

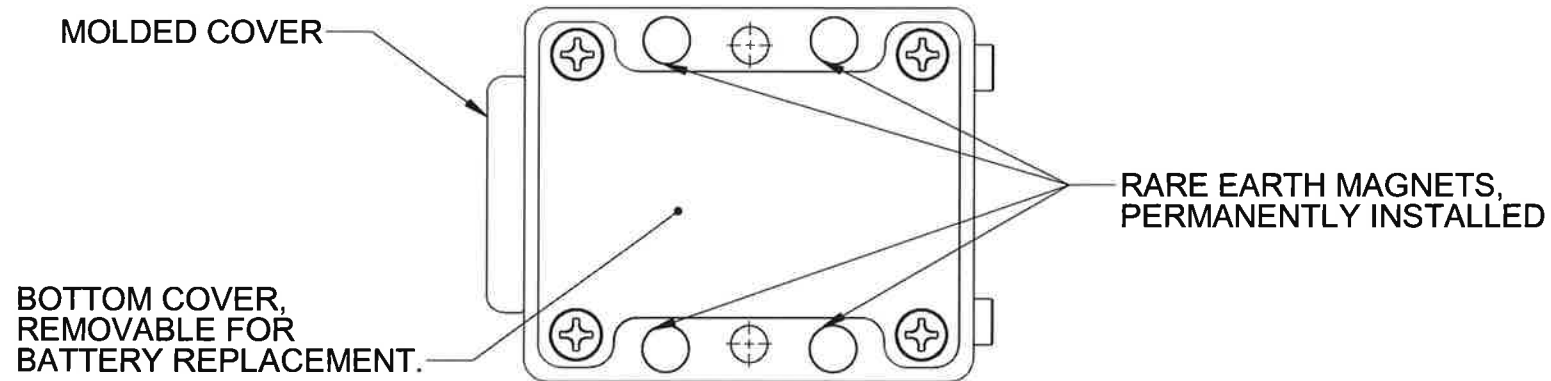
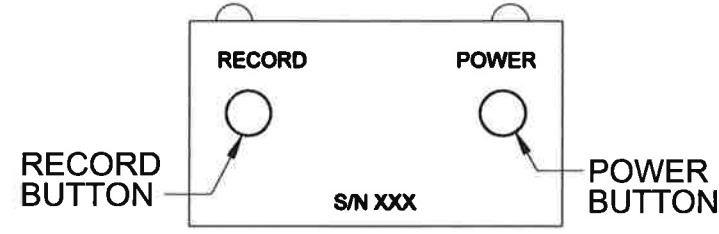
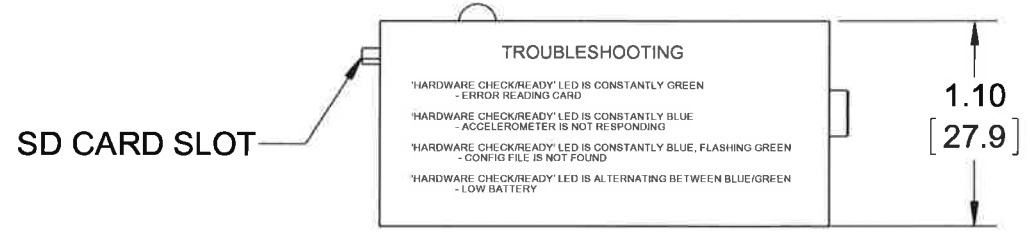
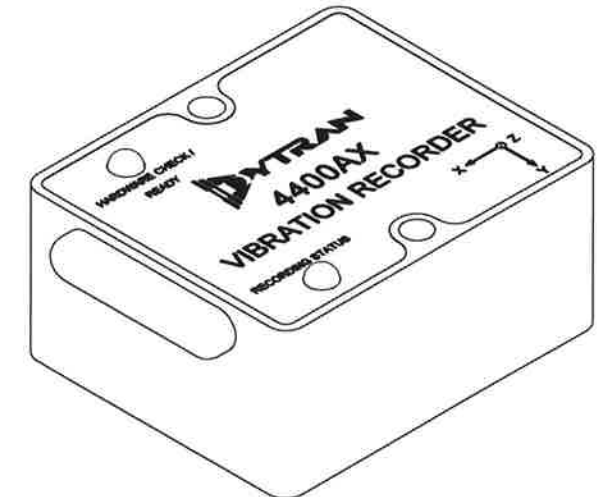
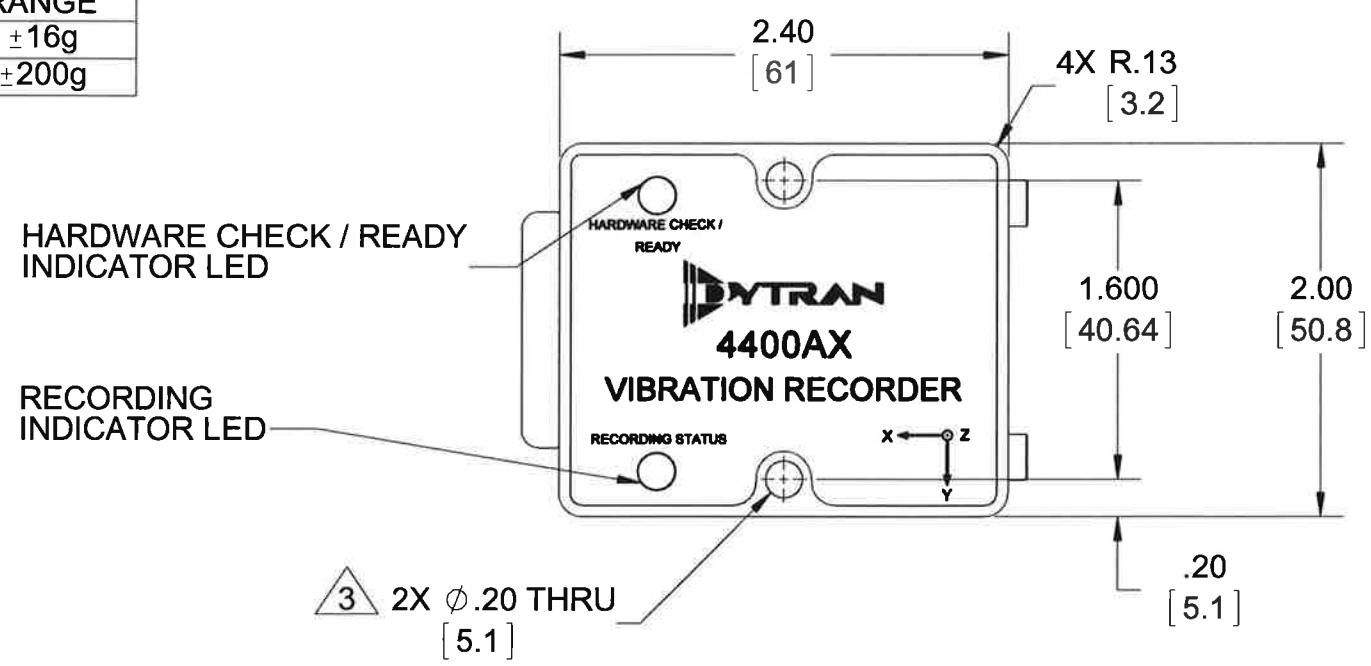
PROPRIETARY AND CONFIDENTIAL

REVISIONS

REV.	ECN	DESCRIPTION	BY/DATE	CHK	APPR
A	11375	INITIAL RELEASE	LN 10/13/14	<i>[Signature]</i>	AS

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MODEL	RANGE
4400A	±16g
4400A1	±200g



- 3 MOUNTING SCREW, MODEL 6246, 10-32 UNF-3A X 1.25, QTY. 2, SUPPLIED. MOUNTING SCREW, MODEL 6694A1, M5 X 0.8 X 35mm, QTY. 2, SUPPLIED.
- 2. HOUSING MATERIAL: ALUMINUM ALLOY, ANODIZED, COLOR: BLUE.
- 1. WEIGHT: 160 GRAMS, MAX.

NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED: INTERPRET DIM & TOL PER ASME Y14.5M - 1994. REMOVE BURRS. COUNTERSINK INTERNAL THDS 90° TO MAJOR DIA. CHAM EXT THDS 45° TO MINOR DIA. THD LENGTHS AND DEPTHS ARE FOR MIN FULL THDS. DIMENSIONS APPLY AFTER FINISHING.	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. DIMENSIONS IN BRACKETS [] ARE IN MILLIMETERS TOLERANCES ARE:				MASTER COPY Chatworth, CA ONLY IN RED			
	DECIMALS .XX ±.03 .XXX ±.010	METRIC .X ±0.8 .XX ±0.25					ANGLES ±1°	APPROVALS ORIG LN CHK <i>[Signature]</i> APP <i>[Signature]</i>
	ALL MACHINED SURFACES. ⁶³ ✓ TOTAL RUNOUT WITHIN .005. BREAK SHARP EDGES .005 TO .010. MACHINED FILLET RADII .005 TO .015. WELDING SYMBOLS PER AWS A2.4. ABBREVIATIONS PER MIL-STD-12.			DO NOT SCALE DRAWING	THIRD ANGLE PROJECTION 	SIZE B SCALE: 1:1	CAGE CODE 2W033 DWG NO 127-4400A	REV A SHEET 1 OF 1

MODEL NUMBER 4400A	PERFORMANCE SPECIFICATIONS	DOC NO. PS4400A
	ACCELERATION RECORDER, TRIAXIAL	REV A, ECN 11375, 10/13/14



- RECORDS THREE-AXIS VIBRATION UP TO 24 HOURS
- IP64 RATED
- SDHC CARD COMPATIBLE
- DUAL MOUNTING CONFIGURATIONS

PHYSICAL
Weight, Max.
Mounting
Housing

	ENGLISH		SI	
Weight, Max.	5.6	oz	160	grams
Mounting	Screws / Magnets		Screws / Magnets	
Housing	Aluminum, Anodized	Material	Aluminum, Anodized	

PERFORMANCE
Acceleration Range
Maximum Frequency Range, -3dB
Resonance Frequency
Linearity [1]
Transverse Sensitivity, Max
Noise, Max.
Recording Time, Max.
Sampling rate [2]
Memory Card Type
Acquisition Type

	ENGLISH		SI	
Acceleration Range	±16	Gpeak	±157	m/s ² peak
Maximum Frequency Range, -3dB	0 to 1000	Hz	0 to 1000	Hz
Resonance Frequency	>5.5	kHz	>5.5	kHz
Linearity [1]	< ±0.5	%F.S.	< ±0.5	%F.S.
Transverse Sensitivity, Max	5	%	5	%
Noise, Max.	0.015	G rms	147	mm/s ² rms
Recording Time, Max.	24	hours	24	hours
Sampling rate [2]	100 - 3200	samples/s	100 - 3200	samples/s
Memory Card Type	SDHC, Class 4		SDHC, Class 4	
Acquisition Type	Free Run / Triggered		Free Run / Triggered	

ELECTRICAL
Battery

	9V		9V	
--	----	--	----	--

ENVIRONMENTAL
Shock Max
Vibration Max
Operating Temperature
Seal

	ENGLISH		SI	
Shock Max	1,000	g pk	9810	m/s ²
Vibration Max	100	g pk	981	m/s ²
Operating Temperature	-40 to +185	°F	-40 to +85	°C
Seal	Environmental / IP64		Environmental / IP64	

Model	Range (Gpeak)	Noise (G rms)	Oper. Temp(°F)	BandWidth(Hz)
4400A1	±200	0.06	-40 to +185	0 to 1000

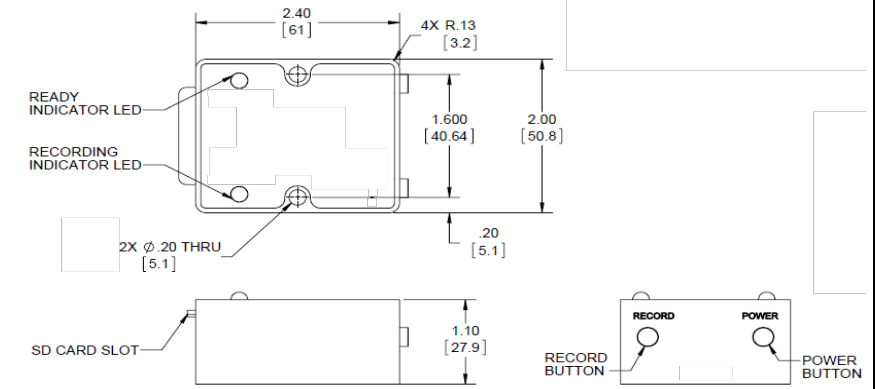
Refer to the performance specifications of the products in this family for detailed description

Supplied Accessories:

- 1) Accredited calibration certificate (ISO 17025)
- 2) Mounting Screw, Model 6246, 10-32 X 1.25, Qty. 2
- 3) Mounting Screw, Model 6694A1, M5x0.8 X 35mm, Qty. 2

Notes:

- [1] Linearity is % of specified full scale (or any less full-scale range), zero-based best fit straight line method.
- [2] 3200 samples/sec sampling rate is not recommended for Free Run mode. Maximum data loss of .05% is possible when sampled at 3200 samples/sec in Free Run mode. Lower sampling rates result in no data loss. Triggered acquisition at 3200 samples/sec result in no data loss.




Units on the line drawing are in inches, units in brackets are in millimeters. Refer to 127-4400A for more information.



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MODEL NUMBER 4400A1	PERFORMANCE SPECIFICATIONS	DOC NO. PS4400A1
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	ACCELERATION RECORDER, TRIAXIAL	REV A, ECN 11375, 10/13/14
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- 
- RECORDS THREE-AXIS VIBRATION UP TO 24 HOURS
 - IP64 RATED
 - SDHC CARD COMPATIBLE
 - DUAL MOUNTING CONFIGURATIONS

	ENGLISH		SI
Weight, Max.	5.6	oz	160
Mounting	Screws / Magnets		Screws / Magnets
Housing	Aluminum, Anodized	Material	Aluminum, Anodized

	ENGLISH		SI
Acceleration Range	±200	Gpeak	±1962
Maximum Frequency Range, -3dB	0 to 1000	Hz	0 to 1000
Resonance Frequency	>5.5	kHz	>5.5
Linearity [1]	< ±0.5	%F.S.	< ±0.5
Transverse Sensitivity, Max	5	%	5
Noise, Max.	0.06	G rms	589
Recording Time, Max.	24	hours	24
Sampling rate [2]	100 - 3200	samples/s	100 - 3200
Memory Card Type	SDHC, Class 4		SDHC, Class 4
Acquisition Type	Free Run / Triggered		Free Run / Triggered

	ENGLISH	SI
Battery	9V	9V

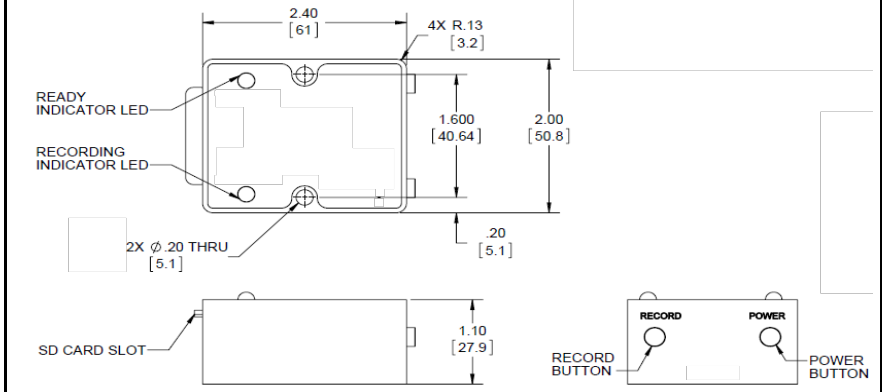
	ENGLISH		SI
Shock Max	1,000	g pk	9810
Vibration Max	250	g pk	2453
Operating Temperature	-40 to +185	°F	-40 to +85
Seal	Environmental / IP64		Environmental / IP64

Model	Range (Gpeak)	Noise (G rms)	Oper. Temp(°F)	BandWidth(Hz)
4400A	±16	0.015	-40 to +185	0 to 1000

Refer to the performance specifications of the products in this family for detailed description

- Supplied Accessories:**
- 1) Accredited calibration certificate (ISO 17025)
 - 2) Mounting Screw, Model 6246, 10-32 X 1.25, Qty. 2
 - 3) Mounting Screw, Model 6694A1, M5x0.8 X 35mm, Qty. 2

- Notes:**
- [1] Linearity is % of specified full scale (or any less full-scale range), zero-based best fit straight line method.
 - [2] 3200 samples/sec sampling rate is not recommended for Free Run mode. Maximum data loss of .05% is possible when sampled at 3200 samples/sec in Free Run mode. Lower sampling rates result in no data loss. Triggered acquisition at 3200 samples/sec result in no data loss.



Units on the line drawing are in inches, units in brackets are in millimeters. Refer to 127-4400A for more information.

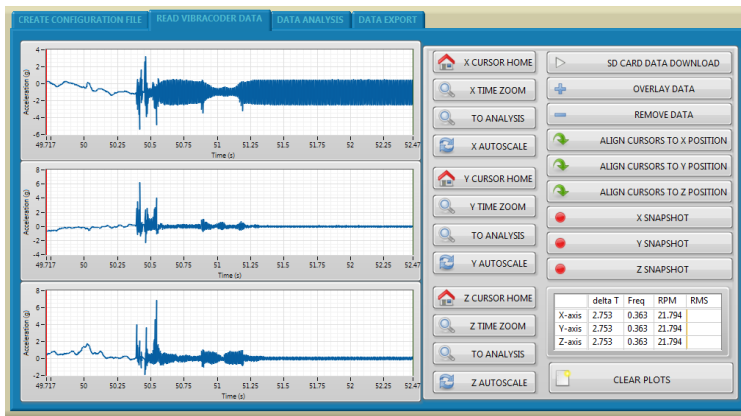


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OG4400A
REV A, 10/30/2014 ECN 11375

OPERATING GUIDE

4400A VIBRATION RECORDER





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The Dytran 4400A is a vibration recorder with built-in 3-axes MEMS accelerometer capable of recording acceleration in three orthogonal directions and write the data on an SD card.

I. Device Features

-System components:

- 4400A vibration recorder
- SD card (Class 4 SDHC with 8Gbytes data space is recommended)
- 9007 Software Toolkit (stored on supplied USB drive)

-4400A is powered by a 9Volt battery.

-Built-in firmware handles three axes acceleration data storage on the SD card

II. Software Features

- Immediate data retrieval from the SD card to the computer screen
- Easy cursor operation for data selection, zoom, and cursor alignment
- One press of a button snap shot
- Data overlay
- Filtering
- Oversampling
- Time Synchronous Averaging
- FFT analysis
- Data export

III. Acronyms used in this manual

GUI- Graphical User Interface

FFT- Fast Fourier Transform

JPG-Joint Photographic File format

ASCII-American Standard Code for Information Interchange

TDMS-Technical Data Management Solution (Binary and ASCII file saving option for smaller file sizes with stored header information)

UFF58- Universal File Format 58 (purely binary file format for data recording)

MAT- Matlab Compatible data file

IV. Minimum System Requirements

Desktop or a Laptop x86 based personal computer
Operating System: Windows Vista/Seven/Win8 32-bit
CPU: Intel i3 or better
RAM: 1 GB
Hard Disk space: 1 GB
USB 2.0
Display Resolution 1280×780.

V. Installation

Insert USB flash drive into an available USB port (If *Autorun* is enabled, computer will automatically run the *Autorun* menu as shown in *Figure 1*, which will provide one click access to installation files). If *Autorun* is disabled, from <My Computer> double click on the USB drive letter, navigate to *Autorun.exe*.



Figure 1: Autorun Menu

There are two additional installations that are required prior to installing the 9007 software. Install Data Plug-ins by clicking the button on the *Autorun* menu. This will install plug-ins for data export.

To install the runtime software, click on *9007* to start the installation of the 9007 4400A Vibracorder software. Make sure that no other applications are open and proceed with the following steps.

1. When the installer initialization is completed, click on “*Next*”. In the following window, the user can define the directories in which the *4400A Vibracorder* software and the National Instrument libraries will be saved. Click on “*Browse*” to select a different folder, and then click on “*Next*” to proceed.

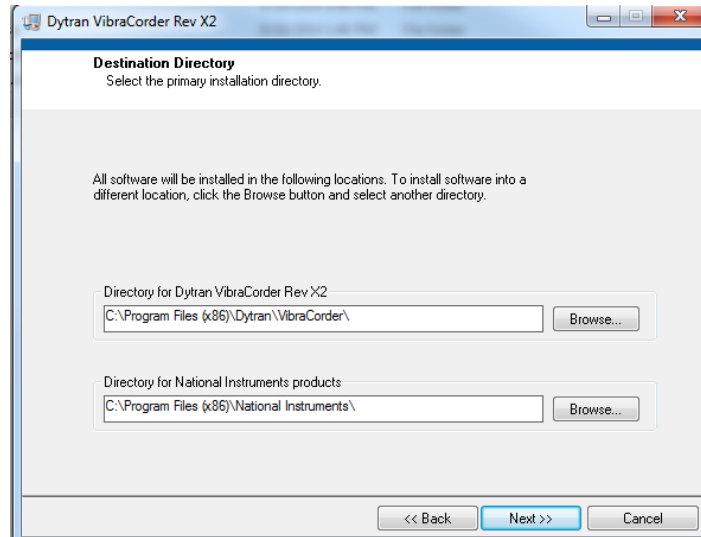


Figure 2: Install Destination Directory

2. In the next window, select *"I accept the license agreement..."* to accept *Dytran 4400A Vibracorder* license conditions and then click on *"Next"*.
3. Select *"I accept the license agreement..."* to accept *National Instrument* license conditions and then click on *"Next"*.
4. At this point, select *"I accept 2 license agreement(s)..."* to accept *Microsoft Silverlight 5 EULA* and *Microsoft Silverlight Privacy Statement* conditions. Click on *"Next"* to proceed.
5. The *"Start Installation"* window will appear. It indicates whether a component will be upgraded or installed for the first time. Click on *"Next"* to start the installation. This process may take a few minutes. Please wait until the installation is complete.
6. When the installation is complete, click on *"Next"* to proceed.
7. If asked, reboot your PC by clicking on *"Restart"* in the following window.



Figure 3: Restart after Installation Completed.

VI. Operation

1. After the computer is restarted, the user will find the “9007 Vibracorder” icon in the Windows menu, as shown in Figure below. A Shortcut will also be created on the Desktop for ease of access.



Figure 4: Vibracorder Icon.

2. Insert the SD card into the slot and launch the software.

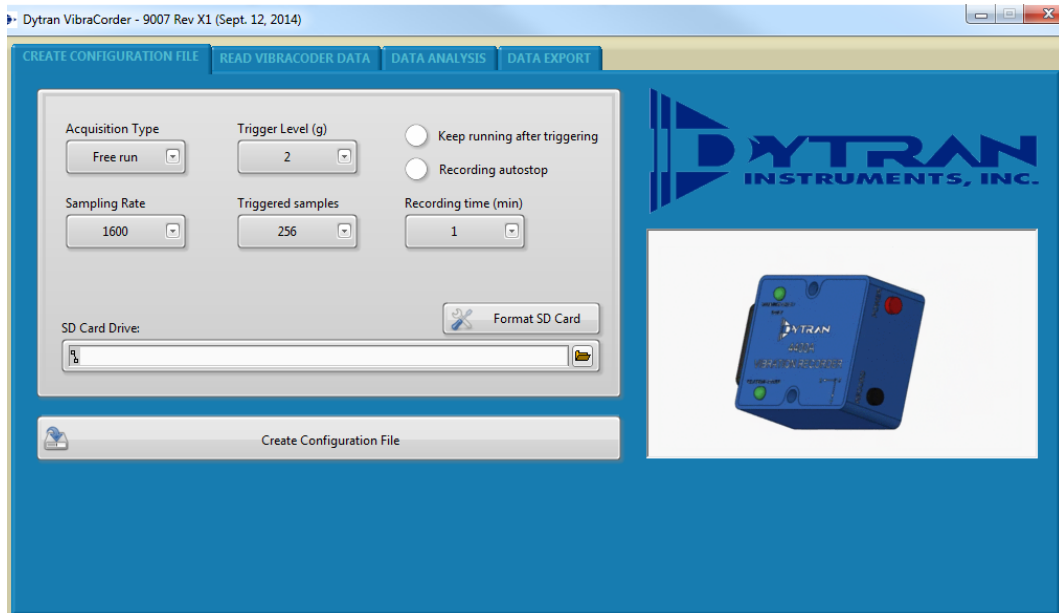


Figure 5: 9007 Software

3. Create configuration file – this tab allows the creation of the configuration file for the data acquisition.
 - 3.1 It is recommended to format your SD card before every use. Use SD card drive navigation window to select the card and press “Format SD card” button.
 - 3.2 Select data acquisition parameters: Free run allows for continuous recording whereas triggered acquisition records predefined number of triggered samples every time trigger level is reached. Default value of 40 pre-triggered samples is provided.
 - 3.3 Four different sampling rates are available. The measurements bandwidth is effectively half of the selected sampling rate.
 - 3.3 “Keep running after triggering” check box will allow for continuous recording once the triggered value is reached (Triggered acquisition has to be selected for this feature).
 - 3.4 “Recording autostop” will terminate the recording after selected “Recording time (min)” interval.
 - 3.5 After the desired acquisition parameters are selected, press “Create configuration File button”
 - 3.6 After the popup “Config.txt created” appear, press “Ok” button and safely eject the SD from the slot



4. Insert the SD card into the 4400A SD card slot and press the “Power” button.
 - 4.1 The firmware of the Vibracorder will verify the SD card operation. The green light of “HARDWARE CHECK/READY” LED will blink once if the SD card of standard capacity is used (Ver. 1.0), the green light will blink 2 times if the SDHC (High capacity SD card) is used, the green light will blink 3 times if SD of standard capacity (Ver. 2.0) is used.
The green light will stay lit if there is an error reading the card. **Although, multiple types of cards might be acceptable for use with the Vibracorder, Dytran Instruments, Inc. recommends using SDHC class 4 type devices with no more than 8Gbytes and no less than 2Gbytes storage space.**
 - 4.2 After the card is checked, the firmware will proceed to the accelerometer check. The “HARDWARE CHECK/READY” LED will blink 3 times. The blue light will stay on constantly if the firmware finds a problem with the accelerometer.
 - 4.3 After the accelerometer is checked, the firmware will check for the presence of the configuration file. If the configuration file was not found, the blue light will stay on while the green light is flashing.
 - 4.4 After the configuration file is found, the firmware will select a name for the data file. It will scan the SD card for any test files created before and pick the consecutive name for the next data file. The data files are named “TESTA.txt”, “TESTB.txt”, and “TESTC.txt” ... all the way to “TESTZ.txt”. If the “HARDWARE CHECK/READY” LED stays dark, it means that there are no more available names and the SD card needs to be cleared. If data file name is selected properly, the blue light will light up once for half a second.
 - 4.5 Once the file name is selected, the “HARDWARE CHECK/READY” LED will turn red, which means it is ready for recording.
 - 4.6 If “HARDWARE CHECK/READY” LED alternating between blue and green, it means the battery is low and needs to be replaced

HARDWARE CHECK/READY LED STATUS INDICATIONS	
GREEN	Blink 1X : SD Card, Standard Capacity (v. 1.0) detected
	Blink 2X : SDHC (High Capacity) Card detected
	Blink 3X : SD Card, Standard Capacity (v. 2.0) detected
	Stays lit : Error reading card
BLUE	Blink 3X: Checking accelerometer
	Stays lit : Problems in checking accelerometer
BLUE on, GREEN flashing	Configuration file not found
RED	Ready to record data
Alternating GREEN/BLUE	Low battery

5. Press “Record” button to start recording.
 - 5.1 The “RECORDING STATUS” LED will turn green and “HARDWARE CHECK/READY” LED will shut off, which means recording is in progress.
 - 5.2 Press “RECORD” button to stop recording. Both “RECORDING STATUS” LED and “HARDWARE CHECK/READY” LED will turn blue, which mean the data file was created. It is safe to turn off the power to the device and remove the SD card.

6. Insert the SD card into PC and click on “READ VIBRACORDER DATA” tab.
 - 6.1 Press “SD CARD DATA DOWNLOAD” button and navigate to the data file using explorer window. Double click on the file and the recorded data will appear on the graphs.
 - 6.2 Each axis has its set of data manipulation buttons: “CURSOR HOME”, “TIME ZOOM”, “TO ANALYSIS”, and “AUTOSCALE”. User can utilize those buttons for data examination and event selection.
 - 6.3 Additional data files can be overlaid using “OVERLAY DATA” button. Once pressed, it will prompt the user to select additional data files. If one data file is greater than another, the missing data will be padded with 0s. “REMOVE DATA” button will remove the latest added data.
 - 6.4 If one particular event is selected using cursors on any axis, the other two axis data for the same time interval can be selected by the user using “ALIGN CURSOR TO X POSITION”, “ALIGN CURSOR TO Y POSITION”, or “ALIGN CURSOR TO Z POSITION”.
 - 6.5 Data snapshot can be taken in JPEG format for any axis using “SNAPSHOT” buttons.
 - 6.6 Data table shows the immediate cursor information for each axis: delta T, Frequency (Calculated based on cursor positions when they are located on one period), RPM (Calculated based on cursor positions when they are located on one period), and RMS value of the signal between cursors. See *Figure 6* for example:

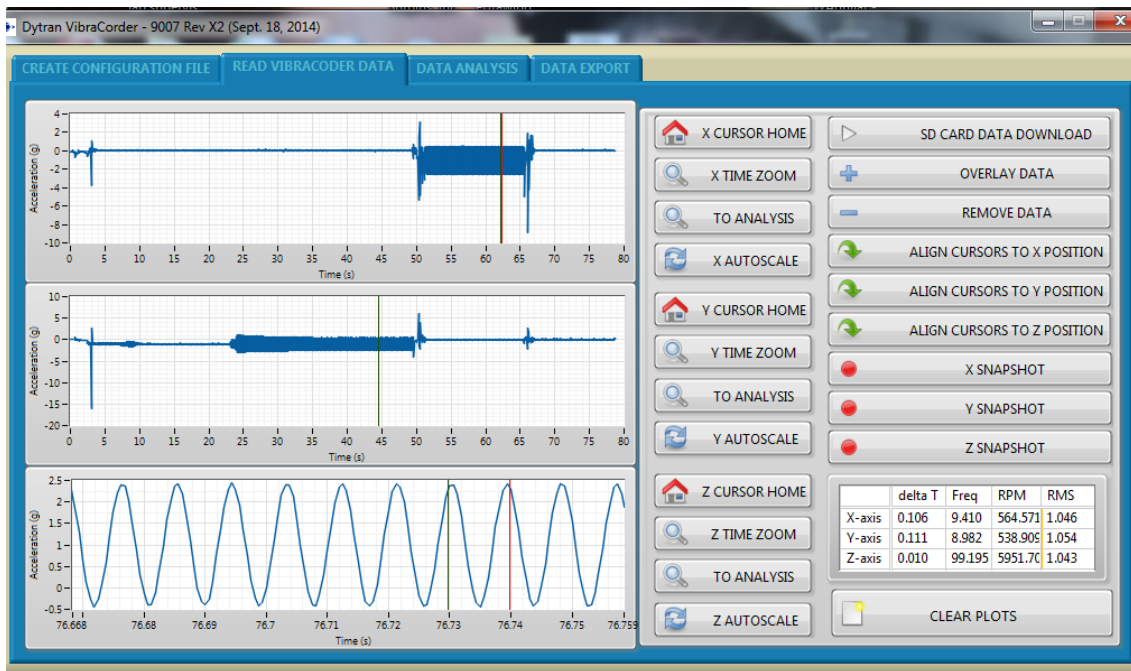


Figure 6: Axis Z data of 100Hz sinusoidal vibration at 1 g RMS.

- 6.7 “CLEAR PLOTS” button will clear all the data from the plots.

7. By pressing “TO ANALYSIS” button from any axis, the currently selected data between the cursors will be exported to the “DATA ANALYSIS” tab with corresponding data from other two axes.
 - 7.1 The software will prompt the user to either append data set or create a new one. This feature allows comparison of two or more separate data sets. When selected Append, the traces shall be overlaid. When selected new, all the previously displayed data shall be erased and substituted with newly imported data set.
 - 7.2 “RELOAD SELECTED DATA” button shall reload the original set of data into the analysis window.
 - 7.3 “LOW PASS FILTER” and “HIGH PASS FILTER” buttons shall apply specified filter to the data, user shall be prompted for corner frequency and filter order. Butterworth topology is used.
 - 7.4 “SINGLE INTEGRATION” and “DOUBLE INTEGRATION” buttons will apply either single or double numerical integration. The software shall automatically apply a high pass filter before performing integration (to avoid any data run off). User shall be prompted for corner frequency of the filter.
 - 7.5 “OVERSAMPLING” button shall perform non-linear interpolation on the data set, calculating additional data point in between the existing one. The user will be prompted for the oversampling frequency:

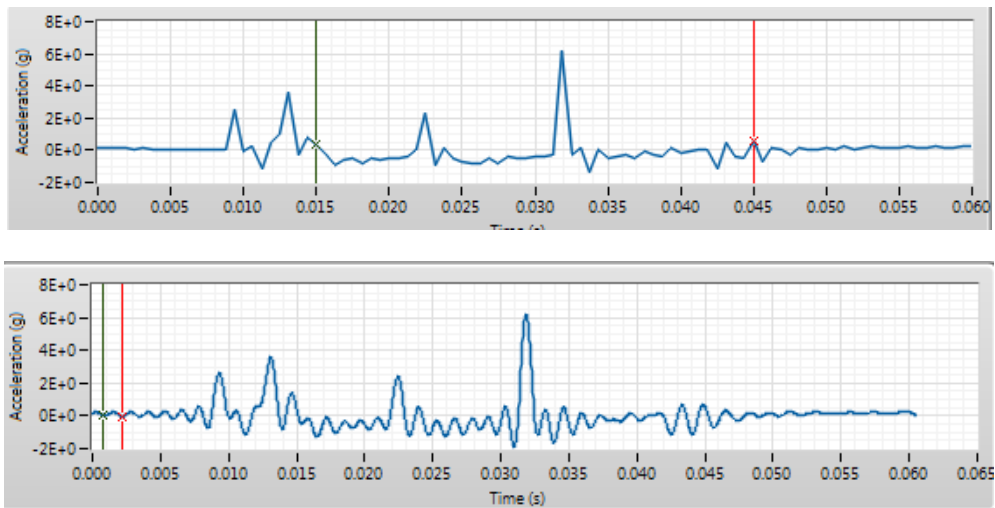


Figure 8: Same data set before and after oversampling with 32,000Hz frequency

- 7.6 “TIME SYNCHRONOUS AVERAGE” button shall perform time domain averaging on the set of data using user entered RPM value. The data set will be chopped using frequency from RPM window and averaged with each other. The user shall be prompted for number of periods to display:

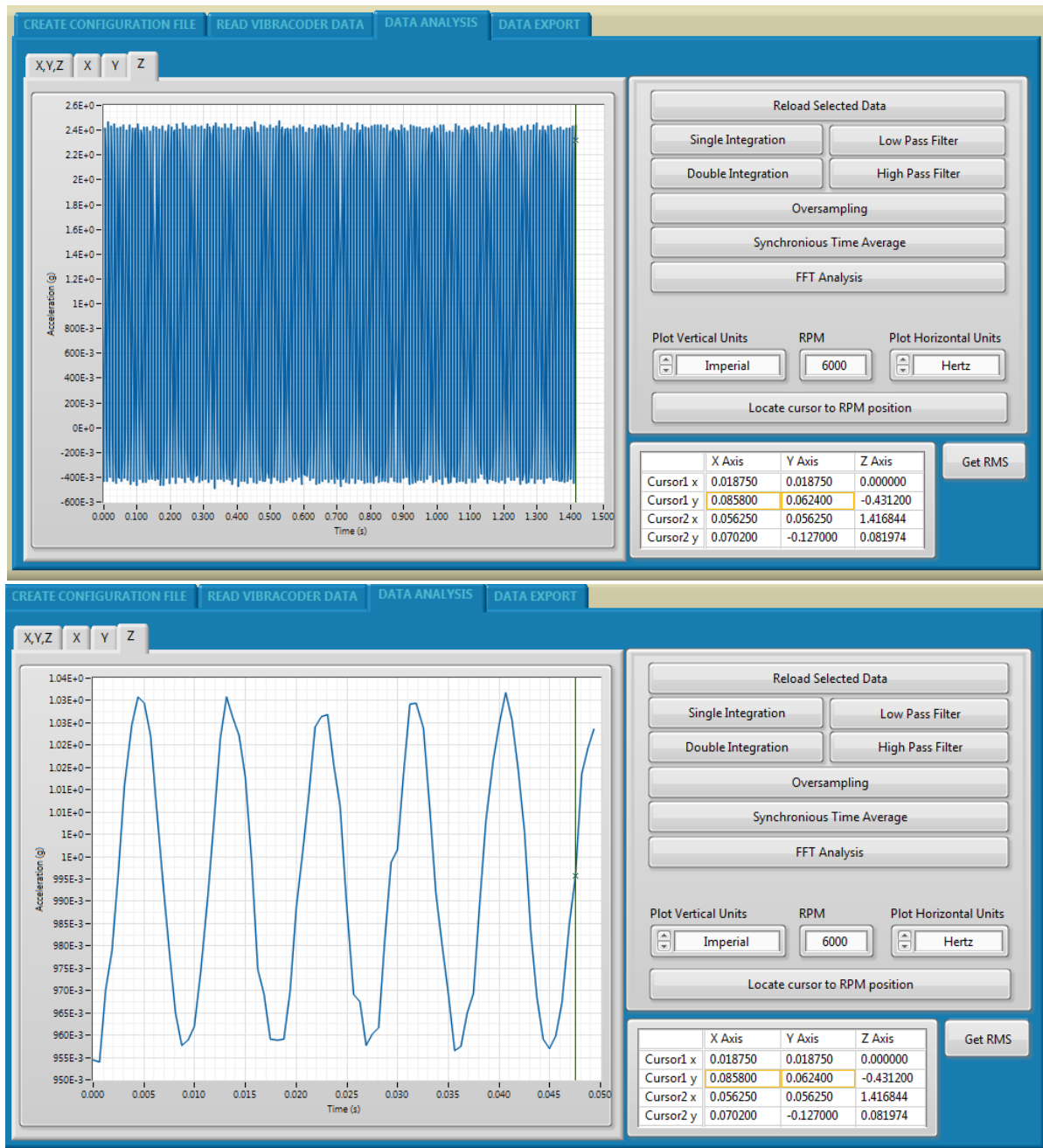


Figure 9: TSA analysis results for 5 periods

- 7.7 “FFT ANALYSIS” button will perform Fast Fourier transform.
- 7.8 “PLOT VERTICAL UNIT” selector allows selection of acceleration units between English and Metric.
- 7.9 “RPM” control requires user input for TSA calculations and cursor location.



- 7.10 "PLOT HORIZONTAL UNITS" allows the change between Hertz, Orders, and RPM for FFT graph.
- 7.11 "GET RMS" button shall show the RMS signal value for each axis.
- 8. "DATA EXPORT" tab allows the export of the data to conventional file formats: *.csv*, *.mat*, *.tdms*, *.uff*, and *.sqlite*
 - 8.1 User shall define the location of the file on the PC using the explorer.
 - 8.2 If "EXPORT ALL RAW DATA" is checked, the software will export all the raw data from the measurements file. If the "EXPORT ALL RAW DATA" is not checked, the software will export only the content of the analysis screen.

VII. Mechanical configuration and mounting

- 1. Refer to 127-4400A drawing for physical dimensions of the device.
- 2. The mounting provisions consist of 2 mounting holes, 0.200" in diameter. Two 10-32 socket head screws are supplied with the device. In order to mount the device, tap two 10-32 holes, 0.300" deep, 1.60" apart per 127-4400A recommendation.
- 3. Alternative method of mounting is four magnets embedded into the mounting surface of the Vibracorder.

VIII. Data recording considerations

The Vibracorder is designed to be powered with standard 9 Volt battery. The minimum continuous recording time is defined as 24 hours. The recording will be automatically broken down to 1.5 hours files. That means if the recorder is left in free run, it will record the data for 1.5 hours into TESTA.txt, then it will close TESTA.txt, open new file TESTB.txt and continue the recording. It will do that operation every 1.5 hour until it reaches TESTZ.txt or the battery runs out. In case the battery runs out earlier than TESTZ.txt file name is reached, the Vibracorder will close the current acquisition file and go into idle mode. Evidently, data recordings for as long as 36 hours are possible if battery capacity allows.



IX. Software License, Restrictions, and Disclaimer

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