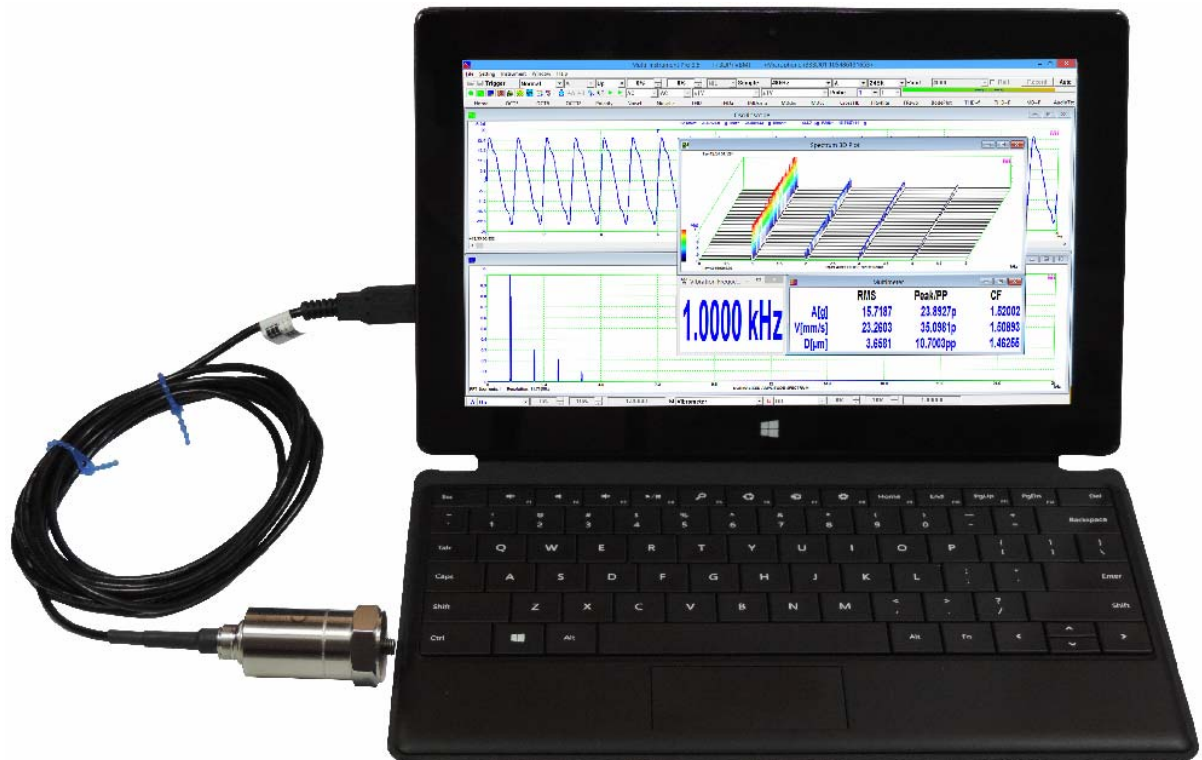


Digiducer 333D01 USB Digital Accelerometer + Multi-Instrument Manual



Note: VIRTINS TECHNOLOGY reserves the right to make modifications to this manual at any time without notice. This manual may contain typographical errors.

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1 Installation and Quick Start Guide

Digiducer 333D01 USB digital accelerometer is the first fully integrated and ruggedized packaging of a high-resolution, broad-frequency piezoelectric accelerometer with integrated internal digital data acquisition. When used in conjunction with Multi-Instrument® software, the setup allows you to take reliable and quality vibration measurements as simply as plug & play. No external power supply, data acquisition hardware, driver installation and manual entry of sensor sensitivity are required. It is a truly hassle-free portable vibration test & measurement solution.

1.1 Package Contents

A standard package contains the following items:

- 1) Digiducer 333D01 USB digital accelerometer with a 2.9 m USB cable.
- 2) Hardware activated Multi-Instrument Pro* software license (the software will be automatically activated with the USB accelerometer connected to the computer).
- 3) CD (contains the copy-protected Multi-Instrument software)
- 4) Magnetic mounting base



1.2 Multi-Instrument Software Installation

Insert the installation CD into your computer's CD-ROM drive and follow the instruction on the screen to install the Multi-Instrument software. The software can also be downloaded from www.virtins.com/MIsetup.exe.

1.3 Hardware Driver Installation

The USB accelerometer supports sound card MME driver which comes natively with all Windows versions. Thus, hardware driver installation is not required. Sound Card MME

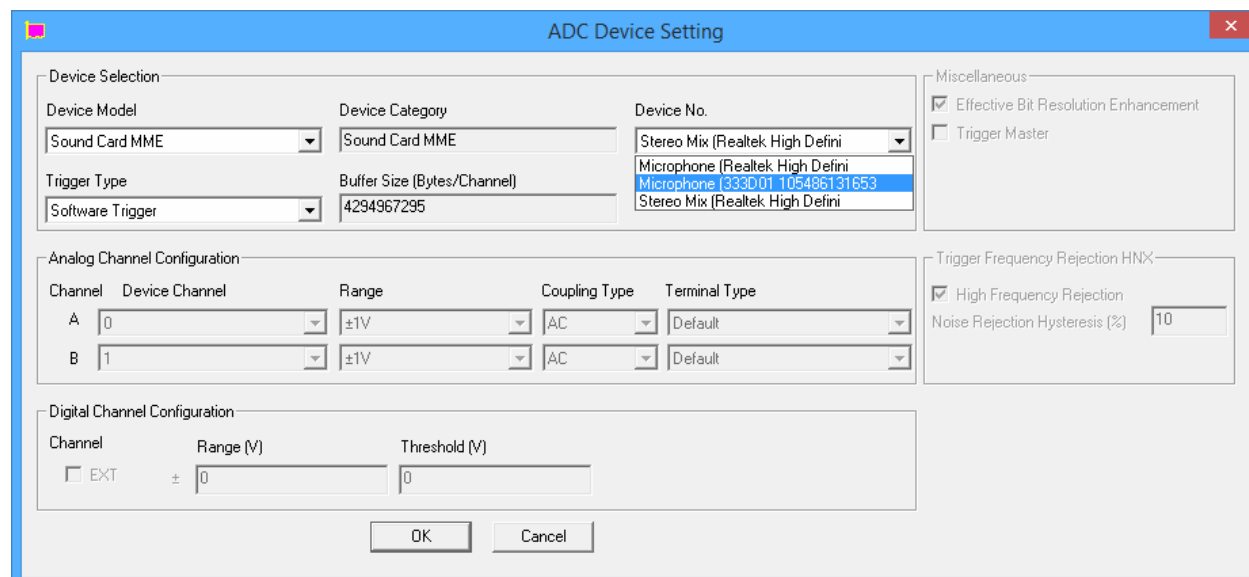
supports Sampling Rate Conversion (SRC). That is, if you select a sampling rate that is not natively supported by the hardware, the driver will do the sampling rate conversion automatically without popping up an error message. Sampling rate conversion may introduce additional noises and distortions. Thus for vibration measurement, it is recommended to use the sampling rates that are originally supported by the hardware. Please check the hardware specifications for details.

It is possible to use sound card ASIO driver for the USB accelerometer. The ASIO driver can be downloaded from <http://www.asio4all.com>. ASIO driver only supports sampling rates which are natively supported by the hardware.

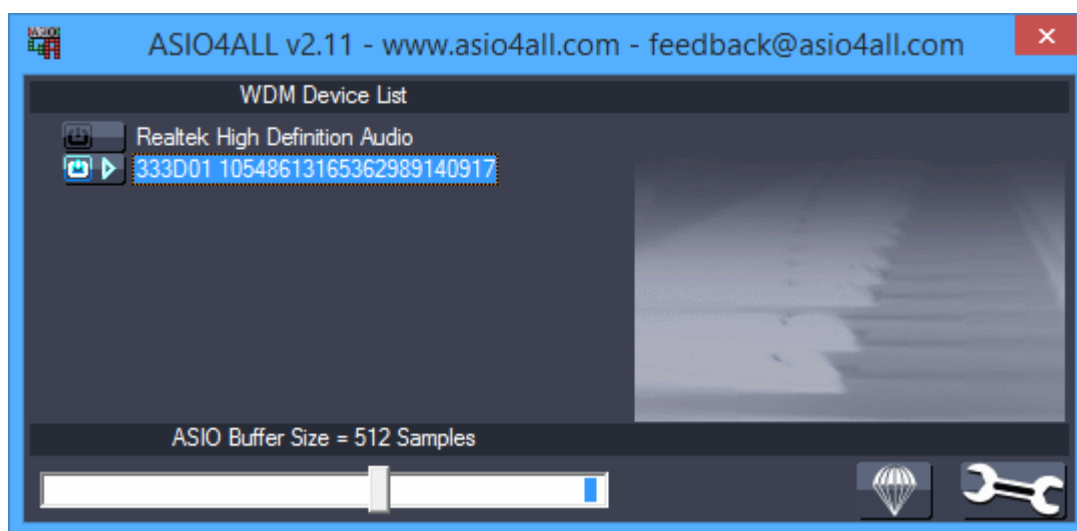
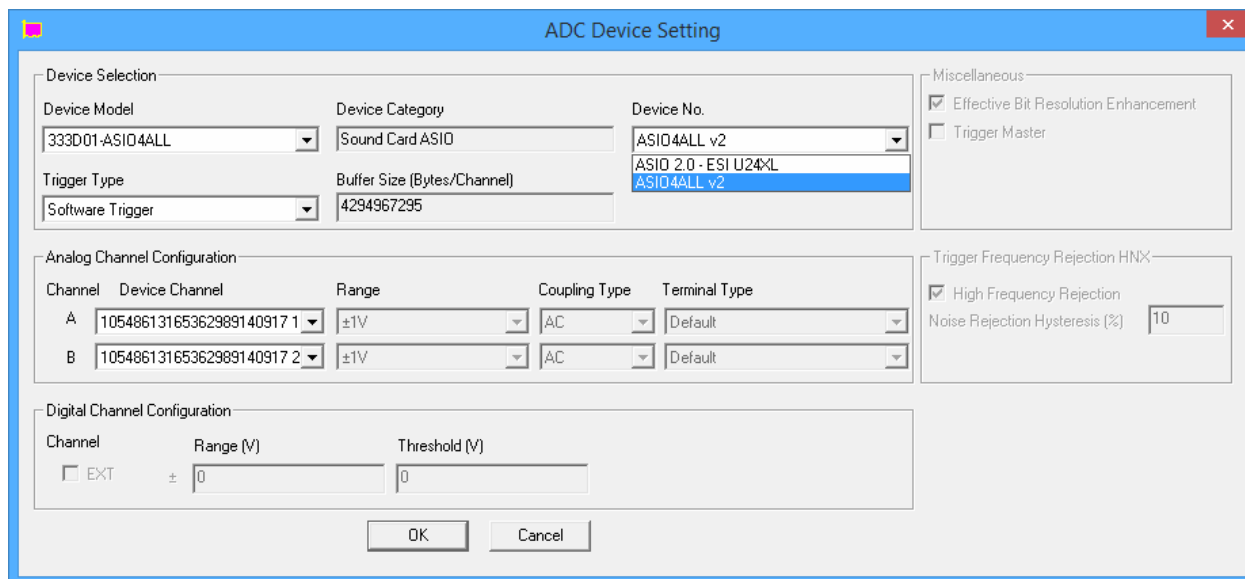
1.4 Start Multi-Instrument Software

To start the Multi-Instrument software, **with the USB accelerometer connected**, on Windows desktop, click the MI icon directly, or select [Start]>[All Programs]>[Multi-Instrument]>[VIRTINS Multi-Instrument] (for Windows XP, Vista, 7 and similarly for other Windows versions). The software will get activated automatically.

The USB accelerometer may not be the default ADC device used by the software. To configure the USB accelerometer as the ADC device of the software, stop the oscilloscope first by clicking the green button at the upper left corner of the screen, then go to [Setting]>[ADC Device] and select “Sound Card MME” in the Device Model selection box, and select “...333D01...” in the Device No. selection box. You can now use the USB accelerometer to do vibration measurement.



If you want to use ASIO driver instead, select “333D01-ASIO4ALL” in the Device Model selection box, and select “ASIO4ALL...” in the Device No. selection box. You need also to select “333D01” in the ASIO4ALL panel. You can then use the USB accelerometer to do vibration measurement.



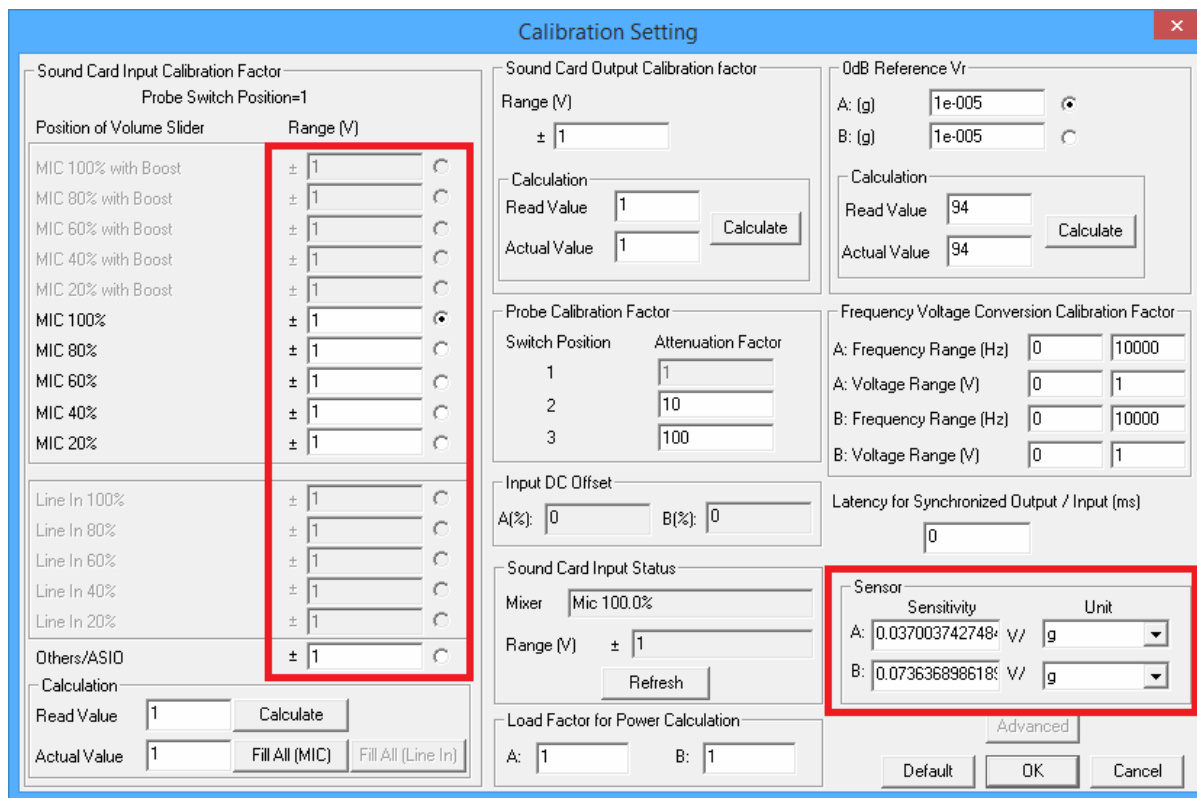
The default sampling rate of 333D01 is set to 48 kHz and the default bit resolution is set to 24 bits. This will give optimal measurement accuracy although other sampling rates and bit resolutions are also supported.

1.5 Sensor Sensitivity

The sensitivity of USB accelerometer is calibrated individually in factory and persisted in the hardware. Multi-Instrument is able to read it out automatically and use it to scale the acquired data for processing, analysis and display. So usually you do not need to bother about it.

The USB accelerometer has two sensitivity values, one for each of the two channels. The sensitivity of Channel B roughly doubles that of Channel A, thus the measurement range of Channel B is about 1/2 of that of Channel A.

If you want to check the sensitivity values, go to [Setting]>[Calibration]. The sensitivity will be shown with the unit of g/V. Please make sure that the values in “Range (V)” column under Sound Card Input Calibration Factor are all “1” V (default values). The measurement range of the sensor is then ± 1/sensitivity (g).



Please also make sure that in the main software window, “Probe” switch position is at “1” (default values).



1.6 File Input & Output

Multi-Instrument supports standard and extensible WAV files in PCM format. Therefore, you may use some readily available audio recording software on Windows, MacOS, iOS, Andriod, etc. to record vibration data in WAV file format (or record and then convert to WAV file format), and then use Multi-Instrument to analyze the data through [File]>[Open] command. If the WAV file contains sensor sensitivity information, then it will be automatically recognized and used. The vibration data captured using Multi-Instrument can be output as a WAV file with sensor sensitivity embedded through [File]>[Save] or [Save As]. It can also be exported as TXT file with sensor sensitivity information by right clicking anywhere within the oscilloscope window and select [Oscilloscope Export]. You can also use [Oscilloscope Copy As Text] to put the data in Windows Clipboard and later paste them out into a text editing software such as Microsoft Excel.

1.7 Hard Reset

A hard reset can be done via disconnecting the USB accelerometer from your computer and then re-connect it to the computer again. You should only do this with the Multi-Instrument software closed.

1.8 Non-routine Applications

The non-routine applications refer to those applications that are not considered as routine tasks of an accelerometer. With Multi-Instrument's capability of simultaneous input and output, you can generate a stimulus to a Device Under Test (DUT) and acquire the response from it at the same time. Different stimuli can be generated and the responses can be analyzed in different ways. The characteristics of the DUT, such as frequency response and distortion, can then be obtained. You can even configure and then perform a sequence of automated test steps to evaluate a DUT using the Device Test Plan software module.

You can configure the output device via [Setting]>[DAC Device]. For example, the computer sound card can be used to generate vibration stimulus to some external devices which then generate mechanical vibration.

2 Specifications

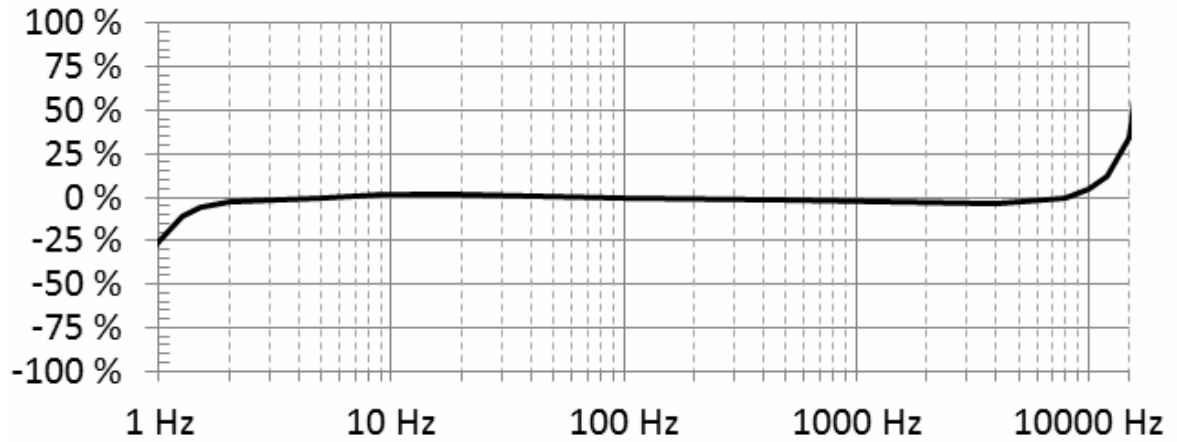
2.1 Digiducer 333D01 USB Digital Accelerometer Specifications

Performance		
	English	SI
Sensitivity ^{1,2}	Channel A: 4.3 % FSV/g Channel B: 8.4 % FSV/g	Channel A: 0.44 % FSV/m/s ² Channel B: 0.86 % FSV/m/s ²
Measurement Range ³	Channel A: ±20 g pk Channel B: ±10 g pk	Channel A: ±196 m/s ² Channel B: ±98 m/s ²
ADC Bandwidth (-3dB)	9.3 cpm to 1374000 cpm	0.155 Hz to 22900 Hz
Frequency Range (±5%)	120 cpm to 480000 cpm	2 Hz to 8000 Hz
Frequency Range (±10%) ³	90 cpm to 660000 cpm	1.5 Hz to 11000 Hz
Frequency Range (±3dB) ³	54 cpm to 900000 cpm	0.9 Hz to 15000 Hz
Resonant Frequency	≥1500000 cpm	≥25000 Hz
Mounted Resonance ³	1044000 cpm	17400 Hz
Mounted Resonance Amplification ³	200%	200%
Broadband Resolution ¹ (1Hz to 10000Hz)	0.0025 g pk	0.0245 m/s ² pk
Non-Linearity ⁴	≤ 2%	≤ 2%
Transverse Sensitivity ³	≤ 5%	≤ 5%

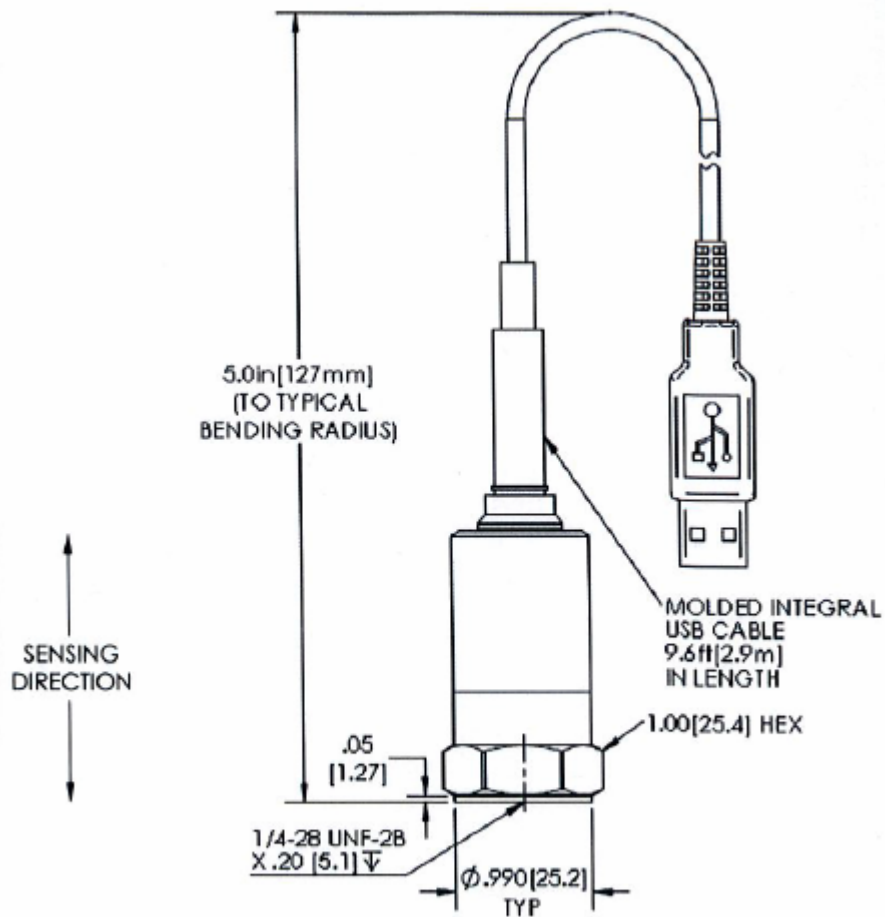
Electrical	
Communication Standard	USB 2.0 Full Speed
Power Consumption ³	≤ 45 mA
Internal ADC	24 bit
Supported Sampling Rates	48 kHz, 44.1 kHz, 32 kHz, 22.05 kHz, 16 kHz, 11.025 kHz, 8 kHz at 24bits / 16bits / 8bits
Case Isolated	No
Interface	USB 2.0 Full Speed / USB 1.1 Full Speed / USB Isolator

Mechanical		
	English	SI
Size-Hex	1.0 in	25.4 mm
Size - Height	2.6 in	66.0 mm
Weight	4.62 oz	131 gram
Mounting Thread	1/4-28 UNF	1/4-28 UNF
Mounting Torque	2 lbf.ft to 5 lbf.ft	2.7 N.m to 6.8 N.m
Sensing Element	Piezoelectric Ceramic	Piezoelectric Ceramic
Sensing Geometry	Shear	Shear
Housing Material	Stainless Steel	Stainless Steel
Sealing	Welded Hermetic	Welded Hermetic
Electrical Connector	USB Type A Male	USB Type A Male
Electrical Connection Position	Top	Top
Cable (Integral) Length	9.6 ft	2.9 m

CE



Typical Frequency Response Curve



Drawing

2.2 Multi-Instrument Software Specifications

Please refer to Multi-Instrument software manual for detail. The following table shows the function allocation matrix for Multi-Instrument series. The Spectrum 3D Plot, Data Logger, LCR Meter, Device Test Plan, Vibrometer are add-on modules/functions and should be purchased separately, and they are only available for Multi-Instrument Lite, Standard, and Pro editions, except that the Vibrometer is only available for Multi-Instrument Standard and Pro editions.

Legend: √ - Function available

		Sound Card Oscilloscope	Sound Card Spectrum Analyzer	Sound Card Signal Generator	Multi-Instrument Lite	Multi-Instrument Standard	Multi-Instrument Pro
General Functions							
ADC / DAC Hardware	Sound Card MME	√	√	√	√	√	√
	Sound Card ASIO						√
	Other Hardware				√	√	√
	vtDAQ, vtDAO software development kit	License automatically activated with the presence of the corresponding hardware, e.g. a USB hardkey or a VT DSO.					
File Operation	Load WAV File	√	√	√	√	√	√
	Load TXT File					√	√
	Load WAV File Frame by Frame (fore Long WAV File)					√	√
	Combine WAV Files	√	√	√	√	√	√
	Extract Data and save them into a new WAV File	√	√	√	√	√	√
	Save/Load Panel Setting	√	√	√	√	√	√
Data Export	Copy Text to Clipboard	√	√	√	√	√	√
	Copy BMP to Clipboard	√	√	√	√	√	√
	Print Preview	√	√	√	√	√	√
	Print	√	√	√	√	√	√
	Export as TXT File	√	√	√	√	√	√
	Export as BMP File	√	√	√	√	√	√
Trigger Settings	Trigger Mode	√	√		√	√	√
	Trigger Source	√	√		√	√	√
	Trigger Edge	√	√		√	√	√
	Trigger Level	√	√		√	√	√
	Trigger Delay	√	√		√	√	√
	High Frequency Rejection				√	√	√
	Noise Rejection				√	√	√
Sampling Settings	Sampling Rate	√	√	√	√	√	√
	Sampling Channels	√	√	√	√	√	√
	Sampling Bit Resolution	√	√	√	√	√	√
	Record Length	√	√		√	√	√
Calibration	Input	√	√		√	√	√
	Output			√	√	√	√
	Probe	√	√		√	√	√
	Sound Pressure Level	√	√		√	√	√
	F/V Conversion					√	√
	Latency for Sync. Output/Input						√
	Sensor Sensitivity	√	√		√	√	√
	Load Factor for Power Calculation	√	√		√	√	√
Graph Operation	Zoom	√	√	√	√	√	√
	Scroll	√	√	√	√	√	√
	Cursor Reader	√	√	√	√	√	√
	Marker	√	√	√	√	√	√
	Chart Type	√	√	√	√	√	√

		Sound Card Oscilloscope	Sound Card Spectrum Analyzer	Sound Card Signal Generator	Multi-Instrument Lite	Multi-Instrument Standard	Multi-Instrument Pro
	Line Width	√	√	√	√	√	√
	Color	√	√	√	√	√	√
	Fast/Slow Display Mode	√	√	√	√	√	√
	Refresh Delay	√	√	√	√	√	√
	Font Size	√	√	√	√	√	√
	Roll Mode					√	√
	Reference Curves					√	√
Others	Gain Adjustment	√	√	√	√	√	√
	Input Peak Indicator	√	√	√	√	√	√
	Sound Card Selection	√	√	√	√	√	√
	Sampling Parameter Auto Setting	√	√	√	√	√	√
	Multilingual GUIs	√	√	√	√	√	√
	Show/Hide Toolbar	√	√	√	√	√	√
	Lock/Unlock Panel Setting	√	√	√	√	√	√
	Hot Panel Setting Toolbar	√	√	√	√	√	√
	ActiveX Automation Server	√	√	√	√	√	√
Oscilloscope							
Type	Individual Waveform	√	√	√ (offline)	√	√	√
	Waveform Addition	√	√	√ (offline)	√	√	√
	Waveform Subtraction	√	√	√ (offline)	√	√	√
	Waveform Multiplication	√	√	√ (offline)	√	√	√
	Lissajous Pattern	√	√	√ (offline)	√	√	√
Digital Filtering	FFT Low Pass					√	√
	FFT High Pass					√	√
	FFT Band Pass					√	√
	FFT Band Stop					√	√
	FFT Frequency Response					√	√
	FIR Low Pass					√	√
	FIR High Pass					√	√
	FIR Band Pass					√	√
	FIR Band Stop					√	√
	FIR Frequency Response					√	√
	IIR Coefficients					√	√
Others	Max, Min, Mean, RMS	√	√	√ (offline)	√	√	√
	Record Mode					√	√
	Persistence Display Mode	√	√		√	√	√
	Equivalent Time Sampling Mode	√	√		√	√	√
	Analog & Digital Signal Mixed Display				√	√	√
Spectrum Analyzer							
Type	Amplitude Spectrum		√		√	√	√

		Sound Card Oscilloscope	Sound Card Spectrum Analyzer	Sound Card Signal Generator	Multi-Instrument Lite	Multi-Instrument Standard	Multi-Instrument Pro
	Phase Spectrum		√		√	√	√
	Auto-correlation		√		√	√	√
	Cross-correlation		√		√	√	√
	Coherence						√
	Transfer Function						√
	Impulse Response						√
Intra-Frame Processing	Frequency Compensation		√		√	√	√
	Frequency Weighting		√		√	√	√
	Remove DC		√		√	√	√
	Smoothing via Moving Average		√		√	√	√
Inter-Frame Processing	Peak Hold		√		√	√	√
	Linear Average		√		√	√	√
	Exponential Average		√		√	√	√
Parameter Measurement	THD, THD+N, SNR, SINAD, Noise Level, ENOB		√		√	√	√
	IMD		√		√	√	√
	Bandwidth		√		√	√	√
	Crosstalk		√		√	√	√
	Harmonics & Phase		√		√	√	√
	Energy in User Defined Frequency Band		√		√	√	√
	Peaks, SFDR		√		√	√	√
FFT	FFT Size 128~32768		√		√	√	√
	FFT Size 65536~4194304						√
	Intra-Frame Average		√		√	√	√
	Window function		√		√	√	√
	Window Overlap		√		√	√	√
Others	Peak Frequency detection		√		√	√	√
	Cross Correlation Peak detection		√		√	√	√
	Octave Analysis (1/1, 1/3, 1/6, 1/12, 1/24, 1/48, 1/96)		√		√	√	√
	Linear/Log Scale for X and Y		√		√	√	√
Signal Generator							
Waveform	Sine			√	√	√	√
	Rectangle			√	√	√	√
	Triangle			√	√	√	√
	Saw Tooth			√	√	√	√
	White Noise			√	√	√	√
	Pink Noise			√	√	√	√
	MultiTones			√	√	√	√
	Arbitrary Waveform			√	√	√	√
	MLS			√	√	√	√
	DTMF			√	√	√	√
	Musical Scale			√	√	√	√

		Sound Card Oscilloscope	Sound Card Spectrum Analyzer	Sound Card Signal Generator	Multi-Instrument Lite	Multi-Instrument Standard	Multi-Instrument Pro
	Wave File					√	√
	Play Waveform in Oscilloscope	√	√	√	√	√	√
	Cyclic Waveform Play in Oscilloscope	√	√	√	√	√	√
Burst (Mask)	Normal			√	√	√	√
	Phase Locked			√	√	√	√
Fade	Fade In			√	√	√	√
	Fade Out			√	√	√	√
Sweep	Frequency Sweep (Linear/Log)			√	√	√	√
	Amplitude Sweep (Linear/Log)			√	√	√	√
Others	Software Loopback (all channels)			√	√	√	√
	Software Loopback (1 channel)				√	√	√
	Sync. with Oscilloscope						√
	Save as WAV file			√	√	√	√
	Save as TXT file			√	√	√	√
	DDS				√	√	√
	DC Offset				√	√	√
Multimeter							
Type	RMS					√	√
	dBV					√	√
	dBu					√	√
	dB					√	√
	dB(A)					√	√
	dB(B)					√	√
	dB(C)					√	√
	Frequency Counter				√	√	√
	RPM					√	√
	Counter					√	√
	Duty Cycle					√	√
	Frequency/Voltage					√	√
	Cycle RMS					√	√
	Cycle Mean					√	√
Settings	Counter Trigger Hysteresis				√	√	√
	Counter Trigger Level				√	√	√
	Frequency Divider				√	√	√
DDP Viewer							
Function	DDP & UDDP display						√
	HH, H, L, LL Alarm						√
	Set Display Precision						√
	Define UDDP						√

Legend: Blank - Function available if purchased Shaded Blank - Function NOT available for that edition

		Sound Card Oscilloscope	Sound Card Spectrum Analyzer	Sound Card Signal Generator	Multi-Instrument Lite	Multi-Instrument	Multi-Instrument Pro
Spectrum 3D Plot							
Type	Waterfall Plot						
	Spectrogram						
Settings	Spectrogram Color Palette						
	Waterfall Color Palette						
	Waterfall tilt Angle						
	Waterfall / Spectrogram Height						
	Linear / Log Scale for X and Y						
	Number of Spectral Profiles (10~200)						
Others	3D Cursor Reader						
Data Logger							
Real Time Logging							
Load Historical Log File							
Three logging methods							
167 derived data points available for logging							
Up to $8 \times 8 = 64$ variables can be logged simultaneously							
LCR Meter							
High Impedance Measurement							
Low Impedance Measurement							
Up to 8 X-Y Plots (Linear/Log)							
Device Test Plan							
18 Instructions							
Create/Edit/Lock/Execute/Load/Save a Device Test Plan							
Up to 8 X-Y Plots (Linear/Log)							
Device Test Plan Log							
Vibrometer							
RMS, Peak/PP, Crest Factor for acceleration, velocity, displacement (in Multimeter)							
Waveform conversion among acceleration, velocity and displacement (in Oscilloscope)							

2.3 Software Development Interface Specifications

Multi-Instrument provides the following secondary development features:

1. Multi-Instrument can work as an ActiveX automation server so that an external program can access the data and functions that Multi-Instrument exposes. You can integrate Multi-Instrument into your own software seamlessly via the ActiveX automation server interfaces exposed by Multi-Instrument.

Please refer to: *Multi-Instrument Automation Server Interfaces*

Download link:

<http://www.virtins.com/Multi-Instrument-Automation-Server-Interfaces.pdf>

The above document and the sample automation client programs in Visual C++ and Visual Basic can be found in the AutomationAPIs directory of the software.

2. You can use the vtDAQ and vtDAO interface DLLs supplied in this software to allow your own back-end software to interface to sound cards, NI DAQmx cards, VT DSOs, etc.. You can also develop your own vtDAQ and vtDAO compatible DLLs to allow Multi-Instrument to interface to your own hardware.

Please refer to: *vtDAQ and vtDAO Interfaces*

Download link:

<http://www.virtins.com/vtDAQ-and-vtDAO-Interfaces.pdf>

The above document and the sample DAQ and DAO back-end programs and sample vtDAQ compatible DLL in Visual C++ can be found in the DAQDAOAPIs directory of the software.

3. Virtins Technology's Signal Processing and Analysis (vtSPA) Application Programming Interfaces (APIs) provides a suite of generic APIs for data processing and analysis. It contains some unique features / algorithms originated and only available from Virtins Technology.

Please refer to: *Signal Processing and Analysis (vtSPA) Interfaces*

Download link:

<http://www.virtins.com/Signal-Processing-and-Analysis-APIs.pdf>

The above document and the sample programs in Visual C++ can be found in the DAQDAOAPIs directory of the software.

3 Multi-Instrument Software License Information

3.1 License Types

The License of Multi-Instrument software has six levels and five add-on modules/functions. The six levels are: Sound Card Oscilloscope, Sound Card Spectrum Analyzer, Sound Card Signal Generator, Multi-Instrument Lite, Multi-Instrument Standard, Multi-Instrument Pro. The five add-on modules/functions are: Spectrum 3D Plot, Data Logger, LCR Meter, Device Test Plan, Vibrometer.

The license contained in the standard Digiducer 333D01 USB Digital Accelerometer + Multi-Instrument package is a hardware activated Multi-Instrument Pro license, without any add-on modules/functions. No softkey (activation code) and USB hardkey (USB dongle) are provided in this type of license. The software will run under the licensed mode as long as the licensed USB accelerometer unit is connected to your computer before you start the Multi-Instrument software.

Note: If the software is started without the licensed USB accelerometer unit connected to the computer, it will enter into 21-day fully functional trial mode, unless the software is activated by a softkey (activation code) or a hardkey (USB dongle), which are NOT included in the standard package here and should be purchased separately as a brand-new license if needed. In other words, the licensed USB accelerometer hardware should always be connected to the computer in order for the Multi-Instrument software to work under the licensed mode, even though you might just want to use your computer sound card for ADC and DAC.

3.2 License Upgrade from one level to another

You can purchase an upgrade of the license, e.g. from Multi-instrument Pro to Multi-Instrument Pro + Spectrum 3D Plot + Vibrometer, at any time if necessary. After you purchase the upgrade, an upgrade file will be sent to you via email. You can then use it to replace the same file under the root directory of the Multi-Instrument software.

3.3 Software Upgrade for the same license level

Software upgrade for the same license level (if the hardware is still supported by the new version), e.g. from Multi-Instrument 3.0 Standard to Multi-Instrument 3.1 Standard, is always FREE. You just need to download the new version from our website and install it to any computer. The downloaded version will automatically recognize the license level your USB accelerometer owns.

Thus, please do visit frequently our website to see if a new version or build is available.

4 Extended Use of Multi-Instrument Software

Multi-Instrument is a powerful multi-function virtual instrument software. It supports a variety of hardware ranging from sound cards which are available in almost all computers to proprietary ADC and DAC hardware such as NI DAQmx cards, VT DSO units, and so on. Furthermore, the ADC and DAC device can be chosen independently in Multi-Instrument. For example, you can use the USB accelerometer for vibration data acquisition and use your computer's sound card for vibration signal generation simultaneously.

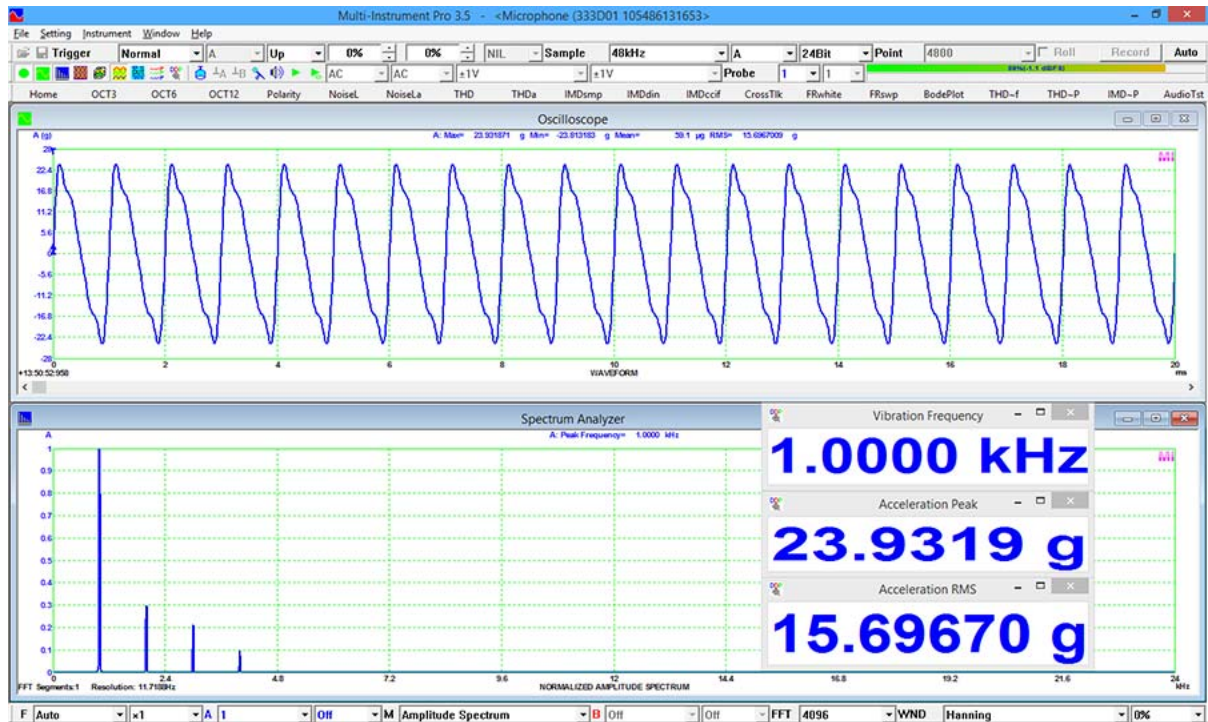
You can change the ADC device via [Setting]>[ADC Device]>[Device Model] (Note: this menu item is disabled when the oscilloscope or the signal generator is running). For example you can also use your computer's sound card as the ADC device.

You can choose a DAC device via [Setting]>[DAC Device]>[Device Model] (Note: this menu item is disabled when the oscilloscope or the signal generator is running). For example, you can use your computer's sound card as the DAC device and thus make full use of the signal generator function of Multi-Instrument.

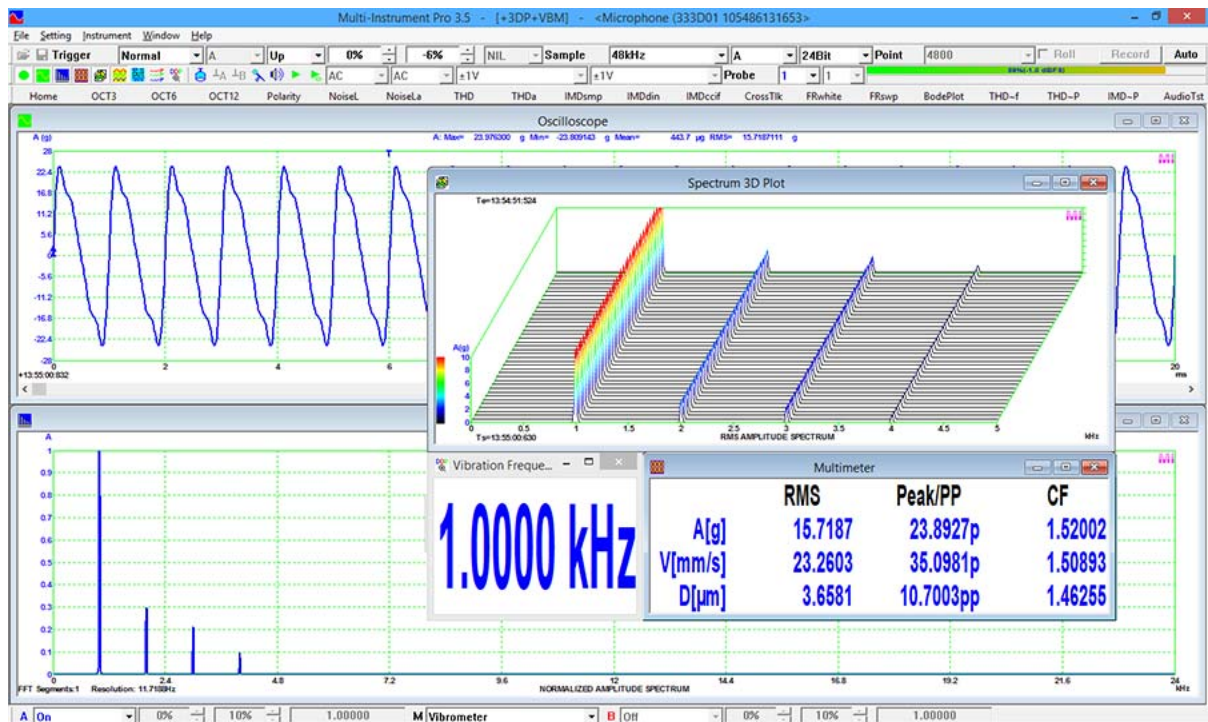
If you want to use the sound card as the ADC/DAC device, you may need to purchase the dedicated sound card oscilloscope probe kit from Virtins Technology separately, or you may make the connection by yourself.

5 Measurement Examples

1) Digiducer 333D01 with Multi-Instrument Pro



(2) Digiducer 333D01 with Multi-Instrument Pro + Spectrum 3D Plot + Vibrometer



6 Safety Instructions



- Always keep in mind that the USB accelerometer are NOT galvanically isolated from the computer connected.
- It should be noted that for many computers (typically desktop PCs or laptop PCs with a built-in AC power supply adapter), the metal case of the accelerometer is connected to mains earth through the USB port of the computer. This is not a problem if the test article surface is not conductive or floating (i.e. isolated from earth). Otherwise, you **MUST** make sure that the accelerometer is mounted on a surface that is also at the same earth potential, or else mounting isolation or a USB isolator should be used.

7 Warranty

Virtins Technology guarantees this product against defective materials and manufacturing defects for a period of 12 months. During this period of warranty, a replacement of the faulty part will be shipped to the buyer's address free of charge upon receiving and verifying the returned faulty part. The Warranty is only applicable to the original buyer and shall not be transferable. The warranty shall exclude malfunctions or damages resulting from acts of God, fire, civil unrest and/or accidents, and defects from using wrong electrical supply/voltage and/or consequential damage by negligence and/or abuse, as well as use other than in accordance with the instructions for operation. The Warranty shall immediately cease and become void if the hardware is found to have been tampered, modified, repaired by any unauthorized person(s). Decisions by Virtins Technology on all questions relating to complaints as to defects either of workmanship or materials shall be deemed conclusive and the buyer shall agree to abide by such decisions.

8 Disclaimer

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