended for more than 3 days. For longer periods, the battery can be changed without interrupting measurements. You can also save yourself a site visit by using the landline or wireless modem dial-up facility to collect your results. The Type 3592 case has a space for the modem/mobile phone, and is transparent to radio waves.

Evaluator Type 7820 software on your PC controls the communication process and allows measurement files to be downloaded directly to your PC's hard disk, thus freeing space for more results.

6

Other Application Software
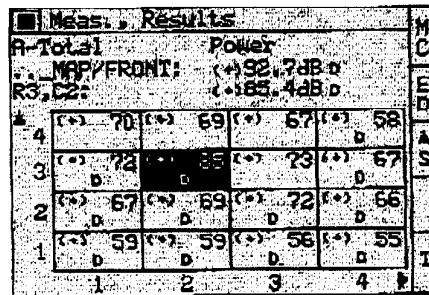
Building Acoustics

*Fig. 10
Building partition measurement results showing a Sound Reduction Index spectrum, R, and Weighted Sound Reduction Index, Rw. Both parameters are calculated by 2260*

For building acoustics measurements, choose 2260 Investigator with Building Acoustics Software BZ 7204. When your measurements are complete, you can, for example, immediately see the sound reduction index or the reverberation decay curve on the analyzer's screen. For workplace noise reduction and the determination of room corrections, choose Reverberation Time Software BZ 7207. For more in-depth analysis and comprehensive reporting, choose Qualifier™ Type 7830 software which is dedicated to working directly with data supplied by BZ 7204 and BZ 7207.

Sound Intensity

*Fig. 11
Sound power measurement results for a 4 × 4 grid*

BZ 7205 software is dedicated to measuring sound intensity and calculating Sound Power. Install this application in your 2260 Investigator, mount the probe, and you have a complete sound intensity measuring system that is truly portable. And because the intensity probe is an integral part of the instrument, there are no wires to get tangled up when measuring in out of the way places. The on-screen display guides you through, for example, the required measuring grid, and if there is any uncertainty about the validity of a measurement, BZ 7205 software will prompt you to redo it without jeopardising the rest of the total measurement.

FFT Analysis

*Fig. 12
A tonal assessment of an FFT spectrum using the built-in JNM2 algorithm. The most prominent tone has been found at 949.2 Hz*

Use BZ 7208 software in your 2260 Investigator for sound or vibration FFT analysis when investigating machinery, for troubleshooting, pure tone investigation, product development, quality control and building vibration analysis. This unique, hand-held FFT analysis system gives you single-channel, real-time operation (no data loss) with internal and external triggers. You can measure transient and continuous signals with a maximum frequency span of 20 kHz (minimum 156 Hz).

There are 429 lines (better than 50 Hz resolution at 20 kHz span), and you can zoom down to better than 0.5 Hz resolution. You can see FFT autospectra, Lin or A-weighted, and compare a measured spectrum to stored reference spectra. PC software is also available for analysis, reporting and archiving.

7

Data Management and Reporting

For comprehensive data management and reporting, consider 2260 Investigator together with one of following dedicated PC-software packages:

o Type 7815 Noise Explorer – data viewing software
o Type 7820 Evaluator – data viewing and calculation software
o Type 7825 Protector – software for calculation of Personal Noise Exposure
o Type 7830 Qualifier – software for viewing and calculation of airborne sound insulation, impact sound insulation and reverberation time

All of the packages allow you to transfer relevant measurement data, using PC-cards or serial interface, from 2260 Investigator to the PC. Moreover, with Evaluator you also have the ability to use a dial-up modem as part of the serial link – ideal for long-term monitoring jobs in out of the way places.

Fig. 13
A typical Noise Explorer screen showing profile, spectrum and statistical displays of measurement data
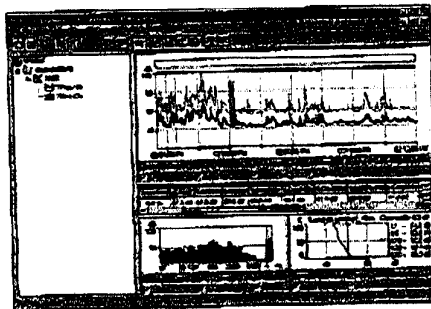
Noise Explorer, Evaluator, Protector and Qualifier all support a wide range of user-definable graphic and tabular displays. Graphs and tables can be imported into standard Windows applications such as word processors and spreadsheets. Additionally, Noise Explorer, Evaluator and Protector are able to be controlled by 2260 Investigator, via the serial link, to produce time-stamped sound files stored on the PC. The analogue sound signal from 2260 Investigator is input via the PC's sound card.

Fig. 14
A typical Evaluator display. The table shows Rating Level calculation results based on marked parts of the measured profile
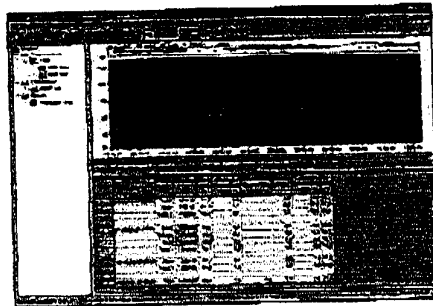
Evaluator Type 7820 has built-in calculation algorithms that allow you to produce compound sound level figures from several contributions (as shown in Fig. 14), some perhaps with impulse or pure tone penalties, according to which measurement standard you choose, for example ISO 1996, DIN 45 645, TA Lärm, NF S 31-010, BS 4142.

Protector Type 7825 calculates noise exposure according to ISO 9612.2. For situations where only workpoint noise measurements are available, Protector can combine these measurements with a profile of a person's movements simulating their personal noise exposure.

Qualifier Type 7830 can further post-process and document your airborne, façade, impact or reverberation-time measurements made with Type 2260. With Qualifier it is possible to manually adjust data used in calculations, for example, to change levels or reverberation times. The results can be observed immediately.

Direct Printing and Export

When directly connected to a printer, for example Portable Printer Type 2322, you can print data graphically or numerically just as it appears on the 2260 screen.

Moreover, 2260 Investigator can output data (via its serial interface) to a spreadsheet format, so that you can easily import your measurements into a spreadsheet for further processing and presentation in reports.

8

Compliance with Standards

CE. C	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 IEC61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use. UL3111-1: Standard for Safety – Electrical measuring and test equipment.
EMC Emission	EN/IEC61000-6-3: Generic emission standard for residential, commercial and light industrial environments. EN/IEC61000-6-4: Generic emission standard for 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. Note: The above is only guaranteed using accessories listed in this Product Data sheet.
EMC Immunity	EN/IEC61000-6-1: Generic standards – Immunity for residential, commercial and light industrial environments. EN/IEC61000-6-2: Generic standards – Immunity for industrial environments. EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements. Note: The above is only guaranteed using accessories listed in this Product Data sheet.
Temperature	IEC 60068-2-1 & IEC 60068-2-2: Environmental Testing. Cold and Dry Heat. Operating Temperature: < 0.5 dB, –10 to +50 °C (14 to 122 °F) Storage Temperature: –25 to +70 °C (–13 to 158 °F)
Humidity	IEC 60068-2-3: Damp Heat: 90% RH (non-condensing at 40 °C (104 °F)). Effect of Humidity: < 0.5 dB for 30% < RH < 90% (at 40 °C (104 °F) and 1 kHz)
Mechanical	Non-operating: IEC 60068-2-6: Vibration: 0.3 mm, 20 m/s², 10–500 Hz IEC 60068-2-27: Shock: 1000 m/s² IEC 60068-2-29: Bump: 1000 bumps at 250 m/s²
Calibration	Initial factory calibration traceable in conjunction with ISO 9001.

Specifications – 2260 Investigator with BZ7210 or BZ7206

Specifications apply to 2260 Investigator fitted with the supplied microphone and input stage. and running BZ7210 or BZ7206

STANDARDS
Conforms with the following:
- IEC60651 (1979) plus Amendment 1 (1993–02) and Amendment 2 (200–10), Type 1
- IEC60804 (2000–10) Type 1
- IEC61672-1 (2002–05) Class 1
- DIN45657 (1997–07)
- IEC61260 (1995–07) plus Amendment 1 (2001–09), Octave and 1/3-octave Bands, Class 0
- ANSI S1.4–1983 (R1997) plus ANSI S1.4A–1985 Amendment, Type 1
- ANSI S1.43–1997 Type 1
- ANSI S1.11–1986 (R1993), Octave and 1/3-octave Bands, Order 3, Type 0-C, Optional Range

SUPPLIED MICROPHONE
Type 4189: Prepolarized Free-field ½" Microphone
Nominal sensitivity: –26 dB ±1.5 dB re 1 V/Pa
Capacitance: 14 pF (at 250 Hz)

INPUT STAGE
ZC 0026
Extension Cables: Up to 100 m in length between the input stage and the Type 2260 can be driven by the input stage

MEASURING RANGES
Linear Operating Range: 80 dB adjustable to give full-scale readings from 80 dB to 130 dB in 10 dB steps
Max. Peak Level: 3 dB above full scale reading
Upper Limit (RMS) for Crest Factor = 10: 17 dB below full scale reading
Passive Attenuation: Microphone attenuator ZF0023 (included) effectively increases all full-scale readings by 20 dB

OCTAVE AND 1/3-OCTAVE BAND FILTERS
Octave Band Centre Frequencies: 8 Hz to 16 kHz
1/3-octave Band Centre Frequencies: 6.3 Hz to 20 kHz

DETECTORS
Parallel detectors on every measurement:
A-weighted broad-band detector channel with three exponential time weightings (Fast, Slow, Impulse), one linearly averaging detector and one peak detector
C- or L-weighted (switchable) as above for A-weighted
Octave and 1/3-octave band filters, pre-weighted either A-, C- or L-, each with a detector channel containing one linearly averaging detector and one exponentially averaging detector switchable between Slow or Fast
Overload detector which monitors the overload outputs of all the frequency weighted channels

INHERENT NOISE LEVEL
(Combination of electrical noise and microphone thermal noise at 20°C). Typical values with supplied microphone of nominal sensitivity:

Weighting	Electrical Noise (2260)	Thermal Noise (4189)	Combined Noise
"A"	12.3 dB	14.6 dB	16.6 dB
"C"	14.0 dB	15.3 dB	17.7 dB
Lin. 5 Hz–20 kHz	19.2 dB	15.3 dB	20.7 dB
Lin. 3 Hz–20 kHz	26.4 dB	15.3 dB	26.7 dB

CORRECTION FILTERS
Sound Incidence: Built-in filters for correction of frontal/random sound incidence
Windscreens: Built-in filters for correcting the influence of Protective Cover UA 1236, and Windscreens UA 0459 and UA 0237

9

MEASUREMENTS
V = frequency weightings C or L
X = frequency weightings A, C or L
Y = time weightings S, F
N = number
M = set level

For Display and Storage (Broadband)

Start Date	Start Time	
Stop Date	Stop Time	Measurem. No.
Elapsed Time	No. of Pauses	Overload %
Underrange %	$L_{Apk(MaxP)}$	$L_{Vpk(MaxP)}$
#Peaks A>M	#PeaksV>M	$L_{AE(ASEL)}$
L_{Aeq}	L_{Veq}	L_{Alm}
L_{VIm}	$L_{Veq-LAeq}$	$L_{Alm-LAeq}$
L_{ASTm3}	L_{AFTm3}	L_{AITm3}
L_{VSTm3}	L_{VFTm3}	L_{VITm3}
L_{ASTm5}	L_{AFTm5}	L_{AITm5}
L_{VSTm5}	L_{VFTm5}	L_{VITm5}
L_{ASMax}	L_{AFMax}	L_{AIMax}
L_{ASMin}	L_{AFMin}	L_{AIMin}
L_{VSMax}	L_{VFMax}	L_{VIMax}
L_{VSMin}	L_{VFMin}	L_{VIMin}
L_{XYN1}	L_{XYN2}	L_{XYN3}
L_{XYN4}	L_{XYN5}	$L_{AEP,d}$
Distribution	Cumulative Distribution	
Event No.*	Event Sample No.*	

For Display and Storage (Octave or 1/3-octave Bands)

L_{Xeq}	L_{XYMax}	L_{XYMin}
L_{XYN1}*	L_{XYN2}*	L_{XYN3}*
L_{XYN4}*	L_{XYN5}*	
Level Distribution*	Cumulative Distribution*	

Only for Display as Numbers or Bargraphs (Broad-band)

$L_{AS(SPL)}$	$L_{AF(SPL)}$	$L_{AI(SPL)}$
$L_{VS(SPL)}$	$L_{VF(SPL)}$	$L_{VK(SPL)}$
$L_{AS(Inst)}$	$L_{AF(Inst)}$	$L_{Ai(Inst)}$
$L_{VS(Inst)}$	$L_{VF(Inst)}$	$L_{Vi(Inst)}$
L_{AST3}	L_{AFT3}	L_{AIT3}
L_{VST3}	L_{VFT3}	L_{VIT3}
L_{AST5}	L_{AFT5}	L_{AIT5}
L_{VST5}	L_{VFT5}	L_{VIT5}
$L_{Apk(Peak)}$	$L_{Vpk(Peak)}$	

For Storage During Logging (Broadband)
Nothing or
All parameters or
All parameters without statistics or
6 Major Parameters:

L_{Aeq}	$L_{Cpk(MaxP)}$	(or $L_{Lpk(MaxP)}$ if L is selected)
L_{AFMax}	L_{Ceq}	(or L_{Leq} if L is selected)
L_{AFMin}	L_{Alm}	

For Storage During Logging (Spectrum)
Nothing or
All parameters or
All parameters without statistics* or
L_{eq} (pre-weighting A, C or L as selected)

Only for Display as Numbers or Spectra (Octave or 1/3-octave Bands)
$L_{XY(SPL)}$ $L_{XY(Inst)}$

SAMPLING FOR STATISTICS
The octave or 1/3-octave Band level Distribution*, Cumulative Distribution* and statistics L_{XYN1-5}* are based on sampling L_{XY}(Inst.) every 100 ms into 1 dB wide classes over a range of 80 dB
The broad-band Level Distribution, Cumulative Distribution and Statistics L_{XYN1-5} are based upon sampling $L_{XY(Inst)}$ every 10 ms into 0.2 dB wide classes over 80 dB

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* BZ 7206 only

FAST LOGGING (BZ 7206 only)
Broadband $L_{AF(Inst.)}$ may be stored every 100 ms during background logging and/or during event logging

CALIBRATION
Initial calibration is stored for comparison with later calibrations.
Acoustic: Using Multifunction Acoustic Calibrator Type 4226, Pistonphone Type 4228 or Sound Level Calibrator Type 4231
Electrical (internal): Uses internally generated electrical signal combined with a keyed-in value of microphone sensitivity.
Initial calibration is stored for comparison with later calibrations
CIC (Charge Injection Calibration): Injects internally generated electrical signal in parallel with microphone diaphragm.
Reference CIC ratio is stored for comparison with later CIC
• A reference CIC is done automatically during External or Internal calibration and stored for later comparison with a new CIC
• A manual CIC can be done whenever no measurement is in progress
• An automatic CIC can be part of a logging measurement, where the CIC repetition rate can be set to be up to 4 times in a 24 hr. period.
• An automatic CIC starts at a "logical" break in a measurement sequence, shortening the following measurement period by 15 s

MEASUREMENT CONTROL
Measurement Types:
Manual – manually controlled single measurement
Automatic – with pre-set measurement time from 1 s to 100 hours in 1 s steps (BZ 7210 only)
Sequence – repetition of a single measurement up to 9999 times (results stored with or without statistical data). Measurement time selectable from 1 s to 100 hours in 1 s steps (BZ 7206 only)
Logging – a single measurement with a selectable duration of 1 s to 100 days in 1 s steps. Logging duration divided into logging intervals of 1 s to 100 hours in 1 s steps
Logging with Events – as Logging, but with the ability to measure a different set of parameters and timebase when an event trigger is recognised (BZ 7206 only)
Elapsed Time:
When not in Logging mode, elapsed time resets/starts and pauses/continues according to the respective command. In Logging Mode, elapsed time continues in real-time, regardless of pauses in a measurement

TRIGGERS (BZ 7206 only)
Four types of event trigger are available:
• Level – monitors $L_{AF(Inst)}$ every 1 s. Event triggered when $L_{AF(Inst)}$ exceeds the set level for set period (both user-defined for 1 dB/1 s increments)
• Softkey – using <Start Event> and <Stop Event> softkeys
• External – +5V on pin 9 of serial interface
• Remote – start and stop commands sent over the serial interface
All triggers can have pre- and post-trigger time intervals of up to 15 s (in 1 s increments) allocated to them

GPS DATA
A position can be attached to a measurement job by inputting data from a GPS (Global Positioning System) receiver via the Serial Interface
Receiver Standards Supported: NMEA 0183 ver. 2.20, optional corrected to Differential GPS using RTCM 104 ver. 2.1
Baud Rate: 4800 bps

TIMERS
Up to nine independent timers can be specified. Each timer "wakes-up" the analyzer at a specified date and time and initiates a measurement in accordance with pre-defined set-ups. Timed measurement can be repeated up to 999 times. Timers from different software applications can be mixed

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BACK ERASE

Up to the last 15 s of data can be erased.

MARKERS

One data exclusion marker and four user-definable markers for on-line annotation of sound categories heard during the measurement (logging only)

Markers can be edited, while measuring, up to 60 s after the sound is heard (BZ 7206 only)

CONTROL OF SOUND RECORDING

Sound recording (.wav files on a PC using 7815, 7820 or 7825) can be controlled from 2260 via RS-232 interface and Aux output connected to the sound card on a PC

Markers and Events (BZ 7206 only) can be used to control recording on a PC

MEASUREMENT DISPLAYS

SLM: One main and five secondary parameters can be specified plus one analogue bar with zoom facilities

Cumulative Distribution for one of the octave bands (BZ 7206 only) or 1/3-octave bands (BZ 7206 only) or broad-band plus one analogue bar

Level Distribution for one of the octave bands (BZ 7206 only) or 1/3-octave bands (BZ 7206 only) or broad-band. Class width can be specified. Also with one analogue bar. Zoom facilities provided

Profile: The last 15 s of $L_{AF(Inst)}$ plus one analogue bar for manual or measurement sequence type or the last 60 s with markers for logging measurements

Spectrum: Octave or 1/3-octave band spectrum + two broad-band bars plus one peak bar. Zoom facilities provided.

The four graphical displays also have cursor read-out facilities

CIC: Periodic CICs viewed during or after a measurement

STORAGE SYSTEM

Internal Hard Disk: 32 Mbyte for application software, user set-ups and data

External Memory Card for store/recall of measurement data (SRAM or SanDisk ATA Flash Cards)

MS-DOS® compatible file system (from ver. 3.3)

SERIAL PRINTER/OUTPUT

Set-ups and measurement data can be printed on an IBM® Proprinter® (or compatible), Portable Printer Type 2322 or 2318. The formats can be screen dumps, tables or graphs

Measurement data can be output in spread sheet format or as a binary file for post processing on a PC

HELP AND USER LANGUAGES

Concise context-sensitive help throughout in English, German, French, Italian, Spanish, Czech

CLOCK

Back-up battery powered clock. Accuracy better than 1 minute per month

DISPLAY

Type: Transflective back-lit LCD 192 × 128 dot matrix with internal temperature compensation

INPUT STAGE CONNECTION

Connector: 10-pin LEMO

AUX. OUTPUTS (2 independent)

Can be set to:

LAF(Inst.): 0 to 4 V DC signal updated every 100 ms

Reference: 4 V square-wave for output calibration

Meas. Status for triggering external devices during measurements (including SONY TCD-D7/D8 and TCD-D100 DAT)

Signal from amplified frequency weighted signal (A, C/L)

Event from amplified frequency weighted signal (A, C/L) during events only

Event Status: as Meas. Status, but only during events (BZ 7206 only)

Limited Event Status: as Event Status, but with a maximum specified duration (1 s to 100 mins.) (BZ 7206 only)

AC INPUTS/OUTPUTS(2)

As Output: Buffered, unweighted microphone signal

Output Impedance: 2 × 200 Ω

Maximum Load: 47 kΩ||200 pF (Short-circuit protected)

As Normal Input: Alternative to microphone input

As Hand-arm Vibration input: For use with 3-channel Human Vibration Front-end Type 1700 – indication of a_{hw} in m/s^2 in the Spectrum display

As Whole-body Vibration Input: For use with 3-channel Human Vibration Front-end Type 1700 – indication of a_{wx}, a_{wy}, a_{wz} and a_v in m/s^2 in the Spectrum display

Connector: 3-pin LEMO (balanced input)

SERIAL INPUT/OUTPUT

Conforms to EIA ITIA 574 (RS 232), coupled as data terminal equipment (DTE)

Connector: 9-pin D-type male

Baud Rates: 1200, 2400, 4800, 9600, 19200, 38400, 115200

Word Length: 8 bits, no parity or stop bits

Handshake: None, XON/XOFF, RTS/CTS

PCMCIA INPUT/OUTPUT

Computer with PCMCIA/JEIDA standards release 1.0.

SETTLING TIME

From Power On: approximately 35 s

BATTERIES

Type: 6 × LR14/C-size 1.5 V alkaline

Lifetime (at 20°C): 5 to 9 hours continuous

EXTERNAL DC POWER SUPPLY

Voltage: regulated or smoothed 10 to 14 V, max. ripple 100 mV

Power: 3.5 W, current: 300 mA, Inrush current: 1000 mA

Socket: Ø5.5 mm with Ø2.1 mm pin (positive)

WEIGHT AND DIMENSIONS

1.2 kg (2.6 lb.) with batteries

375 × 120 × 52 mm (14.8 × 4.7 × 2.0 ")

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Ordering Information

Type 2260	Modular Precision Sound Analyzer including Basic Sound Analysis Software BZ7210
Type 2260F	Modular Precision Sound Analyzer with Enhanced Sound Analysis Software BZ7206
BZ7206	Enhanced Sound Analysis Software

Accessories included with the Modular Precision Sound Analyzer

BZ7210	Sound Analysis Software
Type 4189	Prepolarized Free-field ½" Microphone
ZC0026	Input Stage
ZF0023	20 dB Capacitive Attenuator
AO1442	9-pin to 25-pin PC or serial printer interface cable
UA1236	Protective Cover
UA0237	Large Round Windscreen
DH0696	Wrist Strap
KE0342	Shoulder Bag (with room for 2260 and 4231)
6 × QB0009	1.5 V LR 14/C size alkaline cells

Optional Accessories

CALIBRATION

Type 4226	Multifunction Acoustic Calibrator
Type 4228	Pistonphone
Type 4231	Sound Level Calibrator (fits in KE0342)
2260 CAI	Accredited Initial Calibration of Type 2260
2260 CAF	Accredited Calibration of Type 2260

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

Type 7830	Qualifier – software for viewing and calculation of airborne sound insulation, impact sound insulation and reverberation time
Type 2322	Portable Printer
UL 1008	32 Mbyte ATA Flash Memory Card

MAINS POWER SUPPLIES

ZG0386	EU Version
ZG0387	UK Version
ZG0388	US Version

MEASURING

Type 3592	Outdoor Measuring Gear (see Product Data BP1744)
AO0440	AC input/output cable
AO0441	3 m Microphone Ext. Cable
AO0442	10 m Microphone Ext. Cable
AO0522	Headphones Adaptor
AO0543	2260 to Jack Cable
AO0586	Cable from 2260 to Audio input on a PC
AQ1698	Cable for 12 V Supply
AQ1700	Remote Control Cable for SONY TCD – D7/D8
KE0371	Carrying Case for 2260 and accessories
QB0051	12 V Battery
UA0459	Small Round Windscreen
UA0587	Tripod
UA0801	Small Tripod
UA1317	Microphone Holder
UA1404	Outdoor Microphone Kit
ZG0404	Battery Charger, 100 – 240 V AC
ZH0631	Event Hand-switch

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

Brüel & Kjær

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