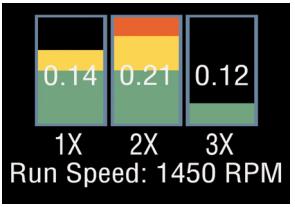
9070 Smart Vibration Meter Instruction Manual

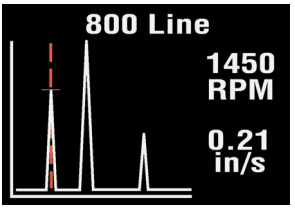
Overall machine and bearing conditions:
vibration values are displayed with color coded alarm levels for ISO values and Bearing Damage (BDU).

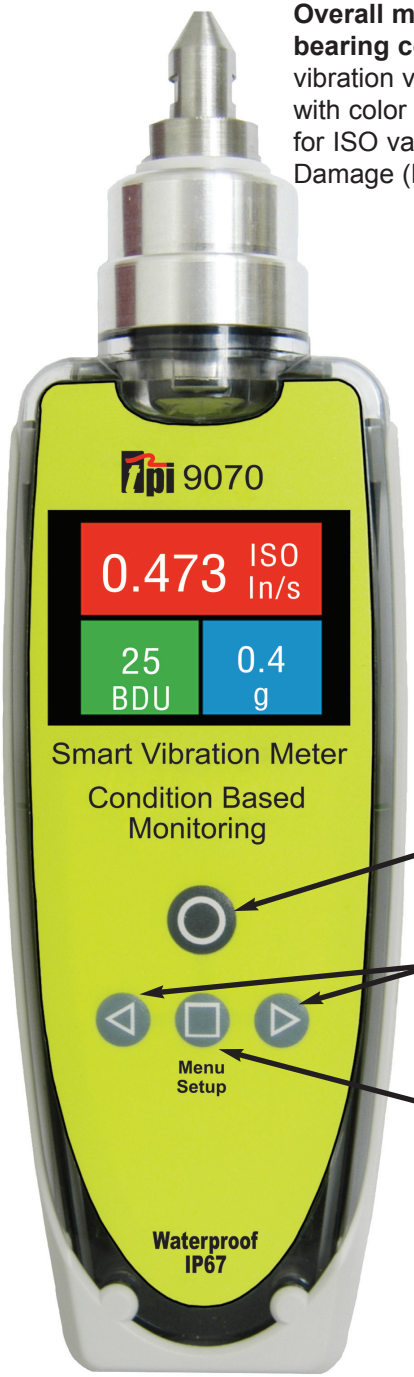


Easy vibration analysis:
1X (unbalance)
2X (misalignment)
3X (looseness)



Identify complex issues:
100 to 800-line spectrum with zoom and cursor.





Power ON & Measure

Navigation & Cursor Movement

Screen Select / Push & Hold for 2 seconds for Menu Setup

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1 OVERVIEW

The **9070** is a simple to use vibration monitoring and analysis tool that allows easy display of vibration signals. The meter automatically performs vibration analysis functions based on machine running speed to help diagnose faults such as unbalance, misalignment and looseness.

The system is designed to enable a user to take vibration measurements from assets (e.g. pumps, motors, fans and bearings). The unit displays vibration frequency plots and allows vibration severity and bearing condition to be monitored.

1.1 Control buttons

Turning the meter ON is achieved simply by pressing the power on (circle) button. The unit automatically turns OFF if not used for 1 minute (this time period can be increased up to 60 minutes using the Setup Wizard).

1.2 Batteries

The **9070** requires two AA size batteries and these can be replaced by removing the battery compartment cover (held in place by 6 screws) as shown in the photographs below. Use a #1 phillips head screwdriver to loosen and tighten the battery cover screws. Using the incorrect screwdriver will result in damage to the screws.





Care must be taken when the batteries are changed. Make sure the gasket is properly seated when reinstalling the battery door otherwise the IP67 rating will be compromised.

1.3 Service

The 9070 contains no user serviceable parts. In the unlikely case of malfunction, please return the complete unit to your supplier for repair.

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2 Operation

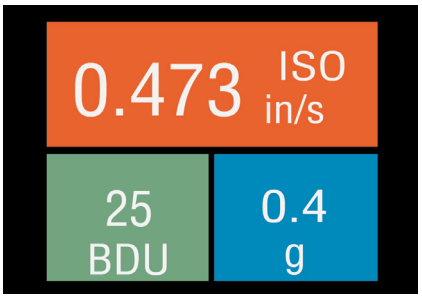
2.1 Changing the probe tip



Warning: In order to prevent possible damage, the probe tip should only be tightened using the machined flats on the probe tip's mounting plate and 8mm & 16mm wrenches, as illustrated in the photo opposite. Do NOT hold or clamp the case of the Vib Meter when tightening the probe tip or magnet, as this may cause damage and will invalidate the warranty.

2.2 Taking a reading

To take a reading, briefly press the circle button to turn the unit ON and then, while holding the tip of the unit against the machine to be measured, press the circle button again to take the reading.



This causes the overall vibration numbers screen to be displayed as shown in the example screenshot on the left.

This shows an overall view of the machine's vibration condition as explained in the following sections.

2.2.1 Vibration readings

Once a vibration reading has been taken, the display will show three values, as shown in the screenshot above.

- ISO value (velocity in mm/second or in/sec)
- Bearing Noise in BDU (Bearing Damage Units)
- Total g (acceleration)

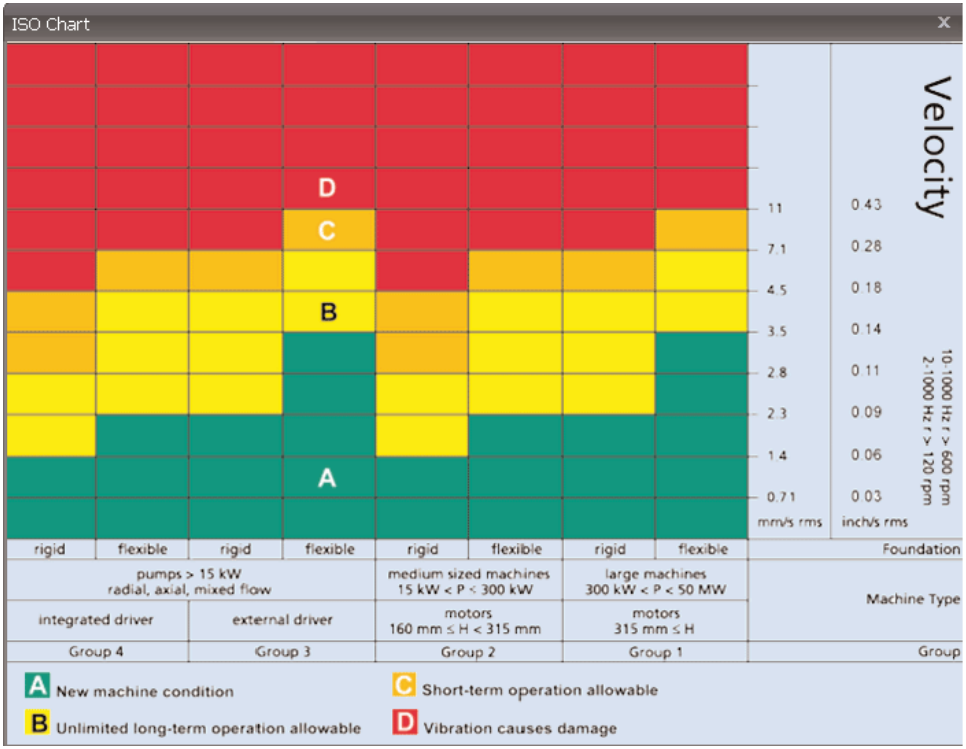
According to ISO standards, values will display on a **Green** background indicating a new machine condition, **Amber** background indicating unlimited long term operation allowable, and **Red** background indicating vibration causes damage. Total g (acceleration) always displays on a **Blue** background. These readings are explained in more detail below with some examples of what they actually mean:

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ISO mm/s or in/sec

The ISO value (in mm/s or inch/s) is the large number at the top of the screen, which is the RMS value of the vibration velocity in the frequency band 10Hz (600 RPM) to 1kHz (60,000 RPM), as specified by the ISO standard[1].

The ISO value background is color coded according to the ISO 10816-1 vibration velocity level chart (see below). The color coded background will indicate the condition of the machine according to the relevant vibration levels for the size and type of machine selected with the **Setup Wizard** (see section 2.2.1).



[1] ISO 10816-1:1995. Mechanical vibration -- Evaluation of machine vibration by measurements on non-rotating parts

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Bearing Noise (BDU)

Below the displayed ISO value and to the left is the value of bearing noise (high frequency vibration) in Bearing Damage Units (BDU), where 100 BDU corresponds to 1g RMS vibration measured above 1kHz. This is a measure of the wear state of the bearings in the equipment being monitored. The higher the number, the more worn the bearing.

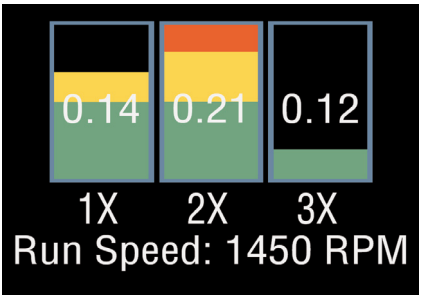
It is generally held that 1g of high frequency vibration (100 BDU) corresponds to a high level of bearing noise and so can be considered indicative of a damaged bearing. In other words, it may be helpful to think of the Bearing Noise figure as being very roughly equivalent to "percentage" of bearing wear.

By default, the bearing noise is displayed on a **Red** background if it is above 100 BDU, an **Amber** background between 50 and 100 BDU and a **Green** background below 50 BDU. The BDU alarm levels can be changed using the **Advanced Settings Menu** (see section 2.3.3.1).

Total acceleration (g)

This is the RMS (average) value of the total vibration in the ISO frequency range (10Hz to 1kHz). This reading is shown in units of g or Earth's gravitational constant, (where 1g = 9.81 m/s^2).

2.2.2 Vibration Analysis



Pressing the square button brings up a display similar to that shown opposite, which shows the readings of vibration velocity (mm/s or inch/s) broken down into each of 3 bands.

The display shows the vibration velocity in frequency ranges that are all based on multiples of the specified **Run Speed** of the machine, and as displayed beneath the 3 bar graphs.

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In order to perform a vibration analysis it is important that the running speed of the machine is entered correctly. This is done using the "Setup Wizard" as described in Section 2.3.1 of this user guide.

The frequency ranges of the bands are based on the following multiples of running speed[2]:

1X (Unbalance):

The level of vibration in the frequency band based on the running speed is usually indicative of how well balanced the machine is. A **large** vibration at the running speed usually indicates that the machine is out of balance. However even a very well balanced machine will usually show some vibration at the running speed but this figure should ideally be quite low (e.g. typically less than about 2 mm/sec or .11 in/sec for a medium sized machine).

2X (Misalignment):

Vibration in the frequency band centered at twice the running speed is a possible indication of misalignment. This is based on the fact that shaft misalignment can result in a double peak in the waveform due to there being two different centres of gravity (one from each shaft). In other words the accelerometer picks up a peak as each centre of gravity passes by and hence there will be two positive and two negative peaks each revolution of the shaft. This will typically give rise to a vibration signal at double the running speed of the machine.

3X (Looseness):

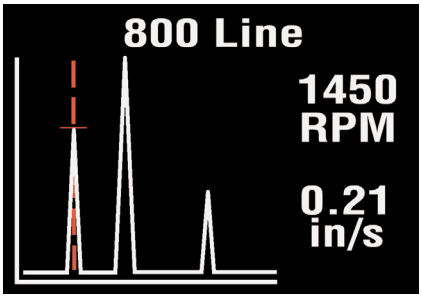
Vibration in the frequency band centered at 3 times running speed is a possible indication that something may be loose (e.g. loose mounting bolts, weak foundations etc.) as it is not usual to see third order vibration in a machine unless there is some structural looseness that is being "excited" by the vibration of the machine.

[2] Multiples of running speed are often referred to as "orders"

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2.2.3 Frequency spectrum

Pressing the square button once more brings up a display similar to that shown below, where the vibration levels are shown as a frequency spectrum in the range from 0 to 1kHz.



The heights of the peaks indicate the RMS vibration level in (mm/s or inch/s) at each frequency point in the spectrum.

The readings to the right of the screen show the frequency in (Hz or RPM) and the RMS vibration level in (mm/s or inch/s) at the position of the cursor (red dotted line).

The cursor position can be moved by use of the left (<) and right (>) arrow buttons.

Continuing to press the square button successively increases the resolution of the frequency axis from 100 Lines (i.e. 10Hz or 600 RPM resolution) to 200, 400 and finally 800 Lines (i.e. 1.25Hz or 75 RPM resolution) as shown in the table below.

Resolution (lines)	Resolution (Hz)	Resolution (RPM)
100	10	600
200	5	300
400	2.5	150
800	1.25	75

Increasing the resolution effectively **zooms** into the frequency spectrum display and at the higher resolutions the display must be **scrolled** by using the left and right arrow buttons in order to view the full spectrum.

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2.3 Settings menu

The Settings menu is entered by pressing and holding down the square button for **2 seconds**.

This brings up the following screen:



Moving up and down the menu is achieved by pressing the left (up) and right (down) buttons which causes the menu item to be highlighted. Pressing the square button will select the highlighted menu item.

2.3.1 Setup Wizard

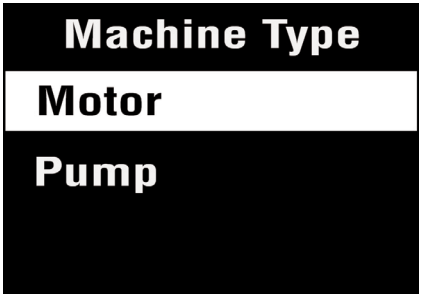
Selecting the Setup Wizard opens a dialogue that allows the machine running speed to be entered and the ISO alarm levels to be set automatically according to the size and type of machine to be monitored.



The first screen to be displayed shows the running speed in the previously selected units (Hz or RPM).

Changing the running speed is achieved by pressing the left (to decrease run speed) or right (to increase run speed) arrow buttons.

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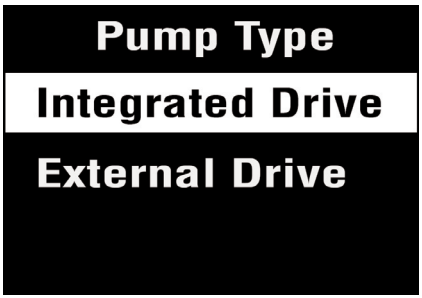
Pressing the square button again brings up the next screen which allows the machine type (motor or pump) to be selected.

Motor - Electrical machine normally with sleeve or rolling element bearings and depending on size, operating speeds above 120RPM to 15,000RPM.

Pump - Multivane impeller with separate or integrated drive (centrifigul, mixed flow, and/or axial flow) with sleeve or rolling element bearings.

If a **motor** is selected the size must be selected (under or over 300kW) or if a **pump** is selected, it must be specified whether it has an integrated or external drive unit.





Selecting the machine type and size allows the ISO alarm levels to be set accordingly, as does specifying the type of machine mounting (rigid or flexible).

As a basic “rule of thumb”, unless a machine is bolted down to concrete, it should be considered as being **flexible**.

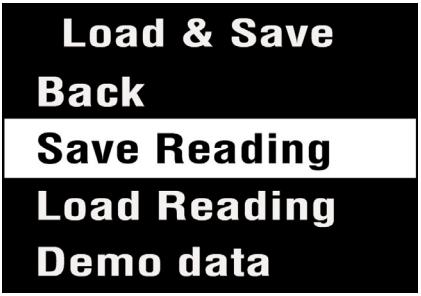
Most motors and pumps are mounted on some kind of frame or structure and as such should definitely be considered as flexibly mounted.



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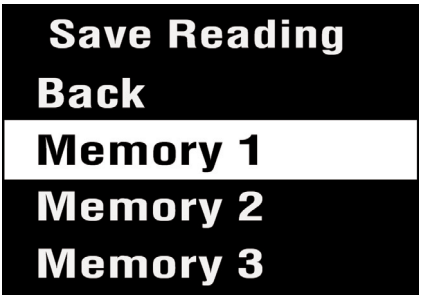
2.3.2 Load & Save Readings

Pressing the square button when **Load & Save** is highlighted brings up the following menu:



Selecting **Save Reading** opens a screen that allows the user to choose from one of 3 Memories in which to save the reading.

Selecting **Load Reading** brings up a similar screen from which the user can choose to load a previously saved reading from any one of the 3 Memories.



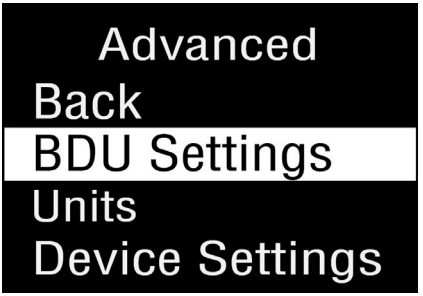
The reading can then be examined in the same way as when it was first taken via the overall numbers, Vibration Analysis, and frequency spectrum display screens.

The final option on the Load & Save screen allows the user to select **Demo Data**, which loads pre-stored vibration readings from one of two sets of demonstration data (Demo 1 and Demo 2).

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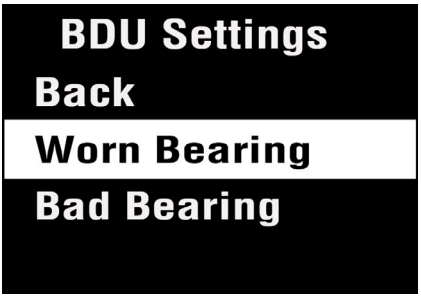
2.3.3 Advanced Settings

Selecting Advanced from the Settings menu causes a further menu to appear as shown in the screen shot right. Selecting an option is again done by pressing the arrow buttons followed by the square button.



2.3.3.1 BDU settings

Selecting **BDU Settings** allows the alarm levels at which the BDU readings change color to be altered by the user. Normal levels are displayed on a **Green** background.



The BDU threshold values are designated as Worn Bearing (where readings turn **Amber**) and Bad Bearing (where readings turn **Red**).

Both these threshold values can be set independently using the left and right arrow buttons.

The default BDU thresholds are 50 for “Worn Bearings” (**Amber level**) and 100 for “Bad Bearings” (**Red level**). These levels are indicative of medium sized machine bearings operating at run speeds in the region of 1000 to 3000 RPM.



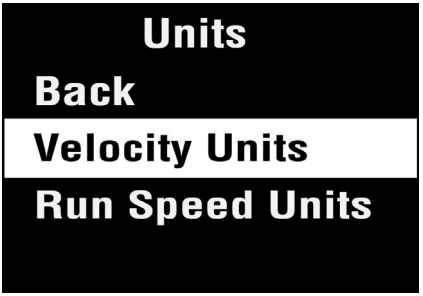
Higher run speeds may need increased BDU threshold values to identify worn or bad bearings. Lower run speeds may need decreased BDU threshold values to identify worn or bad bearings.

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2.3.3.2 Units

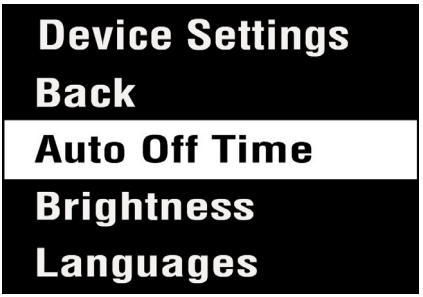
Selecting Units from the Advanced Settings menu allows the velocity readings to be displayed in either mm/s or in/s (inch/second).

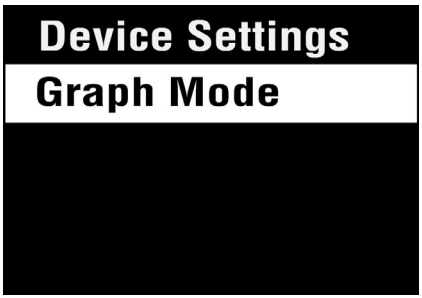
Run Speed units can be displayed in units of Hertz3 (Hz), RPM or CPM.



2.3.3.3 Device Settings

There are two pages of Device Settings menus. To advance to the second page the right arrow button should be used. Selecting a menu option is again achieved by pressing the square button.





The **Auto Off Time** can be set from 1 minute up to a maximum value of 60 minutes, in increments of 1 minute.

The **Brightness** level can be set anywhere between 1 (least brightness) up to 100 (full brightness).

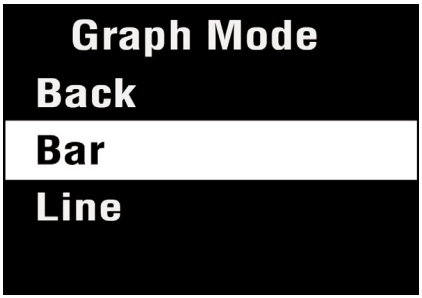
[3] Hertz are equivalent to, and also sometimes referred to as, cycles per second (CPS).
[4] Revolutions per minute (RPM) are sometimes also referred to as cycles per minute (CPM)

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The operating Language can be selected from any one of 4 different languages.

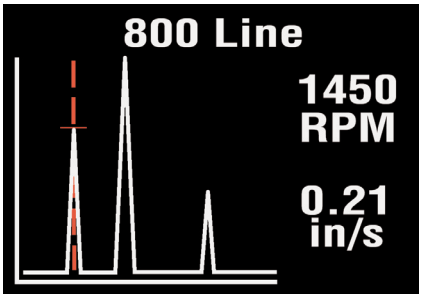
A total of 14 languages are available, 4 of which are loaded depending on the exact model of 9070.

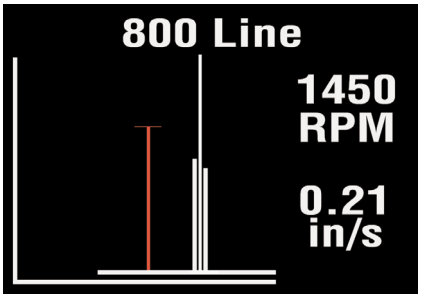




The **Graph Mode** can be set to display the frequency spectrum as either a **Bar** graph or a **Line** graph.

Examples of these two graph modes are shown below:





3 Maintenance & Care

Wipe clean with soft towel and lukewarm water. Do not place in dishwasher or other cleaning device. Do not use detergents to clean housing. Do not subject meter to water at or above 122°F (50°C).

Care must be taken when the batteries are changed. Make sure the gasket is properly seated when reinstalling the battery door otherwise the IP67 rating will be compromised.

Do not drop the instrument. Damage to the probe tip / accelerometer and/or OLED display may occur.

No internal user serviceable parts.

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4 Specifications

Size	7.9” x 2.4” x 1” (200 mm x 60mm x 26mm)
Weight	9.9oz. (280g) (not including magnet)
Environmental	
Water, Sand & Dust:	IP67 Waterproof (Depth of 3.28’ (1m) up to 30 minutes) Care must be taken when batteries are changed. Make sure gasket is properly seated otherwise IP67 rating will be compromised. Never open the meter housing. There are no user serviceable parts inside. Opening the housing will compromise the IP67 rating.
Operating:	32°F to 122°F (0°C to 50°C)
Storage:	-4°F to 158°F (-20°C to 70°C)
Power supply	2 x AA batteries
Battery life	Auto power OFF - typically 50 hours operating time depending on brightness setting.
Frequency range	2 Hz to 1 kHz (ISO) 1 kHz to 15 kHz (BDU)
Max frequency resolution	1.25 Hz @ 800 lines FFT setting
Displayed Vibration Amplitude Units	Acceleration in g Velocity in mm/s (or inch/s) Bearing noise in BDU (bearing damage units)
Displayed Frequency Units	Hertz (Hz), RPM or CPM
Input range	+/- 50g
Dynamic range	72 dB (0.05g resolution)
VA diagnostic bands (RPM = run speed)	Unbalance 1x RPM Alignment 2x RPM Looseness 3x RPM
Accessories	• Screw in probe tip (1/4" UNF 28) part number A9071 • Nylon carrying case part number A9070
Options	• Accelerometer mounting magnet part number A9073 • Extended probe tip (stinger) part number A9072

5 Revision History

ISSUE	PAGES	DATE	NOTES
1.0	16	March 2012	First Issue - JKA

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Photo Actual Size

Standard accessories

A9070: Carrying case

A9071: Standard stinger

Optional accessories

A9073: Magnet

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