PRODUCT DATA

**Investigator™ Modular Precision Sound Analyzer — Type 2260C
Including Noise Profile Software BZ7203**

A Powerful Combination

A software-driven hand-held sound level analyzer (Investigator™ Type 2260C) and dedicated post-measurement PC software (Evaluator™ Type 7820) is a powerful combination for analysing, evaluating and reporting on the fluctuations of ambient noise in any community.

Consisting of the 2260 platform and Noise Profile Software BZ7203, the Investigator Type 2260C is effectively an electronic level recorder which measures and logs noise levels over a 110 dB dynamic range. It also has extensive capabilities for on-the-spot, meaningful data processing, including measurement annotation.

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2260C

Brüel & Kjær

❍ Noise profile measurement, for example, of:

- Industrial and construction site noise
- Residential noise
- Road and rail traffic noise

❍ Evaluation of noise in the environment against noise limits according to international and national legislation

❍ Continuous logging of up to 19 noise parameters

❍ Periodic reports of levels and statistics

❍ On-line annotation and data exclusion

❍ 110dB dynamic range

Measurements in the Field

Fig. 1 2260C simultaneously records 3 types of data. You can add markers to annotate or exclude data
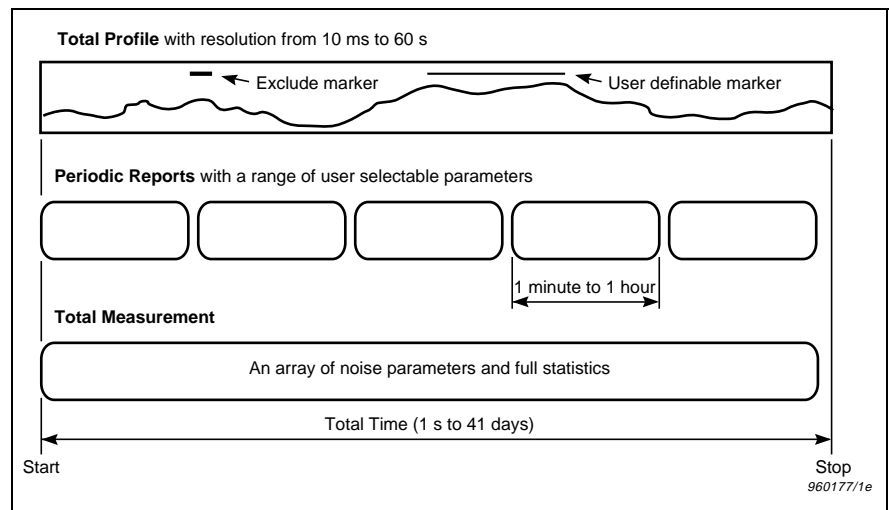
The Investigator Type 2260C including the Noise Profile Software BZ 7203, provides all you need to make valid noise measurements in the field. In this respect you can regard the 2260C as an advanced, multi-channel electronic level recorder which does not need chart paper. Instead, everything is logged electronically, even your annotation marks.

Simultaneous Recording

The 2260C simultaneously records the following (see Fig. 1):

❍ Total Profile
❍ Periodic Reports
❍ Total Measurement

Total Profile

Throughout monitoring, new samples of ambient noise level are logged regularly to the Total Profile. This gives you a plot describing the fluctuations of the ambient noise level. Up to 19 noise parameters can be logged at intervals of 1s and above. At shorter sampling intervals, up to three can be logged.

The Total Profile gives you a graphical overview of parameter levels against time, in much the same way as a level recorder does.

Adding Markers

During the measurement, you can annotate the Total Profile using 5 types of markers. One of these is a "data exclude" marker for excluding unrelated noises, for example, a siren. The other four markers are user-definable and are for annotating particular noises, for example, discrete tones, impulses or barking dogs (see Fig. 2). Data marked with the Exclude Marker is not included in the Periodic Reports and Total Measurement (see below).

Fig. 2 Display of Total Profile showing added markers
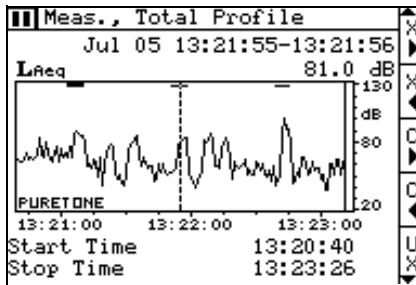
The markers are operated using the Investigator's five soft-keys. You can label the four annotating markers as you wish when you set up the Investigator.

The markers help you to look back on the measurement and see what happened and when. They also make your post-processing simpler by marking the parts of the profile where data should be excluded or where penalties should be added.

Periodic Reports

These are of a pre-selected period length (1 minute to 1 hour) and are produced successively at regular intervals. Each report consists of a pre-selected array of noise parameters, statistics and housekeeping data.

Total Measurement

This is an array of noise parameters, statistics and housekeeping data which is updated every second. They can all be viewed any time during the measurement. A Total Measurement calculates noise-parameter values which describe the ambient noise level as a whole, for example L_{90} can be used to describe background noise, or L_{eq} to describe an average noise level. In many cases, 5 to 10 minutes measurement will suffice to give typical values for longer periods. With a suitable power supply, 41 days of data can be stored.

Viewing Data on the 2260C

The recorded data from a Total Profile or from Periodic Reports can be viewed as a function of time in the profile display. In addition, a table of values from a Periodic Report or from the Total Measurement can be viewed in the sound level meter display. The statistics measured in Periodic Reports or in a Total Measurement can be viewed as level and cumulative distributions.

Data Transfer

Once back at the office, raw data from any or all of the 3 data types (Total Profile, Periodic Report or Total Measurement) can be transferred and viewed on your PC using the Evaluator Type 7820 or Noise Explorer Type 7815. All annotations in the Total Profile are transferred, including marker labels.

Transfer from the 2260C is either direct, via its RS 232 serial interface, or indirect, via PC-cards. A Serial Interface Cable AO 1442 is available for data output to a PC via the serial interface.

Editing and Combining Measurement Results to a Rating Level

Evaluator Type 7820 PC software is specially designed to make calculation of rating levels easy, fast and repeatable. As well as offering comprehensive calculation, file storage and reporting facilities, Evaluator interfaces directly with a number of Brüel & Kjær sound level meters, including Investigator Type 2260C, and direct import of data from other Brüel & Kjær software (for more information, see the Evaluator Product Data Sheet BP 1752-12).

Together, Evaluator and Investigator Type 2260C are a powerful combination for evaluating environmental noise emissions according to a range of international and national standards (for example, in UK, France and USA).

A Clear Data Organisation

Once downloaded, all data relating to a particular task (for example, when evaluating whether a factory exceeds night-time noise limits) are stored together in a "project". A Project Tree View (see Fig. 3) gives an overview of the measured data (Measurements), post-processed data (Calculations) and Rating Level calculations (Results).

Editing Measurements

Imported data is always in read-only form, ensuring the safe-keeping of your hard-won field measurements. This data is found in the Measurements branch of a project.

From here you just drag-and-drop selected measurement data into the Calculations branch for post-processing. For example, the markers assigned by the 2260C Investigator can be adjusted and given attributes such as a penalty for tonal content. You can also cut and paste measurements to isolate certain time periods or combine different profile samples into one long profile.

Of the many unique features of Evaluator, it is worth highlighting the Automatic Marker. With this tool Evaluator can find the loudest period in the data over a specified time, search for and mark constant tones, search for and mark impulse noise, or set up a level trigger that will mark all data above a certain level for a specified period of time, for example to locate aircraft fly-over or auto pass-by events.

Fig. 3 A typical display of the Evaluator Type 7820 showing, on the left, the Project Tree, top right, a Profile with markers and, bottom right, a Rating Level worksheet
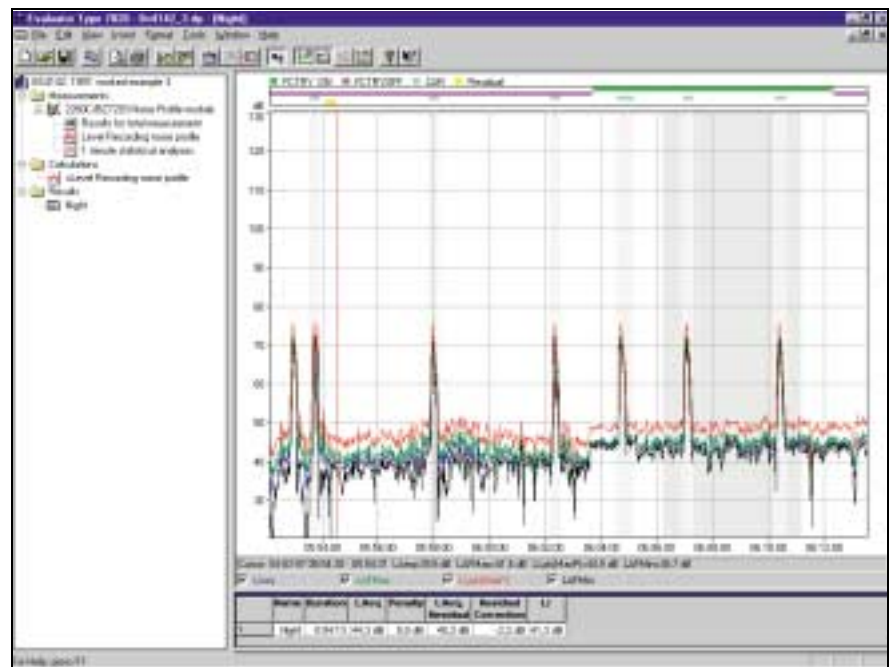
Combining Contributions to give a Rating Level

Once you have selected the data you want and handled it in the Calculations branch, you add the data to the Results branch. The Results branch contains a spreadsheet that you set up to suit the standards to which you are measuring. Different times of day can be specified, impulse corrections can be added, constant tone penalties accounted for - in fact all the different aspects of Rating Level calculation that you will find in the most common international standards.

Reporting Results

Results from any stage in the above process can be output to a printer or to the Windows™ clipboard for inclusion in reports.

More About the Investigator Type 2260 Platform

Concept

The Investigator Type 2260 platform is a dedicated noise & vibration analysis computer on which application software such as Noise Profile Software BZ 7203 is installed. More than one application software package can be installed at the same time, making the Investigator Type 2260 an extremely flexible instrument with a great potential when used with other software applications. Each software application is provided on a PC-card. Basic Sound Analysis Software BZ 7210, for octave and 1/3-octave band analysis is pre-installen on all 2260's.

Acoustically Streamlined

Its acoustically "streamlined" body minimises the effect that the analyzer has on the sound field to within ± 0.4 dB throughout its working frequency range; well within IEC Type 1 tolerances. This, coupled with excellent directional characteristics, ensures that the validity of your measurements is unaffected by the presence of the Investigator in the sound field.

Microphone and Preamplifier

The Investigator Type 2260C is supplied with a robust Falcon™ Range microphone and preamplifier which conform with IEC and ANSI Type 1 standards.

The preamplifier is detachable and able to drive a 100 m long cable; a valuable asset when remote location of the microphone is necessary.

Calibration

Internal and external calibration facilities are provided. Both are semi-automatic.

The external methods make use of an external reference sound source, for example from Brüel & Kjær's Sound Level Calibrator Type 4231.

Furthermore, the Type 2260 C "remembers" its "Initial Calibration" (and the serial number of the microphone provided) and will report any deviation from this. An Accredited Initial Calibration (EK 0462) is made only at the factory.

Specifications 2260 C

Specifications apply to Type 2260 fitted with the supplied microphone and input stage.

STANDARDS:
Conforms with the following:
• IEC 651 (1979) Type 1 plus Amendment 1
• IEC 804 (1985) Type 1 plus Amendment 2
• ANSI S1.4 (1983) Type 1
• ANSI S1.43-199X Type 1 (Draft 1993)

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

SUPPLIED INPUT STAGE:
ZC 0026
Input Impedance: 10 GΩ ‖ <1 pF
Extension Cables: Up to 100 m in length can be added between the input stage and the Type 2260 without affecting measurements

MEASURING RANGES:

	Lin. 5 Hz–20 kHz	"C"	"A"
Thermal noise	15.3	13.0	14.6
Electrical noise	21.0	14.1	12.4
Inherent noise	22.0	16.6	16.6
Lower limit Primary Indicator Range	38	32	30
Upper limit	130	130	130
Max. peak level	133	133	133

The 2260C covers the entire measuring range with a single setting. Values are given for an input stage and microphone of nominal sensitivity. The upper limit is the maximum level of a sinusoidal signal (crest factor 3 dB) at the reference frequency (1 kHz) which does not overload. This level is also the upper limit of the Primary Indicator Range. Inherent noise levels are given as typical values at the reference temperature (+20°C). Inherent noise is the combination of the electrical noise (analyzer plus input stage) and the thermal noise of the microphone (all values given in decibels).
From the above come the ranges shown in the following table (also given in decibels):

	Lin. 5 Hz–20 kHz	"C"	"A"
Dynamic range	108.0	113.4	113.4
Lower limit Primary Indicator Range	92.0	98.0	100.0

PEAK DETECTORS:
For Lin frequency weighting: conforms with IEC 651
For C-weighting: The following responses are for a single-cycle tone burst compared with the theoretical value based on the RMS level of a continuous tone with the same amplitude

Frequency	Peak minus Continuous	Tolerance
31.5 Hz	2.5 dB	±1.0 dB
500 Hz	3.5 dB	±0.5 dB
8 kHz	3.4 dB	±1.0 dB

ATTENUATOR ZF 0023
Using this, the upper limit can be moved upwards by 20 dB to 150 dB

MEASUREMENTS:
V = frequency weightings C or L
X = frequency weightings A, C or L
Y = time weightings S, F or I
T = clock time of the parameter
N = a number
The contents referred to under the following three headings are measured in parallel. Where applicable, you choose what from the respective tables (see also Fig. 1)

Parameters available in Total Profile:
Sampling interval can be set from 10 ms to 60 s
For sampling intervals below 1 s, up to three of the following are selectable

L_{Aeq}, L_{Veq}, $L_{Vpk(MaxP)}$

For sampling intervals above 1 s

Up to 19 of the following are selectable

Aeq	Veq	
Apk(MaxP)	Vpk(MaxP)	
ASMax	AFMax	AIMax
VSMax	VFMax	VIMax
ASMin	AFMin	AIMin
VSMin	VFMin	VIMin
AIm	VIm	AE(ASEL)

The following is always included
Overload Y/N

Parameters available in Periodic Reports
Intervals can be set from 1 min to 1 h

The following are selectable

Aeq	Veq	
Apk(MaxP)	Vpk(MaxP)	
TApk(MaxP)	TVpk(MaxP)	
ASMax	AFMax	AIMax
TASMax	TAFMax	TAIMax
VSMax	VFMax	VIMax
TVSMax	TVFMax	TVIMax
ASMin	AFMin	AIMin
TASMin	TAFMin	TAIMin
VSMin	VFMin	VIMin
TVSMin	TVFMin	TVIMin
AE(ASEL)		
AIm	VIm	
ASTm3	AFTm3	
VSTm3	LVFTm3	
ASTm5	AFTm5	
VSTm5	LVFTm5	
#PeaksA>L	#PeaksV>L	
XYN1	XYN2	XYN3
XYN4	XYN5	XYN6
XYN7		

Full statistics for level and cumulative distribution

The following are always included

Start date	Start time
Stop date	Stop time
Elapsed Time	Overload%

The following can be calculated

Veq-LAeq   AIm-LAeq
XYN1-7 if full statistics are measured

Parameters available in Total Measurement:
Measurement time can be set from 1 s to 41 days

The following are always included

Aeq	Veq	
Apk(MaxP)	Vpk(MaxP)	
TApk(MaxP)	TVpk(MaxP)	
ASMax	AFMax	AIMax
TASMax	TAFMax	TAIMax
VSMax	VFMax	VIMax
TVSMax	TVFMax	TVIMax
ASMin	AFMin	AIMin
TASMin	TAFMin	TAIMin
VSMin	VFMin	VIMin
TVSMin	TVFMin	TVIMin
AE(ASEL)		
AIm	VIm	
ASTm3	AFTm3	
VSTm3	LVFTm3	
ASTm5	AFTm5	
VSTm5	LVFTm5	
#PeaksA>L	#PeaksV>L	

Full statistics for level and cumulative distribution

Start date	Start time
Stop date	Stop time
Elapsed Time	Overload%

The following can be calculated

Veq-LAeq	Alm-LAeq	XYN1-7

STATISTICS
Level and cumulative-level distributions as well as the percentiles L_{XYN1-7} are based on sampling $L_{XY(INST.)}$ or L_{Xeq} every 50 ms and a class width of 1 dB over the range 110 dB. L_N values are interpolated to within a resolution of 0.1 dB

DATA EXCLUSION
On-line exclusion of data for Total Measurement and Periodic Reports.

MARKERS
Four user-definable markers for on-line annotation of sound categories heard during the measurement.

CALIBRATION
External (acoustic): Using Multifunction Acoustic Calibrator Type 4226, Pistonphone Type 4228 and Sound Level Calibrator Type 4231
Internal: Using internally generated electrical signal with keyed-in value of microphone sensitivity
Charge Injection Calibration: Manual initiated check

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.

MEASUREMENT DISPLAYS
SLM: For Total Measurement and Periodic Reports, one main and five secondary parameters can be specified plus one analogue bar with zoom facilities
Cumulative Distribution For Total Measurement and Periodic Reports. Broad-bands plus one analogue bar
Level Distribution For Total Measurement and Periodic Reports. Broad-bands plus one analogue bar. Zoom facilities also provided

Profile:
For Total Profiles and for Periodic Reports, one measured parameter as a function of time, either the Total Measurement time or zoomed to 150 samples. Scroll and cursor facilities provided

STORAGE SYSTEM
Internal disk for application software, user set-ups and data. Set-ups and data can be recalled

Capacity:
Internal: 32 Mbyte for software module and measurement data (software module requires approximately 1.5 Mbyte). Amount of data depends on measurement set up. For example, Total Profile with 5 parameters sampled every second and Periodic Reports every 10 minutes requires approx. 1.5 Mbyte for a 24 hour measurement
External Memory Card for store/recall of measurement data (SRAM or ATA Flash Cards)
MS-DOS® compatible file system (from ver. 3.3)

SERIAL PRINTER/OUTPUT
Set-ups and measurement data can be printed on a Portable Printer Type 2322 or IBM Proprinter compatible. The formats can be screen dumps or tables
Measurement data can be output in spread sheet format or as a binary file for post processing on a PC
Baud Rates: see below

HELP AND USER LANGUAGES
Concise context-sensitive help throughout in English, German, French, Italian, Spanish, Czech and Slovakian

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

DISPLAY
Type: Transflective LCD 192×128 dot matrix with internal temperature compensation
Back-light: User-definable on-time

INPUT STAGE CONNECTION
Connector: 10-pin LEMO

AUX OUTPUTS (2 independent)
Can be set to:
L_{AF}(Inst.) 0 to 4 V proportional to L_{AF}(Inst.) and updated 10 times per s for tracing on a level recorder
Meas. Status 0 or 4.5 V status signal (Stop/Measuring) for starting or stopping external equipment such as a tape or level recorder
Input (Low): (Aux. 1 only) unweighted analogue signal with adjustable gain for aural monitoring (covers the nominal range 20 to 100 dB)
Input (High): (Aux. 2 only) unweighted analogue signal with adjustable gain for aural monitoring (covers the nominal range 50 to 130 dB)
Signal: from amplified, frequency weighted microphone signal

AC INPUTS/OUTPUTS
Signal output: Buffered, unweighted microphone signal
Output impedance: $2 \times 200\,\Omega$
Maximum load: 47 kΩ‖200 pF (Short-circuit protected)
Signal input: From an external source such as a tape recorder
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

SETTLING TIME
From Power On: approximately 25 s

EFFECT OF TEMPERATURE
Operation: <0.5 dB −10°C to +50°C (+14°F to +122°F)
Storage (without batteries): −20°C to +70°C (4°F to +158°F)

EFFECT OF HUMIDITY
<0.5 dB for 30% < RH < 90% (at 40°C and 1 kHz)

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, maximum 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

Compliance with Standards

CE , C-Tick	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive. C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand
Safety	EN 61010–1 and IEC 61010–1: Safety requirements for electrical equipment for measurement, control and laboratory use. UL 3111–1: Standard for Safety – Electrical measuring and test equipment
EMC Emission	EN 50081–1 (1992): Generic emission standard. Part 1: Residential, commercial and light industry. EN 50081–2 (1993): Generic emission standard. Part 2: Industrial environment. CISPR 22 (1993): Limits and methods of radio disturbance characteristics of information technology equipment. Class B Limits. FCC Class B limits.
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[a] dB or greater will be affected by no more than ±0.5 dB.

a. This is 19dB better than what is required in the addenda to the standards IEC 651 and IEC 804 as well as in the forthcoming standard IEC 1672 (Draft June 1996)

Ordering Information

Type 2260C   Modular Precision Sound Analyzer (with Noise Profile Software BZ 7203)

Accessories included:

BZ 7203:	Noise Profile Software
Type 4189:	Prepolarized Free-field 1/2″ 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 2260C 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)
2260 CAI:	Accredited Initial Calibration of Type 2260

POST-PROCESSING + REPORTING:

Type 7820 002	Evaluator (English language)
Type 7820 003	Evaluator (French language)
Type 7820 004	Evaluator (German language)
Type 7820 005	Evaluator (Italian language)
Type 7820 006	Evaluator (Spanish language)

Type 2322:	Portable Printer
AO 1442:	9-pin to 25-pin Interface Cable for use with PC or serial printer
UL 1003:	20 Mbyte ATA Flash Memory Cards

MAINS POWER SUPPLIES:

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

MEASURING:

UA 0237:	Large Round Windscreen
UA 0459:	Small Round Windscreen
UA 0587:	Tripod
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

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