impaq Elite

4 channel dynamic signal analyzer

BENSTONE INSTRUMENTS, INC

●Pioneering ●Partnership ●Performance

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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 high-speed 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, Benstone Instruments has developed modular software for specific applications. It is very easy to install the modular software to an existing 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 required for modal, ODS testing or sound intensity measurements. Also supported is continuous spectral measurements and waterfall display, for proper analysis of varying speed machines.
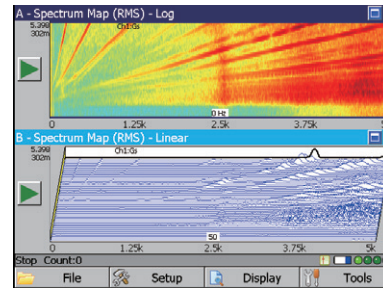
- General vibration analysis
- Modal testing
- Sound intensity measurement
- Operational deflection shape measurement
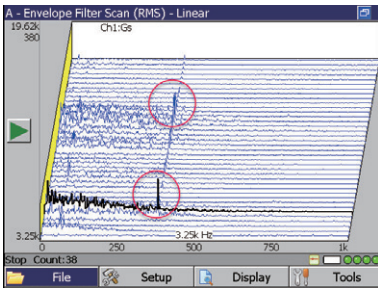- Bearing diagnosis
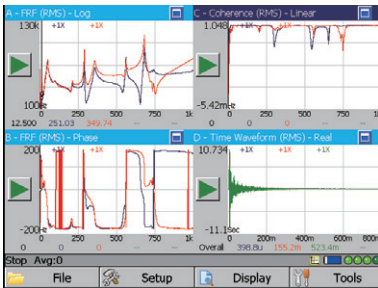
Display the amplitude and phase of FRF's, Coherence and time waveform
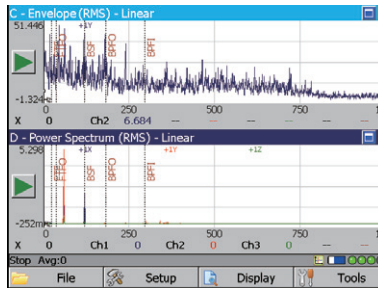
Display envelope spectrum with bearing fault frequencies

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

Envelope filter scanning mode shows the envelope spectrums from different filter settings on a 3D waterfall plot for finding the best filter setting and confirming bearing damage. The example to the left shows that the bearing fault frequency can be observed clearly when the center frequency of envelope filter is set as 3.25 kHz or 12.5 kHz.

According to ISO 7626-1, impaq Elite can show bump test results with Accelerance, Mobility, Compliance and Stiffness functions for investigating the dynamic stiffness of the structure.

ROTOR BALANCING

The Impaq Elite with the (optional) 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 are minimized at the same time. By enabling coast-down measurements for 1X vibration, the heavy spot is identified correctly 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 time required to balance. Other features / functions are:

- Multi-point balancing
- Component calculation
- Drill depth calculation
- Allowable residual unbalance calculated from the ISO 1940 standard
- 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
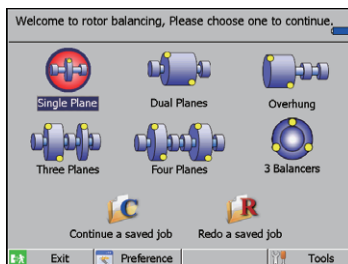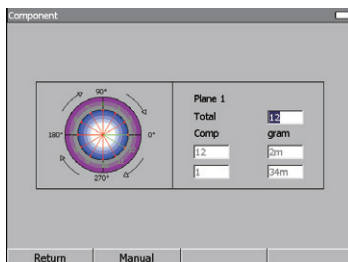

Select the desired balancing function from the main display
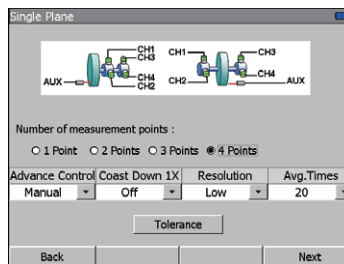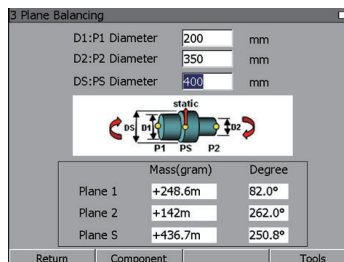

Select up to 4 measurement points for single plane balancing
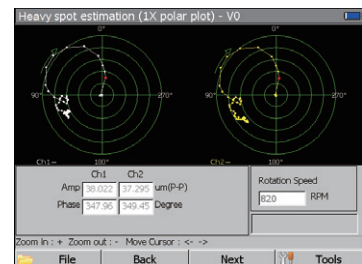
Find out the heavy spot location from a single coast-down measurement of 1X vibration


Component calculation for discrete weight locations

Conversion of dual plane balancing into static and couple balancing

COMPUTED ORDER TRACKING

The computed order tracking program is designed to analyze the sound or vibration signals of a varying speed machines. Typical applications for this software module are NVH (Noise, Vibration, Harshness) testing of vehicles or advanced vibration analysis of turbine machines. Calculation of 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. 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.
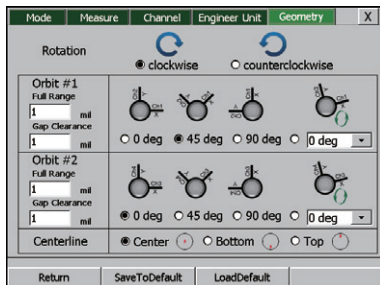
Setup the sensor locations and rotating direction for orbit, polar and centerline measurements
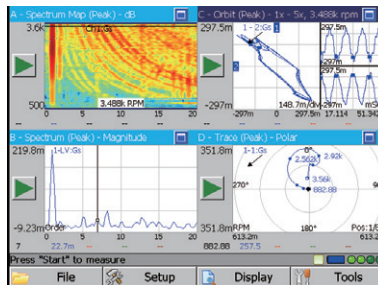
Display order spectral map, orbit and waveform, order spectrum and order trace
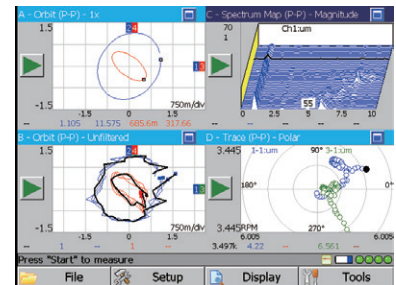

Display filtered orbit, unfiltered orbit, waterfall plot and polar plot for 1X vibration

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.
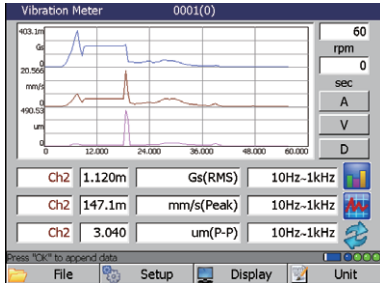
Measure and display overall level of acceleration,velocity and displcement in trend plot
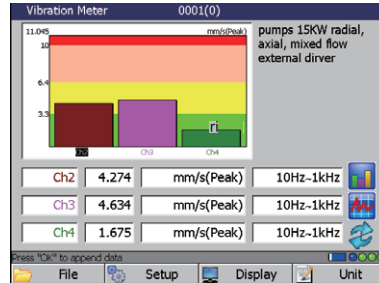
Display bar plot with severity clor in background (ISO 10816-3 or user defined)
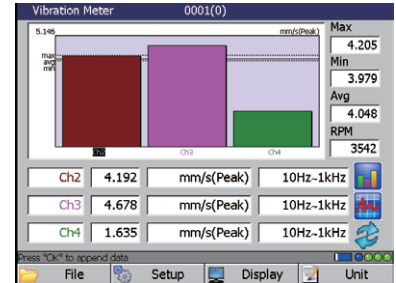
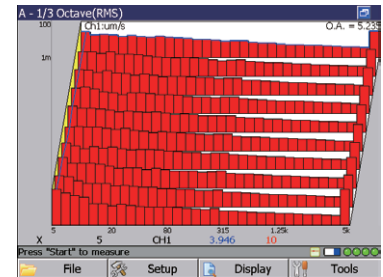Display vibration velocity in bar plot for multi channel measurement

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 measurements with the special weighting of ISO 6954, ISO8041, ISO2631 and more. When measuring floor vibration, impaq Elite can display the VC curves on the spectrum, providing real-time evaluation of the vibration severity in the field.
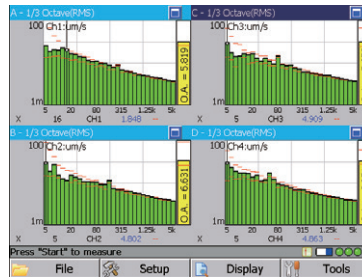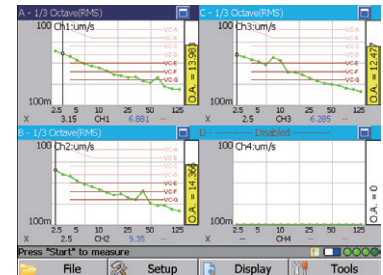

Real-time 4 channel measurements of Octave, 1/3 Octave and 1/12 Octave spectrum.

Continuous measurements with waterfall or intensity map display.

Selectable weighting functions, like A, C, ISO 2631, 6954, 8041 and user defined.

Display VC (Vibration Criteria) curves on 1/3 octave for quick evaluation of floor vibration.

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. Post processing of Raw Data Recorder files such as FFT, Order Tracking or Octave Analysis from the playback mode can be done with Novian Computer based software.
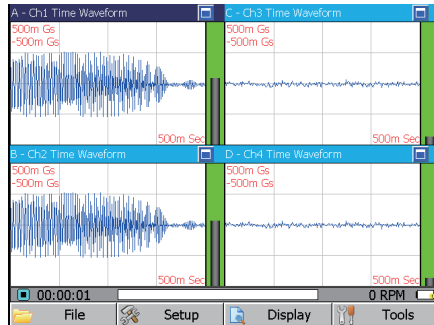
Record raw data with real-time waveform or spectrum view.
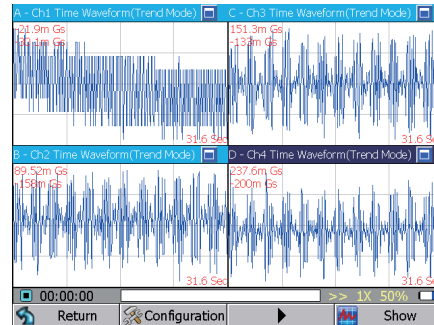
Playback of the recorded waveform after data recording.
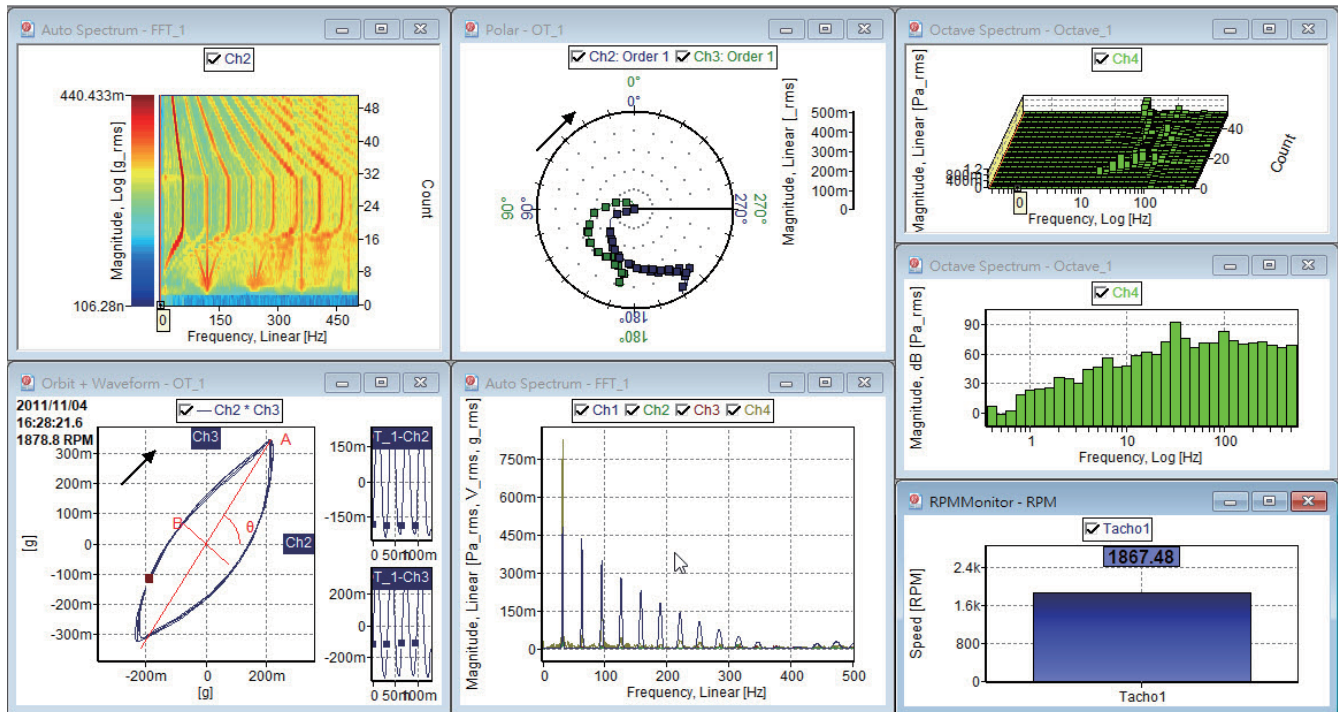
Computer based Novian software can be used to investigate the test data. Conduct FFT, Order Tracking or Octave spectrum analysis with the playback mode of PC software. Create Microsoft Word Test reports, export to a variety of formats, ie. XML, UFF, etc… Novian software can be used to investigate the test data from other software modules.

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)
DSP processor	TI TMS320C6713B
External memory	Compact flash card
Battery	Li-Po 7.4V 5800 mAhr, 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)
Input signal range	±5Volt, ±20Volt
Dynamic range	>130 dB (measured from spectrum)
A/D converter	24 bit sigma-delta A/D converter
Frequency range	40KHZ
Input impedance	1M Ohm

Feature for FFT Analysis	
FFT real time rate	40 kHZ, dual 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, side band cursor
Envelope filters	500~2kHz, 1k~2.5kHz, 2k~5kHz, 5k~10kHz or user defined.

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 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: 20kHz, 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 ISO 2631, 6954, 8041 and 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 channels
Data analysis	Raw data files can be replayed by Novian software with FFT, octave or order tracking analysis.

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

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