BRÜEL & KJÆR® Sound Level Meters

Hand-held Analyzer Types 2250 and 2270 for Vibration Measurements
using FFT Analysis Software BZ-7230 and Enhanced Vibration and Low Frequency Option BZ-7234

Types 2250 and 2270 are the easy, safe and clever approach to machinery noise and vibration assessment, diagnostics and quality control. The analyzers combine advanced analysis techniques, tap-and-drag operation and a wide dynamic range to become the perfect on-location machine vibration tool.

Acceleration, velocity, and displacement are parameters traditionally used to assess a machine's health when initially installed or after maintenance, repair or overhaul (MRO). The crest factor is used to detect and diagnose defects in roller element bearings.

Frequency analysis based on the fast Fourier transform (FFT) algorithm is an advanced tool for measurement and diagnostics of machinery noise and vibration. The frequency 'profile' of a machine is its fingerprint, revealing its sources of noise and vibration and their paths to the measurement position.

Uses and Features

Uses
- Machinery troubleshooting
- Product development
- Quality control and inspection
- Maintenance, repair and overhaul (MRO)
- Single-channel FFT analysis of sound or vibration

Features
- Wide dynamic range
- PC software for analysis, reporting and archiving included
- User-defined metadata to aid documentation

Enhanced Vibration
- Time domain integration to velocity and displacement
- RMS and true peak in acceleration, velocity and displacement
- Peak-to-peak in displacement
- Optional 1/3-octave spectra in acceleration or velocity
- Crest factor with 1 kHz high-pass filter

FFT Spectra
- Up to 6400 lines of analysis
- Spans from 100 Hz to 20 kHz in a traditional 1-2-5 sequence
- Improved frequency resolution: down to 16 mHz, broadband or zoom
- Dual-overlay spectrum display
- Compare spectrum to reference spectrum
- Max. hold spectrum
- Capture transient events with signal level triggers, including pre-trigger

Measurements
- Transducer database
- CCLD input for accelerometers
- Relate noise or vibration to rotational speed with simultaneous tachometer
- Measurements in SI (metric) and UK/US units
- Unit scaling (RMS, Pwr, PSD, ESD, Peak, P-P)

Quality Control
- Tolerance windows with check against preset limits
- Quality Check template for quick and clear results
- TTL output for control of external devices

Signal Recording (optional)
- Record input signal, one channel for Type 2250 and two channels with Type 2270, for later playback or analysis, 16- or 24-bit

Hand-held Analyzer Types 2250 and 2270 are both innovative, 4th generation Brüel & Kjær analyzers with an award-winning design based on extensive research amongst sound and vibration technicians, engineers and consultants from around the world.

Type 2270, with its dual-channel measurement capability, and the single-channel Type 2250, can host many of the same measurement application modules.

Two such modules are FFT Analysis Software BZ-7230 and Enhanced Vibration and Low Frequency Option BZ-7234. FFT Analysis Software is a single-channel application that can be used one channel at a time on Type 2270. Enhanced Vibration and Low Frequency Option BZ-7234 allows single-channel measurements on Type 2250 and dual-channel measurements on Type 2270. The measurement procedures and functionality are the same regardless of the analyzer.

See Ordering Information on page 14 for all available application modules.

Fig. 1
Optional accessory, KE-0459, is a shoulder bag for storage and transport

Once you have taken your measurements, you need to do something with them. Your hand-held analyzer offers three storage options: internal disk, secure device (SD) memory cards or USB stick. From there, the included USB or LAN cable makes data transfer to an archive on your PC, or network location, easy. Alternatively, if you have used a memory card, just insert it into the computer's card reader.

Enhanced Vibration and Low Frequency Option BZ-7234

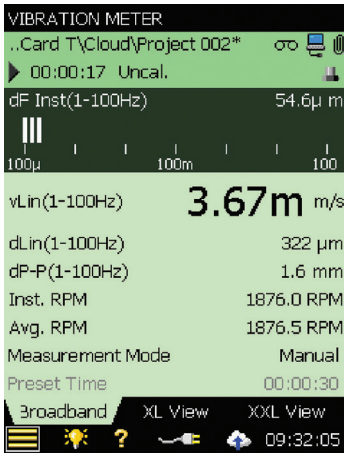


Fig. 2
Enhanced vibration allows velocity and displacement measurement

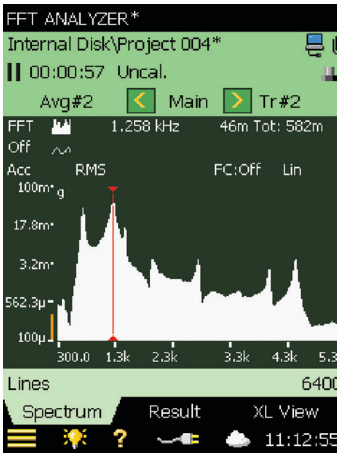
Vibration is often measured in units of velocity (in/s or mm/s) or displacement (Mil and mm). This is especially common in the maintenance, repair and overhaul (MRO) of valuable machines such as gas turbines and compressors.

Enhanced Vibration and Low Frequency Option BZ-7234 transforms the acceleration, measured by an accelerometer, to velocity and displacement. BZ-7234 uses time domain filters so that the actual peak values can be measured in acceleration, velocity and displacement and peak-to-peak values in displacement. Peak, peak-to-peak and rms values are used to assess a machine's health, for example the ISO 10816 series of standards. It is also common to measure velocity and displacement in a limited frequency range. Enhanced Vibration and Low Frequency Option BZ-7234 also includes band-limiting filters, also in the time domain.

FFT Analysis Software BZ-7230

The fast Fourier transform (FFT) is a digital signal processing technique that converts a time record into a narrow-band constant bandwidth filtered spectrum. The measurement is defined by specifying a frequency span and a number of lines (or filters). A zoom facility allows you to focus on any part of the frequency range by specifying the centre frequency for the analysis span. FFT Analysis Software BZ-7230 allows resolutions down to 1/64 Hz, when you use a 100 Hz frequency span and 6400 lines of analysis.

Fig. 3
Spectrum view showing high dynamic range and high frequency resolution

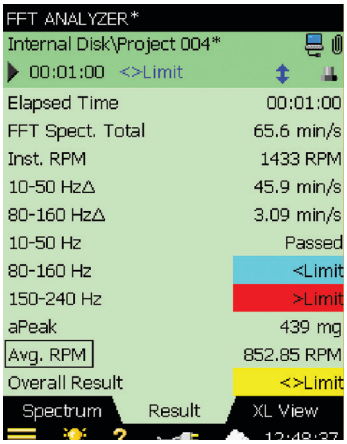


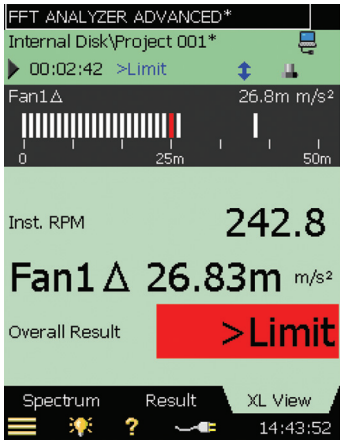
FFT spectrum analysis (Fig. 3) is ideal for noise or vibration source identification with 6400 lines of real-time frequency analysis at better than 5 Hz resolution – all the way to 20 kHz. Tapping the screen turns on the Frequency Correction algorithm*, which computes peak frequencies with ten times better resolution. The wide dynamic range (over 150 dB) allows accurate sound and vibration measurement on the first attempt.

FFT analysis is all about the details and the beauty of Hand-held Analyzer Types 2250 and 2270 is their details: secure in your hand, solid in construction and pleasantly intuitive. Each analyzer's high-resolution touch-screen colour display brings enhanced usability and enables easy cursor and display parameter transition. Setup is also easy. Connect and position your transducer, press Start/Pause and view your spectrum. If you want to zoom in, drag the stylus across the desired frequency span, tap *Zoom* and you can now measure using the correct range – *Easy, Safe, Clever*.

In addition to the standard FFT Analyzer template, the FFT Analysis Software comes with two supplementary templates:

Fig. 4
FFT Analyzer Advanced provides two additional tabs with detailed test result information



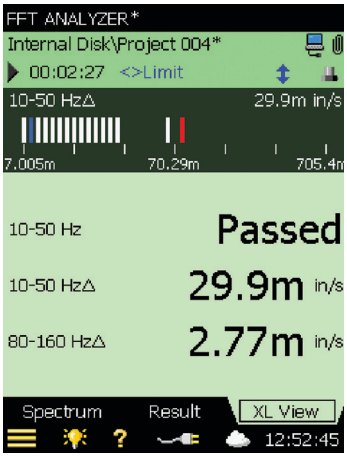


FFT Analyzer Advanced Template

In this template, the Results tab offers a view with 11 selectable results, which can be configured by tapping on any parameter label.

The XL View tab provides a bar graph and three selectable results. The bar graph shows the FFT spectrum total, a user-selectable delta sum or a single-value parameter. The bar graph also incorporates a quick view of the maximum value (white line) and upper limit (red line) into its display.

Fig. 5
The FFT Quality Check template provides specific customizable information for well-established tasks



FFT Quality Check Template

The FFT Quality Check template provides a bar graph and four selectable results in an easily readable large font. The bar graph shows the FFT spectrum total, a user-selectable delta sum or a single-value parameter. The bar graph also incorporates a quick view of the maximum value (white line) and upper limit (red line) into its display.

This template is particularly useful when tolerance windows are well established and FFT spectra are not needed for viewing, which is often the case with quality inspection tasks.

* Brüel & Kjær Technical Review No. 4 1987, "Use of Weighting Functions in DFT/FFT Analysis" (Part II), Appendix F

Machinery Analysis and Troubleshooting

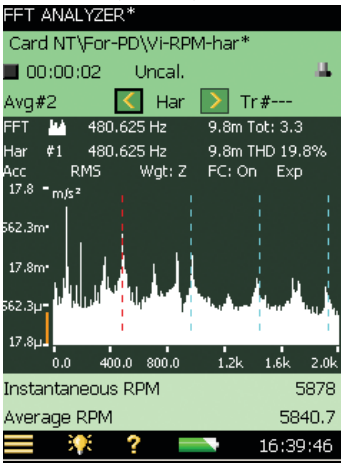


Fig. 6
View showing an RPM readout, with harmonic cursors and vibration measurement units

The portability of the analyzer gives you easy access to any product, lets you recall a baseline reference spectrum, and then compare it instantly with a spectrum you have just measured.

You can set the tolerance window feature over a range of frequencies to warn of machinery failure. Harmonic and delta cursors help you identify rotational and mesh frequencies, steering you efficiently toward operational deficiencies.

The analyzer's trigger input can even accept a tachometer input – providing a direct readout of RPM (see Fig. 6) with a gear ratio you define. The unique commentary feature of the analyzer lets you verbally record your field observations and attach them directly to the measurement result. The analyzer's multi-user facility allows you to define user-specific configurations and measurement points, so you can organize your field measurements, and the included Measurement Partner Suite program makes it easy to review the results on your PC.

Troubleshooting

160091

Fig. 7
Ruggedized Accelerometer Type 8341 for machine analysis and troubleshooting

FFT Analysis Software BZ-7230 includes the analysis tools and measurement units for a wide range of troubleshooting applications. For example:

- Measuring an engine mount's movement at idle RPM as displacement. Simply attach an accelerometer and set up the tachometer trigger input and the running speed will be displayed
- Spot-checking the output of a random vibration shaker is also easy. Use the stylus to set the delta cursor for the desired frequency span and read out the Power Spectral Density (PSD), then select g^2/Hz or $(m/s^2)^2$/Hz as your reference units
- You can also easily find a component's resonant frequencies. Switch the analyzer's FFT from continuous to transient signals and tap the component to excite its resonances. The internal trigger starts the measurement, and the FFT software will use a rectangular time window to capture the entire transient. Save the resonance spectrum as a reference then measure a machine's vibration spectrum to see if any resonance lines up with the operational frequencies

Quality Testing and Inspection – Tolerance Windows

Rotating or reciprocating elements (such as pistons, shafts and gears) in many machines, tools and vehicles lead to vibrations and noise. Measurements and analyses of that noise and vibration can be used to detect assembly faults and ensure compliance with required standards.

The tolerance windows feature in BZ-7230 makes quality control measurements easy.

The designers of the machine, tool or vehicle specify limits for permissible deviations. These specifications can be set up on Types 2250 and 2270 using one or several tolerance windows, each of which defines an upper and lower limit for the levels over a specific frequency range.

The value checked can be set to the level of the FFT lines or to the sum of FFT lines (delta sum).

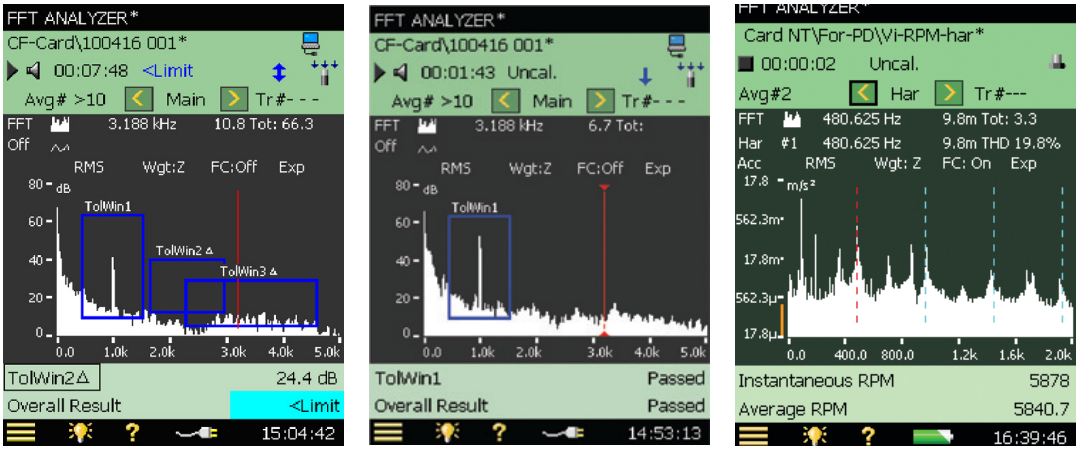
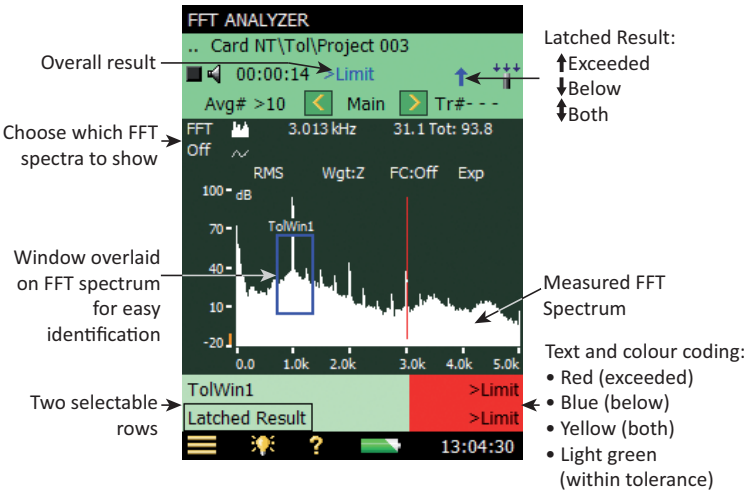


Fig. 8
Left:
Drawing the tolerance window by dragging the stylus
Centre:
Resulting tolerance window (set to check FFT lines)
Right:
Additional tolerance windows (set to delta sum) – up to 10 windows can be active and may overlap

Settings and preferences for a particular application can be saved collectively in templates. By recalling a template, Type 2250/2270 is ready for specific measurements in just seconds, including the specification of tolerances. Up to 10 tolerance windows per template can be active at the same time, making it possible to test different tolerances for different frequency ranges in one measurement. In addition, it is possible to test for two limit ranges over the same frequency range, which is as easy as overlapping tolerance windows. In addition you can define tolerances for four non-FFT values; for example, two instantaneous parameters (L_{AF} and Instantaneous RPM) and two average parameters (L_{Aeq} and Average RPM).

During measurement, the FFT spectrum and single values are compared to set limits (indicating 'above upper limit', 'within limits', 'below lower limit', 'above and below limits'). The test is performed and indicated for each window. An overall result is also indicated. It will indicate 'failed' if the spectrum or single parameters crossed the upper or lower tolerances for any window or 'passed' if within the tolerances for all windows.

Fig. 9
BZ-7230 provides comprehensive indication of the test result



The pass/fail indication is also available as an electrical signal at the analyzer's output socket. A 3.3 V DC output indicates an exceeded upper limit, a −3.3 V DC indicates levels below the lower limit, and an alternating ±3.3 V indicates violation of both limits. This feature makes it easy to utilize Type 2250/2270 in production control systems where the output signal can trigger warnings or start specific actions for the failed item. Being able to listen to the signal makes it easier to identify the problem source. You can therefore configure the analyzer to start recording automatically when data exceed tolerances (license for Signal Recording Option BZ-7226 is required). The input signal, which will be attached to the specific project, can be played back or exported to a PC for further analysis. For more information on BZ-7226, see page 6.

Quality Testing and Inspection – Programmable Automation

2250 REST: Using REST interface for the Type 2250/2270 platform, you can connect to an analyzer, set up and control it, and read out single values from the current measurement (but not complete projects). This interface uses HTTP and only requires the IP address of the instrument. This interface can be used from any platform (Windows®, Mac®, iOS, Android®, Linux, etc.).

Product Development

Fig. 10
Vibration measurement using a hand-held analyzer and Laser Tacho Probe Type 2981

Early component performance evaluation can greatly improve product design. The FFT analyzer's dual-overlay display makes it easy to compare measurements between design iterations.

You can also benchmark competitive and previous generation products. Use narrow-band analysis to identify forcing functions and resonances to aid in setting the standards for the next generation product.

Measurement Partner Suite BZ-5503 makes it easy to transfer measurement data to a PC where data viewing, exporting and archiving complete the analysis and reporting project.

Metadata

Fig. 11
The Annotations page showing six user-defined metadata items and a pick-list for the Location entry

Metadata are supplementary information entries about your measurement that make archiving, retrieving and post-processing data easier and more efficient. Examples of metadata are file name, date and time, setup and annotations made by the operator.

In addition you can define the names and types of up to 30 text strings. The entry format may be editable text, a user-defined pick-list, numeric or an index number that automatically increments when a measurement is saved.

Metadata functionality can also be used for sorting measurements in Measurement Partner Suite BZ-5503.

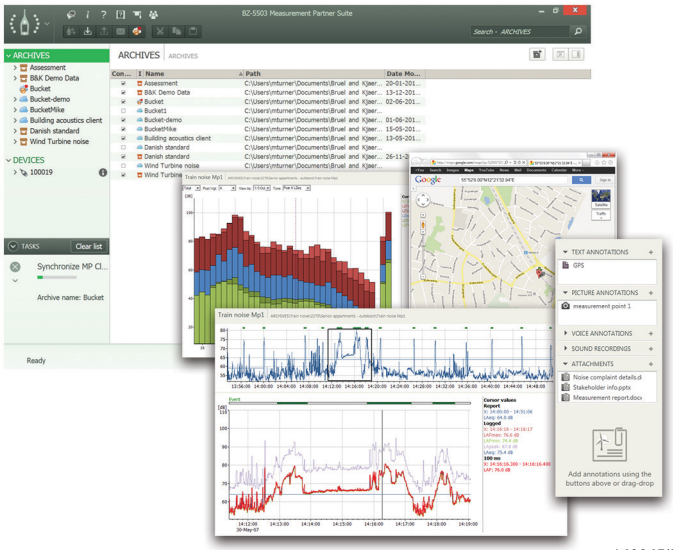
Signal Recording Option BZ-7226

Signal Recording Option BZ-7226 enables input signal recording for later playback or analysis. The recording can be automatic (lasting for the duration of the measurement), controlled manually, or last as long as the limit level is exceeded. Pre- and post-recording delays and duration limits can be set (FFT Analysis Software BZ-7230 only). The recording upper frequency limit can be set to either 20, 10, 5 or 2.5 kHz in four steps to save memory. To optimize memory space or dynamic range, 16- or 24-bit recording resolution is available.

Signal recording files can be quite large, so you will be directed to store your measurements (and recording) on a memory card in either of the hand-held analyzer's integrated SD card slot or on an attached USB stick. Type 2250/2270 supports SDHC cards, which provide memory capacity of up to 32 GB. The standard recorded WAV files are easily input into other analysis tools, for example Brüel & Kjær's BK Connect® software.

Post-processing Software

Fig. 12
Measurement Partner Suite BZ-5503



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Measurement Partner Suite BZ-5503, in its basic configuration, comes with your hand-held analyzer (see product data BP 2430). It is the Brüel & Kjær data viewing and post-processing toolbox for environmental noise and vibration.

The free, basic configuration provides data archive, preview and export capabilities, software maintenance and online display. Archives can be stored locally or on network drives.

Advanced post-processing functionality is available with a Measurement Partner Suite post-processing module licence. A range of subscription or capex licence options are available, locked to either your instrument's serial number or a USB dongle, giving you the flexibility to choose the licence model that meets the needs of your business.

Your hand-held analyzer has generous hardware and software specifications creating an extremely flexible instrument to cover your current and future measurement and analysis needs. For more information on the entire Type 2250/70 platform, see product data BP 2025.

Standard Software Modules

The following software modules (applications) are included with every Type 2250/2270 analyzer:

- **Sound Level Meter Software BZ-7222 –** standard sound level meter software according to IEC 61672–1/ ANSI
- **Frequency Analysis Software BZ-7223 –** analyse, in real-time, the 1/1- and 1/3-octave filter bands with a dynamic range in excess of 135 dB
- **2-channel Option BZ-7229 (Type 2270 only) –** realize the full potential of your analyzer with 2-channel functionality for SLM, Frequency Analysis, Logging, Enhanced Logging, and Building Acoustics software
- **Tone Assessment Option BZ-7231 –** when used in conjunction with the FFT Analysis application, this software provides an objective in-field assessment of tonal noise components

Optional Software Modules

The Type 2250/2270 analyzer platform allows you to choose different combinations of software modules. Modules can be purchased when needed and are delivered as easily installed licenses. In this way your investment in the analyzer platform is securely protected: when your need for measurements and analyses expands, the analyzer can accommodate them. HBK is committed to maintaining an ever-growing range of Type 2250/2270 applications.

For information on the optional software modules, see product data BP 2025.

Configuration Functionality

The table below gives the functionality of Type 2250/2270 with software included as standard and with FFT Analysis BZ-7230 and Enhanced Vibration and Low Frequency Option BZ-7234.

	TYPE 2250 OR TYPE 2270		
	BASIC ANALYZER	BZ-7234	BZ-7230
Measurements in SI (metric) or UK/US units	•	•	•
FFT unit scaling (RMS, Pwr, PSD, ESD, Peak, P-P)			•
FFT span from 100 Hz to 20 kHz			•
Up to 6400 FFT lines			•
FFT zoom analysis			•
Tolerance windows with check against preset limits			•
Integration to velocity and displacement, frequency domain			•
Integration to velocity and displacement, time domain		•	
Band-limited velocity and displacement		•	
True peak-to-peak displacement		•	
Crest factor including optional 1 kHz high-pass filter	•	•	
RPM measurement from external tacho probe	•	•	•
Tacho pulse embedded in recording*	•	•	•
Peak particle velocity (PPV)		•	
Human vibration filters: Wb, Wc, Wd, We, Wj, Wk, Wh, Wxb and KBF		•	
1/3-octave velocity for vibration criteria		•	

* Requires a BZ-7226 recording and BK Connect analysis software

Accredited Calibration and Hardware Maintenance at HBK

For Types 2250 and 2270, you can order accredited calibration and choose between DANAK, A2LA, UKAS, Eichamt (Austria), RvA, ENAC, NATA and Inmetro. We recommend you order accredited calibration together with a new instrument. Should the technician detect the need for adjustment during calibration, this can be performed while it is in our hands so you do not have to be without your analyzer. You can minimize the risk of unexpected costs by purchasing a hardware maintenance contract with a five-year warranty.

These specifications refer to Types 2250 and 2270 unless otherwise stated

Hardware Interface

PUSHBUTTONS
11 buttons with backlight, optimized for measurement control and screen navigation

ON-OFF BUTTON
Function: Press 1 s to turn on; press 1 s to enter standby; press for more than 5 s to switch off

STATUS INDICATORS
LEDs: Red, yellow and green

DISPLAY
Type: Transflective back-lit colour touchscreen 240 × 320 dot matrix
Colour Schemes: Five different – optimized for different usage scenarios (day, night, etc.)
Backlight: Adjustable level and time

USER INTERFACE
Measurement Control: Using pushbuttons
Set-up and Display of Results: Using stylus on touchscreen or pushbuttons
Lock: Pushbuttons and touchscreen can be locked and unlocked

USB INTERFACE
USB 2.0 OTG Micro AB and USB 2.0 Standard A sockets for Wireless USB-A Adapter UL-1050, printer or weather station

MODEM INTERFACE
Connection to Internet through GPRS/EDGE/HSPA modem connected through the USB Standard A Socket.
Supports DynDNS for automatic update of IP address of host name

PRINTER INTERFACE
PCL printers, Mobile Pro Spectrum thermal printer or Seiko DPU S245/S445 thermal printers can be connected to USB socket

MICROPHONE FOR COMMENTARY
Microphone, which utilizes automatic gain control (AGC), is incorporated in underside of analyzer. Used to create voice annotations for attaching to measurements

CAMERA (TYPE 2270 ONLY)
Camera with fixed focus and automatic exposure is incorporated in underside of analyzer.
Used to create image annotations for attaching to measurements
Image Size: 2048 × 1536 pixels
Viewfinder Size: 212 × 160 pixels
Format: jpg with exif information

SECURE DIGITAL SOCKET
2 × SD sockets
Connect SD and SDHC memory cards

LAN INTERFACE SOCKET
- Connector: RJ45 Auto-MDIX
- Speed: 100 Mbps
- Protocol: TCP/IP

INPUT SOCKET
One socket with Type 2250; two with Type 2270
Connector: Triaxial LEMO. Used for Direct input as well as input with constant current line drive (CCLD) power supply
Input Impedance: ≥1 MΩ
Direct Input: Max. input voltage: ±14.14 V_{peak}, 10 V_{RMS} for sinusoidal input signals, no damage for signals up to ±20 V_{peak}, Source impedance ≤1 kΩ
CCLD Input: Max. input voltage: ±7.07 V_{peak}, (no indication for violation of this level), no damage for signals in the range –10 to +25 V_{peak}
CCLD Current/voltage: 4 mA/25 V
CCLD Cable Break/Short Indication: Checked before and after measurements

TRIGGER SOCKET
Connector: Triaxial LEMO
Max. Input Voltage: ±20 V_{peak}, no damage for signals up to +50 V_{peak}
Input Impedance: >47 kΩ
CCLD Current/Voltage: 4 mA/25 V

OUTPUT SOCKET
Connector: Triaxial LEMO
Max. Peak Output Level: ±4.46 V
Output Impedance: 50 Ω

HEADPHONE SOCKET
Connector: 3.5 mm Minijack stereo socket
Max. Peak Output Level: ±1.4 V
Output Impedance: 32 Ω in each channel, short-circuit proof without affecting the measurement results
Sources: Input conditioned (gain adjustment –60 to +60 dB), playback of voice annotations and signal recordings (gain adjustment –60 to 0 dB) and playback of recordings (gain adjustment –60 to +60 dB); however, max. gain is 0 dB for 16-bit wave files

Storage

INTERNAL FLASH-RAM (NON-VOLATILE)
512 MB for user set-ups and measurement data

EXTERNAL MEMORY CARD
SD and SDHC Card: For store/recall of measurement data

USB MEMORY STICK
For store/recall of measurement data

Power

EXTERNAL DC POWER SUPPLY REQUIREMENTS
Used to charge the battery pack in the analyzer
Voltage: 8 – 24 V DC, ripple voltage <20 mV
Current Requirement: min. 1.5 A
Power Consumption: <2.5 W, without battery charging, <10 W when charging
Cable Connector: LEMO Type FFA.00, positive at centre pin

EXTERNAL AC MAIN SUPPLY ADAPTOR
Part No.: ZG-0426
Supply Voltage: 100 – 120/200 – 240 V AC; 47 – 63 Hz
Connector: 2-pin IEC 320

BATTERY PACK
Rechargeable Li-Ion battery
Part No.: QB-0061
Voltage: 3.7 V
Nominal Capacity: 5500 mAh (typical); 5200 mAh (minimum)
Typical Operating Time:
Single-channel: >11 h (screen backlight dimmed); >10 h (full screen backlight)
Dual-channel: >7.5 h(full screen backlight)
Battery Cycle Life: >500 complete charge/discharge cycles
Battery Aging: Approximately 20% loss in capacity per year
Battery Indicator: Remaining battery capacity and expected working time may be read out in % and in time
Battery Fuel Gauge: The battery is equipped with a built-in fuel gauge, which continuously measures and stores the actual battery capacity in the battery unit
Charge Time: In analyzer, typically 10 hours from empty at ambient temperatures below 30 °C (86 °F). To protect the battery, charging will be terminated completely at ambient temperatures above 40 °C

(104 °F). At 30 to 40 °C, charging time will be prolonged. With External Charger ZG-0444 (optional accessory), typically 5 hours
Note: It is not recommended to charge the battery at temperatures below 0 °C (32 °F) or over 50 °C (122 °F). Doing this will reduce battery lifetime

CLOCK
Back-up battery powered clock. Drift <0.45 s per 24-hour period

Environmental

WARM-UP TIME
From Power Off: <2 min
From Standby: <10 s for prepolarized microphones

WEIGHT AND DIMENSIONS
650 g (23 oz) including rechargeable battery
300 × 93 × 50 mm (11.8 × 3.7 × 1.9″) including preamplifier and microphone

Wireless Connection to Mobile Device

Specifications apply to Wireless USB-A Adapter UL-1050
Operating Frequency: 2.4 GHz
Data Rate:
- IEEE 802.11n: up to 150 Mbps
- IEEE 802.11g: up to 54 Mbps
- IEEE 802.11b: up to 11 Mbps

Encryption/Authentication:
- 64/128-bit WEP
- WPA-PSK
- WPA2-PSK

Range: The range is similar to a standard WLAN unit, typically from 10 to 50 m (33 to 164′), depending on the environment and the number of other WLAN transmitters in the area (smartphones, Wi-Fi, etc.)
Power Requirements: Power Consumption: <1 W

Software Interface

USERS
Multi-user concept with login. Users can have their own settings with jobs and projects totally independent of other users

PREFERENCES
Date, time and number formats can be specified per user

LANGUAGE
User interface in Catalan, Chinese (People's Republic of China), Chinese (Taiwan), Croatian, Czech, Danish, English, Flemish, French, German, Hungarian, Japanese, Italian, Korean, Polish, Portuguese, Romanian, Russian, Serbian, Slovenian, Spanish, Swedish, Turkish and Ukrainian

HELP
Concise context-sensitive help in Chinese (People's Republic of China), English, French, German, Italian, Japanese, Polish, Romanian, Serbian, Slovenian, Spanish and Ukrainian

UPDATE OF SOFTWARE
Update to any version using BZ-5503 through USB or update via Internet

REMOTE ACCESS
Connect to the analyzer using:
- Measurement Partner Suite BZ-5503
- the 2250/2270 SDK (software development kit)
- a REST interface through HTTP
- an Internet browser supporting JavaScript

The connection is password protected with two levels of protection:
- Guest level: for viewing only
- Administrator level: for viewing and full control of the analyzer

Input

DUAL CHANNELS (Type 2270 only)
All measurements are made from either Ch.1 or Ch.2
Two independent measurement channels are available on Type 2270 to enable you to measure various parameters, subject to having a dual-channel application license

TRANSDUCER DATABASE
Transducers are described in a transducer database with information on Serial Number, Preamplifier ID, Nominal Sensitivity, CCLD Required and Weight.
The analogue hardware is set up automatically in accordance with the selected transducer

Calibration

Initial calibration for each transducer is stored for comparison with later calibrations For accelerometer Types 4397-A, 4513, 4513-001, 4513-002, 4514, 4514-001, 4514-002, 4533-B, 4533-B-001, 4533-B-002, 4534-B, 4534-B-001, 4534-B-002, 8324, 8341, 8344 and 8347-C + 2647-C, the lower frequency limit will be optimized to match the specifications for the accelerometer.

ELECTRICAL
Uses internally generated electrical signal combined with a typed-in value of microphone sensitivity

MECHANICAL
Using Calibrator Exciter Type 4294 or custom calibrator

DIRECT ELECTRICAL
Using an external voltage reference

CALIBRATION HISTORY
Up to 20 of the last calibrations made are listed and can be viewed on the analyzer

Data Management

METADATA
Up to 30 metadata annotations can be set per project (text from keyboard or text from pick list, number from keyboard or auto-generated number)

PROJECT TEMPLATE
Defines the display and measurement set-ups. Set-ups can be locked and password-protected

PROJECT
Measurement data stored with the project template

JOB
Projects are organized in jobs.
Explorer facilities for easy management of data (copy, cut, paste, delete, rename, open project, create job, set default project name)

Measurement Control

MANUAL
Manually controlled single measurement

AUTOMATIC
Preset measurement time from 1 s to 24 h in 1 s steps

MANUAL CONTROLS
Reset, Start, Pause, Back-erase, Continue and Store the measurement manually

AUTO-START
A total of 10 timers allow set up of measurement start times up to a month in advance. Each timer can be repeated. Measurements are automatically stored when completed

BACK-ERASE
The last 5 s of data can be erased without resetting the measurement

Measurement Status

ON SCREEN
Information such as overload and running/paused are displayed on screen as icons

TRAFFIC LIGHTS
Red, yellow and green LEDs show measurement status and instantaneous overload as follows:
- Yellow LED flashing every 5 s = stopped, ready to measure
- Green LED flashing slowly = awaiting calibration signal
- Green LED on constantly = measuring
- Yellow LED flashing slowly = paused, measurement not stored
- Red LED flashing quickly = intermittent overload, calibration failed

NOTIFICATIONS

Sends an SMS or email daily at a specified time or if an alarm condition is fulfilled

Alarm Conditions:

- Disk Space below set value
- Trig. Input Voltage below set value
- Internal Battery enters set state
- Change in Measurement State
- Reboot of analyzer

Annotations

VOICE ANNOTATIONS

Voice annotations can be attached to measurements so that verbal comments can be stored together with the measurement

Playback: Playback of voice annotations can be listened to using an earphone/headphones connected to the headphone socket

Gain Adjustment: – 60 dB to +60 dB

TEXT ANNOTATIONS

Text annotations can be attached to measurements so that written comments can be stored with the measurement

GPS ANNOTATIONS

A text annotation with GPS information can be attached (Latitude, Longitude, Altitude and position error). Requires connection to a GPS receiver

IMAGE ANNOTATIONS (TYPE 2270 ONLY)

Image annotations can be attached to measurements. Images can be viewed on the screen

Measurements

DUAL-CHANNEL MEASUREMENTS (TYPE 2270 ONLY)

Two independent measurement channels are available on Type 2270 to enable you to measure various parameters, subject to having a dual-channel application license

REFERENCE ENVIRONMENTAL CONDITIONS

Air Temperature: 23 °C

Static Pressure: 101.325 kPa

Relative Humidity: 50%

Broadband Analysis

DETECTORS

Parallel detectors on every measurement:

- **Detector 1:** Broadband detector with two exponential time weightings (Fast, Slow)
- **Detector 2:** Broadband detector (1 k – 20 kHz) with two exponential time weightings (Fast, Slow)
- **One peak detector**
- **Overload Detector:** Monitors the overload outputs of all the frequency weighted channels

MEASUREMENTS

For Display and Storage:

Start Time	Stop Time	Overload %
Elapsed Time	Time Remaining	
aLinear	aLin(1k–20kHz)	
aFast max	aF max(1k–20kHz)	
aSlow max	aS max(1k–20kHz)	
aFast min	aF min(1k–20kHz)	
aPeak	aT_{Peak}	
Crest Factor	Avg. RPM	

Linear (f1 – f2)*

* where f1 and f2 are frequency bands in the spectrum

Spectra:

Linear	Fast max.	Slow max.
Fast min.	Slow min.	

Only for Display as Numbers or Quasi-analog Bars:

aFast Inst	aF Inst(1k–20kHz)
aSlow Inst	aS Inst(1k–20kHz)
Inst RPM	Trig. Input Voltage

Instantaneous GPS Data:

Latitude	Longitude

RPM MEASUREMENT

RPM is measured on the signal connected to Trigger input when Tacho is set to On

Range: 1 to 6,000,000 RPM

Gear Ratio: 10^{-5} to 10^{38}. The displayed RPM is the measured RPM divided by the RPM gear ratio

MEASUREMENT DISPLAYS

SLM: Measurement data displayed as numbers of various sizes and one quasi-analog bar

Measured sound data are displayed as dB values, vibration data as dB values or in physical units (SI units (m/s^2) or US/UK units (g)), direct data as voltage in dB or V, housekeeping data as numbers in relevant format.

Instantaneous measurement L_{XF} or Fast Inst is displayed as a quasi-analog bar

Spectrum: One or two spectra superimposed

Table: One or two spectra in tabular form

Y-axis: Range: 5, 10, 20, 40, 60, 80, 100, 120, 140, 160 or 200 dB. Auto zoom or auto scale available. Data are displayed as dB values or in physical units (SI units (m/s^2) or US/UK units (g))

Cursor: Readout of selected band

Frequency Analysis

STANDARDS

Conforms with the following national and international standards:

- IEC 61260 – 1 (2014), 1/1-octave Bands and 1/3-octave Bands, Class 1
- IEC 61260 (1995 – 07) plus Amendment 1 (2001 – 09), 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI S1.11 – 1986, 1/1-octave Bands and 1/3-octave Bands, Order 3, Type 0 – C
- ANSI S1.11 – 2004, 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI/ASA S1.11 – 2014 Part 1, 1/1-octave Bands and 1/3-octave Bands, Class 1

CENTRE FREQUENCIES

1/1-oct. Band Centre Frequencies: 8 Hz to 16 kHz

1/3-oct. Band Centre Frequencies: 6.3 Hz to 20 kHz

Software Specifications – FFT Analysis Software BZ-7230

Specifications for FFT analysis are given for the analyzer with software BZ-7230 installed and fitted with one of the recommended transducers (see table below)

FFT ANALYSIS

Sampling Frequency: Downsampling from 51.2 kHz

Frequency Span: 100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz

Lines: 100, 200, 400, 800, 1600, 3200, 6400*

Zoom Centre Frequency: Can be set so that the Frequency Span is placed in the range 0 to 20 kHz

Spectrum: Averaged and Maximum

* The actual number of lines is one more than stated, to provide symmetry around the centre frequency.

Pre-weighting: Z (none), A, B or C (microphone input only)

Measurement Control

Measurements can be manually started and stopped using a pushbutton or an external signal

MANUAL START

Exponential Averaging: With an averaging time of up to 999 spectra, measured with Hanning window and 67% overlap
Linear Averaging: Up to 8388607 spectra measured with Hanning window and 67% overlap

TRIGGERED START

Transient Signal Type: Linear averaging of up to 32767 triggered spectra measured with rectangular window and 0% overlap
Continuous Signal Type: Linear averaging of up to 32767 spectra measured with Hanning window and 67% overlap. Up to 32767 spectra are averaged on each trigger
Auto-start: A total of 10 timers allow set up of measurement start times up to a month in advance.
Each timer can be repeated. Measurements are automatically stored when completed

TRIGGERS

Delay: From 16383 samples before the trigger time to 300 seconds after
Hold Off: 0 to 300 s
Internal Trigger: Uses the time signal from the measurement transducer. The Internal Level is set in the relevant measurement units
External Trigger: Uses the Trigger Input. The External Level is set in the range –20 to 20 V
Offset at Trigger Input: Typically between –70 mV and 200 mV
Hysteresis (only for External Trigger): 0 to 10 V
Slope (only for External Trigger): Rising, Falling

MEASUREMENT RANGE

(See table below)

Table 1 Measurement ranges with the recommended transducers

TRANSDUCER	NOMINAL SENSITIVITY	SPURIOUS FREE DYNAMIC RANGE FOR HIGH LEVELS	SPURIOUS FREE DYNAMIC RANGE FOR LOW LEVELS	TYPICAL FREQUENCY RESPONSE LOW FREQUENCY: EXTENDED/NORMAL
4397-A	1 mV/(m/s^2)	3 mm/s^2 – 5 km/s$^2_{Peak}$	300 µm/s^2 – 75 m/s$^2_{Peak}$	1.25/6.3 Hz – 20 kHz
4533-B 4534-B	1 mV/(m/s^2)	3 mm/s^2 – 5 km/s$^2_{Peak}$	300 µm/s^2 – 75 m/s$^2_{Peak}$	0.2/6.3 Hz – 12.8 kHz
4533-B-001 4534-B-001	10 mV/(m/s^2)	300 µm/s^2 – 500 m/s$^2_{Peak}$	30 µm/s^2 – 7.5 m/s$^2_{Peak}$	0.2/6.3 Hz – 12.8 kHz
4533-B-002 4534-B-002	50 mV/(m/s^2)	60 µm/s^2 – 100 m/s$^2_{Peak}$	6 µm/s^2 – 1.5 m/s$^2_{Peak}$	0.2/6.3 Hz – 12.8 kHz
8341	10 mV/(m/s^2)	300 µm/s^2 – 500 m/s$^2_{Peak}$	30 µm/s^2 – 7.5 m/s$^2_{Peak}$	0.7/6.3 Hz – 10 kHz
8344	250 mV/(m/s^2)	12 µm/s^2 – 20 m/s$^2_{Peak}$	1.2 µm/s^2 – 300 mm/s$^2_{Peak}$	0.2/6.3 Hz – 3 kHz
8347-C + 2647-D	1 mV/(m/s^2)	3 mm/s^2 – 7 km/s$^2_{Peak}$	300 µm/s^2 – 75 m/s$^2_{Peak}$	1.25/6.3 Hz – 12.8 kHz

The lower limit of the measurement range is influenced by self-generated random noise and self-generated tones called spurious signals. The influence of the random part can be reduced to a level below the spurious signals by selecting a small analysis bandwidth (small span and many lines). Therefore, the lower limit is specified as the maximum Peak level of the spurious signal lines
BZ-7230 has only one measuring range but the spurious level depends on the peak level of the signal. Therefore, two specifications are given. One for high levels, where the upper limit is the overload limit, and one for low levels
The Typical Frequency Response shows the ±1 dB limits for Direct Input and microphones, and the ±10% limits for accelerometers

RPM MEASUREMENT

RPM is measured on the signal connected to Trigger input when Tacho is set to On
Range: 1 to 6000000 RPM
Instantaneous RPM: Instantaneous RPM is only displayed (and not stored)
Average RPM: Displayed and stored together with each Spectrum result. In Linear Averaging it is an average over the same time as the spectrum. In Exponential averaging it is the last measured RPM
Gear Ratio: 10^{-5} to 10^{38}. The displayed RPM are the measured RPM divided by the RPM Gear Ratio

OVERLOAD

Instantaneous Overload: Instantaneous overload is displayed as an icon on the display and is also indicated by the traffic light
Spectrum Overload: Displayed and stored together with each spectrum result

DISPLAY SPECTRA

Two spectra superimposed
Scaling: RMS, Peak, Peak-to-Peak, Power, PSD, ESD
Reference Spectrum: Compare spectrum to stored (measured) reference
Axis: Logarithmic or linear Y-axis; Logarithmic or linear X-axis
X-axis: Display full frequency range or expand the X-axis until only 20 FFT lines are displayed. Scroll available
Y-axis Display Range: 5, 10, 20, 40, 60, 80, 100, 120, 140, 160, 180 or 200 dB. Auto-zoom or Auto-scale available
Digital Post-weighting: Z (none) or A-weighting*

DISPLAY PARAMETERS

Sound: Sound pressure level in dB
Vibration: Acceleration, velocity or displacement in dB or physical units. SI units (m/s^2, m/s or m) or US/UK units (g, m/s or Mil)
Direct: Voltage in dB or V

CURSORS

Readings: Total level within the spectrum
Frequency Correction: For spectra measured with a Hanning window, spectral peaks are interpolated to a higher precision
Main: Reads level versus frequency
Symmetrical Delta and Delta: Defines lower and upper frequency limit for any part of the spectrum and calculates the level sum within that frequency range
Harmonic: Identifies fundamental frequency and harmonics in the spectrum and calculates the Total Harmonic Distortion† (THD)
Reference: Reads the difference between the main cursor Y-value and the reference cursor Y-value

TOLERANCE CHECK

Tolerance Window: Determines the upper and lower levels and the top and bottom frequency at which the spectrum is checked. The check can either be made on all the FFT Lines within the specified range or on the Delta Sum of the lines.
The following parameters are measured for check on Delta Sum with exponential averaging:

- Delta Sum

* Microphone input only.
† Total Harmonic Distortion (THD) is the sum (in %) of all the harmonics relative to the sum of the fundamental and all the harmonics.

- Max Delta Sum
- RPM at time for Max Delta Sum
- LAF at time for Max Delta Sum
- FFT Spectrum at time for Max Delta Sum

Up to 10 tolerance windows can be specified per template.
Single Values Check: Tolerances can be set for the parameters: L_{AF}, Instantaneous RPM, L_{Aeq} and Average RPM
Indication: Results for each tolerance window and for the four single values can be displayed. An Overall Result (combination of all results) and a Latched Result (latched during measurement) can be displayed and are indicated in the status panel.
When tolerance limits are violated, a recording can be started (license for BZ-7226 required) and a 3.3 V DC signal (above upper limit), a −3.3 V DC (below lower limit), a 3 V DC signal (Level 3), a 2 V DC signal (Level 2), a 1 V DC signal (Level 1) or a signal alternating between 3.3 V and −3.3 V (both above and below limits) can be output to the Output Socket

BAR GRAPH

LAF, LZF, Total of Spectrum and Delta Sum can be displayed on a bar graph with indication of Max Delta Sum and Upper, Level 2 max, Level 1 max and Lower Limits.

For engineering units, the axis on bar graph can be logarithmic or linear and can be zoomed

Broadband Parameters

Broadband parameters are measured simultaneously with the FFT parameters, however, their measurement starts when the Start/Pause pushbutton is pressed and it ends at the nearest whole second after the end of the FFT measurement.
When Type 2250/2270 is fitted with an accelerometer, the following broadband parameters can be displayed in engineering units:

- LXeq
- LYeq
- LXFmax
- LYFmax
- LXFmin
- LYFmin
- LVpeak
- LXF
- LYF

Software Specifications – Enhanced Vibration and Low Frequency Option BZ-7234

Enhanced Vibration and Low Frequency Option BZ-7234 is enabled with a separate license. It adds human vibration parameters, and integration and double integration of the acceleration signal for vibration and displacement parameters to Sound Level Meter, Frequency Analysis, Logging and Enhanced Logging Software and adds low frequency 1/1- and 1/3-octave analysis to Frequency Analysis, Logging and Enhanced Logging Software

General Vibration

Specifications for general vibration parameters apply to Type 2250/2270 fitted with an accelerometer

Standards

Conforms with the following International standards:

- ISO 2954
- ISO 10816 series

Analysis

DETECTORS

Addition to the Acc Linear and Acc 1k – 20 kHz settings for the two broadband detectors:

Vel 3 – 20000 Hz	Vel 0.3 – 1000 Hz	Vel 10 – 1000 Hz
Vel 1 – 100 Hz	Dis 10 – 1000 Hz	Dis 30 – 300 Hz
Dis 1 – 100 Hz		

The weighting for the peak detector can be set to one of the settings chosen for the broadband detectors or Acc Linear.
The weighting for the spectrum detectors can be set to Acc Linear or Vel 3 – 20000 Hz, Vel 0.3 – 1000 Hz, Vel 10 – 1000 Hz or Vel 1 – 100 Hz
Single Values for Display and Storage: Peak-Peak for displacement

Human Vibration

Specifications for Human Vibration parameters apply to Type 2250/2270 fitted with an accelerometer.

Standards

Conforms with the following International Standards:

- ISO 8041:2005
- ISO 5349–1
- ISO 2631 series
- DIN 45669-1:2010–09

Analysis

DETECTORS

Two broadband detectors can each be set to one of the weightings:

Acc Linear	Vel 0.3 – 1000 Hz	Vel 1 – 100 Hz
W_b	W_c	W_d
W_e	W_j	W_h
W_k	W_m	W_{xb}
W_{hb}	W_{mb}	

W_{mb} is the band limiting part of W_m. W_{hb} is the band limiting part of W_h and W_{xb} is the band limiting part of W_b, W_c, W_d, W_e, W_j and W_k
The weighting for the peak detector can be set to one of the settings chosen for the broadband detectors or Acc Linear.
The weighting for the spectrum detectors can be set to Acc Linear or Vel 0.3 – 1000 Hz or Vel 1 – 100 Hz

MEASUREMENTS

Single Values for Display and Storage:

MTVV	KBF_{max}	KBF_{Tm}
Peak-Peak		

Single Values for Display Only:

aW,1s	KBF

Low Frequency 1/1- and 1/3-octave Analysis

Frequency Analysis

CENTRE FREQUENCIES
1/1-oct. Band Centre Frequencies: 1 Hz to 16 kHz
1/3-oct. Band Centre Frequencies: 0.8 Hz to 20 kHz

Standards

Conforms with the following national and international standards:
- IEC 61260 – 1 (2014), 1/1-octave Bands and 1/3-octave Bands, Class 1
- IEC 61260 (1995 – 07) plus Amendment 1 (2001 – 09), 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI S1.11 – 1986, 1/1-octave Bands and 1/3-octave Bands, Order 3, Type 0–C
- ANSI S1.11 – 2004, 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI/ASA S1.11 – 2014 Part 1, 1/1-octave Bands and 1/3-octave Bands, Class 1

Vibration Measurements

Brüel & Kjær recommends Low-level Accelerometer Type 8344 for low-frequency vibration measurements

Software Specifications – Signal Recording Option BZ-7226

Signal Recording Option BZ-7226 is enabled with a separate license.
For data storage, signal recording requires:
- SD Card
- USB Memory Stick

RECORDED SIGNAL
A-, B-, C- or Z-weighted sound signal from the microphone or acceleration signal from the accelerometer

AUTOMATIC GAIN CONTROL
The average level of the signal is kept within a 40 dB range, or the gain can be fixed

SAMPLING RATE AND PRE-RECORDING
The signal is buffered for the pre-recording of the signal. This allows the beginning of events to be recorded even if they are only detected later

SAMPLING RATE (KHZ)	8	16	24	48
Maximum Pre-recording (s) 16-bit	470	230	150	70
Maximum Pre-recording (s) 24-bit	310	150	96	43

Memory (kB/s) 16-bit	16	32	48	96
Memory (kB/s) 24-bit	24	48	72	144

PLAYBACK
Playback of signal recordings can be listened to using the earphone/ headphones connected to the headphone socket

RECORDING FORMAT
The recording format is either 24- or 16-bit wave files (extension .wav) attached to the data in the project, easily played back afterwards on a PC using BZ-5503, Type 7820 or 7825. Calibration information and possible tacho trigger information are stored in the .wav file allowing BZ-5503 and BK Connect to analyse the recordings

Functions

Manual Control of Recording: Recording can be manually started and stopped during a measurement using a pushbutton or an external signal
Automatic Control of Recording: Start of recording when measurement is started. Minimum and Maximum recording time can be preset

Specifications – Measurement Partner Suite BZ-5503

BZ-5503 is included with Types 2250 and 2270for easy synchronization of setups and data between the PC and hand-held analyzer. BZ-5503 is supplied on ENV DVD BZ-5298

PC REQUIREMENTS
Operating System: Windows® 7, 8.1 or 10 (all in 32-bit or 64-bit versions)
Recommended PC:
- Intel® Core™ i3
- Microsoft®.NET 4.5
- 2 GB of memory
- Sound card
- DVD drive
- At least one available USB port
- Solid State Drive

ONLINE DISPLAY OF TYPE 2250/2270 DATA
Measurements on the analyzer can be controlled from the PC and displayed online with the PC, using the same user interface on the PC as on the analyzer
Display: 1024 × 768 (1280 × 800 recommended)

DATA MANAGEMENT
Explorer: Facilities for easy management of analyzers, users, jobs, projects and project templates (copy, cut, paste, delete, rename, create)
Data Viewer: View measurement data (content of projects)
Synchronization: Project templates and projects for a specific user can be synchronized between PC and analyzer

USERS
Users of Type 2250/2270 can be created or deleted

EXPORT FACILITIES
Excel®: Projects (or user-specified parts) can be exported to Microsoft® Excel® (Excel 2003 – 2016 supported)
Brüel & Kjær Software: Projects can be exported* to BK Connect

POST-PROCESSING
With the post-processing module licence, Measurement Partner Suite includes a range of post-processing tools for data acquired with Type 2250/2270. These tools help to assess logging data and measured spectra, such as calculating contribution from markers on a logging profile, or correcting spectra for background noise

HAND-HELD ANALYZER SOFTWARE UPGRADES AND LICENSES
The software controls analyzer software upgrades and licensing of the analyzer applications

* Not all data are available in all exports. The data exported are dependent on the type and target of the export.

INTERFACE TO HAND-HELD ANALYZER
USB, LAN or Internet connection

LICENSE MOVER
To move a license from one analyzer to another use BZ-5503 together with License Mover VP-0647

LANGUAGE
User interface in Chinese (People's Republic of China), Chinese (Taiwan), Croatian, Czech, Danish, English, Flemish, French, German, Hungarian, Japanese, Italian, Korean, Polish, Portuguese, Romanian, Russian, Serbian, Slovenian, Spanish, Swedish, Turkish and Ukrainian

HELP
Concise context-sensitive help in English

Ordering Information

To measure vibration, add an accelerometer and accelerometer cable along with software modules to the basic analyzer, Type 2250-W or Type 2270-W. Alternatively, add the accelerometer + cable to one of our preconfigured vibration analyzer systems:

Type 2250-V-S01 Integrating Hand-held Vibration Analyzer (1/n-octave band analysis only)
which includes the following:
- Type 2250-W: Hand-held Analyzer
- BZ-7234: Enhanced Vibration and Low Frequency Option

Type 2250-V-SC1 Integrating Hand-held Vibration Analyzer with calibrator (1/n-octave band analysis only)
which includes the following:
- Type 2250-W: Hand-held Analyzer
- BZ-7234: Enhanced Vibration and Low Frequency Option
- Type 4294: Calibration Exciter

Type 2250-V-S02 Integrating Hand-held Vibration Analyzer (1/n-octave, FFT and signal analysis)
which includes the following
- Type 2250-W: Hand-held Analyzer
- BZ-7234: Enhanced Vibration and Low Frequency Option
- BZ-7230: FFT Software
- BZ-7226: Signal Recording Option

Type 2250-V-SC2 Integrating Vibration Analyzer with calibrator (1/n-octave, FFT and signal analysis)
which includes the following
- Type 2250-W: Hand-held Analyzer
- BZ-7234: Enhanced Vibration and Low Frequency Option
- BZ-7230: FFT Software
- BZ-7226: Signal Recording Option
- Type 4294: Calibration Exciter

Both Types 2250-W and 2270-W include the following as standard:
Software:
- BZ-7222: Sound Level Meter Software
- BZ-7223: Frequency Analysis Software
- BZ-7231: Tone Assessment Option
- BZ-7232: Noise Monitoring Software
- BZ-7229: 2-channel Option (Type 2270 only)

Accessories:
- FB-0679: Hinged Cover (Type 2250 only)
- FB-0699: Hinged Cover (Type 2270 only)
- QB-0061: Battery Pack
- ZG-0426: Mains Power Supply
- Accessory Kit UA-1710-D01 including:
  - KE-0441: Protective Cover for Hand-held Analyzer
  - UL-1050:Wireless USB-A (M) Adapter
  - UA-1651: Tripod Extension for Hand-held Analyzer
  - UA-1654: 5 Extra Styli
  - UA-1673: Adapter for Standard Tripod Mount
  - DH-0696: Wrist Strap
  - DD-0594: Protection Plug for Hand-held Analyzer without Preamplifier
  - AO-1494: Cable, USB 2.0, USB-A (M) to USB-micro-B (M) black, 1.8 m (5.9 ft), max. +70 °C (158 °F)
  - BZ-5298: Environmental Software

NOTE: These accessories are also available separately

Software and Accessories Available Separately

SOFTWARE MODULES

BZ-7224	Logging Software
BZ-7225	Enhanced Logging Software
BZ-7225-UPG	Upgrade from Logging Software BZ-7224 to Enhanced Logging Software BZ-7225 (does not include memory card)
BZ-7226	Signal Recording Option
BZ-7229	2-channel Option (Type 2270 only)

MEASUREMENT PARTNER SUITE SOFTWARE

BZ-5503-012	Post-processing Module, 1-year subscription for one instrument
BZ-5503-ND	Post-processing Module, permanent license for any instrument (dongle)
BZ-5503-NI	Post-processing Module, permanent license for one instrument

MEASUREMENT ACCESSORIES

Type 4397-A	Accelerometer, with 1 mV/ms^{-2} sensitivity, suitable for high-frequency and high-level measurement, with M3 connection
Type 4533-B	Accelerometer, general purpose, with 1 mV/ms^{-2} sensitivity and 10 – 32 UNF, side connection
Type 4533-B-001	Accelerometer, suitable for low-level measurement, 10 mV/ms^{-2} and 10 – 32 UNF, side connection
Type 4533-B-002	Accelerometer, suitable for very low-level measurement, 50 mV/ms^{-2} and 10 – 32 UNF, side connection
Type 4534-B	Accelerometer, general purpose, with 1 mV/ms^{-2} sensitivity and 10 – 32 UNF, top connection
Type 4534-B-001	Accelerometer, suitable for low-level measurement, 10 mV/ms^{-2} and 10 – 32 UNF, top connection
Type 4534-B-002	Accelerometer, suitable for very low-level measurement, 50 mV/ms^{-2} and 10 – 32 UNF, top connection
Type 8324	Piezoelectric Charge Accelerometer, industrial, with 1 pC/ms^{-2} sensitivity and 2-pin 7/16-27 UNS connection
Type 8341	Accelerometer, industrial, with 10.2 mV/ms^{-2} sensitivity and MIL-C-5015 top connection
Type 8344	High-sensitivity Accelerometer, with 250 mV/ms^{-2} sensitivity and 10–32 UNF side connection
Type 2647-D-004	Charge-to-CCLD Converter with integrated cable and connectors for Accelerometer Type 8324 and Type 2250/2270; 80 Hz – 10 kHz

MISCELLANEOUS

Type 2981	Laser Tachometer Probe
Type 4294	Calibration Exciter
UA-0588	Tripod Adaptor for ½″ Microphone/Preamplifier Assemblies
UA-0801	Small Tripod
UL-1009	SD Memory Card
UL-1017	SDHC Memory Card
ZG-0444	Charger for QB-0061 Battery Pack
QS-0007	Tube of Cyanoacrylate Adhesive
UA-0642	Mounting Magnet for accelerometer 10 – 32 UNF mounting
UA-1077	Mounting Magnet for accelerometer M3 mounting
YJ-0216	Beeswax for mounting accelerometer
KE-0440	Travel Bag
KE-0459	Shoulder Bag

CABLES

AO-0440-D-015	Signal Cable, LEMO to BNC, 1.5 m (5 ft)
AO-0701-D-030	Accelerometer Cable, LEMO to M3, 3 m (10 ft)
AO-0702-D-030	Accelerometer Cable, LEMO to 10 – 32 UNF, 3 m (10 ft)
AO-0722-D-050	Accelerometer Cable, LEMO to MIL-C-5015, 5 m (16 ft)
AO-0726-D-030	Cable for Laser Tachometer Probe, LEMO to SMB, 3 m (10 ft)
AO-0726-D-050	Cable for Laser Tachometer Probe, LEMO to SMB, 5 m (16 ft)
AO-0727-D-015	Signal Cable, LEMO to BNC Female, 1.5 m (5 ft)

Service Products

SLM-ADV-CAF	SLM Advanced, Accredited Calibration incl. microphone
SLM-ADV-CAI	SLM Advanced, Initial Accredited Calibration incl. microphone
VM-CAF	Vibration Meter, Accredited Calibration incl. accelerometer
VM-CAI	Vibration Meter, Initial Accredited Calibration incl. accelerometer

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