PRODUCT DATA

Hand-held FFT System
2260 Investigator and FFT Software BZ 7208 — Type 2260 H

With FFT Software BZ 7208, 2260 Investigator™ becomes a single-channel FFT analyzer. It is suitable for measuring continuous and transient signals (for both sound and vibration) in environmental and industrial applications. A flexible internal trigger is provided, as well as an external trigger for transients. To evaluate the tonal content in noise, the software can identify tones and calculate their audibility.

For vibration measurements 2260 Investigator uses a DeltaTron® Adaptor ZG 0423 that accepts DeltaTron accelerometers and, via Charge Converter Type 2647, also accommodates charge accelerometers.

Most importantly, all the functions you need in the field (e.g., frequency span, zoom and cursors) are easily activated from 2260 Investigator's front panel.

The combination of sound and vibration capability draws on Brüel & Kjær's long experience in FFT for sound and vibration applications.
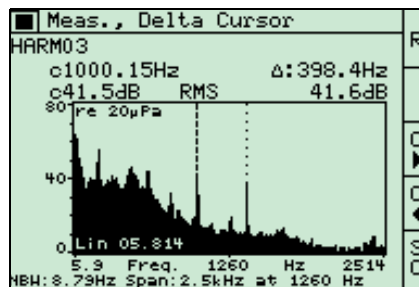
2260 H, BZ 7208

Brüel & Kjær

○ FFT analysis of sound or vibration

○ Machinery troubleshooting

○ Tone assesment for environmental noise measurements

○ Product development

○ Quality control

○ Building vibration analysis

○ Hand-held FFT analysis of sound or vibration

○ Single-channel analysis

○ Real-time operation (no data loss)

○ Internal and external trigger

○ Measures transient and continuous signals

○ Max. frequency span 20 kHz; min. 156 Hz

○ Over 400 lines (better than 50 Hz resolution @ 20 kHz span)

○ Zoom down to better than 0.5 Hz resolution

○ FFT autospectrum Lin. or A-weighted

○ Compare spectrum to stored reference

○ PC software for analysis, reporting and archiving (not included in BZ 7208)

FFT Analysis on 2260 Investigator

Fast Fourier Transform (FFT) is a standard feature of advanced vibration analyzers and is also found in many simple vibration meters. FFT is a measurement technique that uses post-processing of a digital time record for narrow-band filtering. Modern digital processors can repeat the analysis fast enough to provide real-time measurement. That is, all samples are represented equally in the results and no data is lost because of calculation down-time.

Fig. 1
With 2260 FFT software, you get more than 400 lines for a 20 kHz frequency span, with zoom down to better than 0.5 Hz resolution

2260 Investigator with FFT Software BZ 7208 provides a constant bandwidth spectrum extending from 0.1 Hz to 20 kHz. This spectrum is characterised by the number of frequency bands called FFT lines. Type 2260 has over 400 lines, with better than 50 Hz resolution for the 20 kHz span.

To increase resolution by factors of 2, the frequency span can be reduced using zoom. For example, with a span of 313 Hz, the resolution is better than 1 Hz. The same, high resolution can be selected around any frequency within the 20 kHz span.

In the acoustics community, 1/3-octaves are satisfactory for most frequency analyses, while octave bands are sufficient for applications such as room acoustics and environmental noise. However, for analysing noise that includes annoying tones, narrow-band FFT filtering is often preferred and recommended in national and international standards. BZ 7208 includes tone assessment in accordance with Joint Nordic Method, ver. 2, DIN 45681 and ISO 1996–2.

Machinery tends to have vibration modes (and noise) with narrow peaks, or vibration and noise with repetitive patterns. Therefore, the FFT analyzer is a valuable tool for the troubleshooter or machinery developer.

The ability to make FFT measurements of both sound and vibration means that 2260 Investigator with FFT Software BZ 7208 is not just a tool for environmental measurements – it is also a useful tool for industrial applications.

Fig. 2
2260 Investigator allows you to connect either a microphone or an accelerometer so that you can measure sound or vibration

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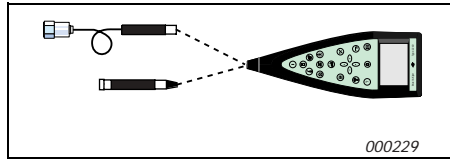
For vibration measurements, DeltaTron Adaptor ZG 0423 is available. It accepts DeltaTron accelerometers. With Charge Converter Type 2647, it also accommodates charge accelerometers.

Applications

Machinery Troubleshooting

Fig. 3
Using FFT to troubleshoot vibration insulation in a large power plant

Consider a turbogenerator causing excessive noise both in a power plant and in the environment surrounding the plant. You might guess that there is insufficient vibration insulation, but 2260 Investigator with FFT Software allows you to prove this and to find the solution quickly. By measuring the noise level to identify critical frequencies and then, without changing software, measuring the vibration levels at both sides of each insulator, you can compare vibration levels to find and replace the faulty insulator.

Tone Evaluation

Fig. 4
Using FFT to evaluate the tonal content of noise at the boundary of an industrial plant

The portability of 2260 Investigator, and its ability to compare spectra and evaluate tones, help you solve problems arising from complaints about tonal noise from a plant. By listening for tones at the plant perimeter or in a residential area, measuring spectra at selected positions and times and checking the tone audibility and penalty, you can determine whether the rating level, L_r, with tone penalty exceeds the legal/allowed limits. You can then solve the problem by muffling the tone or by changing work schedules.
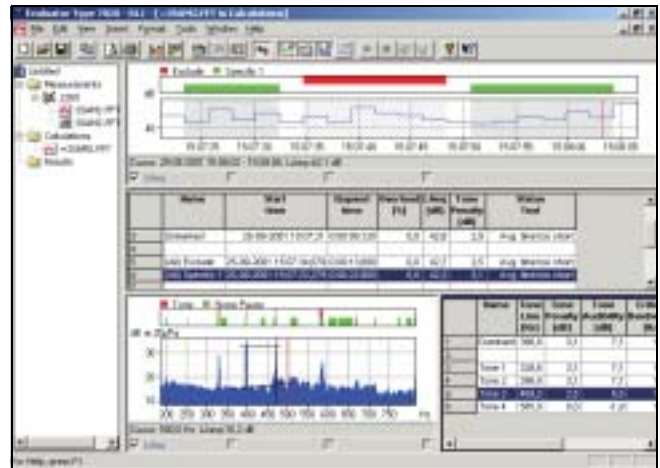
Resonance Investigation

With its portability, internal trigger and exponential time window, 2260 Investigator with FFT software proves ideal for investigation of excessive noise due to resonance. In the case of excessive noise from a blower, impact response measurements using a rubber hammer allow the analysis of peaks in the spectrum. Concluding that the fundamental of the housing is poorly damped, it then becomes a simple matter for you to add an absorbing layer to the housing to remove the problem.

PC Software

FFT software BZ 7208 integrates with other Brüel & Kjær software for Windows®:

❍ Noise Explorer™ Type 7815 for data display, reports and archiving
❍ Evaluator™ Type 7820 for tone evaluation in environmental noise assessment

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 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: 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: 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/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 – Hand-held FFT System

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

INPUT STAGE CONNECTION
Connector: 10-pin LEMO

FITTED WITH OPTIONAL DELTATRON ADAPTOR ZG 0423
Input Impedance: ~ 100 kΩ‖100 pF
Constant Current Supply: > 2 mA
Cable Drive Capability:
Max. 10 m for 20 kHz frequency range
Max. 100 m for 1 kHz frequency range

FITTED WITH OPTIONAL ISOTRON® ACCELEROMETER EE 0103
Nominal Sensitivity: 1.02 mV/(ms^{-2}) or 10 mV/g

AUX. OUTPUT 2
Can be set to:
Tone at Cursor: Sine wave at cursor frequency for comparison with tones in signal
Input: From amplified, frequency-weighted signal (A or Lin.)
Input Tone: Outputs a mix of both input signal and tone at cursor frequency

AC INPUT/OUTPUT
As Output: Buffered, unweighted microphone/accelerometer signal
Output Impedance: 200 Ω
Maximum Load: 47 kΩ‖200 pF (short-circuit protected)
As Input: Alternative to microphone input
Connector: 3-pin LEMO (balanced input)

INPUT SETTINGS
Polarization voltage: 0 or 200 V
Sound Incidence Correction: Frontal or Random
Analogue Pre-weighting: None or A-weighting

OVERALL FREQUENCY RESPONSE
Typical Electrical Response:
With 0.1 Hz filter: 0.5 Hz to 20.156 kHz ± 0.1 dB, − 3 dB at 0.1 Hz
With 5 Hz filter: 17 Hz to 20.156 kHz ± 0.1 dB, − 3 dB at 5.5 Hz

RANGE
Sound Signals: Full scale reading from 70 dB to 130 dB in 10 dB steps (90 dB to 150 dB using 20 dB Capacitive Attenuator ZF 0023)
Vibration Signals: Full scale reading from 3.16 mms^{-2} to 3.16 kms^{-2} in 10 dB steps
Direct Input: Full scale reading from 3.16 μV to 3.16 V in 10 dB steps

DYNAMIC RANGE
Typical Electrical Noise for Top-socket (no preamplifier) or AC I/O 1 Input: > 110 dB below full-scale on top two range for 20 kHz span

FREQUENCY SPAN (BASEBAND OR ZOOM)
20 k, 10 k, 5 k, 2.5 k, 1.25 k, 625, 313, 156 Hz
High-pass: 0.1 or 5 Hz
Resolution: 429 spectral lines, corresponding to a time record of 1024 samples
Zoom: On user-selected frequency

TIME WINDOWS
Hanning, Rectangular

MEASUREMENT CONTROL
Manual Start

Exponential or Linear Averaging: Up to 8 388 607 spectra measured with Hanning window and 67% overlap.
Logging: Up to 32 767 averaged spectra in one file at intervals down to 0.5 s
Triggered Start
Transient Signal Types: Averaging of up to 32 767 triggered spectra measured with rectangular window
Continuous Signal Types: Averaging of up to 32 767 triggered spectra – each spectrum is an average of up to 32 767 spectra measured with Hanning window and 67% overlap
Signal Enhancement: Averaging of up to 32 767 triggered records (single spectra) measured with Hanning or Rectangular window

STORED DATA
Single spectrum
Averaged spectrum
Logged Spectrum (Multispectrum)

TRIGGERS
Internal: Polarity, slope, % of max. input, pre- or post-delay, hold-off delay
External: ±5 V logic signal, pre- or post-delay, hold-off delay

DISPLAY SPECTRA
Exponential or linear average
Current measurement or stored spectrum
143 lines, each covering a maximum of 3 frequency lines, or one line per frequency line with scroll through 429 frequency lines
Scaling: RMS, Peak, Peak-to-Peak, Power, PSD, ESD
Compare spectrum to stored (measured) reference
Axis: Y log, X Lin
Digital Post-weighting: None or A-weighting

DISPLAY PARAMETERS
Sound: Sound Pressure Level in dB or Pa
Vibration: Acceleration, velocity or displacement in dB or physical units. SI units (ms^{-2}, ms^{-1} or m) or US/UK units (g, Inch/s, Mil)
Direct: Voltage in dB or V

CURSORS
Main, delta, harmonic, reference

TONE ASSESSMENT
Standards: The audibility of tones in noise can be assessed according to the following standards:
Joint Nordic Method ver. 2 (1999)
DIN 45681 (1992) (Draft)
ISO/CD 1996-2 (2001-05)
Read-outs: Penalty, Critical Band, Total Tone Level, Masking Noise, Tonal Audibility within critical band, Tone Level of individual tones, and status information describing validity of assessment and hints for improvements

CALIBRATION:
Sound: Using Multifunction Acoustic Calibrator Type 4226, Pistonphone Type 4228 or Sound Level Calibrator Type 4231
Vibration: Using Calibration Exciter Type 4294
Direct: Using an electrical signal
Internal: Uses internally generated electrical signal combined with a keyed-in value of transducer sensitivity
CIC (Charge Injection Calibration): Injects internally generated electrical signal in parallel with microphone diaphragm Reference CIC ratio is stored for comparison with later CIC

GPS DATA
A geographical position can be attached to a measurement 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

STORAGE SYSTEM
Internal: Up to 32 Mbyte disk for application software and storage of setups and measurement data
External Memory Card: For storage/recall of measurement data and transfer of data to and from a PC (SRAM or 5, 10, 20 or 32 Mbyte ATA flash cards of SanDisk type)
MS-DOS®: Compatible file system (from ver. 3.3)

SERIAL INPUT/OUTPUT
Conforms to EIA ITIA 574 (RS 232), coupled as data terminal equipment (DTE)
Connector: 9-pin D-type male

SERIAL PRINTER/OUTPUT
Screendumps can be printed on Portable Printer Type 2322 or on an IBM® Proprinter® (or compatible)
Baud Rate: 1200 to 38 400

REMOTE/LOCAL
Commands for transfer of measurement data (files) in binary form to a PC for use with Brüel & Kjær application software
Baud Rate: 1200 to 115 200

LANGUAGES
User Interface and concise, context-sensitive help in English, German, French, Spanish, Italian and Czech

CLOCK
Back-up battery powered clock. Accurate to within 1 minute per month

DISPLAY HARDWARE
Back-lit LCD 192×128 dot matrix with internal temperature compensation

SETTLING TIME
From Power On: Approximately 35 s

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: 5.5 mm diameter, 2 mm pin (positive)

BATTERIES
Type: 6×LR14/C-size 1.5 V alkaline
Lifetime: (at 20°C) 5 to 6 hours of typical use (decreases significantly at low temperatures)

WEIGHT
1.2 kg (2.6 lb.) including batteries

DIMENSIONS
375×120×52 mm (14.8×4.7×2.0 inch)

Ordering Information

Type 2260 H   Modular Precision Analyzer with FFT Software BZ 7208

Accessories Included in Type 2260 H

BZ 7208	FFT Software
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
UA 0237	Large Round Windscreen

Optional Accessories

CALIBRATION
Type 4226	Multifunction Acoustic Calibrator
Type 4228	Pistonphone
Type 4231	Sound Level Calibrator (fits in KE 0342)
Type 4294	Calibration Exciter
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

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
UL 1006	32 MB ATA Flash Memory Card

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

MEASURING
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 0522	Headphones Adaptor
KE 0371	Carrying Case for 2260 and accessories
UA 0237	Large Round Windscreen
UA 0459	Small Round Windscreen
UA 1317	Microphone Holder
UA 0587	Tripod
UA 0801	Small Tripod
ZG 0423	DeltaTron Adaptor for 2260
Type 2647 A	Charge to DeltaTron Converter (1 mV/pC)
Type 2647 B	Charge to DeltaTron Converter (10 mV/pC)
AO 0038	10–32 UNF/10–32 UNF cable (1.2 m)
AO 0038 F	10–32 UNF/10–32 UNF cable (3 m)
AO 0038 G	10–32 UNF/10–32 UNF cable (5 m)
JP 0145	10–32 UNF to BNC Plug Adaptor
EE 0103	General Purpose ISOTRON® Accelerometer
UA 1219	Mounting Kit for Accelerometers

Brüel & Kjær supplies a wide range of accelerometers. Please ask for more information regarding the different types and their uses

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

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