

FLUKE



Introducing 810 Vibration Tester

Get Answers Now.

Before We Begin...

- Ask questions at any time!
- Please turn your cell phone to vibrate.
- If you must take a call, please feel free but we ask that you take it outside the seminar room.



Agenda

- Maintenance practices
- What is mechanical vibration?
- What are the benefits of vibration testing?
- How a vibration meter works
- Vibration basics
- Introduction to the Fluke 810 Vibration Tester
- Vibration Testing in 3 Easy Steps
 - Setting up the machine
 - Taking a proper measurement
 - Interpreting the diagnosis
- Viewer PC software
- How to start testing vibration in your facility

Maintenance Practices

- **Reactive Maintenance:** Often called “run to failure.” No repair or maintenance actions are taken on machinery until the designed life span is reached...or other variables cause the machinery to fail.
 - **Upside:**
 - Lower upfront maintenance costs
 - Lower maintenance staff costs
 - **Downside:**
 - Unplanned, sometimes catastrophic, downtime and overtime hours
 - Secondary damage to machines impacted by the failed machine
 - Potentially higher capital costs as entire components may need to be replaced
 - Machines control maintenance department
- **Preventive Maintenance (Proactive – Calendar Based):** Also called “Historical or calendar-based maintenance”
 - **Upside:**
 - Increased equipment life
 - Reduced equipment or process failure
 - Flexibility with maintenance scheduling
 - **Downside:**
 - Fault free machines maintained unnecessarily – could lead to incidental problems with components
 - Overhaul reduces reliability of the machine (see the bathtub curve)
 - More labor intensive than Reactive Maintenance

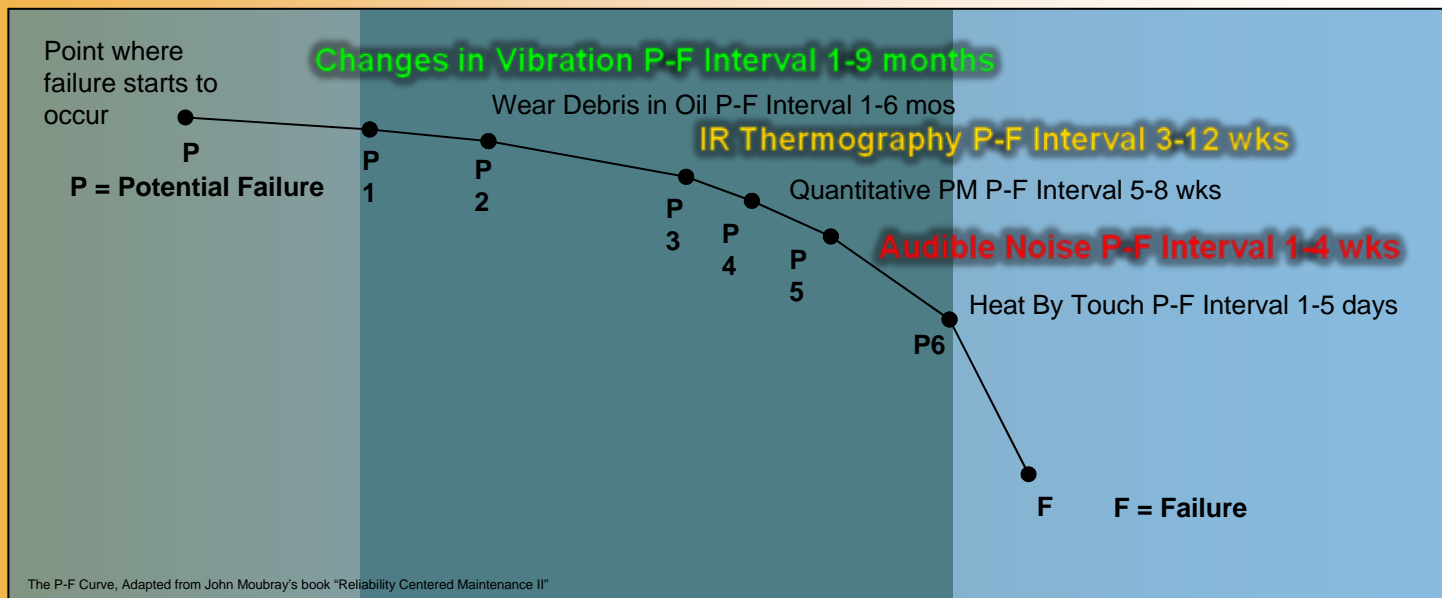
Maintenance Practices

- **Predictive Maintenance (Proactive – Condition Based):** Use of different testing (vibration, thermography, oil analysis, ultrasound are the most common) to understand machine condition and prevent failure
 - **Upside**
 - Allows preemptive action to increase equipment life
 - Increased equipment life
 - Reduced equipment or process failure
 - Reduced repair parts and labor costs
 - Increased safety
 - Reduced likelihood of catastrophic failures
 - **Downside**
 - Increased investment in diagnostic / test equipment
 - Increased investment in training and staff
 - Cost benefits not readily seen by management
 - May require top-down cultural change in maintenance approach

- How is maintenance performed in your facility?
- How often do mechanical breakdowns occur?
- What do you do to keep mechanical breakdowns from recurring?

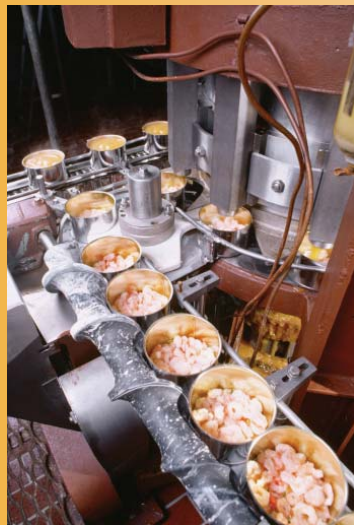
Early Indicators of Machine Health

- In the world of mechanical maintenance, vibration remains one of the earliest indicators of a machine's health.



- With over half of unplanned downtime attributed to mechanical failures, why aren't more companies investing in vibration analysis?

Current Solutions Not for Everyone



- Current vibration analysis tools require a commitment...
 - Upfront investment
 - Full time resources to learn and perform vibration analysis
- Many facilities cannot make the necessary investment, yet struggle daily with mechanical breakdowns.
- The only options available to these facilities have included:
 - Changing parts regularly before they wear out
 - Outsourcing vibration analysis to consultants
 - Using subjective techniques
 - Simply “firefighting” or running to failure
- Maintenance teams need help getting answers to their mechanical problems NOW.

A Vibration Program Pays for Itself

Cost of Downtime / Repair	Cost (RTF)
1. Net income per hour of output for production line or other critical process	\$20,000/hr (critical & non-critical machine failures)
2. Calculate the average downtime (due to mechanical failures) for each equipment failure and number of events per year.	8 hrs down, 5 motors, 1x/yr
3. Multiply the results of step 1 by both values in step 2.	$(\$20,000 * 8) * 5 = \$800,000$
4. Estimate labor (overtime) and equipment parts cost per downtime incident	$\$30/\text{hr} * 8 \text{ hrs} * 2 \text{ techs} = \$480 + \$5000/\text{motor} = \5480
5. Add step 3 and step 4. This is the annual cost in lost revenue plus repair costs	\$805,480 (due to critical/non-critical failures)
Cost of Program Implementation	Cost
1. Average cost of current test equipment (hardware and software)	\$30,000
2. Average cost of dedicated, experienced vibration technician (FTE)(Assume 1 man hour/motor/month)	$1 \text{ hr}/\text{mo}/\text{motor} * 150 \text{ motors} * 12 \text{ mos}/\text{yr} * \$35/\text{man hr} = \$63000$
3. Average upfront equipment training costs + "maintenance training"	\$6000
4. Add steps 1 through step 3. This is the total first year cost of program startup	\$102,000
Vibration Testing Payback	Cost
1. Assume 50% of unplanned downtime and repair costs savings	$\$805,480 * 50\% = \$402,740$
2. Return on Investment & Payback of vibration testing program (total cost per year / total savings per year)	$\$102,000 / \$402,740 = \mathbf{0.25 \text{ yrs or 3 mos}}$

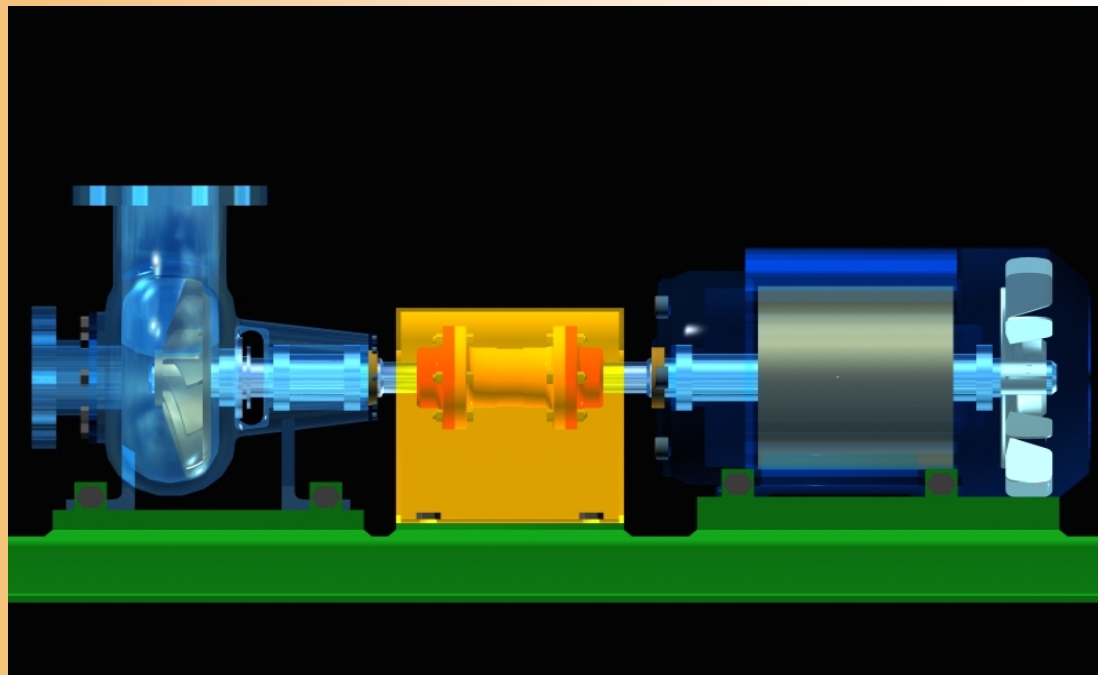
- Basic vibration testing programs pay for themselves...but current solutions are designed for experienced vibration analysts within a predictive maintenance context
- Upfront costs (hardware, software, training, headcount) can still be high

Benefits of Vibration Testing

- Vibration provides the earliest indicator of machine condition
- Vibration addresses all the moving parts of rotating equipment – and can identify root cause
- Saves time by addressing problems earlier
- Saves money by reducing spare parts inventories

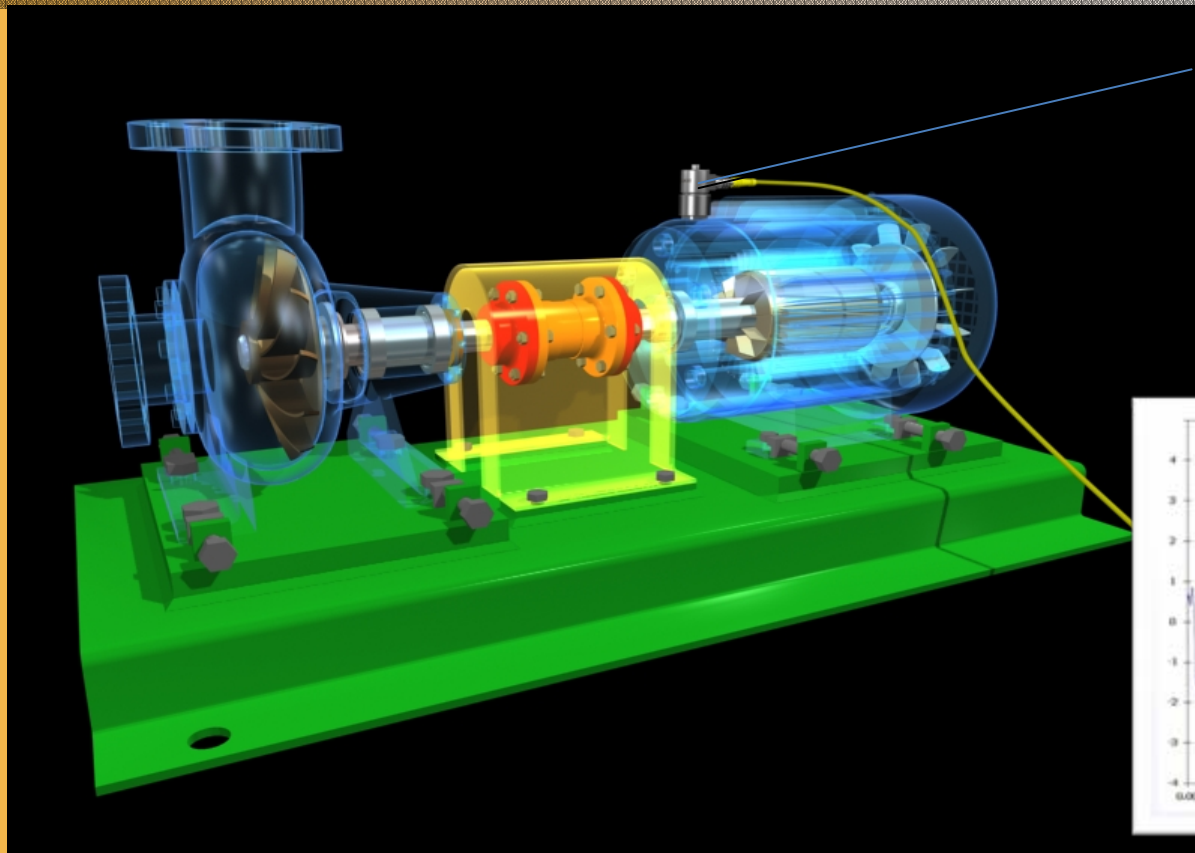


What is Mechanical Vibration?

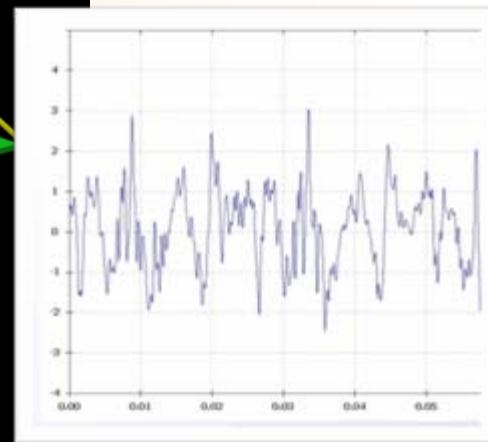


- Vibration is the oscillation of a point, an object, or a part of an object around a fixed reference, or rest, position.
- Some types of vibration are by design...most types are symptoms of other problems such as bearing condition, shaft misalignment, looseness or out-of-balance conditions.

Mechanics of Vibration Testing



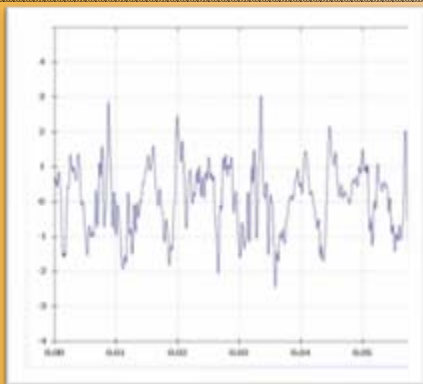
Transducer picks up vibration signals from bearing locations and transmits them to a data collection device



Example of a time waveform

- All rotating equipment generate a unique vibration signal or “signature”
- These unique signals are usually captured in series, with the signal’s amplitude (y-axis) depicted over time (x-axis). This is called a ***time waveform***.

Making Vibration Data Easier to Interpret...Kind Of



Example of a time waveform



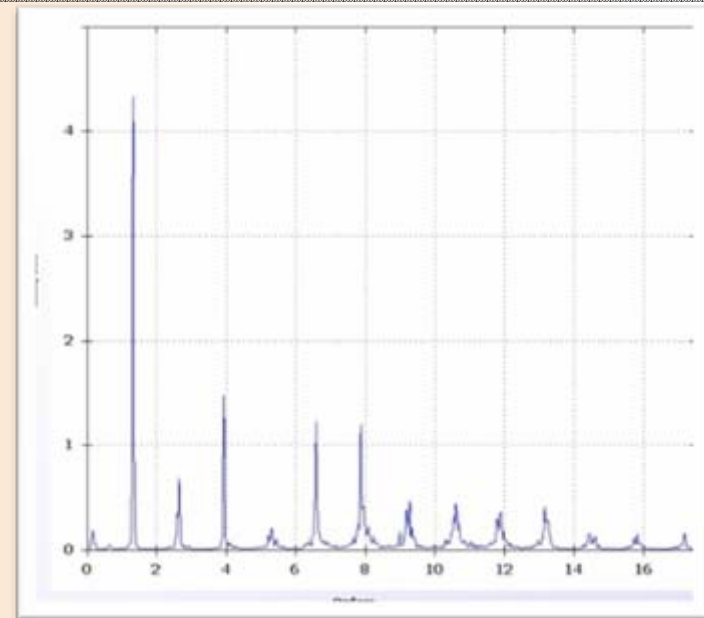
Example of a vibration spectrum

- The wave form contains all the information about the vibration of the machine at the point where it was measured
- But the individual patterns of vibration caused by different events in the machine are all overlapped and jumbled together.
- A frequency analysis performed in the data collector or software clarifies and simplifies the time waveform data. The result is called a **vibration spectrum** (or “vibration signature”, “FFT”, or “spectral plot.”)
- Spectrum is the plot of the vibration signal’s amplitude (y –axis) against frequency (x-axis)

• Most vibration data collectors, analyzers and software get you this far...but a trained technician is still required to interpret the data into something *meaningful* and *actionable*

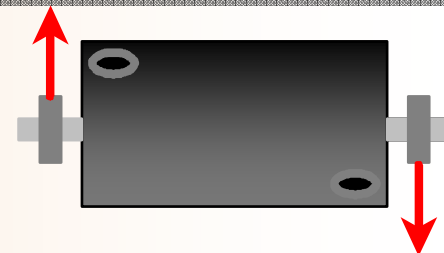
Common Machine Faults & Spectrum Analysis

- Every machinery fault produces a unique type of vibration signal.
- Signals displayed in the vibration spectrum often form characteristic patterns.
- Pattern recognition is a key part of vibration analysis...but significant training and experience are necessary to *read the patterns*.
- In this seminar we will analyze 4 different type of failures:
 - Imbalance
 - Misalignment
 - Looseness
 - Bearing Failures

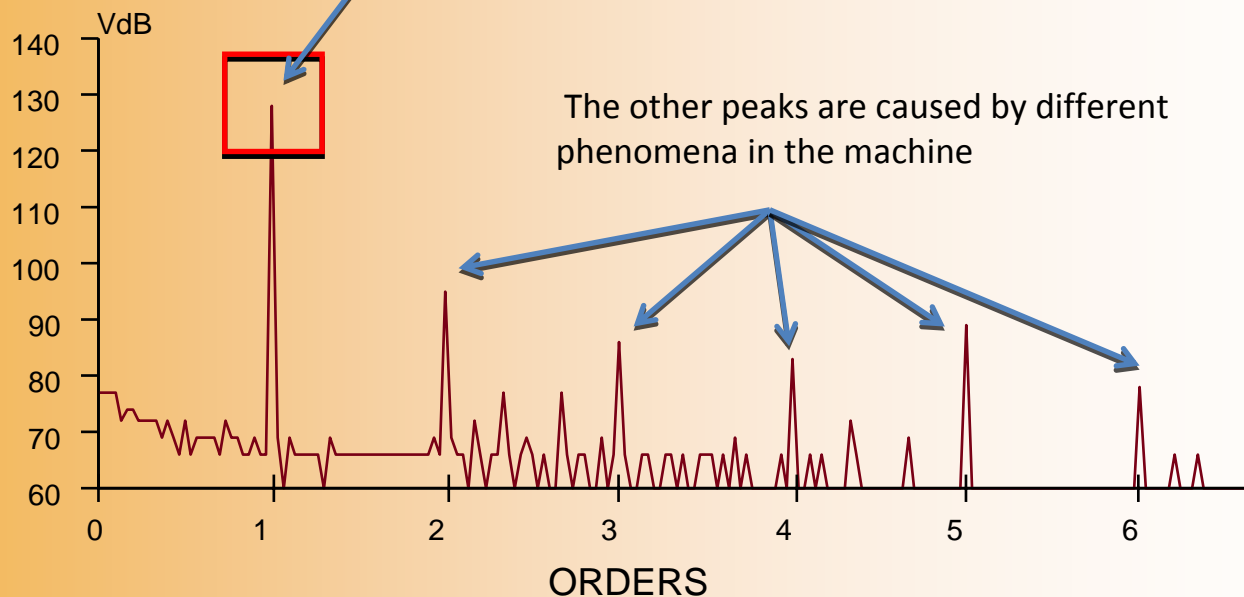


What is Imbalance?

- Imbalance is a condition of a rotating part where the center of mass does not lie on the axis of rotation. In other words, there is a “heavy spot” somewhere on the rotor.



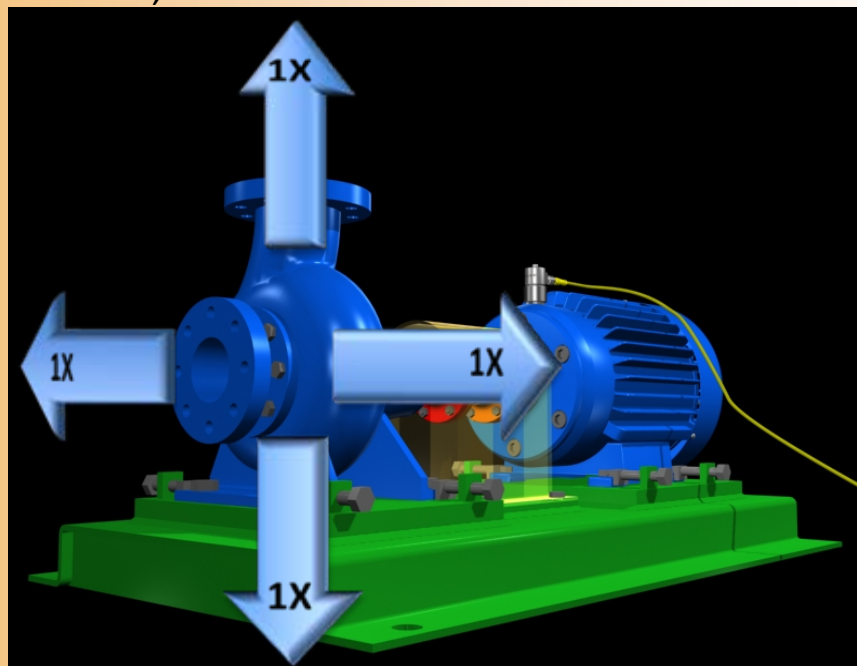
The large peak of 124 VdB at 1X running speed is caused by the imbalance.



Sources of Imbalance

- Various machine conditions can result in imbalance:
 - Dirt accumulation or missing balance weights
 - Lack of homogeneity in materials, especially in castings (e.g. porous sections, blow-holes)
 - Difference in dimension of mating parts (e.g. shaft, bore...)
 - Roller deflection (e.g. paper mill rolls) or machining errors
 - Uneven mass distribution in electrical windings
 - Uneven corrosion, eccentric rotor or erosion of rotors

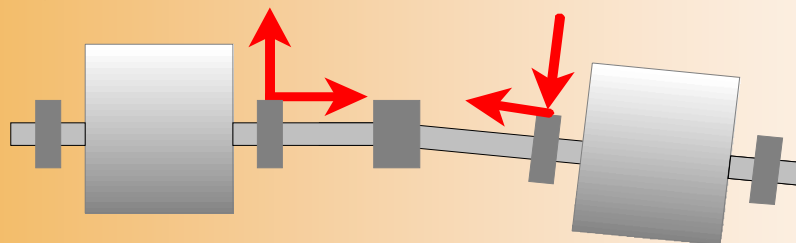
Imbalance typically manifests itself at 1X running speed in any direction



What is Misalignment?

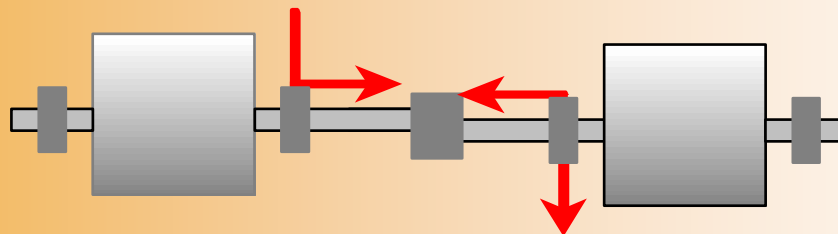
- In machines, perfect alignment occurs when the centerline of two coupled shafts coincide. When they do not coincide, misalignment exists.
- Three types of misalignment are possible:

- **Angular** – the centerline of the two shafts intersect but are not parallel.



Angular Misalignment

- **Parallel** – the centerline of the two shafts are parallel but not concentric.

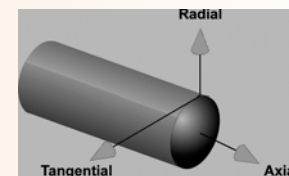
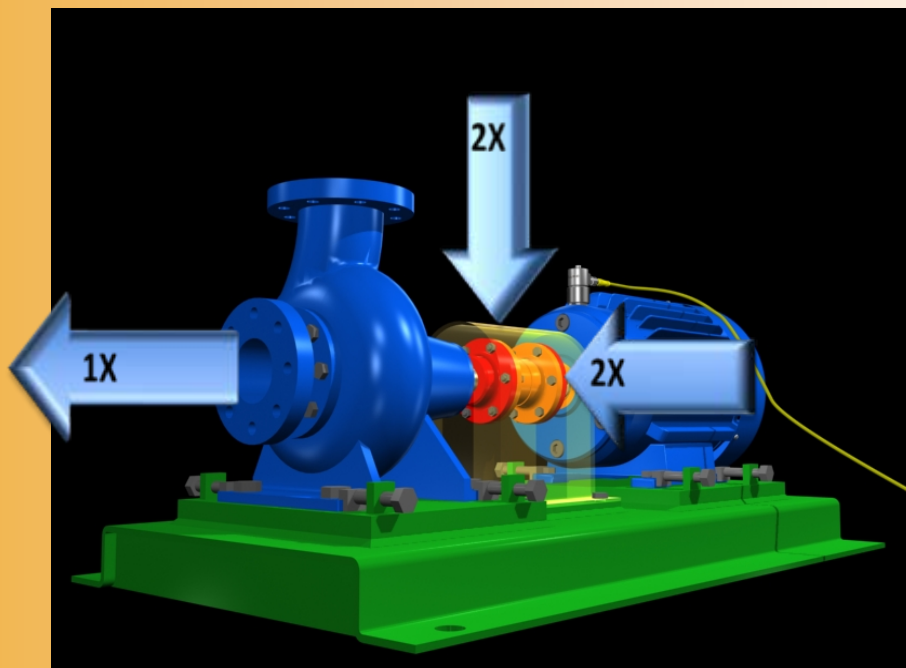


Parallel Misalignment

- **Parallel and Angular (Common)** – most misalignment is a combination of angular and parallel

Sources of Misalignment

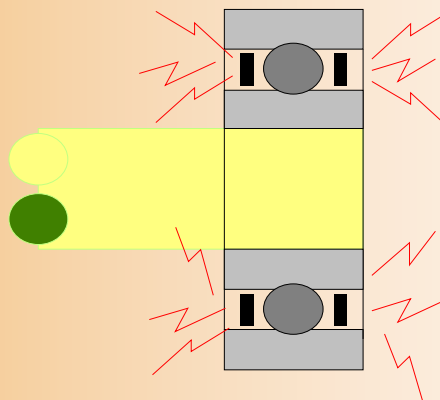
- Misalignment can be caused by several sources, including:
 - Poor assembly or shifting after assembly
 - Distortion due to pipe strain
 - Distortion due to torque combined with flexible support
 - Temperature induced growth of the machine structure
 - Poorly machined coupling
 - Inadequate coupling lubrication



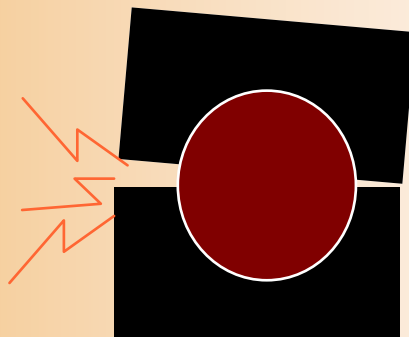
- Misalignment will manifest itself in two ways:
 - At 2X running speed in the Radial & Tangential directions (parallel)
 - At 1X running speed in the Axial direction (angular)

What is Looseness?

- Mechanical looseness can be either of two types:
 - Rotating Looseness: A rotating looseness is caused by excessive clearance between rotating and stationary elements of the machine such as in a bearing.



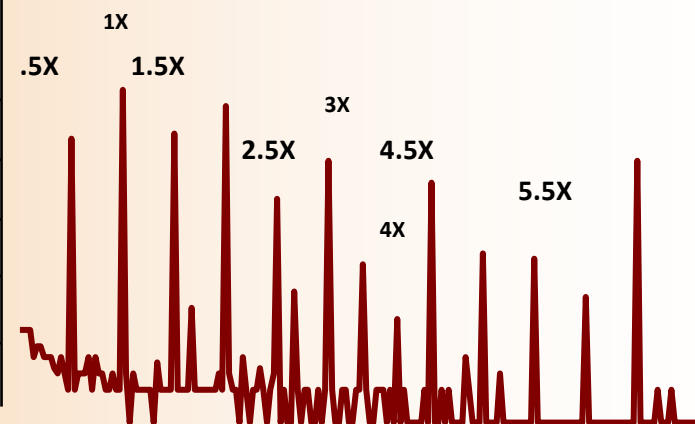
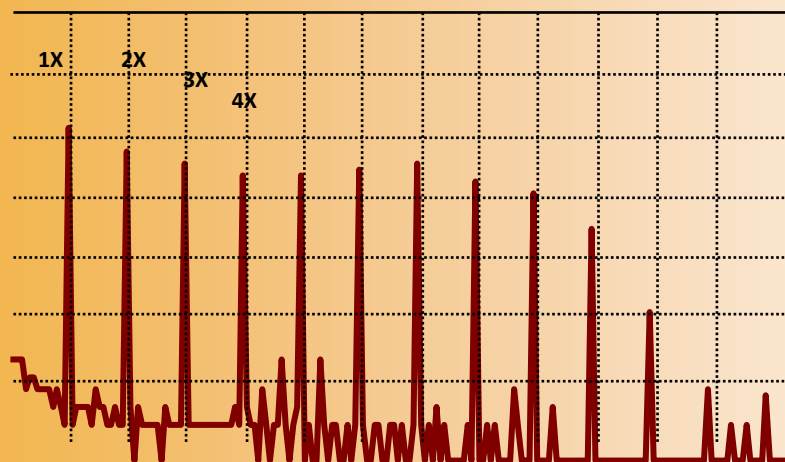
- Non-rotating Looseness: Non-rotating looseness is a looseness between two normally stationary parts, such as a foot and a foundation, or a bearing housing and a machine.



Looseness in the Spectrum

Rotating Looseness

- Excessive clearance in sleeve and rolling element bearings (bearing looseness) will produce harmonics of 1X that can extend in some cases above 10X
- Excessive journal bearing clearance can produce harmonics of 0.5X as shown. They are called half order components or sub harmonics. They can be produced by rubs and severe impacting.

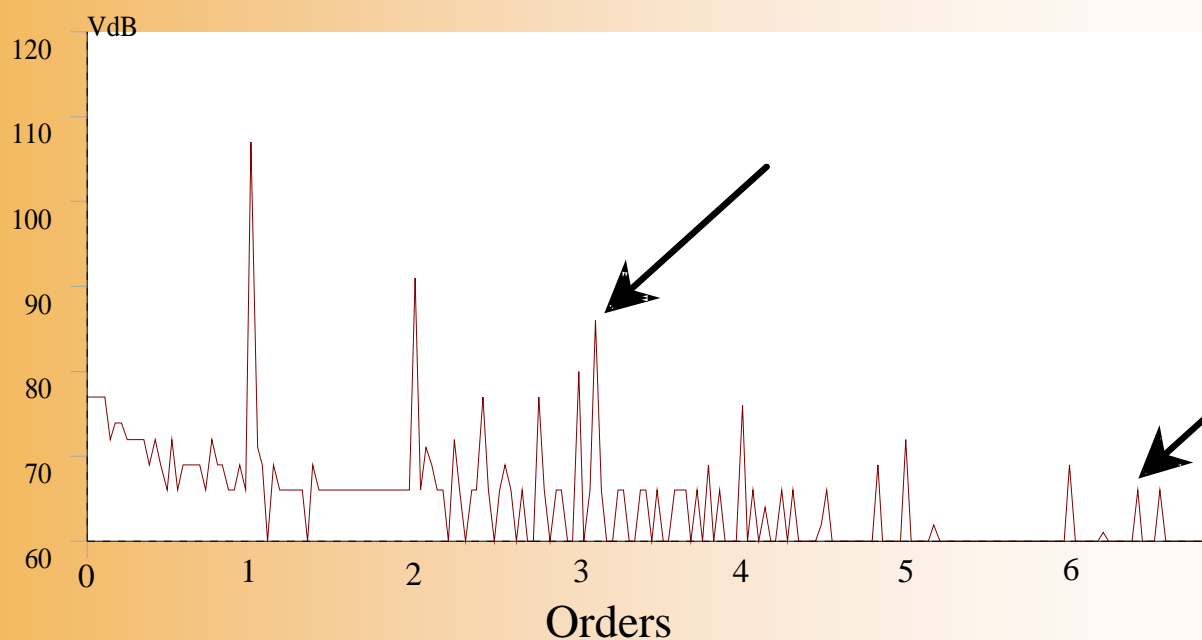


Non-rotating Looseness

- Most types of non-rotating looseness also produce harmonics of run speed, but they usually do not produce as many, nor do they produce sub harmonics. Non-rotating looseness can generate random noise as well as harmonics, and this produces a continuous spectrum rather than definite peaks.

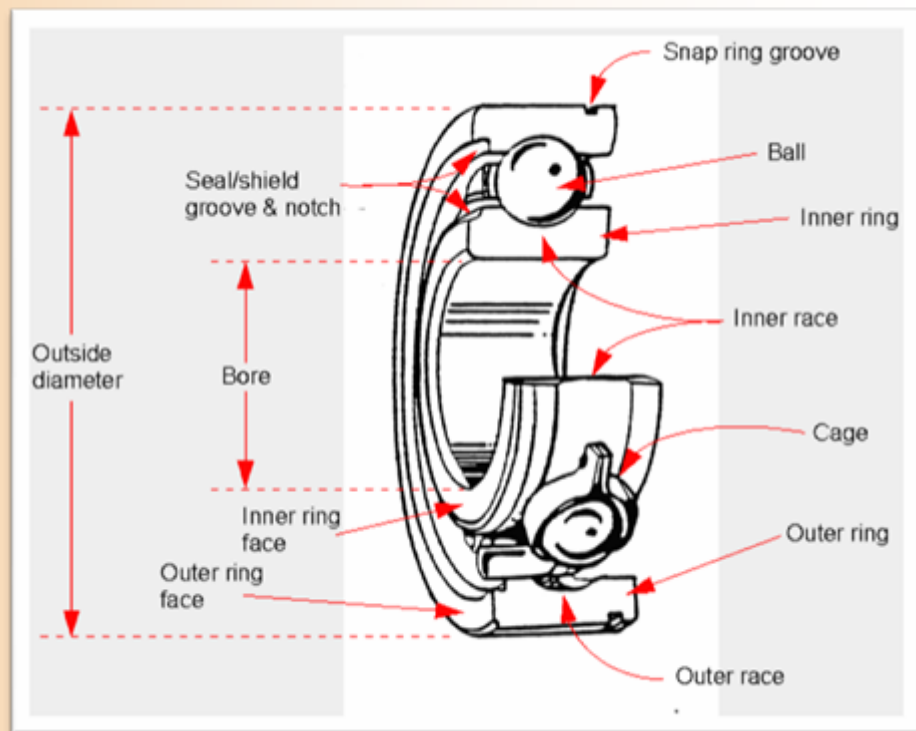
Bearing Tones in Spectra

- The most important fact about bearing tones is that they are *non-synchronous* - - i.e., they are not at the same frequency as any of the harmonics of the RPM.
- The illustration shows bearing tones at about 3.2 and 6.4 orders:

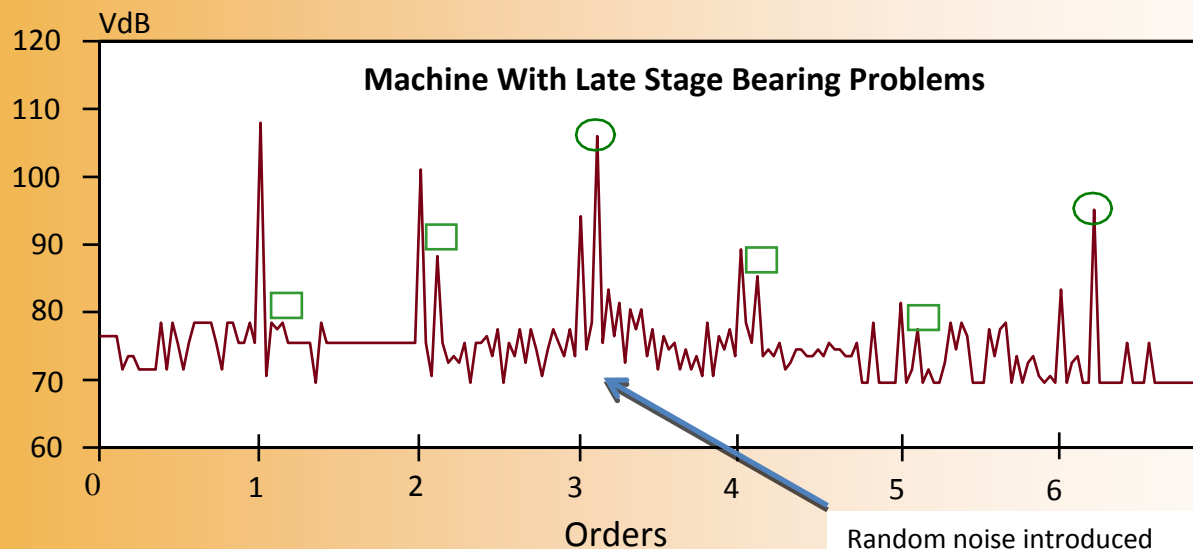
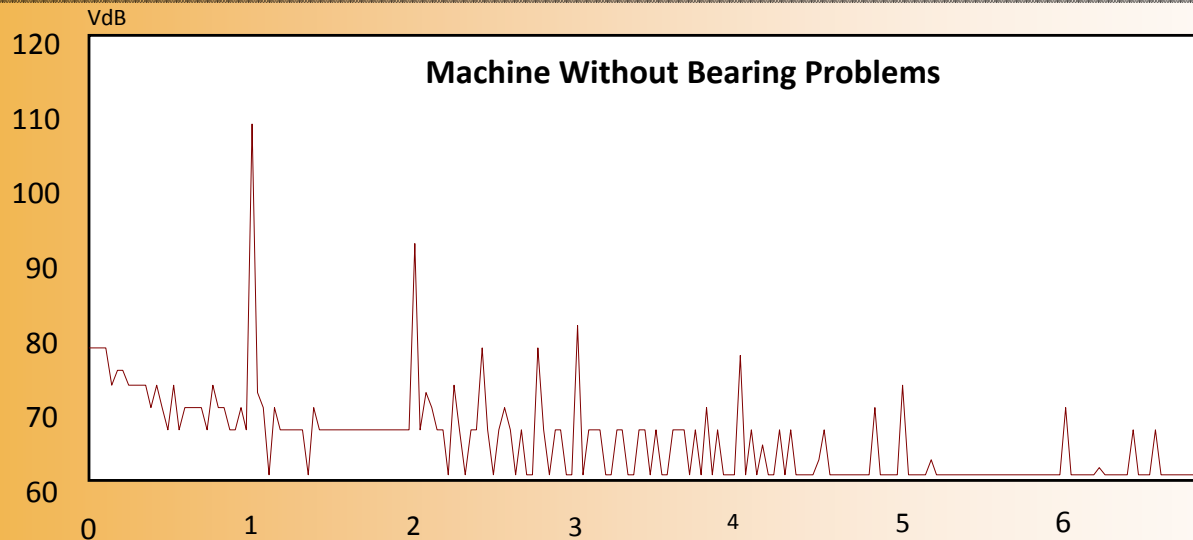


Causes of Bearing Failure

- Bearing condition degrades for a number of reasons:
 - Heavier than anticipated loading
 - Inadequate or incorrect lubrication
 - Ineffective sealing
 - Shaft misalignment
 - Incorrect fit



Typical Bearing Wear Progression



- Broadband noise level increases as bearing fails to carry load
- Excessive bearing temps
- Lubrication loss

Random noise introduced ("haystack") as wear progresses

Let's Review

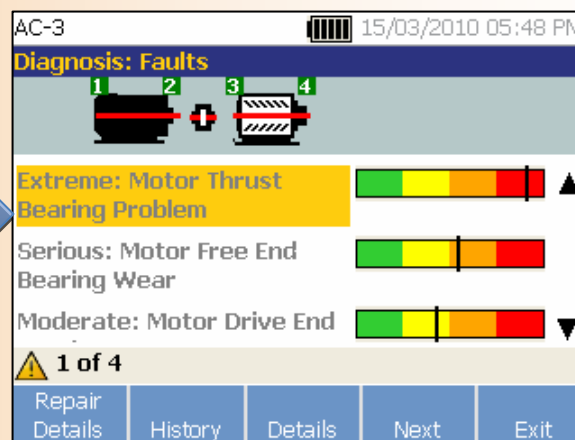
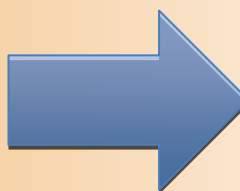
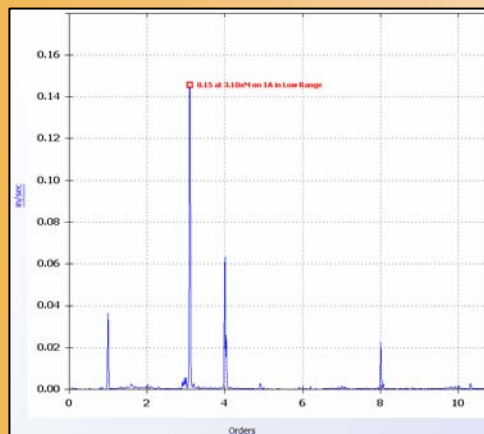
- Vibration provides the earliest indicator of machine condition
- Vibration addresses all the moving parts of rotating equipment – and can identify root cause
- Saves time by addressing problems earlier
- Saves money by reducing spare parts inventories

BUT...

- Upfront startup costs (equipment, training, human resources) can be significant
- Spectra analysis and machine diagnosis still complex
- Cultural change often necessary for PdM

Let's Review

- What if there was a way to understand machine condition
 - With little training
 - With existing maintenance resources
 - With minimal upfront cost
 - *At a glance?*



Fluke redefines mechanical troubleshooting with 810 Vibration Tester



Click on screen to start or pause video

Vibration Testing in 3 Simple Steps

1 SETUP

Vibration testing has never been easier

The 810 asks for basic machine information customers already know. Its onboard Info feature gives field tips for setting up and taking measurements like a pro

2 MEASURE

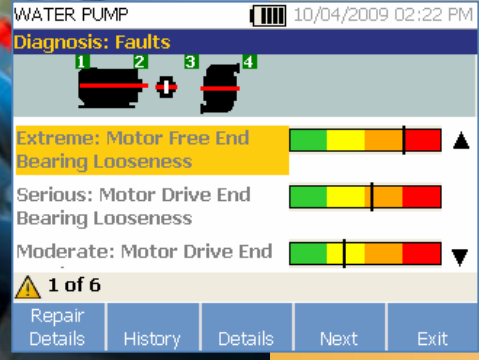
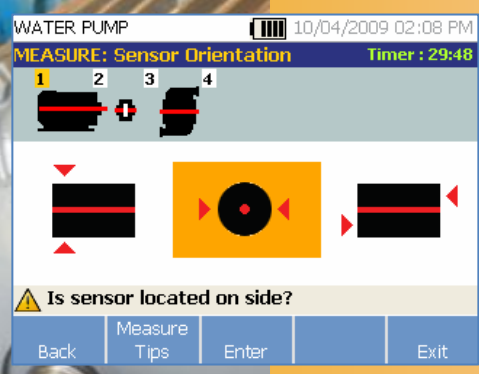
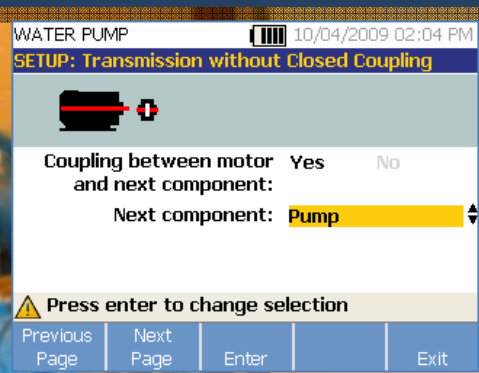
Fluke 810 fits easily into customers' maintenance routine

Use it to quickly troubleshoot problems or monitor machine conditions

3 DIAGNOSE

Fix it right the first time

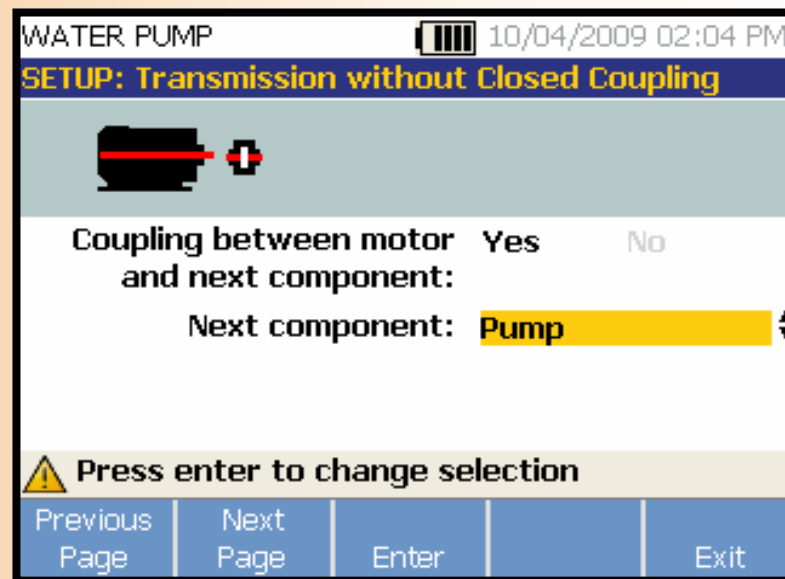
With the press of a button, the Fluke 810 identifies the root cause, its location, and how severe the problem is



Fluke 810 Uses Available Data



- Fluke 810 requires the same information a vibration analyst needs
 - Component types (motors, pumps, etc)
 - Rotating shaft speed
- It automatically sets up the measurements necessary to perform its diagnosis



Diagnoses Four Most Common Faults

1 SETUP

2 MEASURE

3 DIAGNOSE

Covers ~80% of mechanical failures

Bearing Condition

Misalignment

Unbalance

Looseness

- Use on the most common industrial machinery
 - Motors (AC/DC, ¼ HP+)
 - Fans
 - Blowers
 - Belts and Chain Drives
 - Gearboxes
 - Couplings
 - Pumps (Centrifugal, Piston, Sliding Vane, Propeller, Screw, Rotary Thread/Gear/Lobe)
 - Compressors (Piston, Centrifugal, Screw)
 - Closed Coupled Machines
 - Spindles
- 810 **cannot** be used on
 - Turbines
 - Centrifuges (Purifiers)
 - Diesel/gas engines and generators
 - Beveled gearboxes

Most common faults
Most common equipment types
Optimized for everyday troubleshooting

810 Vibration Tester Features



Features

- On-board diagnosis and location of the four most common standard mechanical faults: bearings, looseness, misalignment, unbalance and other (nonstandard faults)
- Fault severity scale with four severity levels: Slight, Moderate, Serious, and Extreme
- Prioritized repair recommendations
- Diagnostic details include cited peaks and vibration spectra
- Context Sensitive Help
- 2 GB expandable on-board memory
- Data export (via USB connection) for more detailed Analysis
- Laser tachometer for accurate machine running speed
- 100 mV/g TEDS tri-axial accelerometer
- Data storage and tracking with included VIEWER Software
- Languages: English, French, German, Italian, Portuguese, Spanish, Japanese, Simplified Chinese

810 Vibration Tester – Product Overview

General Specifications:

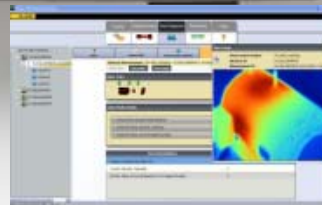
- Multilingual interface
- 2GB memory, expandable with additional SD Card
- 8 hr battery life, rechargeable
- ¼ VGA Color TFT Display

Supports single and tri-axial accelerometer inputs

Mini-USB PC Connection

Laser Tachometer input

Onboard Context-Sensitive Help



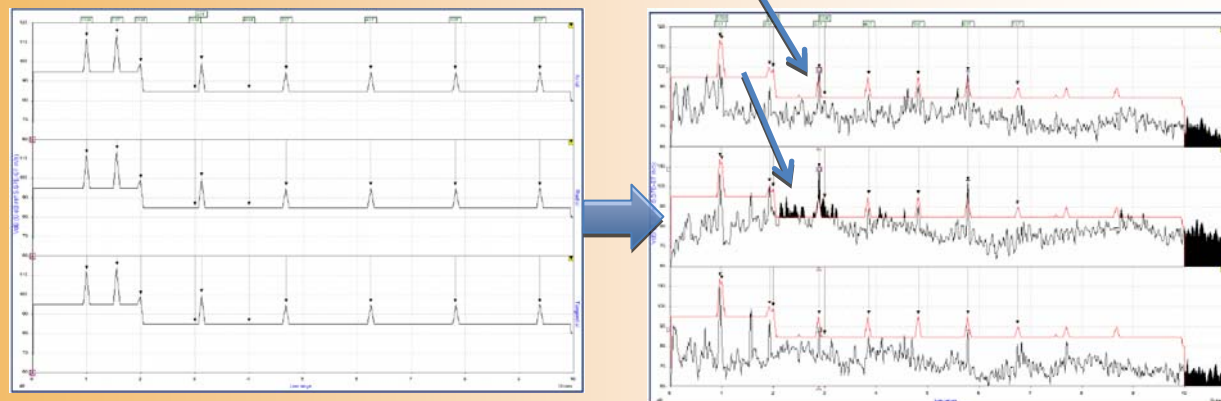
Viewer PC Software

- Machine Setups
- Import/Export/Track Data
- Store Thermal Images

Fluke 810's Diagnostic Engine – How does it work?

- Traditional vibration analysis takes a long-term view, where a baseline condition is established and a machine's condition is compared over time to the original baseline.
- Fluke 810 feeds the setup and measurement data into a set of powerful algorithms to identify a machine's mechanical faults
- Fluke 810 uses an innovative “synthetic baseline” to determine fault severity

Diagnostic Engine marks abnormal peaks



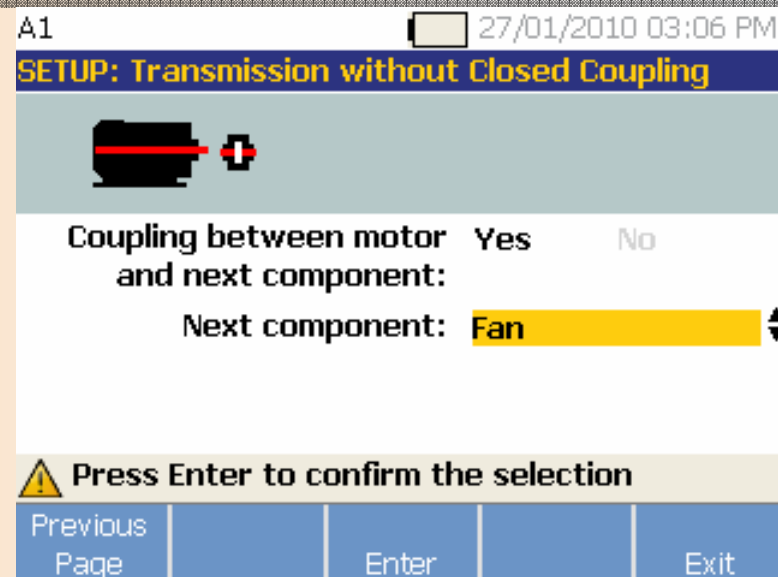
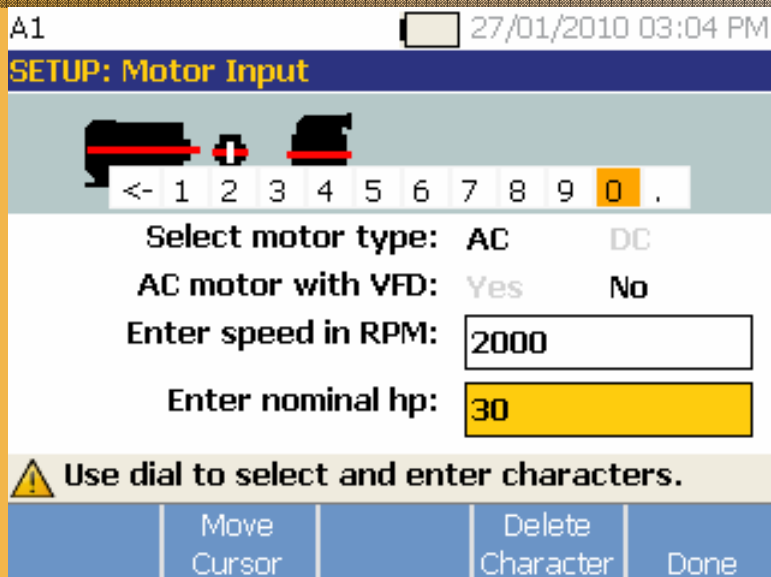
First Step – Setting up a Machine

SETUP Click yellow setup button to start to setup a new machine.



- Machine setups are easy to build, save and recall
- A Setup Wizard guides the user through the process
- Garbage In, Garbage Out: Good machine setups promote better diagnoses

Machine Setup



- The Fluke 810 will ask for basic machine information you already know, like RPM and horsepower.
- The Tester will ask questions regarding the drive train in the following order:
 1. Driver (Motor)
 2. Transmission/Coupling
 3. Driven Component
- As you enter the parameters, the Tester will create an iconic image of the drive train at the top of the screen.

Laser Tachometer



- For accurate running speed, the 810 Vibration Tester ships with a laser tachometer.
- Accurate running speed is a key input to the 810 diagnostic system

An Example Machine Setup




Here is an example of the list of questions that the Tester will ask for a typical pump coupled to an AC Motor:

- Machine Name: Pump 1
- AC Motor
- No Variable Frequency Drive
- RPM: 1800 (Minimum 200 RPM)
- HP: 40
- Motor Mounting: Horizontal
- Motor Bearing Type: Roller Bearing
- Next Component: Flexible Coupling
- Driven Component: Centrifugal Pump
- Impeller is supported by: Two Bearings
- Number of Vanes [optional]: 5

WATER PUMP 10/04/2009 02:06 PM

SETUP: Driven Component



Driven component bearing type: **Roller** Journal

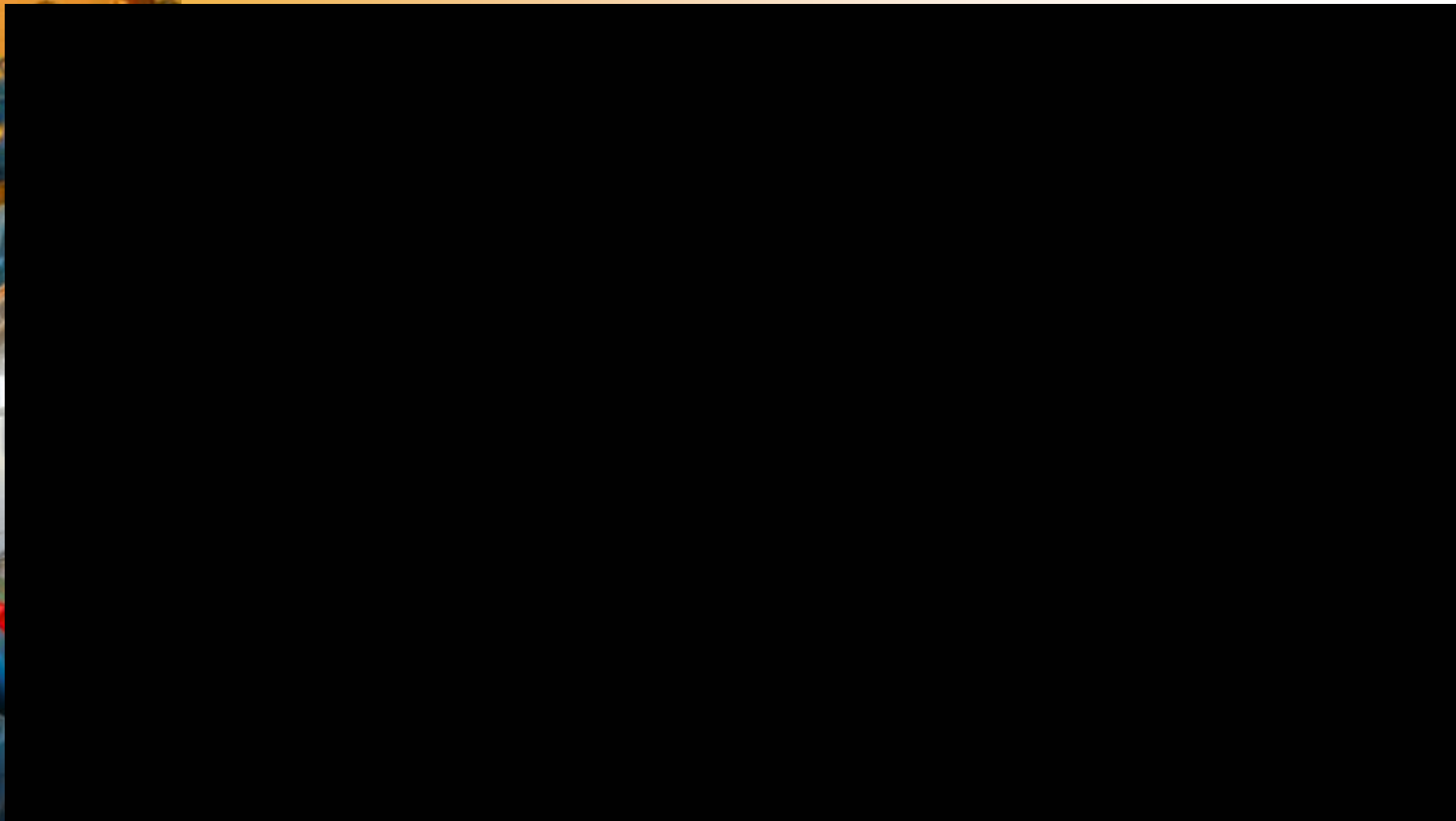
Pump type: **Centrifugal** ▲▼

Impeller is supported by: **Two bearings** ▲▼

⚠ Press enter to change selection

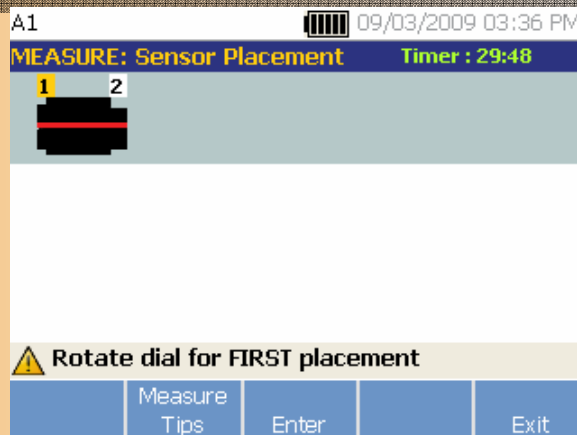
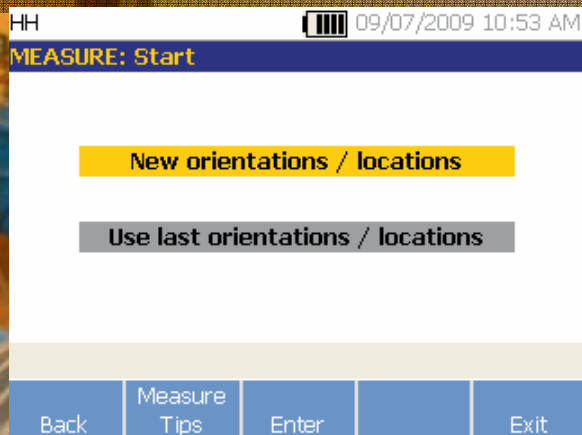
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Review – Setting Up a Machine



Click on screen to start or pause video

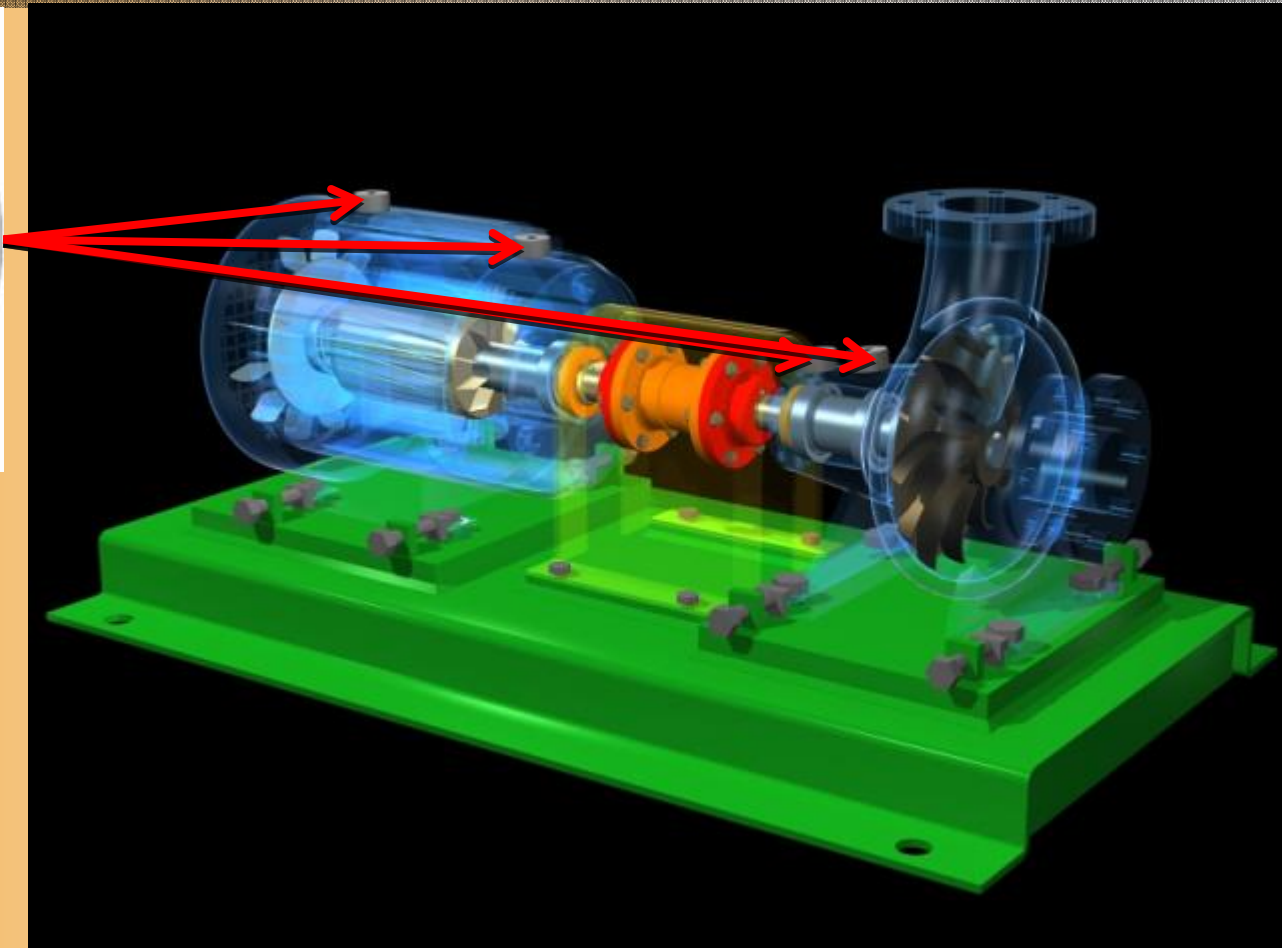
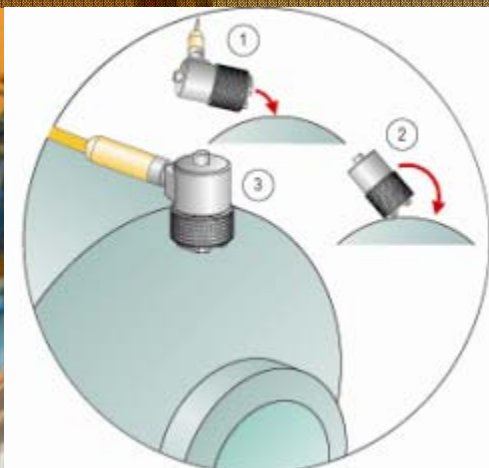
Step 2 – Taking a proper measurement



- Fluke 810 ships with a tri-axial Fluke sensor which can collect vibration signals from three axes simultaneously.
- 810's icon based, visual measurement screens are designed to make the sensor placement and sensor orientation screens easy and convenient for the user.

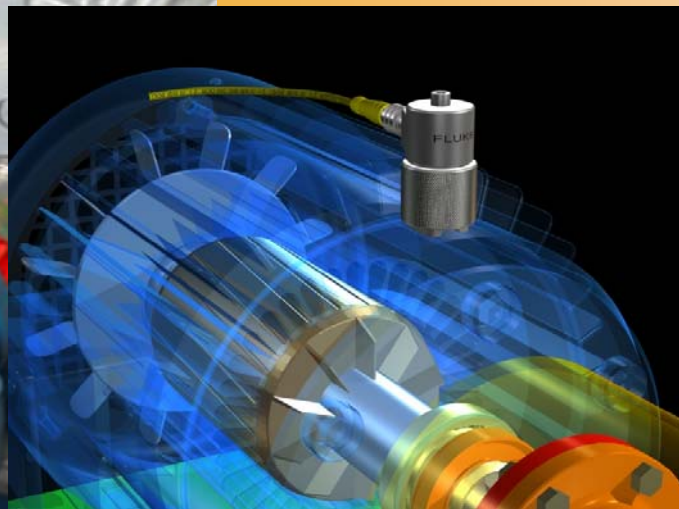
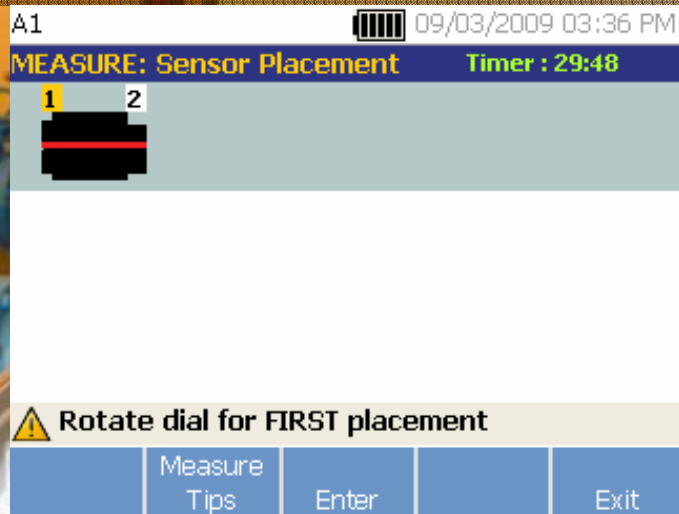
Taking vibration readings is fast and easy with the Fluke 810's tri-axial sensor and user friendly interface.

Sensor Placement



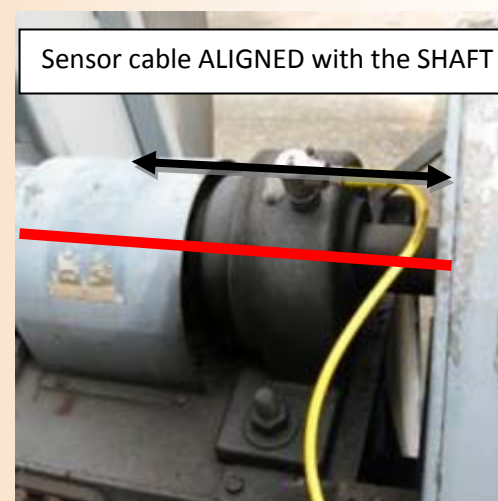
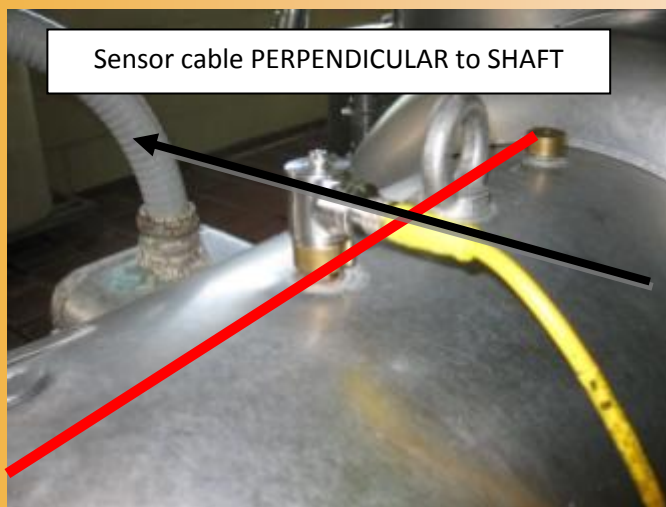
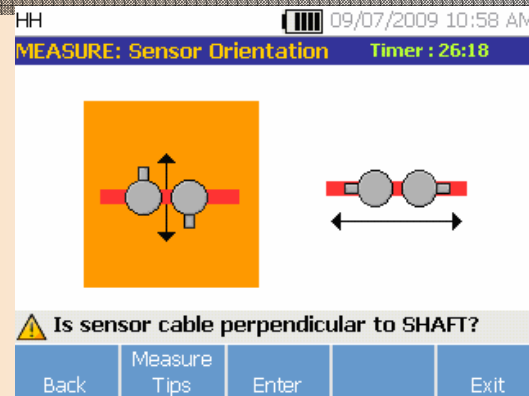
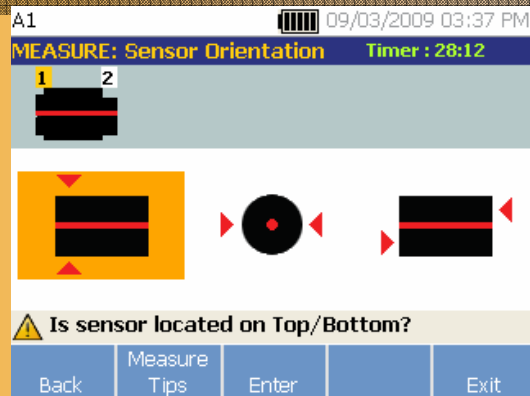
Hold the sensor **firmly** and carefully **roll** it on the top of the drive train to minimize the potential impact damaging the sensor.

Sensor Placement



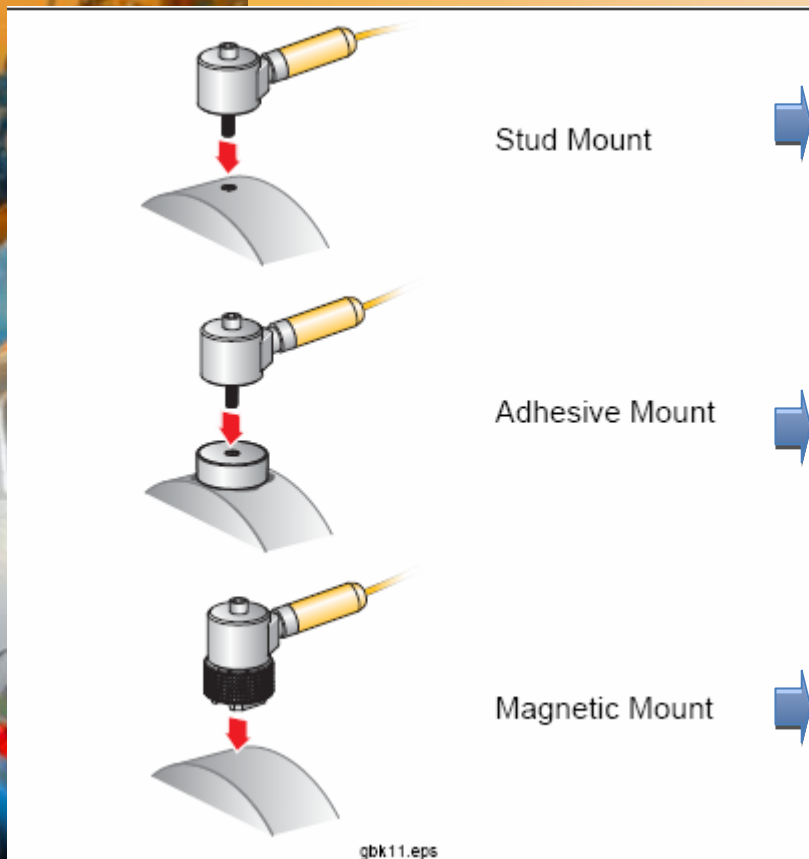
- The numbers at the top of the drive train image indicate measurement locations. Location numbering follows the flow of energy.
- Measurement Tips for measurement location:
 - For consistent diagnoses over time, you must place the triaxial sensor at the exact same location on a machine and with the same orientation.
 - Do not take bearing measurements from a foundation or fabricated base.
 - Do not mistake seal locations for a bearing measurement location on pumps.
 - Attach the Sensor to a clean, flat, bare metal surface if possible. Thick layers of paint, grease, oil, or other matter reduce both the holding force of the magnet and the high frequency response of the sensor.
 - Avoid mounting the sensor on thin surface areas, such as fan shrouds and cooling fins.

Sensor Orientation



- The orientation setup helps the Tester properly correlate vibration signals to each of the three directional axes.
- Simply follow the graphical prompts to properly locate and orient the sensor to the bearing location

Mounting Options



Advantages: Highest frequency response, very repeatable data over time.
Disadvantages: Less practical for “walk-around” troubleshooting due to time needed to screw/unscrew the Sensor from machinery, often difficult to tap a hole in the desired measurement location.

Advantages: High frequency response approaching that of a stud mount without having to tap a hole, very repeatable data over time.
Disadvantages: Less practical for “walkaround” troubleshooting due to time needed to screw/unscrew the Sensor from mounting pad.

Advantages: Fastest, most convenient method for “walkaround” troubleshooting.
Disadvantages: While typically adequate **for** troubleshooting, the magnetic mount does not have as high a frequency range as options that are more permanent.

- Fluke 810 ships with a magnetic mount and 10 mounting pads with adhesive
- Additional mounting pad packs are available as accessories

Review - Taking a proper measurement

Click on screen to start or pause video

Dissecting the Diagnosis

WATER PUMP 10/04/2009 02:22 PM

Diagnosis: Faults

Extreme: Motor Free End Bearing Looseness ▲

Serious: Motor Drive End Bearing Looseness ▶

Moderate: Motor Drive End ▼

1 of 6

Repair Details | History | Details | Next | Exit

Slight	No repair action is recommended. Retest the machine and monitor the condition after maintenance.
Moderate	(Months, even up to a year) – No immediate repair action is required. Increase the frequency of measurements and monitor the condition of the machine.
Serious	(Weeks) – Take maintenance action during the next planned downtime or maintenance period.
Extreme	(Days) – Immediate action is required. Consider shutting down the equipment and taking repair action now to avoid failure.

WHAT IS THE PROBLEM?

WHERE IS THE PROBLEM?

HOW BAD IS THE PROBLEM?

The Fluke 810 Vibration Tester will provide you actionable answers *NOW*.

Diagnosis Details – Cited Peaks

- CITED PEAKS: Mechanical faults are detected at certain running speeds or frequencies in the spectra.

A1 09/03/2009 04:01 PM

Extreme: Motor Free End Bearing Looseness

Loc	Axis, Amp	Orders	Range
1	T 4.76 in/sec	0.33333	Lo
1	A 4.07 in/sec	0.33333	Lo
1	R 1.87 in/sec	0.33333	Lo

⚠ 1 of 30

Back Graph Exit

A1 09/08/2009 11:14 PM

101.15 at 1.33xM on 1R in Lo Range

X: Orders Y: Vdb

⚠ Rotate dial to select axis


Back Zoom In Previous Spectra Next Spectra Exit

Label	Description
Loc	Location of fault. Bearing locations are numbered 1 to n, from free end of motor (1) to end of drivetrain (n).
Axis	Direction of vibration signal: Axial, Radial, or Tangential.
Amplitude	Vibration signal amplitude cited from this specific location.
Orders	Multiples of the running speed or frequency and identifies at which running frequency that the cited amplitude peak is detected.
Range	Frequency range of data collection, Hi or Lo.

Diagnosis Details – Spectra

A1 09/03/2009 04:01 PM

Extreme: Motor Free End Bearing Looseness



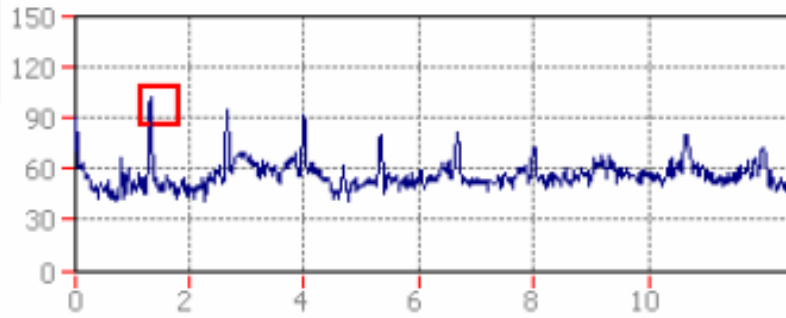
Loc	Axis	Amp	Orders	Range
1	T	4.76 in/sec	0.33333	Lo
1	A	4.07 in/sec	0.33333	Lo
1	R	1.87 in/sec	0.33333	Lo

1 of 30

Back Graph Exit

A1 09/08/2009 11:14 PM

101.15 at 1.33xM on 1R in Lo Range

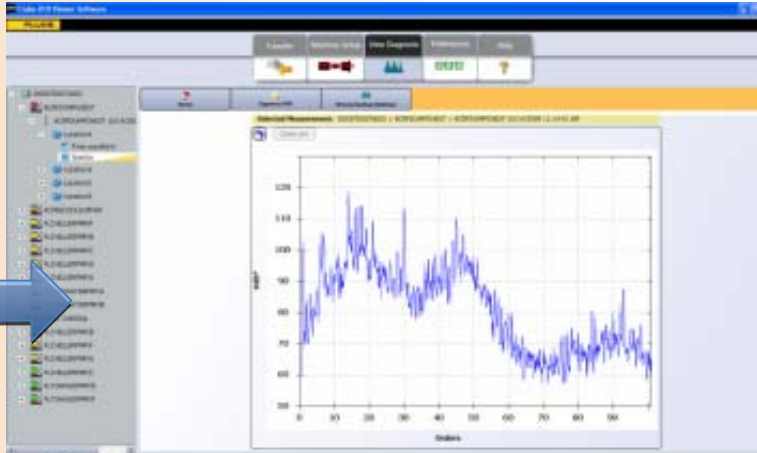


X: Orders Y: vdb

Rotate dial to select axis

Back Zoom In Previous Spectra Next Spectra Exit

- Viewing the spectra is simple on the 810
- Export the data to the Viewer software and view spectra in greater detail



Review – Interpreting the Diagnosis



Click on screen to start or pause video

Viewer PC Software



VIEWER Software enables the users to upload their machine data (machine setups and diagnostic data) to store, keep track and view in greater detail. Also users can use the PC to set up machinery fast and easy.

Transfer



- Transfer machine data to and from the Tester
- Export machine data for additional expert analysis

Machine Setup



- Create, edit, delete machine setups easily with the keyboard

View Diagnosis



- Review full machine diagnosis,
- View spectra in full detail

Preferences



- Modify application settings (e.g. language, date/time, units, sub units, etc.)

Transfer: Import /Export Machine Setup

The screenshot displays the 'Transfer' menu on the left, with 'Import Machine Setup' and 'Export Machine Setup' highlighted in red. The main interface shows a 'Filter' section with date selection options and a table of machine setups.

Transfer Menu:

- Import Machine Setup
- Export Machine Setup
- Import Diagnostic Data
- Export Diagnostic Data
- Fault data

Tester connectivity:

Connected
 Free memory: 1792.31 MB
 Total memory: 1861.69 MB

Filter Section:

Select date

Start date (mm/dd/yyyy): 06/17/2009

End date (mm/dd/yyyy): 09/17/2009

Options: Select ALL, Transferred, Not Transferred

Table of Machine Setups:

Setup name	Setup date	Record status	Modified date	Transfer status
A	09/02/2009 11:44:32	Complete	09/02/2009 11:44:32	Not Transferred
M1	09/02/2009 17:13:32	Complete	09/02/2009 17:13:32	Not Transferred
M2	09/02/2009 17:14:23	Complete	09/02/2009 17:14:23	Not Transferred
M3	09/02/2009 17:15:03	Complete	09/02/2009 17:15:03	Not Transferred
M4	09/02/2009 17:16:17	Complete	09/02/2009 17:16:17	Not Transferred
M5	09/02/2009 17:17:11	Complete	09/02/2009 17:17:11	Not Transferred

- Import Machine Setups created in the Tester to the Viewer software
- Export Machine Setups created in the PC to the Tester

Transfer: Import Diagnostic Data Machine Setup

The screenshot displays the software interface for the Fluke 810 Vibration Tester. The left sidebar contains the following options:

- Import Machine Setup
- Export Machine Setup
- Import Diagnostic Data** (highlighted with a red box)
- Export Diagnostic Data
- Fault data

The main panel shows a 'Filter' section with the following settings:

- Select date
- Start date (mm/dd/yyyy): 06/17/2009
- End date (mm/dd/yyyy): 09/17/2009
- Radio buttons: Select ALL, Transferred, Not Transferred
- Filter button

The data table below shows the following information:

Setup name	Measurement ID	Measurement date	Transfer status
AC	AC-9/1/2009 10:23:28 PM	09/01/2009 22:23:28	Not transferred to PC

The 'Tester connectivity' section at the bottom left indicates the device is 'Connected' with the following memory statistics:

- Free memory: 1792.21 MB
- Total memory: 1881.69 MB

- Import measurement data from the 810 to the PC for further analysis

Transfer: Export Diagnostic Data

The screenshot shows the 'Transfer' menu in the software. The 'Export Diagnostic Data' option is highlighted with a red box. Below the menu, there is a date selection window with the following fields:

Start date (mm/dd/yyyy): 06/17/2009

End date (mm/dd/yyyy): 09/17/2009

Below the date selection is a table of diagnostic data:

	Setup name	Tester serial number	Measurement date
<input type="checkbox"/>	AC	VibrationTester1	09/01/2009 22:23:28
<input type="checkbox"/>	TST	VibrationTester1	09/01/2009 19:38:11
<input type="checkbox"/>	TST	VibrationTester1	09/01/2009 19:44:21

At the bottom of the sidebar, there is a 'Tester connectivity' section showing 'Connected' status and memory usage: Free memory: 1792.21 MB, Total memory: 1881.69 MB.

- Want a second opinion? Export diagnostic information to a metafile for independent analysis

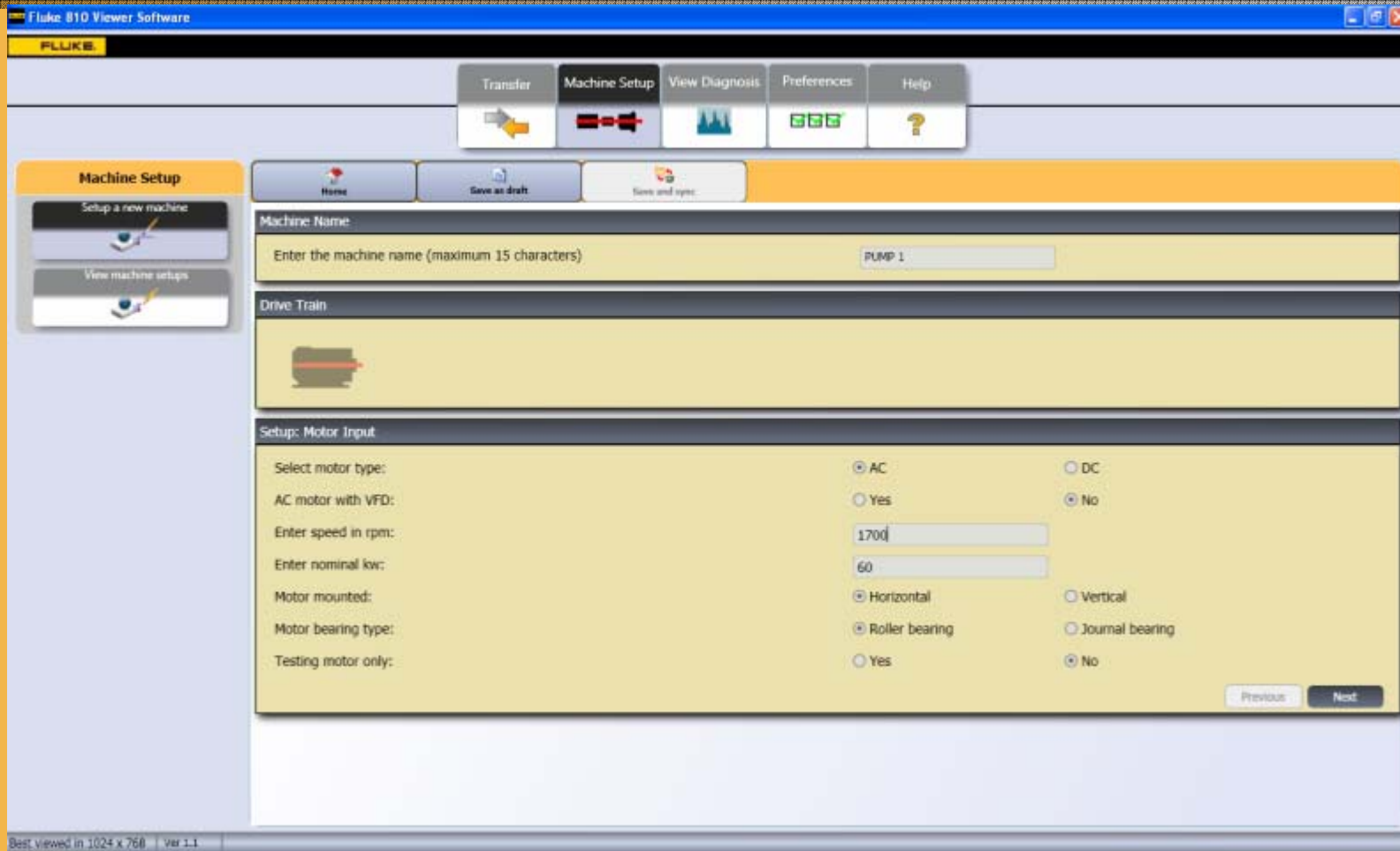
Transfer: Export Fault Data to .pdf

The screenshot shows the software interface for the Fluke 810 Vibration Tester. On the left, a vertical menu titled 'Transfer' contains several options: 'Import Machine Setup', 'Export Machine Setup', 'Import Diagnostic Data', 'Export Diagnostic Data', 'Fault data' (highlighted with a red box), and 'Tester connectivity'. The 'Tester connectivity' section shows 'Connected' status and memory usage: 'Free memory: 1792.21 MB' and 'Total memory: 1881.69 MB'. On the right, there are 'Home' and 'Export to PDF' buttons. Below them is a 'Filter' section with dropdown menus for 'Tester ID' (set to 'VibrationTester1'), 'Machine setup name' (set to 'TST'), and a list of 'Measurement ID' values including 'TST-9/1/2009 7:44:21 PM' and 'TST-9/1/2009 7:38:11 PM'. At the bottom, a table displays fault data with columns for 'Fault description', 'Fault severity', and 'Measurement date'.

Fault description	Fault severity	Measurement date
Motor Drive End Bearing Wear	Extreme	09/01/2009 19:44:21
Fan Imbalance	Serious	09/01/2009 19:44:21
No problems detected	Serious	09/01/2009 19:44:21
Fan Drive End Looseness	Serious	09/01/2009 19:44:21
No problems detected	Serious	09/01/2009 19:44:21
Motor Free End Bearing Wear	Serious	09/01/2009 19:44:21
Fan Free End Bearing Wear	Serious	09/01/2009 19:44:21

- Export your diagnostic data to a .PDF-format report

Machine Setup



- Create and manage your machine setups in the Viewer software, then sync it up with the 810 Vibration Tester

View Diagnosis

The screenshot displays the 'Fluke 810 Viewer Software' interface. The top navigation bar includes 'Transfer', 'Machine Setup', 'View Diagnosis' (selected), 'Preferences', and 'Help'. Below this is a secondary toolbar with 'Home', 'Export to PDF', and 'Browse backup database'. The left sidebar shows a tree view of measurement locations and components, with 'KCRFDUMPCHEST-10/14/2009' selected. The main area shows the 'Selected Measurement' path and a 'Drive Train' diagram with numbered components (1-6). Below the diagram, the 'Cited Peaks Details' section lists two fault types: 'Extreme Non-standard Fault Detected' and 'Extreme Gearbox Input Shaft Looseness Or Possible Pinion Damage'. At the bottom, a 'Recommendations' table provides specific advice.

Recommendations	Priority
Contact Vibration Specialist	4
Inspect Gearbox Input Shaft Bearings And Pinion	4

Best viewed in 1024 x 768 Ver 1.1

View Diagnosis

Tester Name
 Tester ID
 Measurement ID
 Measurement Location

View diagnostic data (Cited peaks, Spectra, Time Waveforms if captured) by Tester Name, by Specific Measurement Record, by Location

View image

Device serial number : FLK-0821 DataDog
 Machine ID : FLCHILLERPMP/B
 Measurement ID : FLCHILLERPMP/B-10/15/2009 11:29:21

Upload and view Thermal Images

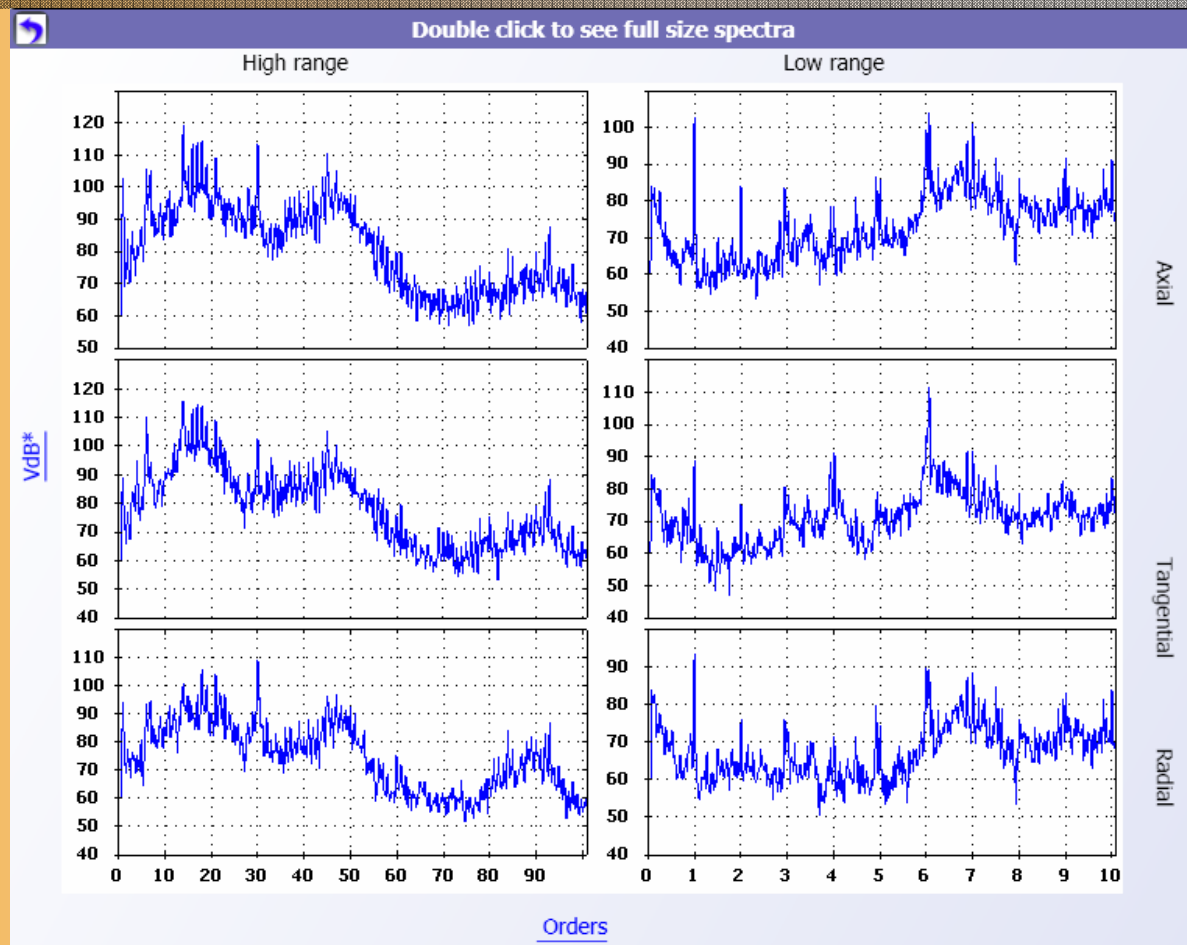
Cited peak details

Cited peak number	Bearing	Axis	Vibration amplitude	Order	Range
Cited peak1	Location2	Tangential	154.96 VdB (Metric)	0.333	Low
Cited peak2	Location2	Radial	132.34 VdB (Metric)	11.5	High
Cited peak3	Location2	Axial	131.05 VdB (Metric)	11.6	High
Cited peak4	Location3	Radial	124.58 VdB (Metric)	11.8	High
Cited peak5	Location3	Tangential	124.15 VdB (Metric)	11.4	High

Fan Imbalance - Serious
 Fan Drive End Looseness - Serious

View Details of Cited Peaks

View Diagnosis - Spectra



- View spectra across the three different dimensions (axial, radial, tangential) and over high and low Ranges

Everything you need... out of the box

Fluke 810 includes everything you need to get started:

- Vibration Tester
- Laser tachometer with pouch
- Triaxial-TEDS accelerometer (sensor)
- Quick disconnect cable
- Sensor mounting pad kit with adhesive
- USB cable
- Viewer PC software
- Shoulder and hand straps
- Hard carrying case
- Quick Reference Guide
- Getting Started Guide
- User Manual CD
- **FREE** Product/Application Training DVD (available separately)

List Price: \$7,999



Fluke 810 and Your Maintenance Routine

Use the Fluke 810 Vibration Tester to:

- Troubleshoot and identify the root cause
- Confirm repairs pre and post maintenance
- Commission new equipment
- Check equipment after installation
- Provide quantifiable proof
- Make the right decision - repair or replacement?
- Prioritize and plan repair activities
- Anticipate equipment failures
- Take control of your spare parts inventory
- Train new or less-experienced technicians



Fluke 810 Pays for Itself...And Then Some

Cost of Downtime / Repair	Cost (RTF)
1. Net income per hour of output for production line or other critical process	\$20,000/hr (critical & non-critical machine failures)
2. Calculate the average downtime (due to mechanical failures) for each equipment failure and number of events per year.	8 hrs down, 5 motors, 1x/yr
3. Multiply the results of step 1 by both values in step 2.	$(\$20,000 * 8) * 5 = \$800,000$
4. Estimate labor (overtime) and equipment parts cost per downtime incident	$\$30/\text{hr} * 8 \text{ hrs} * 2 \text{ techs} = \$480 + \$5000/\text{motor} = \5480
5. Add step 3 and step 4. This is the annual cost in lost revenue plus repair costs	\$805,480 (due to critical/non-critical failures)
Cost of Program Implementation	Cost
1. Cost of Fluke 810	\$7,999
2. Average cost of dedicated, experienced vibration technician (FTE)(Assume 1 man hour/motor/month)	\$0 (Use existing technician resources – no incremental cost)
3. Average upfront equipment training costs + “maintenance training”	\$0 (Training DVD included – no incremental training costs)
4. Add steps 1 through step 3. This is the total first year cost of program startup	\$7,999
Vibration Testing Payback	Cost
1. Assume 50% of unplanned downtime and repair costs savings	$\$805,480 * 50\% = \$402,740$
2. Return on Investment & Payback of Fluke 810 (total cost per year / total savings per year)	$\$7,999 / \$402,740 = \mathbf{1 \text{ wk}}$

- Fluke 810 makes vibration testing easy for maintenance teams – no additional training costs, software and support fees, fits into existing preventive maintenance routines

Fluke Makes Vibration Testing Easier

- With the Fluke 810, vibration testing is within reach
 - It's easy to use
 - It gives you answers when you need them
 - It includes everything you need to get started immediately
- You will understand
 - **Root cause of faults** and fix it right the first time
 - **Severity of failures** and prioritize your repairs
 - **Location of faults** and focus your repair work
- It requires minimal upfront investment...but the ROI is *significant*

Fluke 810 Vibration Tester

Get Answers Now.



Visit www.fluke.com/machinehealth for more information