PRODUCT DATA

Modular Precision Sound Analyzer — 2260 Investigator™ with Basic Sound Analysis Software — BZ 7210

2260 Investigator™ is a versatile, hand-held, battery-operated, two-channel sound analyzer comprising hardware and embedded operating-system software. It is the ideal platform for high-quality, real-time sound analyses. Like a personal computer, it is driven by application software for various tasks.

Basic Sound Analysis Software BZ 7210, shipped with 2260 Investigator, converts the instrument into a precision sound level analyzer which conforms with IEC and ANSI Type 1 standards. Besides the vast array of simultaneously measured parameters (including statistics), direct interfacing with a PC enables data to be downloaded using optional Windows" software developed by Brüel & Kjær.

Other applications available for 2260 Investigator include Enhanced Sound Analysis (BZ 7202), Noise Profile (BZ 7203), Building Acoustics (BZ 7204), Sound Intensity (BZ 7205), Enhanced Sound Analysis 20 kHz (BZ 7206), Room Acoustics (BZ 7207) and FFT Analysis (BZ 7208). These applications are installed into the instrument from PC-cards.

2260/BZ 7210

Brüel & Kjær

USES	❍ Comprehensive sound measurements
	❍ Detailed octave and $^1/_3$-octave band analyses
	❍ Appraisal of noise reduction efforts
	❍ Gathering field-data for further analyses
	❍ Research and development
FEATURES	❍ IEC and ANSI Type 1 sound level meter
	❍ Real-time octave and $^1/_3$-octave band analyses
	❍ Display zoom and cursor facilities
	❍ Lightweight, hand-held, real-time analyzer
	❍ Broad-band statistics
	❍ Multi-language (GB, D, F, I, E) user interface with context-sensitive on-line help

The Platform Expands

2260 Investigator™ is a precision sound analyzer based on a unique platform concept. This Product Data describes 2260 Investigator driven by the Basic Sound Analysis Software BZ 7210, together with details of new features and upgrades.

2260 Investigator is better than ever. The potent combination of upgraded tools and unique application software ensures that 2260 Investigator remains the world's most advanced hand-held, battery operated sound analyzer. A wealth of improvements make 2260 Investigator unbeatable value for even the most discriminating acoustic specialist.

Functionally, the 2260 platform has generous hardware and software specifications (see specifications) suiting an extremely flexible instrument to cover all your current and future sound analyses needs. Simply by loading different software applications provided by Brüel & Kjær on industry standard PC-cards, you change the functionality of the instrument as easily as changing from using a word processor to a spreadsheet on your PC.

2260 Investigator is now shipped with Basic Sound Analysis Software BZ 7210. With this, the analyzer becomes a Type 1 sound level meter with real-time $^1/_3$-octave frequency analysis and Broadband statistical distributions.

For storage, overview and post-processing, the data may be transferred to a PC using the new Noise Explorer™ or Evaluator™ software. Data is displayed graphically or as tables.

If you choose Evaluator you can work with profiles and events on your PC. You can view $^1/_3$-octave spectra to estimate penalties for tonal content. Furthermore you can combine a number of measurements to produce Rating Level figures according to national and international standards.

With Noise Explorer software, transfer your data from 2260 Investigator via a PC-card or an RS–232 serial interface. Use Noise Explorer to manage your data, for example creating backup files of the most important "reference" measurements.

Fig. 1
The slim shape of the 2260 Investigator has a purpose beyond good looks: the effect on the sound field is minimised, assuring accurate measurements. The directional characteristics when fitted with microphone Type 4189 at 1, 2, 4, 8 and 12.5 kHz are shown here for both lateral (red curves) and longitudinal (blue curves) directions
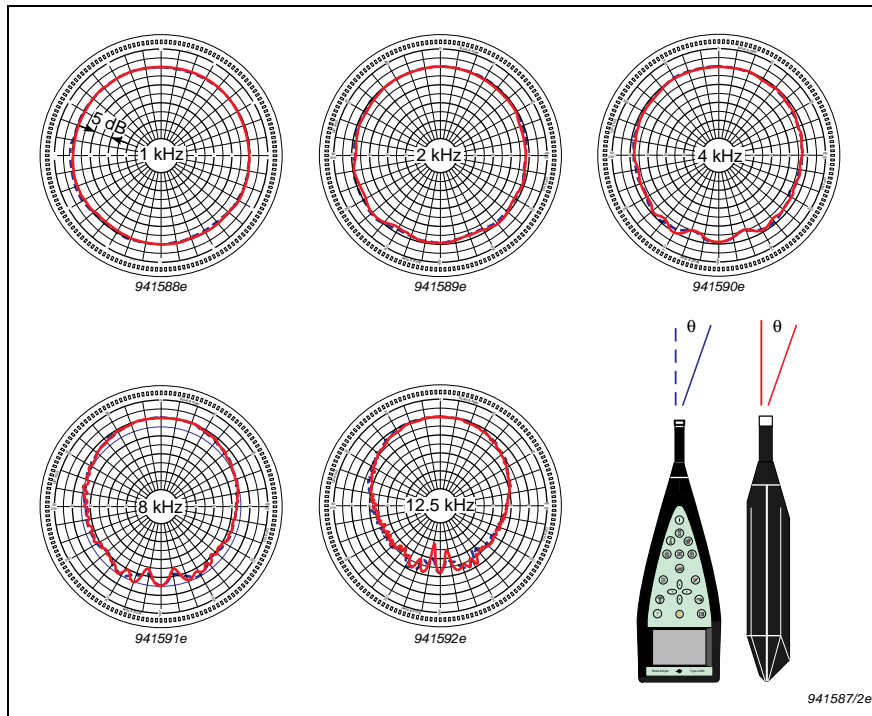
Enhanced Sound Analysis

For all of the benefits BZ 7210 can offer, and more, choose Enhanced Sound Analysis Software 20 kHz BZ 7206. This application has a range of new features, including sound recording and an automatic Charge Injection Calibration (CIC) facility for checking microphone condition. Measurements may be programmed using automatic sequences or timers, and spectral statistics may be measured.

Inputs and Outputs available with BZ 7210

Fig. 2
The inputs and outputs of 2260 Investigator
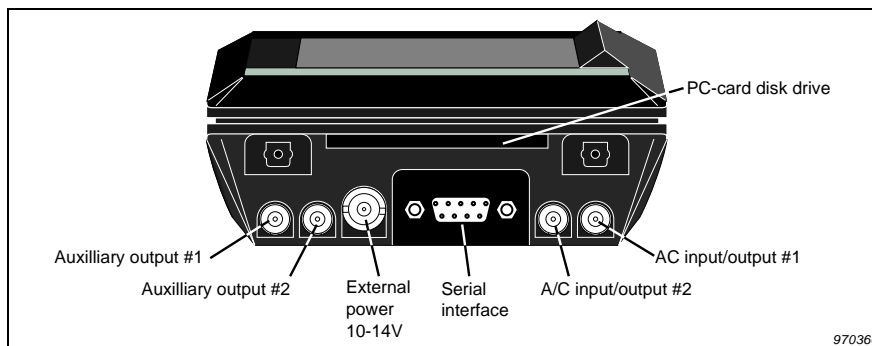
Microphone/Input Stage

2260 Investigator is supplied with a Falcon™ Range $1/2''$ microphone and input stage that conform to IEC and ANSI Type 1 standards. Its input stage is able to drive an extension cable of up to 100 m placed between the microphone/input-stage assembly and the main body; 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, and 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.

RS–232 Serial Interface

2260 Investigator has an RS–232 standard serial interface that allows easy data transfer and remote control of the instrument. Both Noise Explorer and Evaluator software can use this interface to transfer data at up to 38,400 bps. If you use Evaluator you also have the ability to use a dial-up modem – ideal for long-term monitoring jobs in out of the way places.

Calibration Features Available with BZ 7210

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 sound source, such as Brüel & Kjær's Sound Level Calibrator Type 4231 or Pistonphone Type 4228, or the Multifunction Acoustic Calibrator Type 4226. This method calibrates everything in the measurement chain.

### 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 (EK 0462) is done only at the factory. If you need one, or need to renew the one in your analyzer, contact your Brüel & Kjær representative.

Charge Injection Calibration

Basic Sound Analysis BZ 7210 uses the 2260 Investigator's CIC (Charge Injection Calibration) facility. CIC allows the analyzer to monitor the measurement chain right from the microphone diaphragm. 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 initiate a CIC and compare to the reference (see Fig. 3). A stable CIC ratio assures stable operation of microphone, cable, preamplifier and the remaining measurement system.

Fig. 3

Charge Injection Check. High-leakage resistance capacitor C_c is set in parallel with the microphone and 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 preamplifier gain (g), cable parameters, microphone capacitance (C_m), etc., will change e_o/e_i, and hence indicate probable changes in calibration

$$\frac{e_o}{e_i} = g\left(\frac{C_c}{C_m + C_i + C_c}\right)$$

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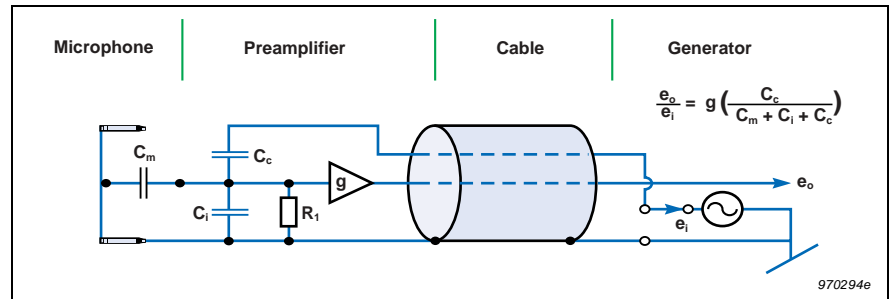
Making Measurements with BZ 7210

However many noise parameters (discrete, spectral and statistical) you select to measure with the 2260 Investigator, they will all be measured concurrently. Serial measurements which are expensive and time-consuming (or downright impossible!) are simply not necessary.

2260 Investigator's real-time digital signal processor (DSP) allows you viewing access at any time to all the parameters measurable. Each parameter can be regarded as a point in a multi-point array continuously being updated. 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, **(broad-band) or** L_{Ceq}-L_{Aeq} **which is 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.**

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

Measurement Parameters

You can see from the specifications box that 2260 Investigator can measure an impressive array of parameters based on various combinations of time and frequency weightings, filtering, detection of peaks, and so forth.

During measurements, the A-weighted, and C or L-weighted sound signals are sampled by two 18-bit A/D converters and processed by the real-time DSP. The DSP continuously calculates the current values for the whole array of selected sound parameters. You can display these immediately and store later when the measurement is completed.

Viewing and Display
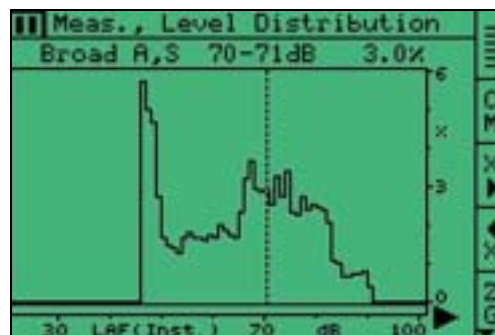
During measurement, or when a set of measurements are in the memory, you can view the data in a number of ways. Spectral data (in octave or $1/3$-octave bands) and statistical data (level and cumulative distributions) can be displayed graphically, complete with display zoom and cursor facilities.

Data & File Management
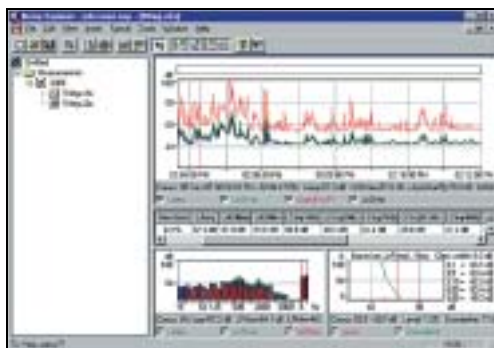
The optional Noise **Explorer Type 7815 PC** software allows you **to download measure-ment** data from 2260 Investigator to a data-base. You **decide later what data to view** and present. Noise Explorer supports a wide range of user-definable graphic and tabular displays. **Graphs and tables can be import-**ed into standard Windows applications such as word processors and spreadsheets.

2260 Investigator also allows data exchange using **PC-cards and serial interface. 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.**

The **Investigator's file structure is based upon embedded MS-DOS**® software, allowing file-management facilities as well as data transfer to and from a PC. 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.

Application Software

Enhanced **Sound Analysis Software**
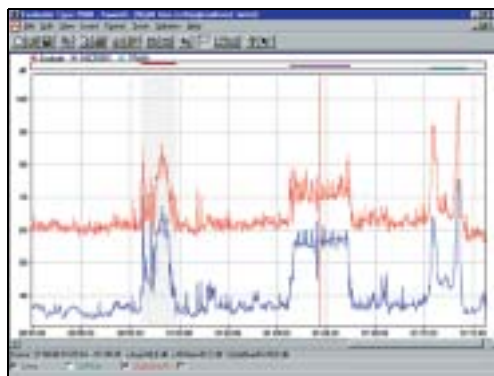
For a comprehensive data management and reporting system, consider Enhanced Sound Analysis Software BZ 7206 for 2260 Investi-gator and Evaluator Type 7820 software **for** your PC. This powerful combination of measurement and **post-processing software** should cover all your community noise measurement requirements. **Evaluator has** built-in calculation algorithms that allow you to produce compound sound level figures from several contributions, **some perhaps** with impulse or pure tone penalties, accord-ing to which measurement standard you choose, for example ISO 1996, DIN 45 645, TA Lärm, NF S 31-010, BS 4142.

Building Acoustics
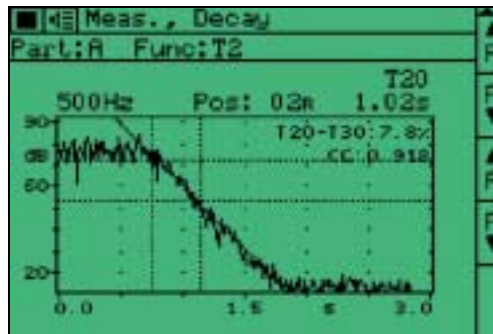
If it is a building acoustics **measurement** problem that you have to solve, choose 2260 Investigator **with Building Acoustics Software BZ 7204 installed. When your measure-**ments are complete, you can, **for example,** immediately see the reverberation decay curve on the analyzer's screen. For a more in-depth analysis, choose **Qualifier**™ Type **7830 software which is dedicated to working** directly with data supplied by BZ 7204. As well as further analysis of building acoustics measurements, Qualifier allows you to create convincing documentation of your work using its powerful reporting and **exporting** tools.

Sound Intensity
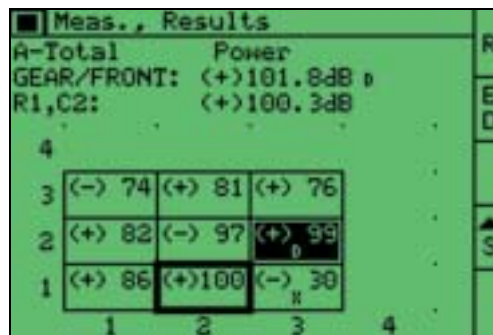
BZ 7205 software is dedicated to **measuring** sound intensity and calculating Sound Pow-er. Install this application in your 2260 In-vestigator, mount the probe, and you have a complete sound intensity measuring sys-tem that is truly portable. **And because the** intensity probe is an integral part 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 jeopard-ising **the rest of the total measurement.**

Fig. 4
2260 Investigator is truly portable. Whichever application you choose to run, you will always be sure of having a laboratory-grade instrument right in the palm of your hand

Use BZ 7208 software **in your 2260 for sound or vibration FFT analysis when investigating** machinery, for troubleshooting, pure tone investigation, product development, quality control and building vibration analysis. **This 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 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.

Compliance with Standards

CE, $\circledcirc$	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 and IEC 61000–6–3: Generic emission standard. Part 1: Residential, commercial and light industry. 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 guaranteed using accessories listed in this Product Data sheet only.
EMC Immunity	EN 50082–1 and IEC 61000–6–1: Generic immunity standard. Part 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 and IEC 61000–6–2: Generic immunity standard. Part 2: 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 guaranteed using accessories listed in this Product Data sheet only.
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/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 – 2260 Investigator with BZ 7210

Specifications apply to 2260 Investigator fitted with the supplied microphone and input stage, and running BZ 7210 software

STANDARDS
Conforms with the following:
- IEC 651 (1979) **Type 1 plus Amendment 1**
- IEC 804 (1985) Type 1 plus Amendment 2
Conform to IEC 1260 (1995) and ANSI S1.11-1986
- IEC 1260 (1995) Octave and $^1/_3$-octave **Bands Class 0**
- ANSI S1.4 (1983) Type 1
- ANSI S1.43-199X Type 1 (Draft 1993)
- ANSI S1.11-1986 Octave and $^1/_3$-octave Bands, Order 4, Type 0-B, 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 70 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 Bands centre frequencies: 31.5 Hz to 8 kHz
$^1/_3$-octave Bands centre frequencies: 16 Hz to 12.5 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 (with the following exceptions for B×T-product reasons) Fast:

1/3-octave centre frequency (Hz)	Time constant (ms)	Averaging time (ms)
100, 80 63	250	500
50, 40 31.5	500	1000
25, 20, 16	1000	2000 (Slow)

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

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

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>L	# PeaksV>L	$L_{AE(ASEL)}$
L_{Aeq}	L_{Veq}	L_{AIm}
L_{VIm}	$L_{Veq-LAeq}$	$L_{AIm-LAeq}$
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}	$L_{AEP,d}$
Level Distribution	Cumulative Distribution	

For Display and Storage (Octave or $^1/_3$-octave Bands)

L_{Xeq}	L_{XZMax}	L_{XZMin}

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

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

Only for Display as Numbers or Spectra (Octave or $^1/_3$-octave Bands)

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

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

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

PRESET MEASUREMENT TIME
Selectable from 1 s to 99 h:59 m: 59 s in 1 s steps

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

MEASUREMENT DISPLAYS
SLM: One main and five secondary parameters can be specified plus one analogue bar with zoom facilities
Cumulative Distribution for broad-band plus one analogue bar

Level Distribution for 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
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

STORAGE SYSTEM
Internal hard disk: 32 Mbyte for application software, user set-ups and data
Application Card for installation of application software
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

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:
L_{AF}(Inst.) 0 to 4 V DC signal updated 10 times per s
Meas. Status 0 or 5 V for triggering
Signal from amplified frequency weighted signal

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 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
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 25 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 mm pin (positive)

WEIGHT AND DIMENSIONS (as illustrated)
1.2 kg (with **batteries**), **375** × 120 × 52 mm

Ordering Information

Type 2260   Modular Precision Sound Analyzer

Accessories included with the platform
BZ 7210   Basic 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×QB 0009   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 KE 0342)
EK 0462   Accredited Initial Calibration of Type 2260

INTERFACING
Type 7815   Noise Explorer – data viewing software

TRADEMARKS
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IBM and Proprinter are registered trademarks of International Business Machines Corporation

Type 7820   Evaluator – data viewing and calculation software
Type 2322   Portable Printer
AO 1442   9-pin to 25-pin PC or serial printer interface cable
VD 4700   1 Mbyte SRAM Memory Card
UL 1001/2/3   5/10/20 Mbyte ATA Flash Memory Cards

MAINS POWER SUPPLIES
ZG 0386   EU Version
ZG 0387   UK Version
ZG 0388   US Version

MEASURING
UA 0801   Small Tripod
UA 0587   Tripod
UA 0522   Headphones Adaptor
KE 0371   Carrying Case for 2260 and accessories
UA 1404   Outdoor Microphone Kit
UA 0237   Large Round Windscreen
UA 0459   Small Round Windscreen
UA 1317   Microphone Holder
AO 0440   AC input/output cable
AO 0441   3 m Microphone Ext. Cable
AO 0442   10 m Microphone Ext. Cable

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

Brüel & Kjær