SKF Microlog Analyzer Module

The concept behind the SKF Analyzer module

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The concept behind the Analyzer module is to provide the operator with just the information required for comparison with a machine fault diagnostics chart (e.g. Spectrum and Phase).

Display of phase is a key piece of information required for the diagnosis of certain types of machine fault. Phase display is achieved by connecting a second accelerometer (option) to channel 2 and placing it onto a fixed reference position.

The roving accelerometer on channel 1 is placed at locations around the machine to make comparative phase measurements relative to the reference. The Analyzer module works on the assumption that the signal being measured is continuous and steady state (e.g., not rapidly changing in speed). To capture signals that are non-stationery (e.g., run up and run down), record the signal using the Recorder module.

Since Analyzer works on the basis that the signal is steady, it is possible to make decisions about some instrument settings to simplify the menus. Therefore, analyzer settings that are fixed by the manufacturer and not selectable by the operator are:

- Input voltage and display scaling – automatic
- Averaging type – Exponential
- Number of averages – 5
- FFT analysis weighting window – Hanning
- Free run triggering
- Overlap processing - 50%

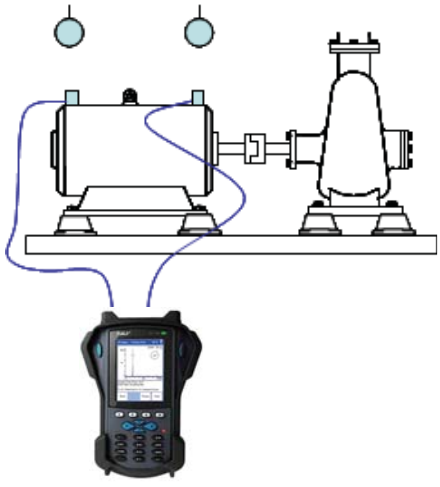


Figure 1. Capturing signals.

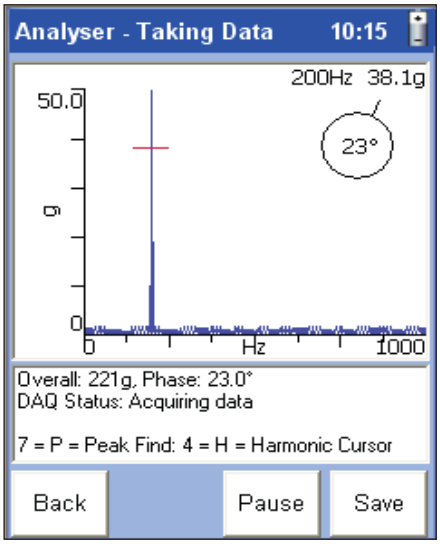
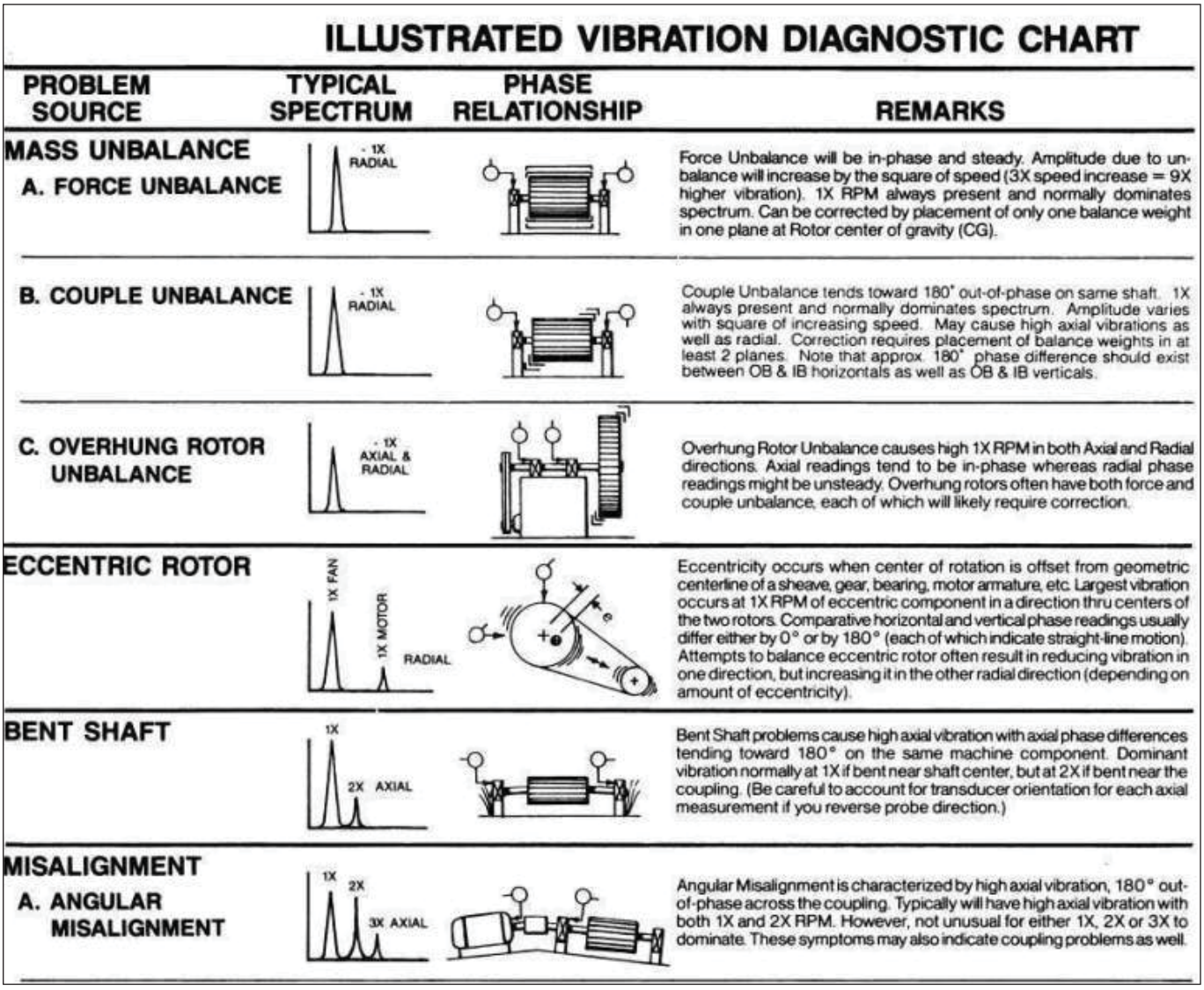


Figure 2. Analyzer – Taking Data screen.

Pocket Vibration Diagnostic Handbook

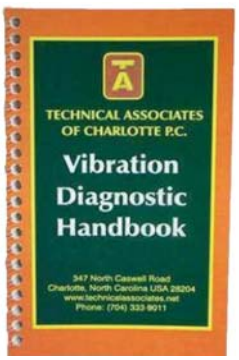


ILLUSTRATED VIBRATION DIAGNOSTIC CHART

PROBLEM SOURCE	TYPICAL SPECTRUM	PHASE RELATIONSHIP	REMARKS
MASS UNBALANCE A. FORCE UNBALANCE	1X RADIAL		Force Unbalance will be in-phase and steady. Amplitude due to unbalance will increase by the square of speed (3X speed increase = 9X higher vibration). 1X RPM always present and normally dominates spectrum. Can be corrected by placement of only one balance weight in one plane at Rotor center of gravity (CG).
B. COUPLE UNBALANCE	1X RADIAL		Couple Unbalance tends toward 180° out-of-phase on same shaft. 1X always present and normally dominates spectrum. Amplitude varies with square of increasing speed. May cause high axial vibrations as well as radial. Correction requires placement of balance weights in at least 2 planes. Note that approx. 180° phase difference should exist between OB & IB horizontals as well as OB & IB verticals.
C. OVERHUNG ROTOR UNBALANCE	1X AXIAL & RADIAL		Overhung Rotor Unbalance causes high 1X RPM in both Axial and Radial directions. Axial readings tend to be in-phase whereas radial phase readings might be unsteady. Overhung rotors often have both force and couple unbalance, each of which will likely require correction.
ECCENTRIC ROTOR	1X FAN, 1X MOTOR, RADIAL		Eccentricity occurs when center of rotation is offset from geometric centerline of a sheave, gear, bearing, motor armature, etc. Largest vibration occurs at 1X RPM of eccentric component in a direction thru centers of the two rotors. Comparative horizontal and vertical phase readings usually differ either by 0° or by 180° (each of which indicate straight-line motion). Attempts to balance eccentric rotor often result in reducing vibration in one direction, but increasing it in the other radial direction (depending on amount of eccentricity).
BENT SHAFT	1X, 2X AXIAL		Bent Shaft problems cause high axial vibration with axial phase differences tending toward 180° on the same machine component. Dominant vibration normally at 1X if bent near shaft center, but at 2X if bent near the coupling. (Be careful to account for transducer orientation for each axial measurement if you reverse probe direction.)
MISALIGNMENT A. ANGULAR MISALIGNMENT	1X, 2X, 3X AXIAL		Angular Misalignment is characterized by high axial vibration, 180° out-of-phase across the coupling. Typically will have high axial vibration with both 1X and 2X RPM. However, not unusual for either 1X, 2X or 3X to dominate. These symptoms may also indicate coupling problems as well.

Figure 3. Illustrated Vibration Diagnostic Chart (extract by permission of Technical Associates of Charlotte).

The concept behind the Analyzer module is to provide the operator with just the information required for comparison with the popular machine fault diagnostics chart (see Technical Associates of Charlotte, www.technicalassociates.net). Anything that requires advanced signal processing should be recorded and analyzed off-line using an appropriate analysis package.



Circa USD 49 – Available for purchase at http://www.technicalassociates.net

Analyzer module – display examples

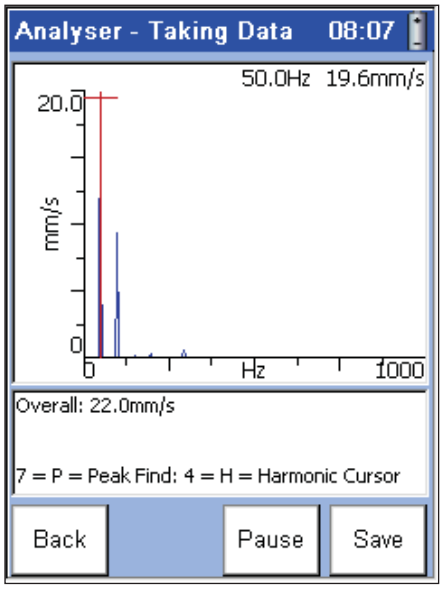


Figure 4. Automatic Peak Find.

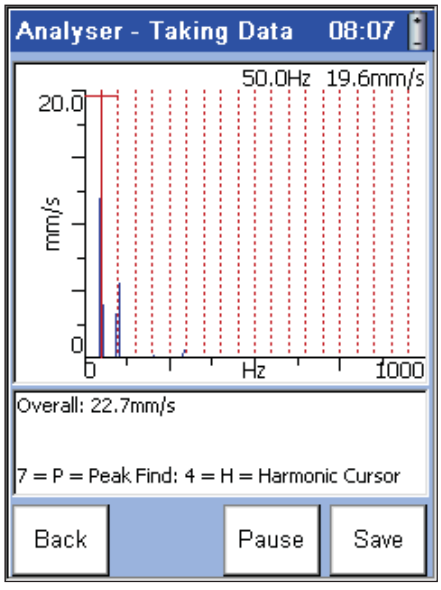


Figure 5. Harmonic Cursor.

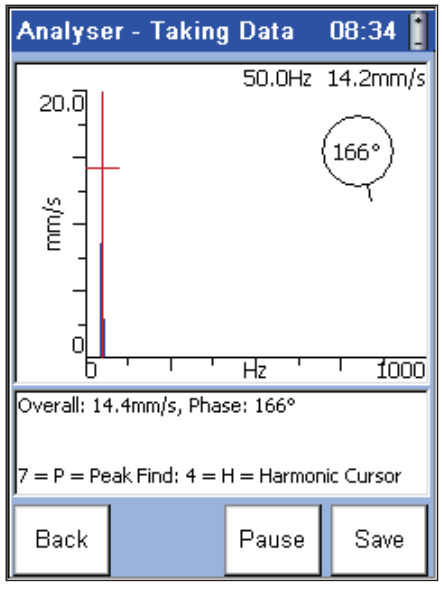


Figure 6. Phase Display.

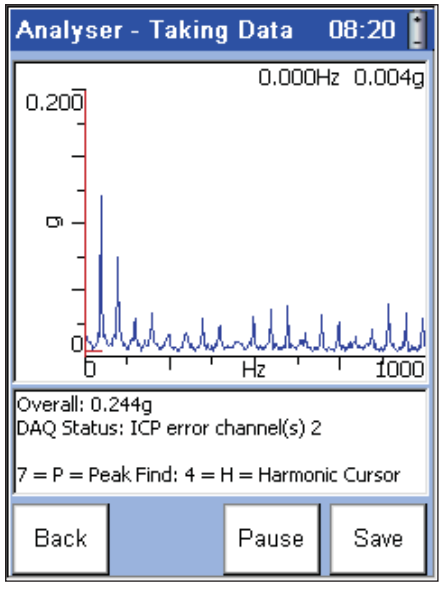


Figure 7. Bearing Analysis.

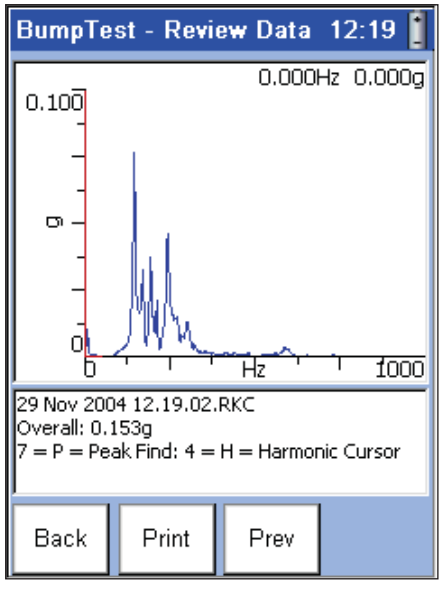


Figure 8. Bump Test.

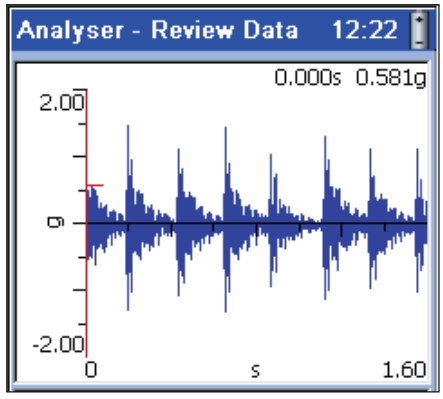


Figure 9. Oscilloscope.

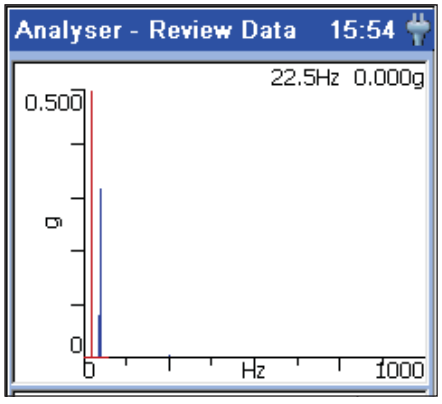


Figure 10. Review of Stored Spectra.

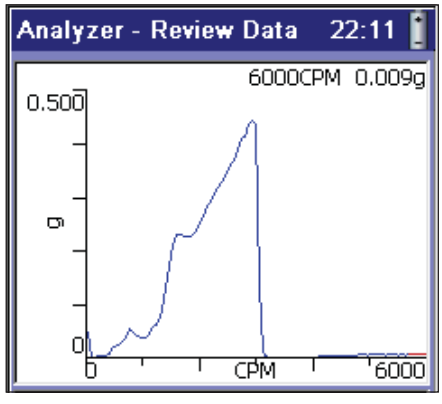
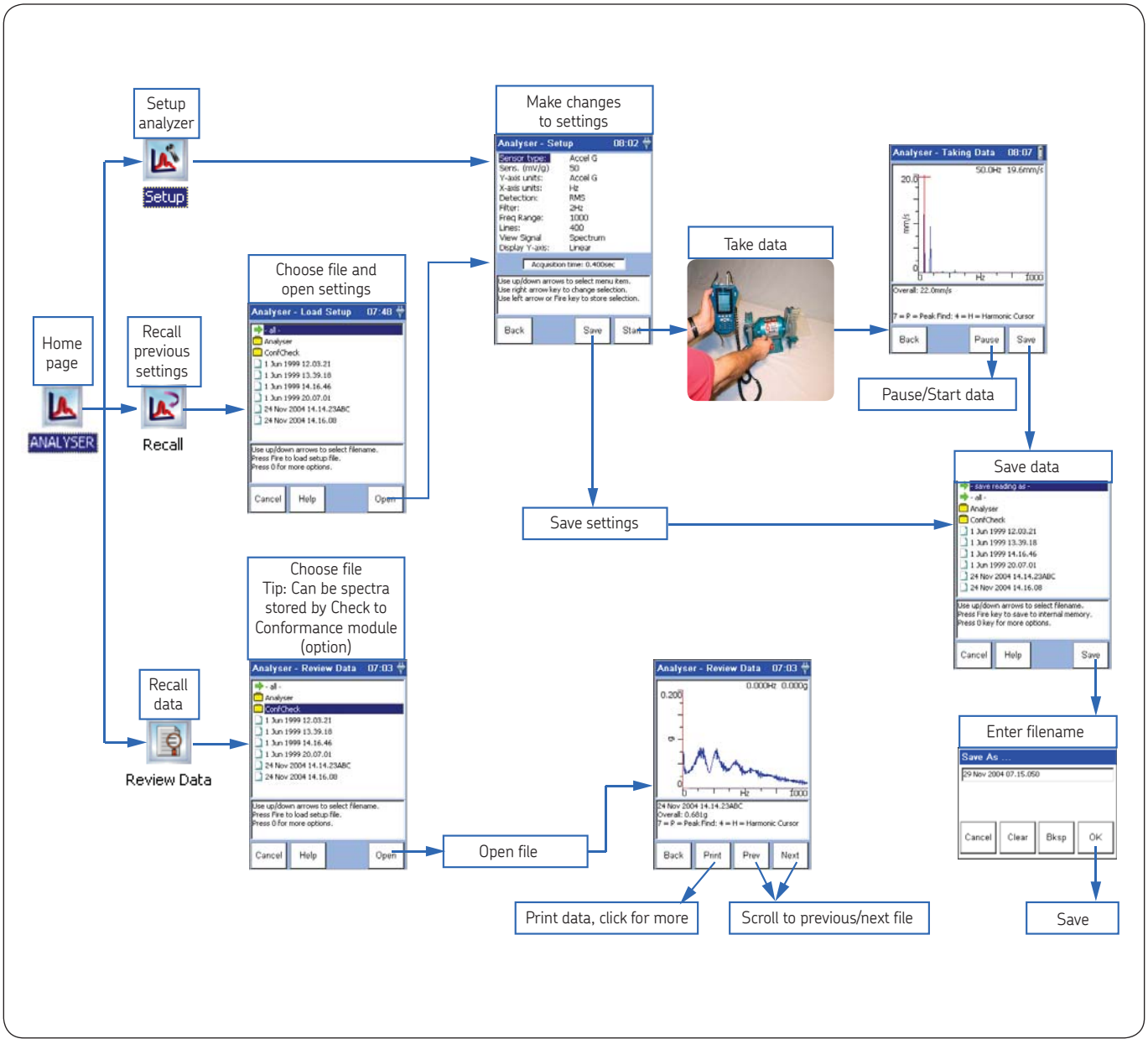


Figure 11. Run Down Test.

Analyzer module – menu map



Analyzer module – settings page in detail

For each of the settings shown on the display, use the ▲▼ navigation keys to select an item. Press the ▶ navigation key to activate a pull down menu of options and select the preferred option using the ▲▼ keys. Press the ◀ key to apply the setting and then press **OK** and **Yes** to save the changes.

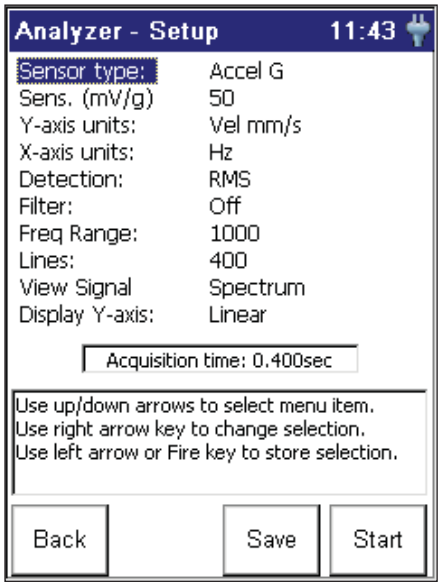


Figure 12. Analyzer – Setup screen.

Sensor Type: Sets the transducer type that is connected to channel 1. The default settings include:

- Accel G – ICP supply on
- Accel m/s^2 – ICP supply on
- Vel IPS – ICP supply off and AC coupled
- Vel mm/s – ICP supply off and AC coupled
- Disp µm – ICP supply off and AC coupled
- Disp Mil – ICP supply off and AC coupled
- Disp Thou – ICP supply off and AC coupled

These default settings can be overridden by using the ICP setting on the control panel.

Sens. (mV/g): Sets the output of the transducer (calibration factor) in millivolts per engineering unit. Use the keypad to enter the value.

Y-axis units: Sets the display Y-axis units. When set to **Time** and **ESP**, the menu selections change. Menu selections include:

- g
- m/s^2
- IPS
- mm/s
- µm
- Mil
- Thou
- ESP
- Time

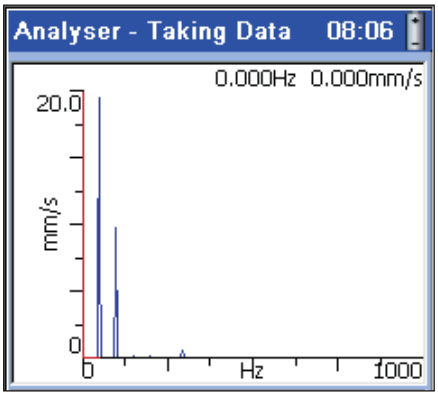


Figure 13. Example of Y-axis and X-axis units.

X-axis units: Sets the X-axis units. Menu selections include:

- Hz
- CPM

Detection: Sets the detector type, which will affect the overall vibration severity reading and the cursor readout: Options include:

- RMS
- Peak
- Pk-Pk
- True Pk
- True Pk-Pk

Filter: Sets the digital filtering to be applied to the signal to remove low frequency interference. Options include:

- Off
- 0.36 Hz
- 1.1 Hz
- 2 Hz
- 10 Hz
- 70 Hz

Freq Range: Sets the frequency range of the spectrum analysis, variable in integer numbers from 2 Hz to 40 kHz. Use the keypad to enter a value. (The instrument may display a rounded up number to the nearest available FFT line.)

Lines: Sets the number of lines of resolution of the FFT spectrum:

- 100
- 200
- 400
- 800
- 1600
- 3200
- 6400
- 12800

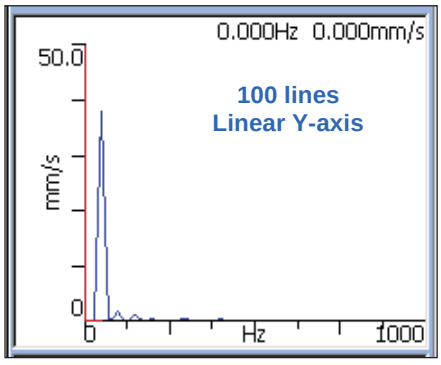


Figure 14. 100 lines linear Y-axis.

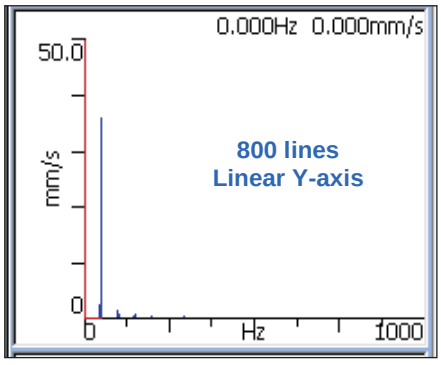


Figure 15. 800 lines linear Y-axis.

View Signal: Selects the option to display spectrum or phase. If phase is not required, choose **Spectrum**.

Display Y-axis: Sets the display Y-axis graph scaling type.

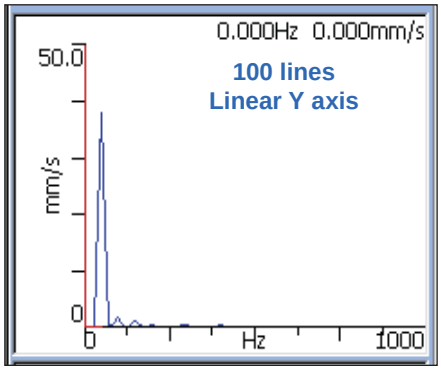


Figure 16. Linear Y-axis, 100 lines.

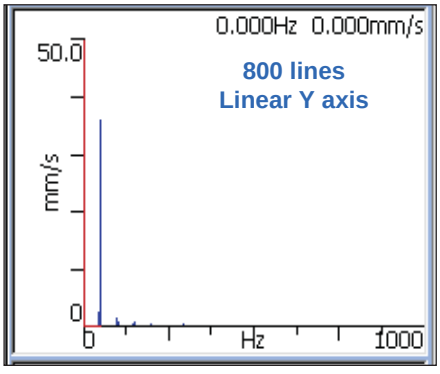


Figure 17. Linear Y-axis, 800 lines.

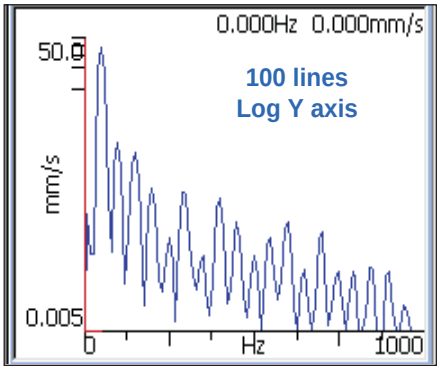


Figure 18. Log Y-axis, 100 lines.

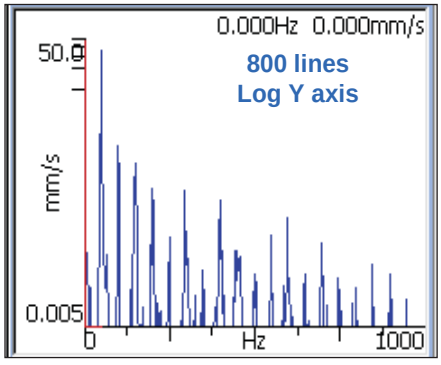


Figure 19. Log Y-axis, 800 lines.

Analyzer module – time/oscilloscope

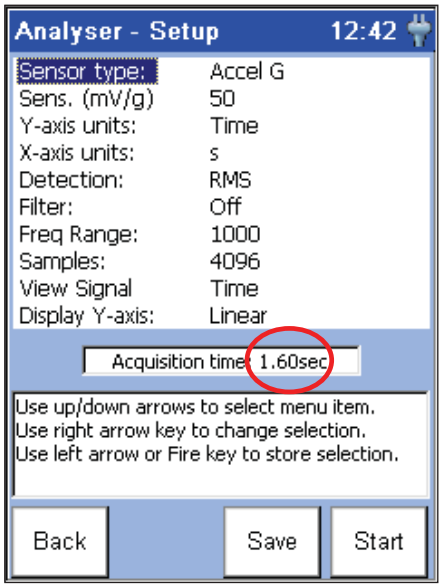


Figure 20. Analyzer – Setup screen.

Y-axis units: Choosing **Time** as the Y-axis units changes the menu selections. **X-axis units:** is locked to seconds (**s**) and [FFT] **Lines** becomes **Samples**.

Samples:

- 256
- 512
- 1024
- 2048
- 4096
- 8192
- 16384
- 32768

The oscilloscope time base (acquisition time) is dependent on the frequency range and the number of samples that have been chosen and the displayed value will change accordingly.

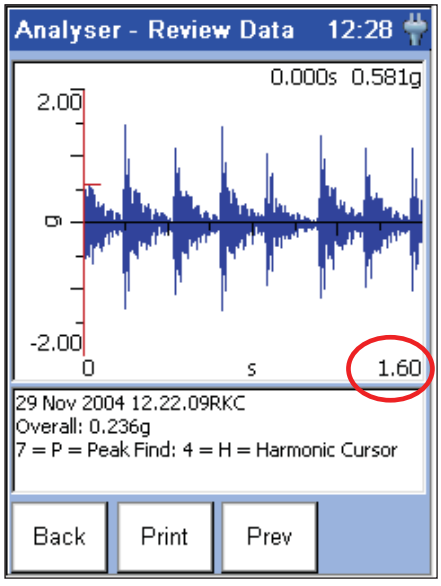


Figure 21. Analyzer – Review Data screen.

Analyzer module – gE

Choosing **gE** as the Y-axis units changes the menu selections to the appropriate filters.

Figure 22. Analyzer – Setup screen.

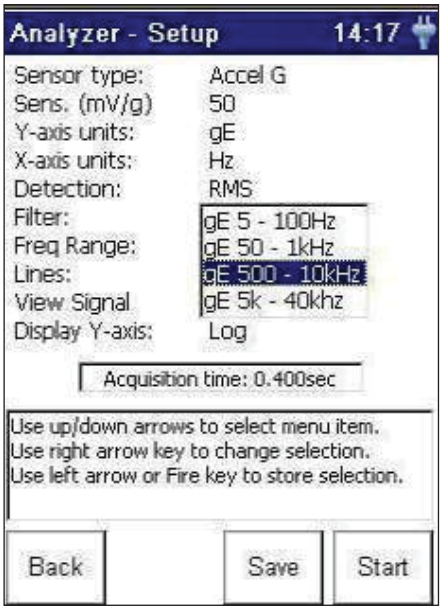


Figure 23. Analyzer – Setup screen, filter selection.

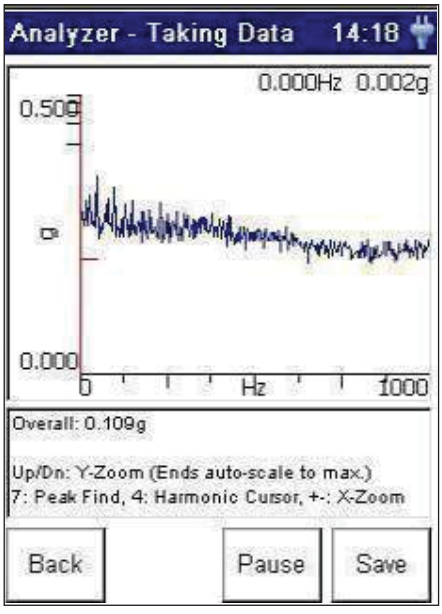


Figure 24. Analyzer – Taking Data screen.

Analyzer module – phase measurement

Display of phase is a key piece of information required for the diagnosis of certain types of machine fault. Phase display is achieved by connecting a second accelerometer (option) to channel 2 and placing it onto a fixed reference position. The roving accelerometer on channel 1 is placed around the machine to make comparative phase measurements relative to the reference.

Tip: To get the best performance, both accelerometers should be of the ICP™ type and of the same model.

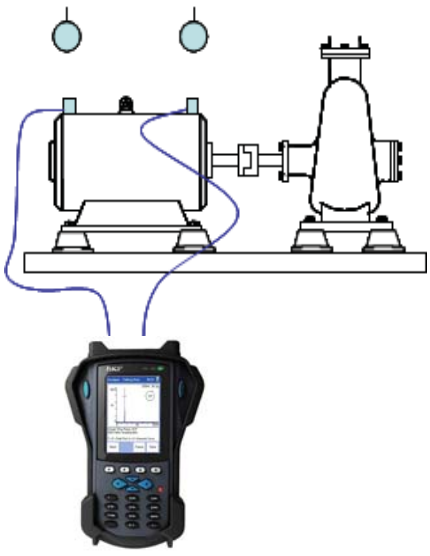


Figure 25. Taking measurements.

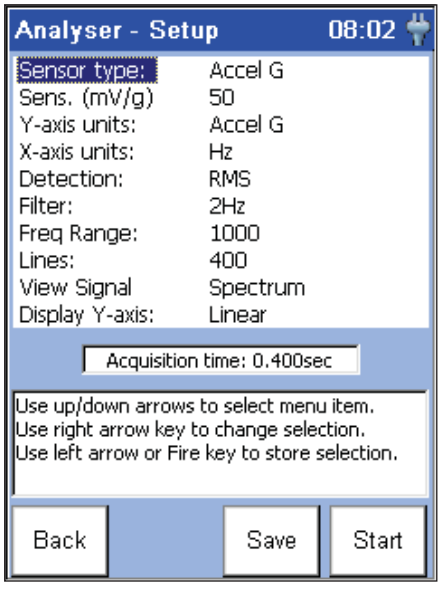


Figure 26. Analyzer – Setup screen.

View Signal: Sets the display Y-axis graph scaling type.

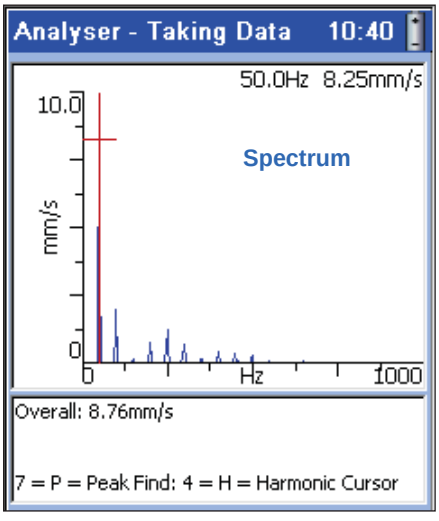


Figure 27. Spectrum display.

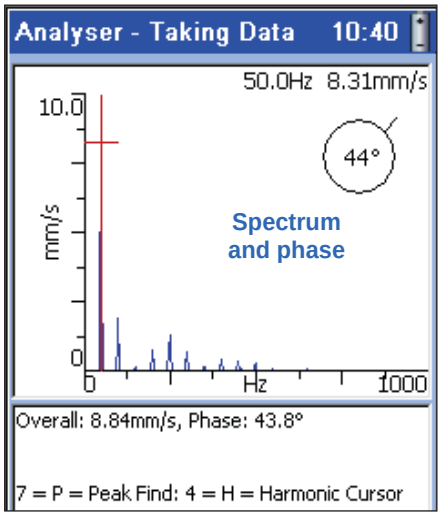


Figure 28. Spectrum and phase display.

Use the navigation keys ◀▶ to move the cursor onto the frequency of interest or press the **7** key to automatically find the peak.

Analyzer module – display controls

The instrument will automatically scale the input voltage and the display full scale range to accommodate the vibration spectrum. It is possible to override the scaling by pressing the ▲▼ keys. Use the navigation keys ◀▶ to move the cursor onto a spectral peak of interest to obtain readout of magnitude and frequency.

The instrument will calculate the square root of the summed squares for all the peaks in the spectrum. This value is equal to the root mean squares of the source signal and gives the overall vibration severity. Press the **7** key on the keypad to automatically find the highest peak in the spectrum.

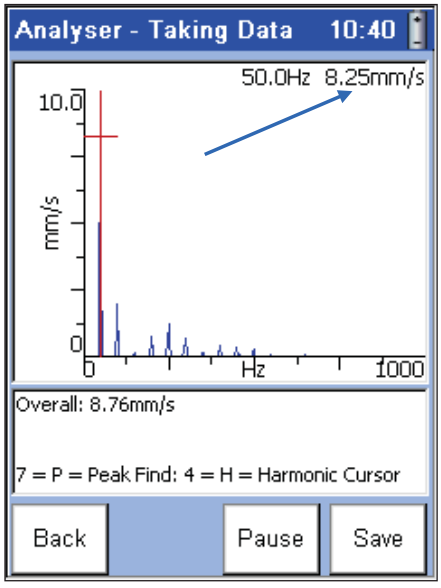


Figure 29. Analyzer – Taking Data screen.

Analyzer module – harmonic cursor

Use the navigation keys ◀▶ (or the **7** key) to move the cursor onto a spectral peak of interest. Press the **4** key on the keypad to invoke the harmonic cursor. Press **4** again to switch the harmonic cursor off.

The **Save** function key enters the save readings options and operates the same as the Check to Conformance save survey. The **Pause** and **Start** function keys freeze and unfreeze the display.

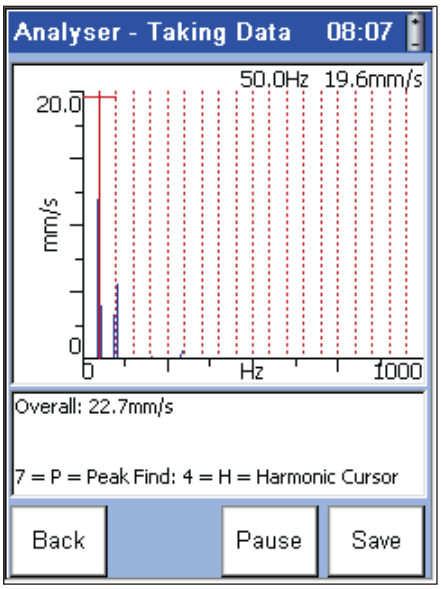


Figure 30. Analyzer – Taking Data screen, harmonic cursor.

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