DT9839E Vibration FFT Analyzer
USB Powered Module for
Sound & Vibration Analysis

The FFT Analyzer provides real time signal analysis, data display, and control for a wide variety of vibration measurements. Applications such as quality testing for consumer devices, signal analysis for lab or field settings, sound analysis, STEM education, among others can utilize its advanced features.

Many other accelerometers including integrated electronic piezoelectric (IEPE) devices are completely supported with internal current source excitation.

Key Features:

- **4 simultaneous**, 16-bit Sigma-Delta IEPE analog input channels...correlated results
- **Excellent noise performance:** SINAD 88.3dB, ENOB 15.4, THD 0.0025%, SFDR 99.5
- **Fast sampling...**up to 52.7 kHz sampling rate per channel
- **Tachometer:** support in the A/D data stream for synchronizing measurements
- **Flexibility...**triggering modes for pre, post, or reference samples
- **Stimulus:** 24-bit D/A converter with ±2.5 V range
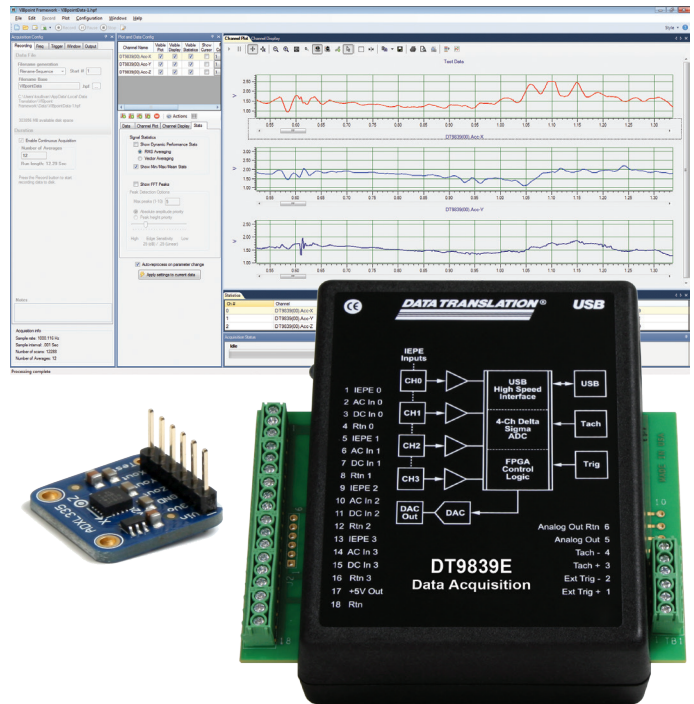- **Included fully-featured** VIBpoint Framework Academic

Figure 1. The DT9839E consists of the USB Sound and Vibration module, the EP400 Accelerometer Kit, and a fully functional VIBpoint Framework Academic license. High performance at a low price.

- **Included EP400 Accelerometer Kit** (triaxial accelerometer, cable, and header)
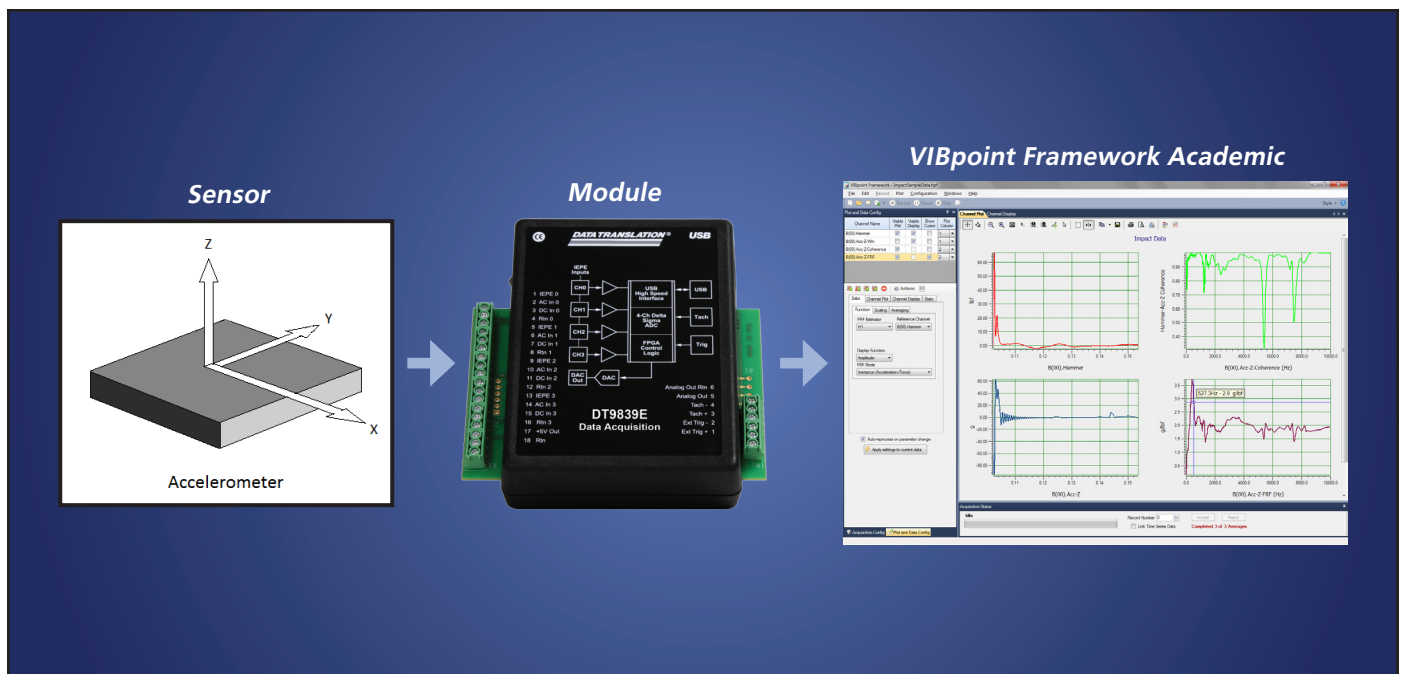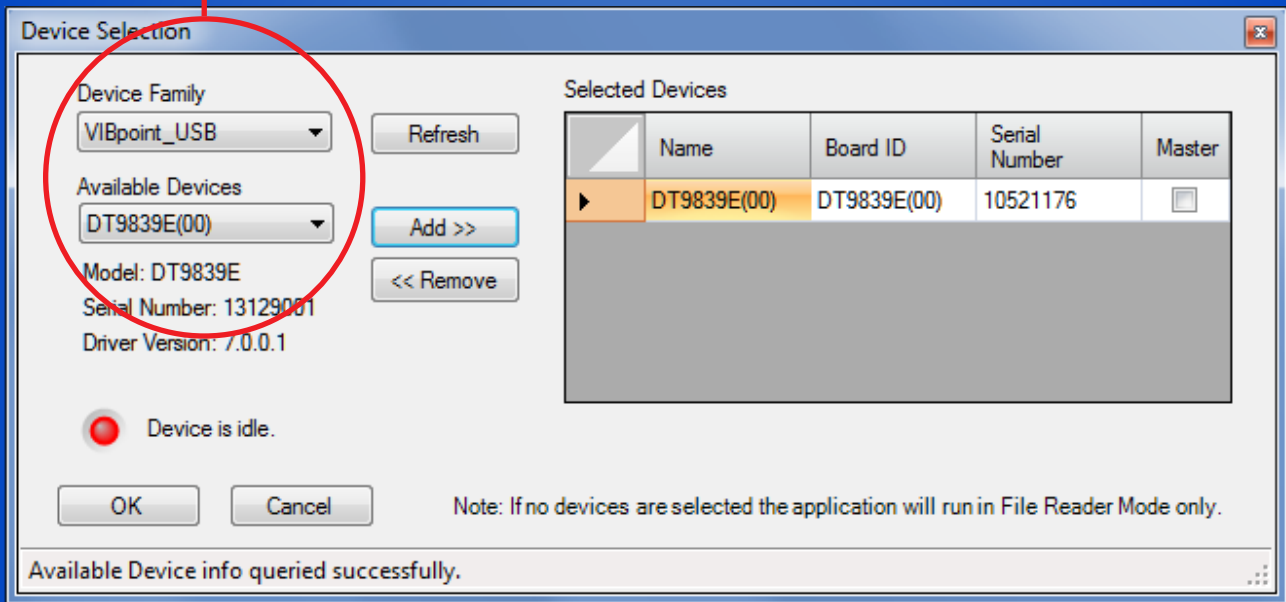- **USB bus-powered** for portability

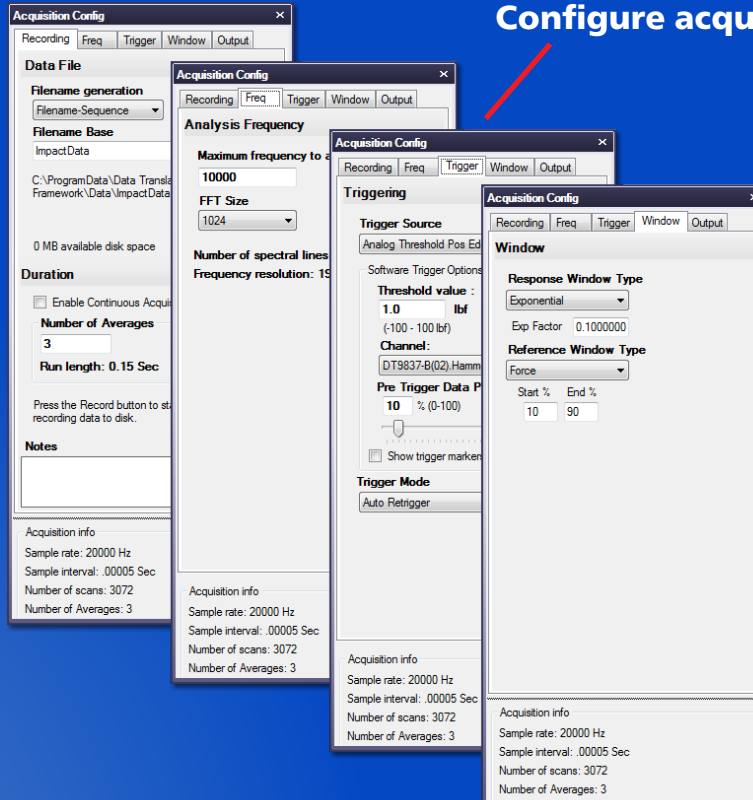*Figure 2. VIBpoint Framework Academic supports the DT9839E.*

Quickly and easily perform sophisticated measurements in 8 simple steps.

Select input device

STEP 1: Select Input Device (DT9839E),

Configure acquisition settings

STEP 2: Use the Recording, Freq, Trigger, Window, and Output tabs to configure the acquisition settings, including the number of records to acquire, the maximum frequency to analyze, the trigger that starts acquisition, the window to apply to the FFT channel, and the analog output channel settings.

Configure sensor inputs

Channel	Enable	Channel Name	Ref/Resp	Range	Engineering Unit (EU)	mV/EU	EU Offset	Point #
DT9839E(00)-0	☑	X-Axis	Reference	-1V to 1V	lbf	330	0	1
DT9839E(00)-1	☑	Y-Axis	Response	-10V to 10V	g	330	0	2
DT9839E(00)-2	☑	Z-Axis	Response	-10V to 10V	g	330	0	3
DT9839E(00)-3	☐	Ain 3	Response	-10V to 10V	V	1000	0	0

STEP 3: Configure settings for channels in the analog input data stream, including the channel name, reference and response channel designations, input range, coupling type, current source, engineering units, scaling factors, and so on.

Configure processing channels

STEP 4: Use the Plot and Data Config window to select the channels to display, to add FFT channels, to configure the parameters for generating the FFT data, and to configure the appearance of the display.

Record data
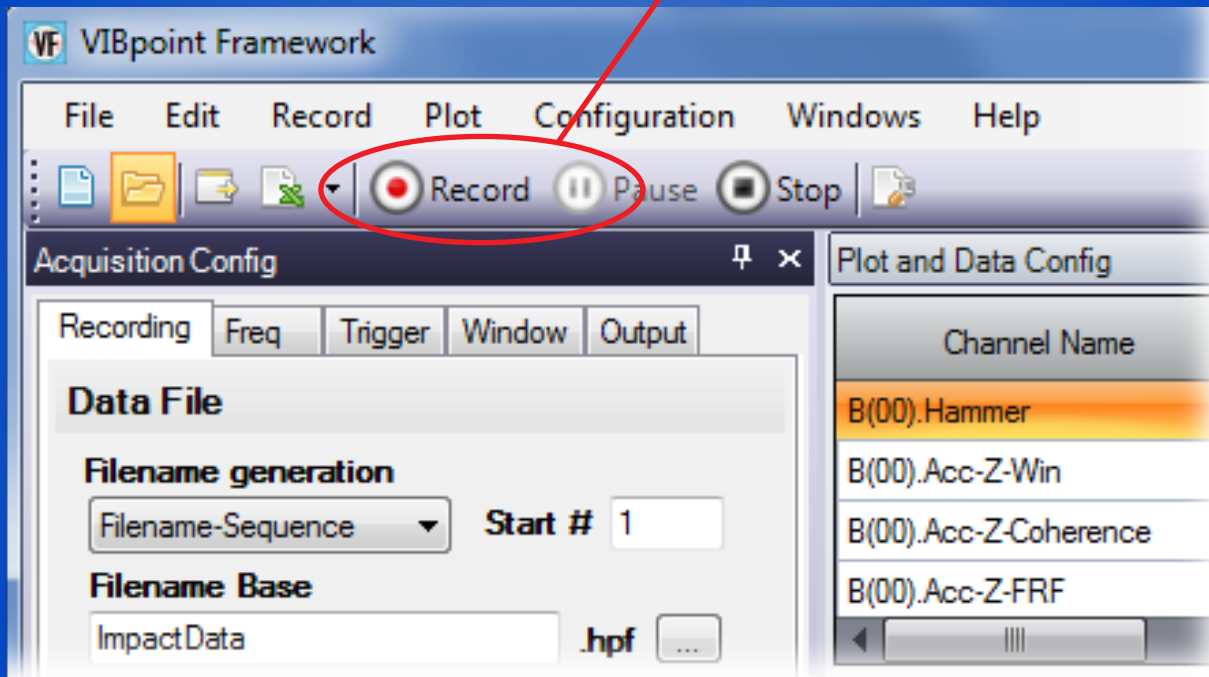
STEP 5: Press the Record button to start the acquisition of continuous, gap-free records.

Analyze
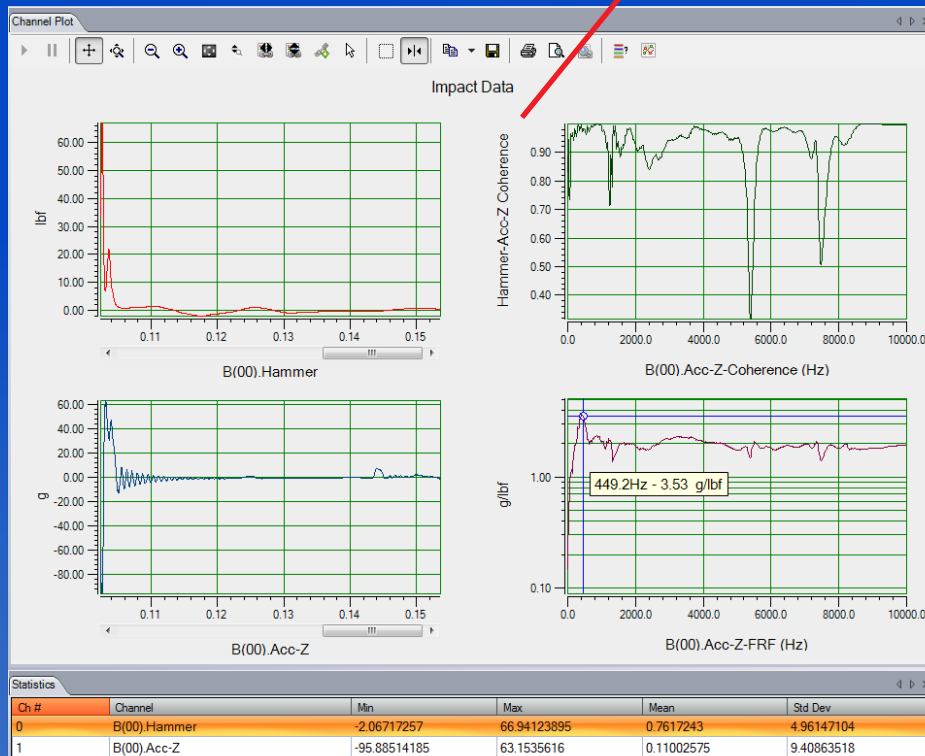
STEP 6: Use the Channel Plot, Channel Display, and Statistics windows to view and analyze the acquired data.
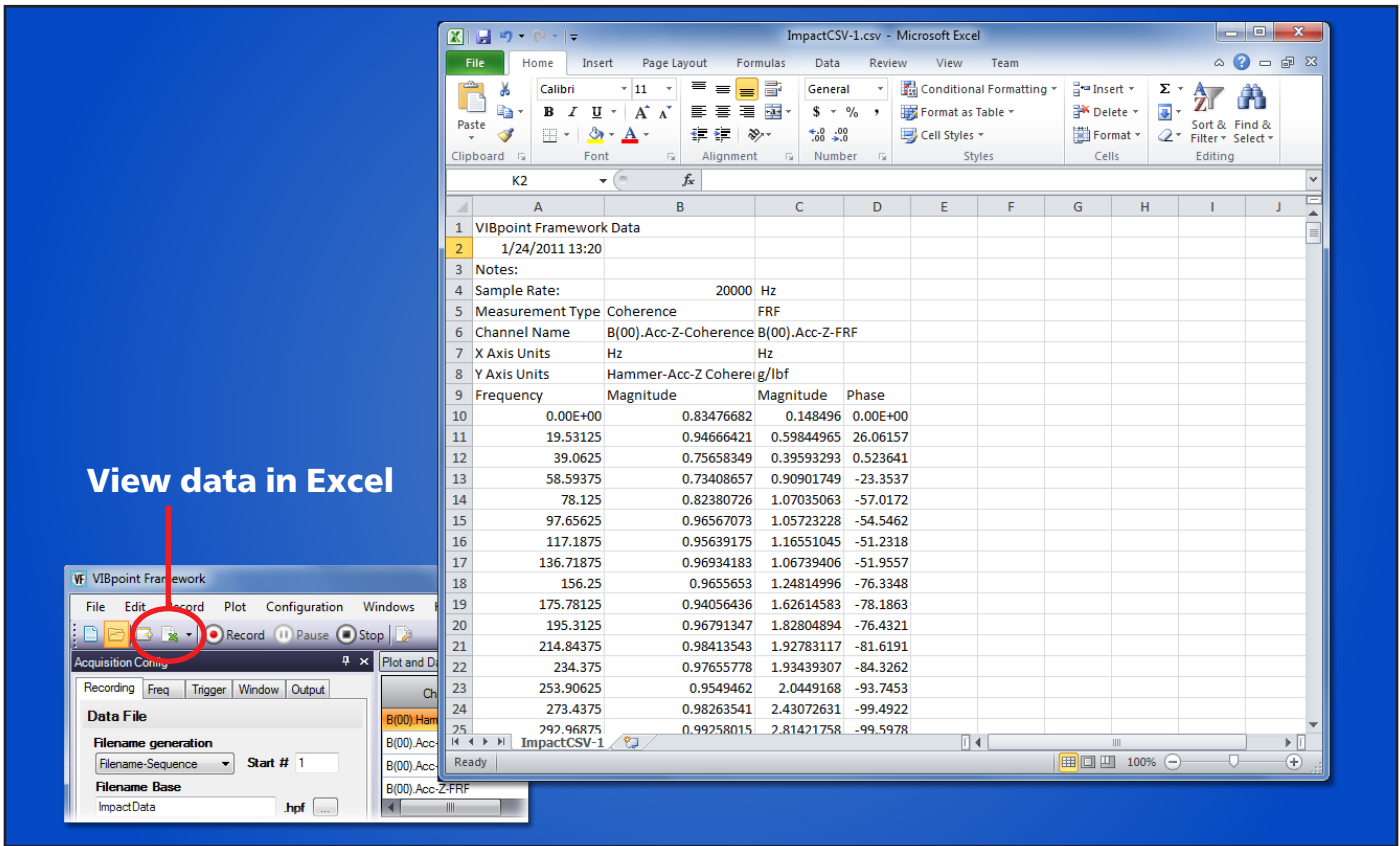
View data in Excel

STEP 7: Click the Open Current Data in Excel button to analyze the data in Excel.

Export data
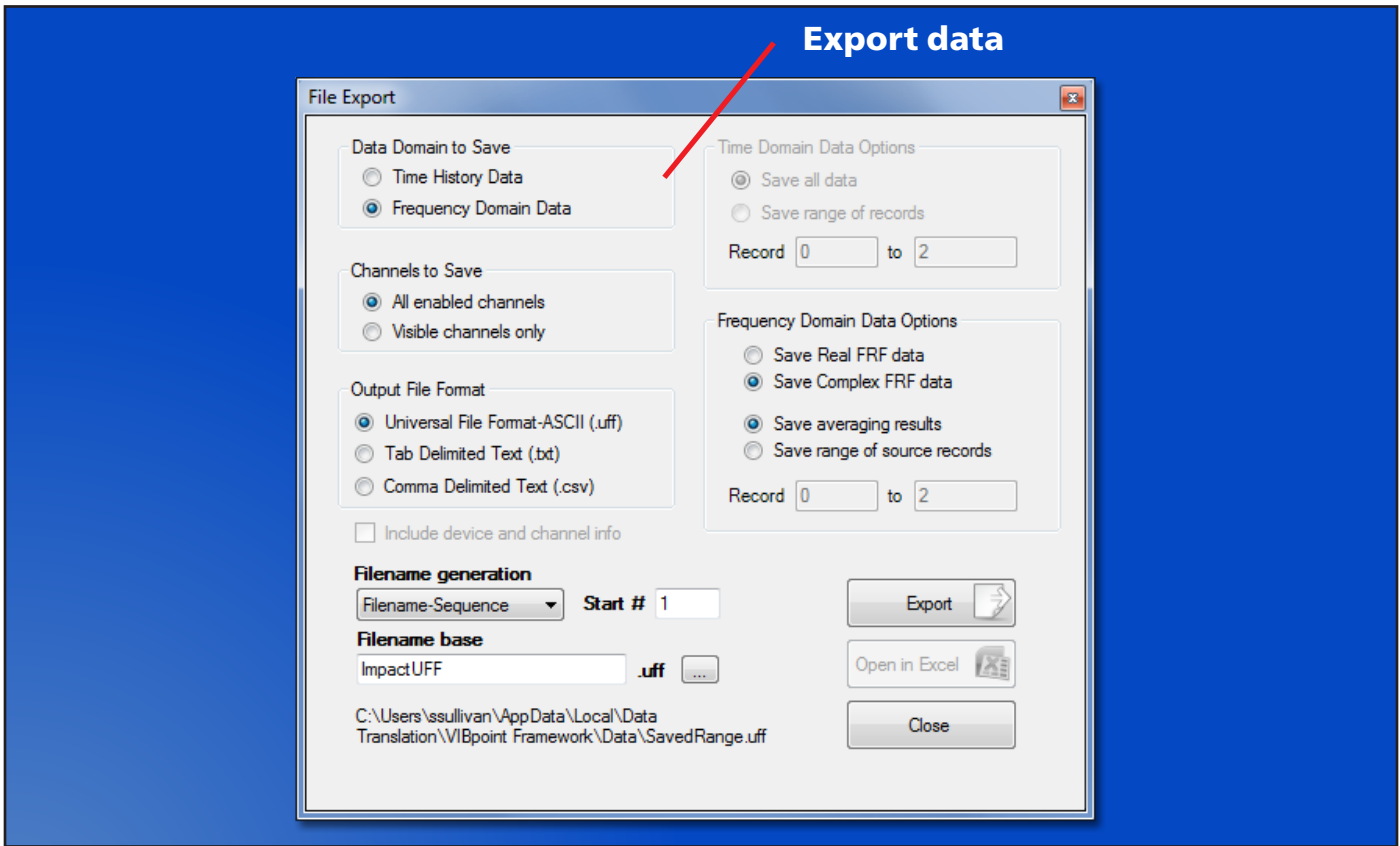
STEP 8: Specify how to save the data. Supported file formats include the Universal File Format – ASCII (.UFF), tab-delimited text (.TXT), and comma-delimited text (.CSV).

The DT9839E consists of the following 3 items:

❶ DT9839E USB Sound & Vibration Module

The DT9839E is a low cost, portable USB-based data acquisition module, for easy connection to a variety of vibration sensors. All provisions for sensor excitation, particularly IEPE sensor conditioning, are built-in to the analog circuitry of the module.   Software programmable IEPE functions for each of the 4 analog inputs include up to 4mA current source for excitation, and coupling for either AC or DC signals.
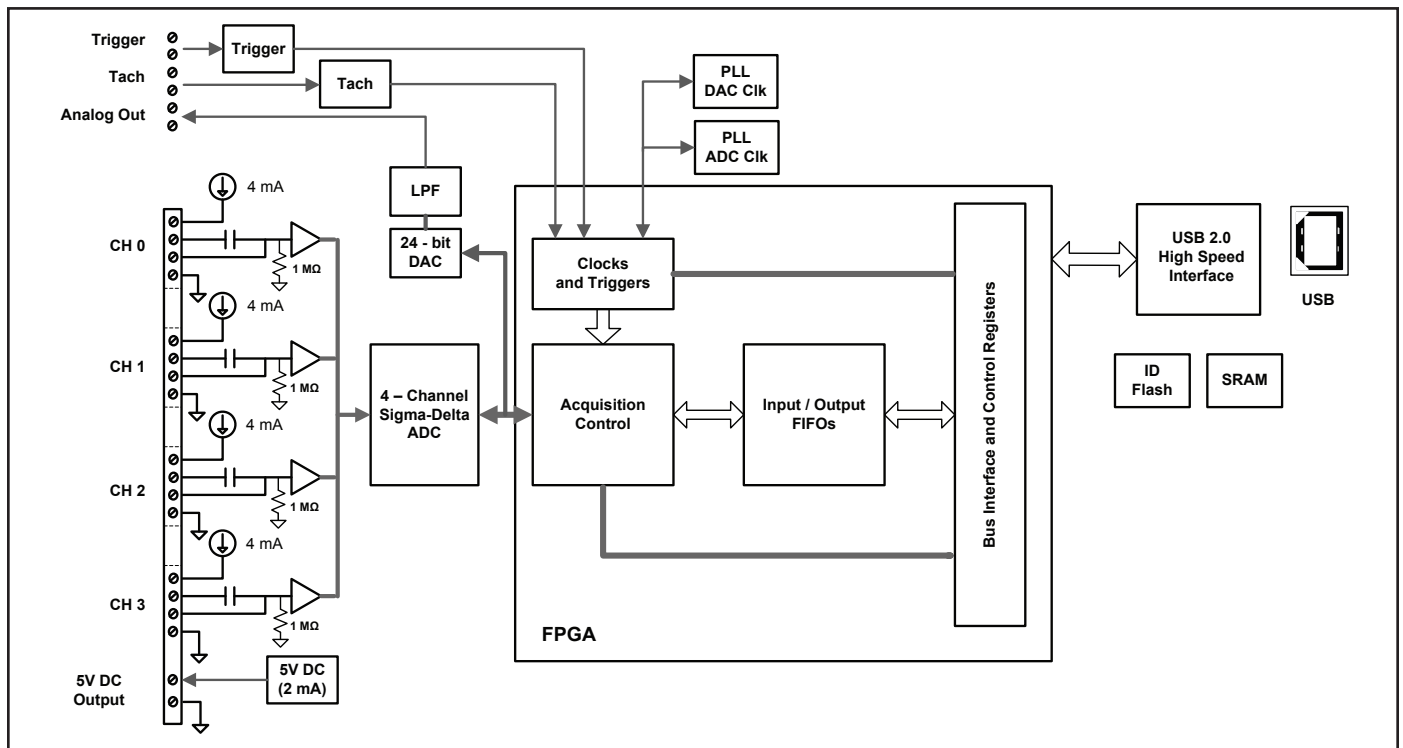

Figure 3. DT9839E Block Diagram

❷ VIBpoint Framework Academic

VIBpoint Framework Academic adds real-time analysis features to the FFT Analyzer. It features tools to acquire continuous and triggered data, record data to disk, read a recorded data file, analyze the acquired data using single FFT and two-channel FFT functions, and produce a variety of output stimuli for analysis testing. The software is navigated through a series of easy-to-use configuration windows, allowing flexible selection of the desired acquisition, processing, plotting and display parameters.
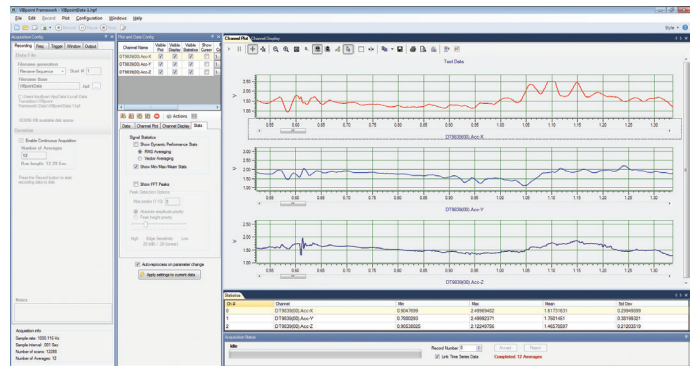
Figure 4. VIBpoint Framework Academic

Data Processing, Analysis, and Waveform Output Key Features:

- Spectrum, Auto Spectrum, Power Spectral Density (PSD)
- Frequency Response Functions (FRF) : Mobility, Compliance, Apparent Mass, Impedance, Dynamic Stiffness or custom FRF with H1, H2, or H3 Estimator types
- Cross Spectrum and Cross Power Spectral Density
- Coherence and Coherent Output Power
- Amplitude, Phase, Real, Imaginary, and Nyquist Displays
- Rectangular, Force, Cosine Taper, Exponential, Hanning, Hamming, Bartlett, Blackman, Blackman Harris, Flat Top Windows
- Output Random, Burst Random, Chirp, Burst Chirp, Swept Sine, and Fixed frequency waveforms
- Synchronize output start/stop with analog input, or start/stop manually

❸ *EP400 Accelerometer Kit*

The EP400 Accelerometer Kit includes the ADXL355 MEMS triaxial accelerometer, ribbon cable, and header. The triaxial MEMS board is easily and directly connected to the DT9839E module with screw terminal connections at the module inputs. This MEMS sensor based accelerometer allows measurement up to ±3 g of dynamic acceleration from shock, motion, or vibration, as well as measurement of static gravity for tilt-sensing applications.
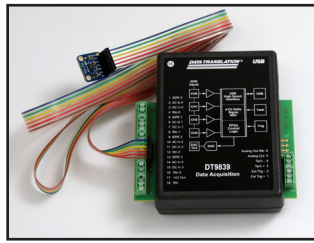

Figure 5. EP400 Accelerometer Kit

Other Software Options

There are many software choices available for application development, from ready-to-measure applications to programming environments.

The following software is available for use with the DT9839E module and is provided on the Data Acquisition Omni CD:

- **DT9839E Device Driver** —The device driver allows you to use a DT9839E module with any of the supported software packages or utilities.
- **DT9839E Calibration Utility** — This utility allows you to calibrate the analog I/O circuitry of a DT9839E module.
- **QuickDAQ 2013** — This application allows you to acquire and analyze data from all Data Translation USB and Ethernet devices, except the DT9841 Series, DT9817, DT9835, and DT9853/54.
- **Quick DataAcq application** — The Quick DataAcq application provides a quick way to get up and running using a DT9839E module. Using this application, verify key features of the module, display data on the screen, and save data to disk.
- **DT-Open Layers® for .NET Class Library** — Use this class library if you want to use Visual C#® or Visual Basic® for .NET to develop application software for a DT9839E module using Visual Studio® 2003-2012; the class library complies with the DT-Open Layers standard.
- **DataAcq SDK** — Use the Data Acq SDK to use Visual Studio 6.0 and Microsoft® C or C++ to develop application software for a DT9839E module using Windows® XP/Vista/7/8; the DataAcq SDK complies with the DT-Open Layers standard.

- **DAQ Adaptor for MATLAB** — Data Translation's DAQ Adaptor provides an interface between the MATLAB® Data Acquisition (DAQ) toolbox from The MathWorks™ and Data Translation's DT-Open Layers architecture.
- **LV-Link** — Data Translation's LV-Link is a library of VIs that enable LabVIEW™ programmers to access the data acquisition features of DT-Open Layers compliant USB and PCI devices.

Specifications

Analog Input Specifications

Feature	Specifications[a]
Number of analog input channels	4, single-ended
Resolution	16 bits
ADC type	Delta-Sigma, simultaneous sampling
Input range	±2.5 V nominal −2.5 V (±1 m V) to +2.5 V (±1 mV)
Maximum sample rate, per channel	52734 Samples/s
Minimum sample rate, per channel	195.3 Samples/s
Offset error after calibration	±1 LSB (±76 µV)
Gain error after calibration	±0.1%
Group delay	38/Sample Frequency, seconds
Settling time	76/Sample Frequency, seconds
Pass band	0.453 x Sample Frequency
Pass band ripple	±0.01 dB
−3 dB bandwidth	0.49 x Sample Frequency
Stop band attenuation (f > 0.547 x sample frequency)	100 dB
Noise (50 Ω input termination)	1 LSBpp (76 µVpp)

Signal-to-noise and distortion ratio (SINAD)[b]
  −3 dB FS, 1 kHz sine wave, f_s = 26367 Samples/s
  −6 dB FS, 1 kHz sine wave, f_s = 26367 Samples/s
	
	74 dB
	85 dB

Effective number of bits (ENOB)[b]
  −3 dB FS, 1 kHz sine wave, f_s = 26367 Samples/s:
  −6 dB FS, 1 kHz sine wave, f_s = 26367 Samples/s:
	
	12.5 bits
	14.5 bits

Total harmonic distortion (THD)[b]
  −3 dB FS, 1 kHz sine wave, f_s = 26367 Samples/s:
  −6 dB FS, 1 kHz sine wave, f_s = 26367 Samples/s:
	
	−74 dB (0.02%)
	−86 dB (0.005%)

Spurious free dynamic range (SFDR)[b]
  −3 dB FS, 1 kHz sine wave, f_s = 26367 Samples/s:
  −6 dB FS, 1 kHz sine wave, f_s = 26367 Samples/s:
	
	82 dB
	90 dB

Data encoding	Offset binary
Maximum input voltage (without damage)	±20 V

Input impedance
  DC input to Return
  AC input to Return
	
	1 MΩ || 10 pF
	0.15 µF in series with DC impedance

AC input, −3 dB high-pass filter	1 Hz
IEPE current source	4 mA ±0.1 mA
IEPE compliance voltage	15 V
IEPE current noise density @1 kHz	200 pA / √Hz
5 VDC output	5 VDC output 5 VDC ±10% with 1 mA load
5 VDC output current	2 mA maximum

ESD protection
  Arc:
  Contact:
	
	8 kV
	4 kV

[a] Unless otherwise noted, specifications are typical at 25° C.
[b] f_s = sample frequency.

Typical Performance Characteristics of the DT9839E

Figure 6 and Figure 7 show the typical performance characteristics of the DT9839E module using the VIBpoint Framework application.

In Figure 6, data was taken on one analog input channel using a 1 kHz sine wave input at –3 dB and a sample rate of 52734 Samples/s. As you can see, the total harmonic distortion (THD) is less than 0.02% (–74.74 dB) and the effective number of bits (ENOB) is 12.6 bits, making the DT9839E module an ideal low-cost, vibration measurement solution.
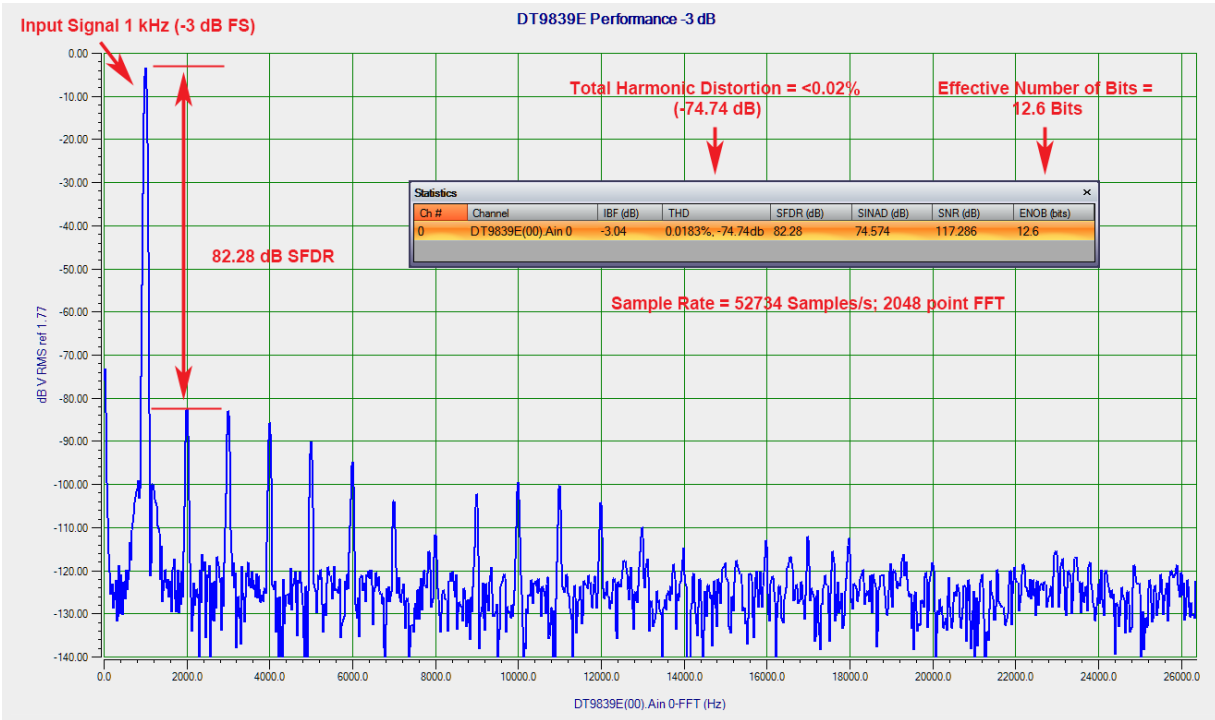

Figure 6

In Figure 7, data was taken on one analog input channel using a 1 kHz sine wave input at –6 dB and a sample rate of 52734 Samples/s. Under these conditions, the total harmonic distortion (THD) is less than 0.003% (–92.02 dB) and the effective number of bits (ENOB) is 15.35 bits.

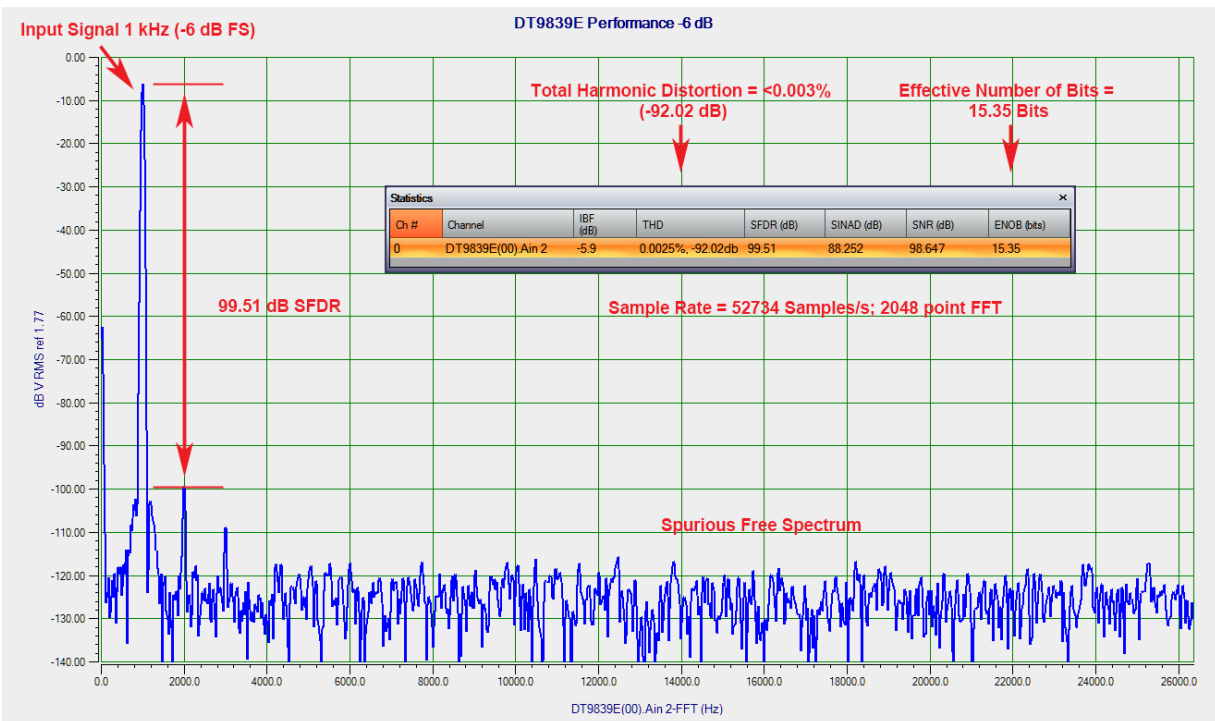*Figure 7*

Analog Output Specifications

Feature	Specifications[a]
Number of analog output channels	1
Resolution	24 bits
Output range	±2.5 Vpk
Output coupling	DC
Data encoding	Offset binary
Output current	±2.5 mA (1 kΩ maximum working load)
Output impedance	10 Ω
Output short circuit	Continuous
FIFO	8192 Samples, total
DC offset after calibration	500 µV
DC gain error after calibration	±0.1%
DAC time delay	29/sample rate, seconds
Power fault and reset	Goes to 0 V ±10 mV if the USB cable is removed or the power fails
Total harmonic distortion (THD)[b] (−6 dB FS, 1 kHz, sine wave, fs = 96 kHz)	0.005% (−85 dB)
Internal clock	sample rate x 512, Hz
Minimum sample rate	10 kHz
Maximum sample rate	96 kHz
DAC pass band[c] 0.454 x sample rate 0.49 x sample rate	±0.002 dB typical −3 dB typical
DAC stop band 0.567 x sample rate	−82 dB minimum
Output filter	85 kHz, low-pass
Output filter response[c] 20 kHz 85 kHz	−0.25 dB −3 dB
ESD protection Arc Contact	8 kV 4 kV

[a] Unless otherwise noted, specifications are typical at 25° C.
[b] f_s = sample frequency.
[c] Total output response is the sum of the DAC pass band and analog output filter response.

Tachometer Input Specifications

Feature	Specifications
Number of channels	1
Resolution	31 bits per channel
Input voltage range	±30 V
Threshold voltage	+2 V with 0.5 V hysteresis
Maximum input frequency	380 kHz
Minimum pulse width high/low (minimum amount of time it takes a C/T to recognize an input pulse)	1.3 µs
Measurement clock frequency	12 MHz (83 ns resolution)

Cross-Series Compatibility Saves Programming Time, Protects Your Investment

Virtually all Data Translation data acquisition modules, including the DT9839E, are compatible with the DT-Open Layers® software standard. This means any application developed with one of Data Translation's software products can easily be upgraded to a new Data Translation module with little to no reprogramming needed.

User Manual

The DT9839E module includes a user's manual that provides getting started and reference information. The manual is provided in electronic (PDF) format on the Data Acquisition Omni CD provided with the module.

Technical Support

Application engineers are available by phone and email during normal business hours to discuss your application requirements. Extensive product information, including drivers, example code, pinouts, a searchable Knowledge Base, and much more, is available 24 hours a day on our website at: www.datatranslation.com.