

impaq Elite™

Benstone
INSTRUMENTS

impaq Elite 4 Channel Signal Analyzer

New Standard for Advanced Sound & Vibration Test in the Field



Benstone Instruments, Inc.

•Pioneering •Partnership •Performance

impaq Elite™

Born for In-Field Testing

Impaq Elite is a portable 4 channel real-time analyzer that is built for advanced noise and vibration measurements in the field. Manufactured with a ruggedized housing by a dual injection molding process and protective sealing to provide an IP 65 rating for measurement in harsh environments. Impaq Elite is equipped with a large 6.4-inch color VGA (640 x 480 high resolution) touch screen. The combination of Microsoft's powerful WinCE operating system and touch screen operation provides a user friendly and intuitive interface. Impaq Elite acquires measurement signal with precision 24 bit sigma delta AD converters to provide a high dynamic range, up to 40 kHz maximum bandwidth. Impaq Elite has an 800 MHz CPU for running the Windows CE system and the fastest commercially available DSP chip TI TMS320C6713B for performing signal analysis at extremely fast real-time rates.



MODULARIZED APPLICATION SOFTWARE

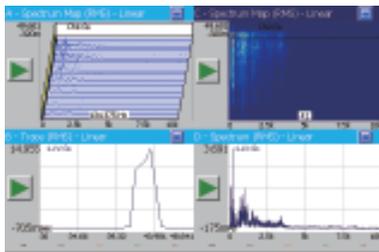
Because every person may have different testing requirements, we have developed modular software for specific applications. It is very easy to install the modular software to an Impaq Elite or to download an updated version from our website. The following application programs are available from Benstone Instruments.



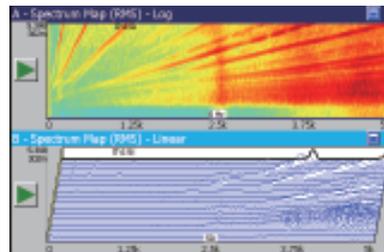
FFT Spectrum Analysis:



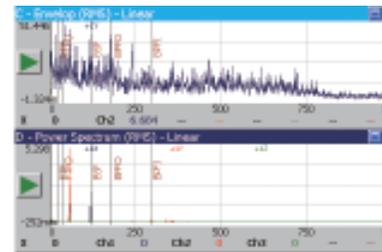
Impaq Elite's powerful FFT program allows you to conduct cross-channel analysis such as FRF, coherence, and cross power spectrum that are required for modal test, ODS testing or sound intensity measurements. Also supported is continuous spectral measurements and waterfall display, which is required for analysis of varying speed machines.



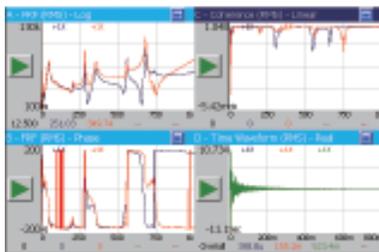
Display data in waterfall plot, intensity plot, trace plot and spectrum plot.



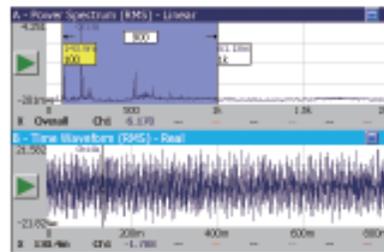
Measure spectral map and display data in 3D waterfall plots and intensity plots



Display Envelope spectrum with bearing fault frequencies



Display the amplitude and phase of FRF, Coherence and time waveform



Display power spectrum with dual cursor and time waveform

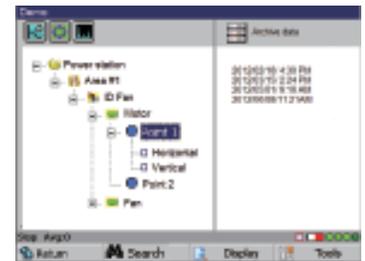
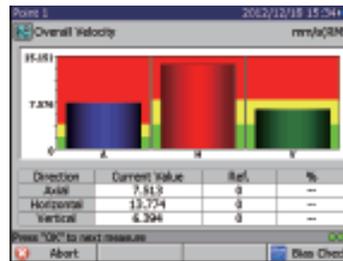
- General vibration analysis
- Modal testing
- Sound intensity measurement
- Operational deflection shape measurement
- Bearing diagnosis

Impaq Elite's FFT program also supports bearing vibration analysis as a standard feature. When the element of a bearing develops a defect, it will create periodic spike signals and excite the natural frequencies of the structure(s). By taking advantage of demodulation technology, one may see the fault frequencies of a bearing on a demodulated spectrum at its early stage of damage. Impaq Elite's bearing analysis program uses a wavelet based Hilbert Transform algorithm, which shows clear spectral pattern(s) and low levels of sidebands in the demodulated spectrum. With a built-in database of bearings, one can easily identify the bearing frequencies on a demodulated spectrum. In this program, one may conduct a scanning process and show the results on a 3D plot, and then select the appropriate envelope filter for the best measurement quality results.



Route Based Data Collector

The data collector program supports simultaneous tri-axial measurement, saving many work hours in the field. Demodulated spectrum analysis is a standard feature for identifying bearing faults at earlier stages of bearing failure. Temperature and other process parameter measurements are also supported in the data collector program.



Triaxial measurement gives global view of machine conditions and saves work hours.

Browse the database of a route from the main display

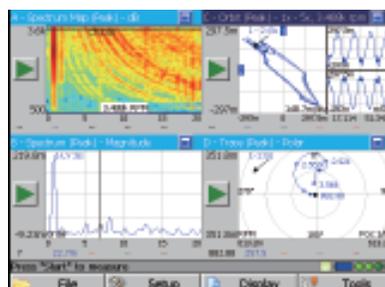


Computed Order Tracking

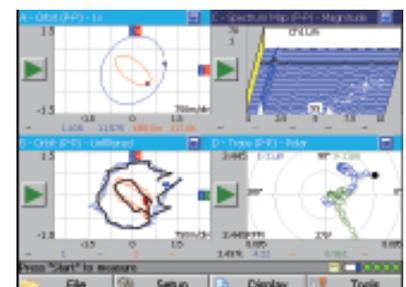
The computed order tracking program is used to analyze the sound or vibration signals of a varying speed machine. Typical applications for this software module are like NVH testing of vehicles or vibration analysis of turbine machines. It calculates the order spectrum, order traces, filtered or unfiltered orbits, gap reading and centerline of a shaft accurately during a start-up or coast-down process. The impaq Elite's order tracking algorithm performs digital re-sampling of the measured signal for ensuring data accuracy. The order spectrum data can be displayed on a waterfall plot or intensity map. One may cut a slice or a trace of data from the waterfall plot and then examine the individual traces. As shown in the figure below, the user can enter geometric position(s) of the vibration sensors to create a plot to display orbit and shaft centerline motion, which relates to the realistic behavior of a turbine machine.



Setup the sensor locations and rotating direction for orbit, polar and centerline measurements



Display order spectral map, orbit and waveform, order spectrum and polar plot



Display filtered orbit, unfiltered orbit, waterfall plot and polar plot for 1X vibration



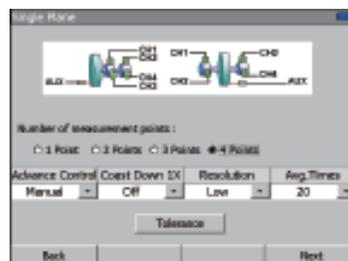
Rotor Balancing :

The Impaq Elite with the balancing software package can balance your rotating machines in the field with industry leading balancing techniques like; single plane, dual plane, overhung dual plane, 3 plane, 4 plane and 3 weights balancing. This advanced balancing software makes it very simple to balance machines in-field with a very high level of accuracy. Now with multiple-point balancing, vibration in BOTH horizontal and vertical directions is minimized at the same time. By conducting coast-down measurements for 1X vibration, the heavy spot can be easily identified with only one measurement saving you time, money and increasing safety. This technique prevents the user from danger by putting the trial weights in the wrong place, and shortens the balance time. Other features / functions are:

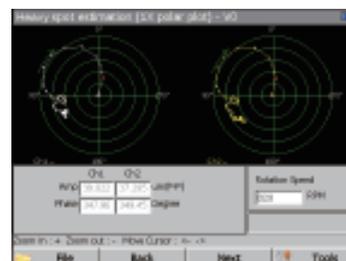
- Multi-point balancing
- Component calculation
- Drill depth calculation
- Unequal radii calculation
- Decoupled balancing (couple + static)
- Review historical vibration data on a polar plot.
- Review historical balancing data on a polar plot
- Heavy spot estimation with one shot measurement.
- Redo a previous balancing job with saved balancing factors.
- Continue an unfinished balancing job from a saved file
- Allowable residual unbalance calculated from the ISO 1940 standard



Select the desired balancing function from the main display



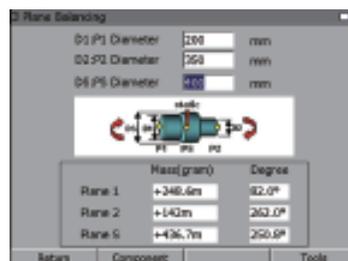
Select up to 4 measurement points for single plane balancing



Find out the heavy spot location from a single coast-down measurement of 1X vibration



Component calculation for discrete weight locations

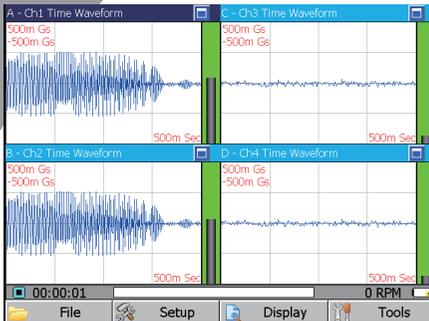


Conversion of dual plane balancing into static and couple balancing

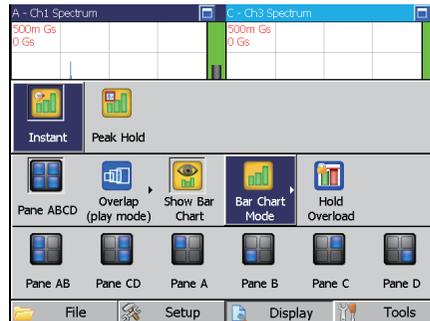
Raw Data Recorder



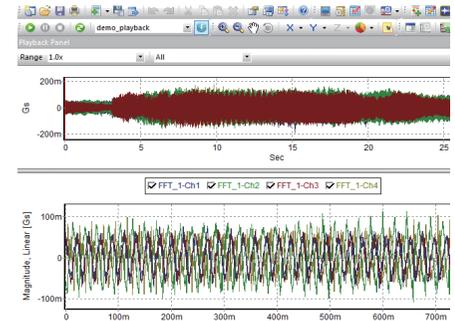
The recorder program directly records raw time data to the built-in compact flash card. For example, a 1 gigabyte file will contain approximately three hours of continuous data with four channels recording at 2 kHz bandwidth. The recorded data can be replayed and listened through the output LEMO connector and a headset for sound quality evaluation purpose. To analyze the recorded data, you may conduct FFT, Order Tracking or Octave analysis from the playback mode of PC software Novian on a computer.



Record raw data with real time waveform view.



Various display modes and tools.

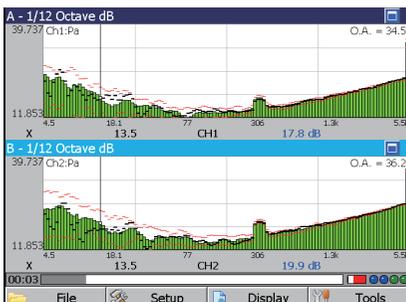


Replay and analyze raw data file with Novian on a PC

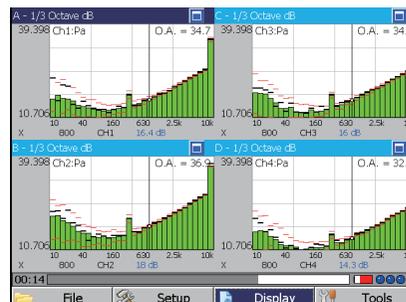
Octave Spectrum Analysis



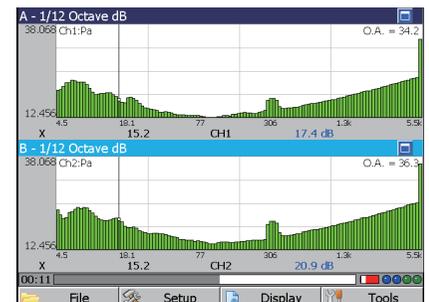
The octave analysis program utilizes real-time digital filtering technology to generate octave, 1/3 octave or 1/12 octave spectrum. Conforming to the IEC 61260 & IEC 61672 standards, the octave program is best suited for acoustic or vibration measurements in the field. For vibration applications, the octave program can perform measurements with user-defined weightings. One example is that impaq Elite can perform tri-axial measurements with the special weighting of ISO 6954.



1/12 octave measurement with maximum, minimum and live bars



Display 1/3 octave in four window format

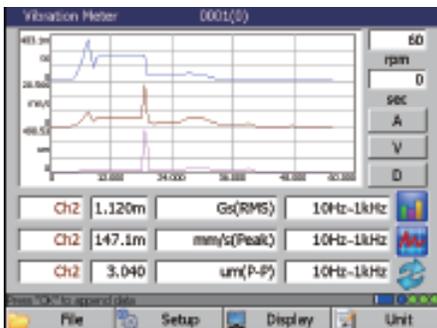


1/12 octave measurement in dual window format

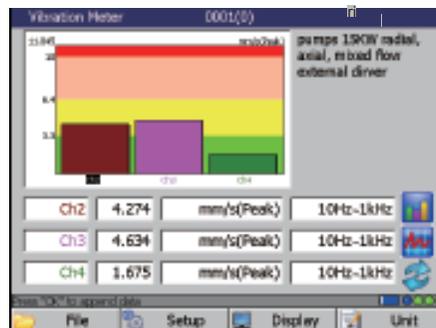


Vibration Meter

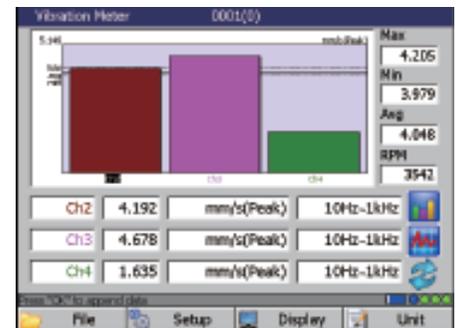
The overall vibration level is a basic parameter for determining a machine's operational condition. By simulating the operation of an analog meter, impaq Elite's vibration meter program performs time domain integration, filtering and root mean square (RMS) calculations for accurate measurements of vibration levels. One to Four channels can be measured at the same time, displaying the results to a trend chart, bar chart, or you may record the data continuously to a file. Easily check vibration severity with the built-in ISO 10816-3 standard. The user may select different filter settings, or create a user defined filter for special measurements.



Measure and display overall level of acceleration, velocity and displacement in trend plot



Display bar plot with severity color in background (ISO 10816-3 or user defined)



Display vibration velocity in bar plot for multi channel measurement



Specifications:

Hardware Feature	Technical Specifications
Operating system	Windows CE™
Number of input channels	4 analog channels and 1 aux channel
Connector of input channels	Analog: BNC and 7 pin Lemo, Aux: 6 pin Lemo
Channel coupling	AC, DC, IEPE, 0V microphone
Aux channel	TTL or non-TTL in (external trigger or tacho), TTL out
DSP processor	TI TMS320C6713B
External memory	Compact flash card
Battery	Li-Po 7.4V 5800 mAh, rechargeable
PC communication interface	USB 1.1, mini B type USB connector
LCD display	640X480 6.4 inch TFT color touch screen
Operating temperature	-10 deg C to + 45 deg C
Safety certifications	CE
Sealing / Ruggedness	IP 65
Housing material	Dual material: hard ABS plastic and soft TPR
Weight	4.5 lb (2.0 kg)
Size	11.2inch*7.1inch*3.0inch (284mm*180mm*76mm)
Max input signal range	±20 Volt
Dynamic range	>130 dB (measured from spectrum)
A/D converter	24 bit sigma-delta A/D converter
Frequency range	0 Hz to 40KHZ
Input impedance	1M Ohm

Feature for FFT Analysis	
FFT real time rate	40 kHz, single channel @12800 lines
FFT resolution	100-12,800 lines
Spectral map	3D waterfall or intensity plots for continuous spectrum measurements
Time windows	Hanning, hamming, flattop, rectangular, force, exponential
Analysis functions	Spectrum, power spectrum, cross power spectrum, FRF, time waveform, envelope spectrum, orbit, coherence and PSD
Engineering units	Automatic units transform with pre-defined table
Zoom FFT	Yes
Average	Linear, exponential, time, peak hold
Trigger	External, input channel triggering, pre/ post triggering
Cursor	Single, harmonic, harmonic+ single, peak, band cursor mark cursor
Envelope filters	500~2kHz, 1k~2.5kHz, 2k~5kHz, 5k~10kHz or user defined.

Feature for Data Collector	
Types of measurement	Overall acceleration, overall velocity, overall displacement, overall bearing vibration (envelope acceleration and high pass velocity), time waveform, power spectrum, demodulated spectrum, Crest factor, temperature, process parameters.
Vibration sensors	support simultaneous 3 axis measurement or uni-axial
Filters	2Hz-1kHz, 5Hz-1kHz, 10Hz-1kHz, 2Hz HP, 5Hz HP, 10Hz HP
Overall display	Bar chart or trend chart (shown with latest 9 historical data)
Spectrum display	Show band alarm or fault frequencies.
Time waveform display	Show waveform and/ or orbit
Search	Search train, machine or point
Tools	Add note, skip point, hide archive points, show all points, show archive points only, insert or delete unscheduled points

Feature for Rotor Balancing	
Rotor type for balancing	Single plane, dual plane, 3 plane, 4 plane, overhung dual plane, 3 weights balancing
Balancing speed	60 rpm to 300,000 rpm
Order resolution	Low, normal, high, 0.03, 0.015, 0.008, and 0.004
Average number	10, 20, 50 and 100
Balancing grade	Built-in ISO 1940 standard or user defined
Tools	1X coast down order trace, decoupled balancing (static and couple), unequal radii, component calculation, drill depth, vibration history, balancing history and recalculation of balancing coefficients.

Feature for Octave Analysis	
Octave spectrum	Full octave, 1/3 octave and 1/12 octave
Maximum band with 4 channel on	Full octave: 32k Hz, 1/3 octave: 10kHz, 1/12 octave: 5kHz
Maximum band with 1 channel on	Full octave: 32kHz, 1/3 octave: 40kHz, 1/12 octave: 20kHz
Integration time (second)	1/128, 1/64, 1/32, 1/16, 1/8, 1/4, 1/2, 1, 2, 4
Detection method	Fast, slow, impulse, linear
Trigger sources	Off, external, input channels, manual
Weighting	A, C, flat or user defined

Feature for Raw Data Recorder	
Recorded data	Raw time data and TTL tacho signal
Monitor display	Waveform, continuous waveform or spectrum (resolution 100, 200 or 400 lines)
Storage media	Compact flash card
Data review	Playback block by block, fast forward or rewind
Maximum file size	1 Gigabyte each
Maximum sampling rate	51.2 kHz for 1 channel, 25.6kHz for 2 channels and 12.8 kHz for 4 channel
Data analysis	Raw data files can be replayed by Novian software with FFT, octave or order tracking analysis.

Feature for Vibration Meter	
Types of vibration	Acceleration, velocity and displacement
Types of detection	RMS, peak, peak to peak, true peak and quest factor
Filters	2Hz-1kHz, 5Hz-1kHz, 10Hz-1kHz, 2Hz HP, 5Hz HP, 10Hz HP
Display	trend chart (vibration vs. time or rpm) or bar chart.
Severity	ISO 10816-3 or user defined

Feature for Computed Order Tracking	
Measurement types	Order trace, order spectrum, spectrum map, RPM profile, orbit, gap and shaft centerline.
Measurement control	Manual, time step, rpm step or both time and rpm step.
Rotation speed	6 rpm to 480,000 rpm
Order resolution	0.5, 0.25, 0.125 and 0.0624
Max. number of traces	User selectable 16 orders plus overall traces.
Max. order	800 order
Waterfall display	Adjustable waterfall plot and intensity plot
Waterfall cursor	RPM cursor and Order cursor
Y-Axis of order traces	Linear, log, dB, real, image, phase, number and polar plot.
Geometry setting	Selectable angular location of sensors



Benstone Instruments, Inc.
 32905 Northland Court- St. Paul, MN 55045
 Telephone: 651-257-6500
 Fax: 651-257-4004
<http://www.benstone.com>

