



NATIONAL INSTRUMENTS VirtualBench All-in-One Instrument User Guide

[Home](#) » [NATIONAL INSTRUMENTS](#) » NATIONAL INSTRUMENTS VirtualBench All-in-One Instrument User Guide



Contents

- [1 NATIONAL INSTRUMENTS VirtualBench All-in-One Instrument](#)
- [2 VirtualBench All-in-One Instrument](#)
- [3 VirtualBench All-in-One Instrument Specifications](#)
- [4 VirtualBench Accessories](#)
- [5 Product Usage Instructions](#)
- [6 Detailed View of VB-8054](#)
- [7 Key Features](#)
- [8 VirtualBench Accessories](#)
- [9 Hardware Services](#)
- [10 Technical Support](#)
- [11 Documents / Resources](#)
 - [11.1 References](#)



NATIONAL INSTRUMENTS VirtualBench All-in-One Instrument



VirtualBench All-in-One Instrument

The VirtualBench All-in-One Instrument is a device that consolidates five of the most commonly used instruments into one device without compromising the performance of each instrument. It reduces the cost and footprint of test and measurement systems, making it ideal for engineers interacting with benchtop test equipment or developing low-cost automated test systems. The VirtualBench hardware family currently consists of three models, VB-8012, VB-8034, and VB-8054, that serve a wide range of applications and price points in academic labs, hardware characterization/debug benches, and automated test systems.

VirtualBench All-in-One Instrument Specifications

Instrument	VB-8012	VB-8034	VB-8054
Mixed-Signal Oscilloscope (MSO) with SPI, I2C, and Parallel Protocol Analysis	100 MHz bandwidth 2 Analog, BNC 34 Digital channels 1 GS/s sample rate	350 MHz bandwidth 4 Analog, BNC 34 Digital channels 1.5 GS/s/channel sample rate	500 MHz bandwidth 4 Analog, BNC 34 Digital channels 2 GS/s/channel sample rate
Digital Multimeter	Resolution: Input Range: 300 V, Category II Isolation Measurement Functions: DC voltage, AC voltage, DC current, AC current, resistance, diode, continuity		
Arbitrary Waveform Generator	Max Frequency: 20 MHz (sine) Waveform Types: sine, square, ramp/triangle, DC, arbitrary	Max Frequency: 40 MHz (sine) Waveform Types: sine, square, ramp/triangle, DC, arbitrary	
DC Power Supply	Channel 1: 0 to 6 V, up to 1 A Channel 2: 0 to -25 V, up to 0.5 A Channel 3: 0 to 25 V, up to 0.5 A	Channel 1: 0 to 6 V, up to 3 A Channel 2: 0 to -25 V, up to 1 A Channel 3: 0 to 25 V, up to 1 A	Channel 1: 0 to 6 V, up to 3 A Channel 2: 0 to -25 V, up to 1 A Channel 3: 0 to 25 V, up to 1 A
Digital I/O	Channels: 8 Channels Logic Levels: 5 V compatible TTL input, 3.3 LVTTTL output		
General	Connectivity: USB and WiFi Size: 10 in. x 7.5 in. x 2.9 in. Interactive Software: Windows (7 SP1 and later), iPad (iOS 9 or later)	Connectivity: USB, WiFi, and Ethernet Size: 12 in. x 8 in. x 3.7 in. Interactive Software: Windows (7 SP1 and later), iPad (iOS 9 or later)	

- Software: Includes VirtualBench application, API support for LabVIEW and text-based languages, shipping examples, and detailed help files
- Up to 500 MHz mixed-signal oscilloscope with protocol analysis
- Arbitrary waveform generator with up to 40 MHz sine output
- 5 ½ digit DMM with 300 V input range
- Three-channel programmable DC power supply, up to 3 A
- Eight general-purpose digital I/O lines
- USB, Ethernet, and WiFi connectivity to Windows and Apple iPad software applications



Five Benchtop Instruments. One Unified Interface.

VirtualBench plays a key role in reducing the cost and footprint of test and measurement systems by consolidating five of the most commonly used instruments into one device without compromising the performance of each instrument. Combined with a modern software experience and simple programming interface, VirtualBench creates new efficiencies for engineers interacting with benchtop test equipment or developing low-cost automated test systems.

The VirtualBench hardware family currently consists of three models most easily designated by oscilloscope analog bandwidth: 100, 350, and 500 MHz. These models allow the VirtualBench family to serve a wide range of applications and price points in academic labs, hardware characterization/debug benches, and automated test systems.

Table 1. NI offers VirtualBench models ranging from 100 to 500 MHz of analog bandwidth.

	VB-8012	VB-8034	VB-8054
Mixed-Signal Oscilloscope (MSO) with SPI, I ² C, and Parallel Protocol Analysis			
Bandwidth	100 MHz	350 MHz	500 MHz
Channels	2 Analog, BNC	4 Analog, BNC	
	34 Digital	34 Digital	
Sample Rate	1 GS/s	1.5 GS/s/channel	2 GS/s/channel
Digital Multimeter			
Resolution	5 ½ Digits		
Input Range	300 V, Category II Isolation		
Measurement Functions	DC voltage, AC voltage, DC current, AC current, resistance, diode, continuity		
Arbitrary Waveform Generator			
Max Frequency	20 MHz (sine)		40 MHz (sine)
Waveform Types	sine, square, ramp/triangle, DC, arbitrary		
DC Power Supply			
Channel 1	0 to 6 V, up to 1 A	0 to 6 V, up to 3 A	
Channel 2	0 to -25 V, up to 0.5 A	0 to -25 V, up to 1 A	
Channel 3	0 to 25 V, up to 0.5 A	0 to 25 V, up to 1 A	
Digital I/O			
Channels	8 Channels		
Logic Levels	5 V compatible TTL input, 3.3 LVTTTL output		
General			
Connectivity	USB and WiFi	USB, WiFi, and Ethernet	
Size	10 in. x 7.5 in. x 2.9 in.	12 in. x 8 in. x 3.7 in.	
Interactive Software	Windows (7 SP1 and later), iPad (iOS 9 or later)		
Programming API	LabVIEW, ANSI C, and Python ¹		

VirtualBench Accessories

NI offers a variety of accessories for VirtualBench, including BNC cables, probes, and power supplies. Please visit the NI website for more information on VirtualBench accessories.

NI-VirtualBench Application Programming Interface (API)

The VirtualBench API allows you to control VirtualBench instruments using LabVIEW, ANSI C, and Python programming languages. Please note that the Python wrapper is community-developed and not officially supported by NI.

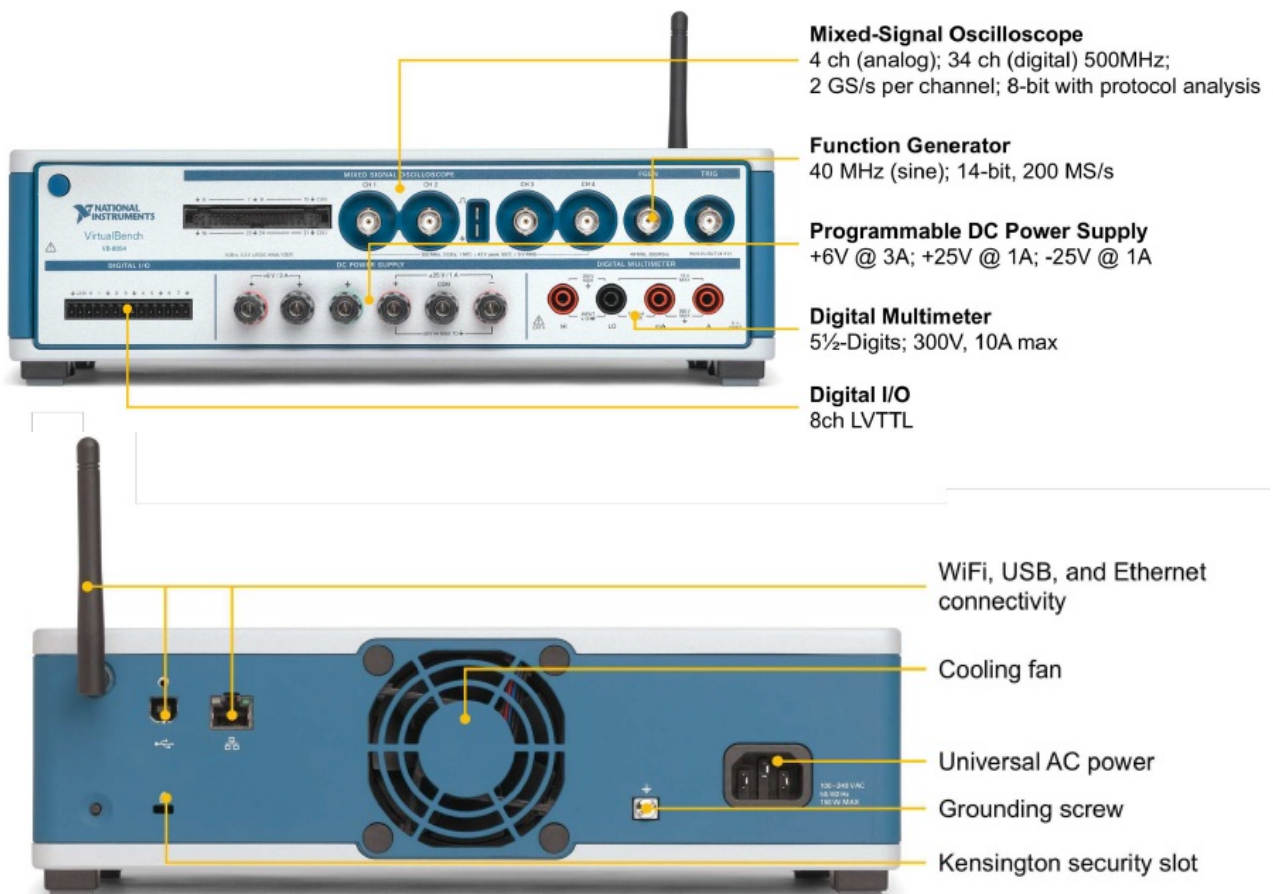
Learn More About VirtualBench Hardware Services

NI offers hardware services for VirtualBench, including calibration, repair, and extended warranty. Please visit the NI website for more information on VirtualBench hardware services.

Product Usage Instructions

1. Connect the VirtualBench device to your computer or iPad using the provided USB or WiFi cable.
2. Launch the Interactive Software on your computer or iPad.
3. Select the instrument you want to use from the menu.
4. Configure the instrument settings using the intuitive configuration menus.
5. Perform measurements using the measurement indicators displayed on the screen.
6. Export screenshots and data using one-click buttons or the hands-free smart capture feature.

Detailed View of VB-8054



Key Features

Unified Software Interface

The VirtualBench application requires zero installation and can load automatically via Windows Autoplay when connected through USB. The integrated view of all five instruments allows you to import/export instrument configurations for easier replication of test conditions. VirtualBench also includes software capabilities like digital phosphor density maps for displaying multiple acquisitions simultaneously, XY mode for plotting channels against one another, and hands-free smart capture for automatic data capture of repeated stable waveforms. In order to future-proof any VirtualBench investment, free software and firmware updates are provided as new features are released. These features, in addition to the consolidated interface, help engineers streamline their approach for benchtop characterization and validation.

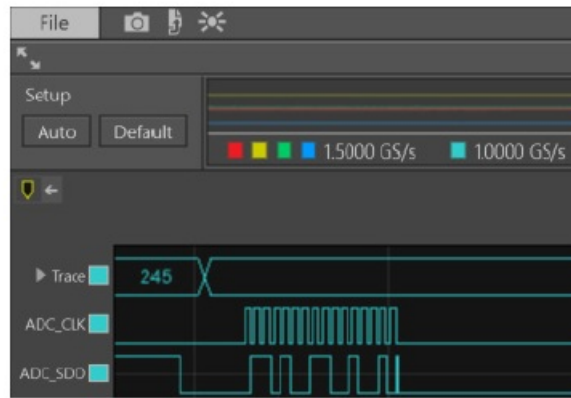


Figure 1: Export screenshots and data using one-click buttons or the hands-free smart capture feature.

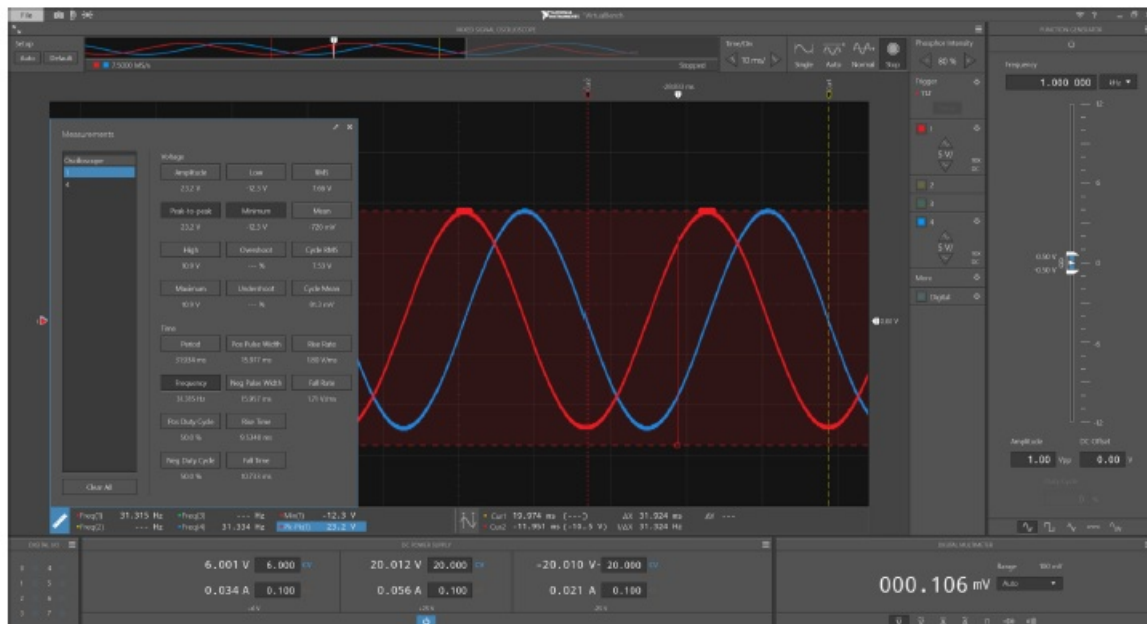


Figure 2: Use measurement indicators to quickly characterize signals like this sine glitch. Choose to display common measurements like amplitude, max/min, RMS, period, and frequency indefinitely beneath the scope graph.

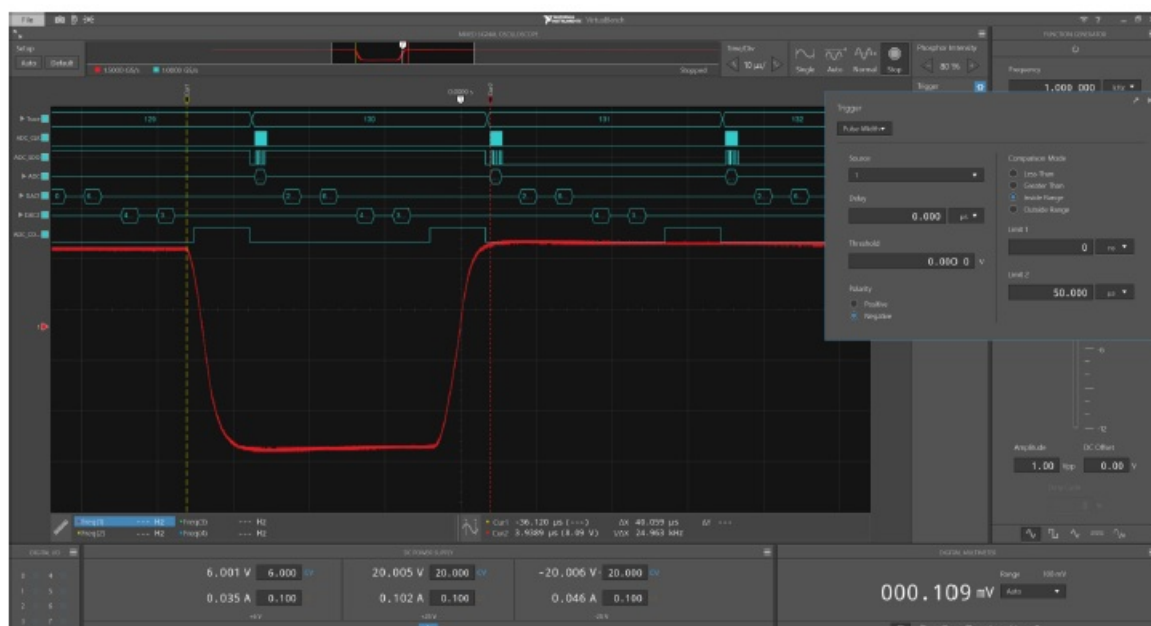


Figure 3: Simplify your measurements using intuitive configuration menus. The configured pulse width trigger

reliably captures the displayed signal glitch.

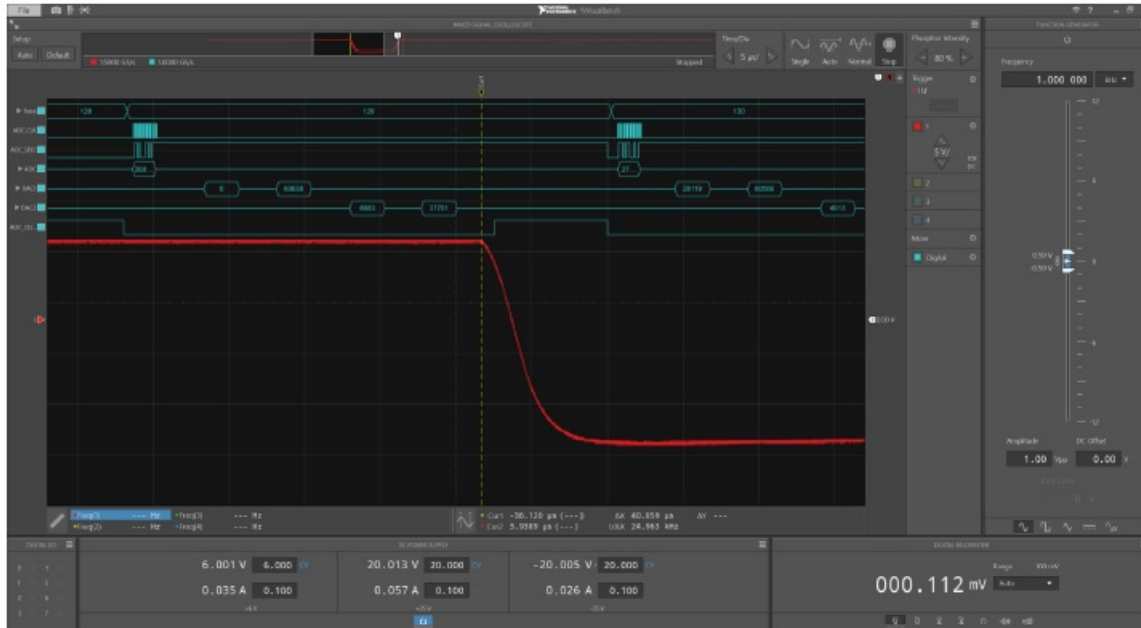


Figure 4: Debug your system more easily by leveraging the built-in protocol decoder alongside the other instruments on the same time scale. The zero registered on the “DAC1” SPI line is likely the culprit of the glitch shown.

VirtualBench Accessories

VirtualBench ships with several accessories to enable common measurements as well as device connection with a PC or iPad.

- Oscilloscopes probes (VB-8012: set of two, VB-8034/VB-8054: set of four)
- DMM probes (set of two)
- MSO logic analyzer 40-pin input cable
- Screw-terminal connectors
- NI screwdriver
- Wireless antenna
- USB cable with locking screw (2 m)
- Power cord

Optional Accessories

In addition to the standard, included accessories, NI has several optional accessories available that further extend the capabilities of VirtualBench.



Binding Post Adapter
(VB-8012 only)



Soft Carrying Case



Desktop Mounting Kit
(VB-8012 only)



Accessory Pouch



Rack Mount Shelf



Logic Analyzer Grabbers
(set of six)



DMM Alligator Clips, Spade
Connectors, & Spring
Hooks (P2 Probe Set)



FGEN BNC Male to
Micrograbber (87 cm)



BNC Cable, 50 Ohm Male
to Male (2 m)



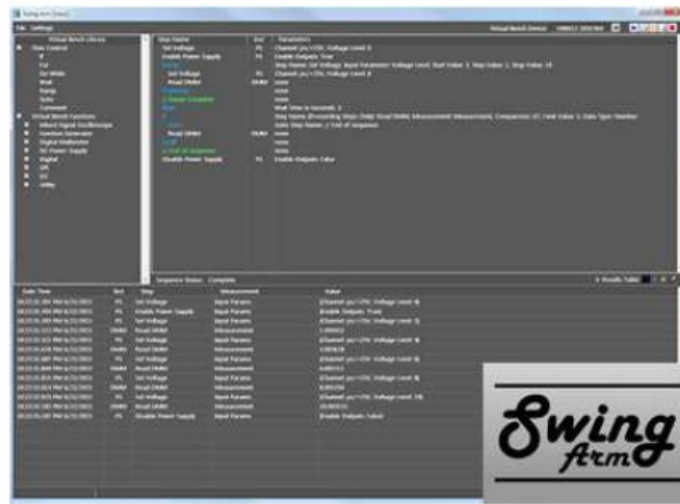
USB Cable with Locking
Screw (1 or 2 m)

Third Party Accessories and Software

Additional industrial accessories have been developed for VirtualBench and are available through alliance partners or the LabVIEW Tools Network.



NI Alliance partner 10X Engineering LLC developed an uninterruptible power supply for the VB-8012, further enabling field work with limited resources.



Clustr, Inc's SwingArm software incorporates drag and drop methodology to create sequences of VirtualBench settings and measurements, ideal for design verification testing as well as repetitive measurements.

Academic Curriculum

Developed in collaboration with the University of Virginia, the free downloadable ECE Fundamentals 1 curriculum leverages both VirtualBench and Multisim to simulate, create, and test circuits with specific analysis methods. The course series aims to redefine teaching of core electrical and computer engineering topics with an innovative, breadth-first approach.

ECE Fundamentals I (v. Instructor)

Developed in Collaboration with

Introduction

Course Map

Labs

0 1 2 3

4 5 6 7

8 9 10 11

12

Final Project

Additional Resources

Preview of FUN 2

A note from the authors:

We envision engineering education pedagogy as being at a crossroads, especially as it relates to electrical and computer engineering. An overarching goal of an engineering education is to allow students to develop an appreciation that large scale systems are assembled from smaller building blocks and that a truly professional designer must have a sense of both. We at UVA are addressing these concerns with a new core curriculum for electrical and computer engineers, the Fundamentals of Electrical Engineering Series, a 3-course sequence. These courses replace our prior sequence: Circuits, Electronics, and Signals and Systems and are taught with a breadth-first approach in a studio style.

The laboratories in this set are designed to mesh with Fundamentals I, our introductory course in the basic principles of electrical and computer engineering. They cover virtually all topics that might be found at the first level and are easily adapted to a variety of learning environments. We create a systematic approach that gradually deepens a student's level of understanding while keeping individual laboratories manageable. These labs make extensive use of the capabilities of the NI VirtualBench and allow experiential lab work to be performed in a relatively small multi-purpose physical space.

Additional laboratories based on VirtualBench have been developed through partners and are available for purchase on LabStore, such as the Electrical Measurements Lab, Fault Detection and Correction Lab, and Electronic Components Characterization Lab.

NI-VirtualBench Application Programming Interface (API)

In addition to the VirtualBench application, the NI-VirtualBench driver includes a best-in-class API that works with a variety of development options such as LabVIEW and C. The driver also provides access to help files, documentation, and online examples you can use as a starting point for your application.

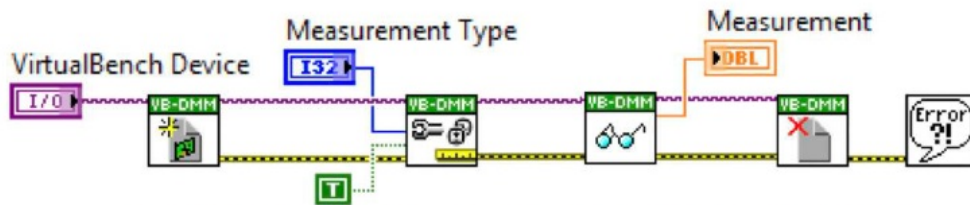


Figure 5: Example LabVIEW code to take a DMM reading on the VirtualBench.

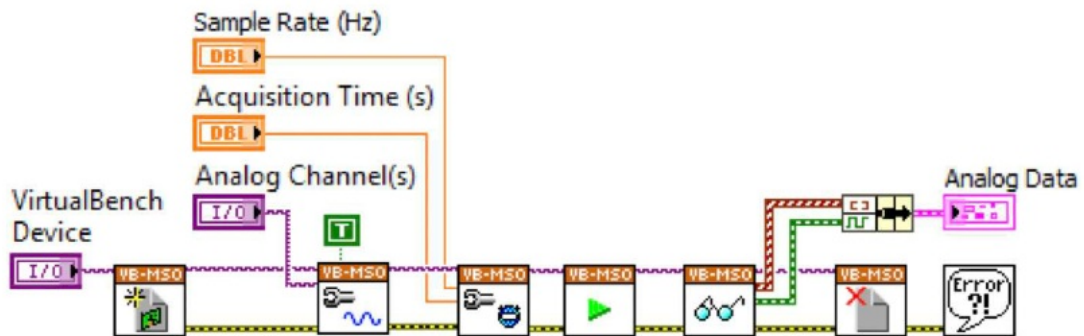
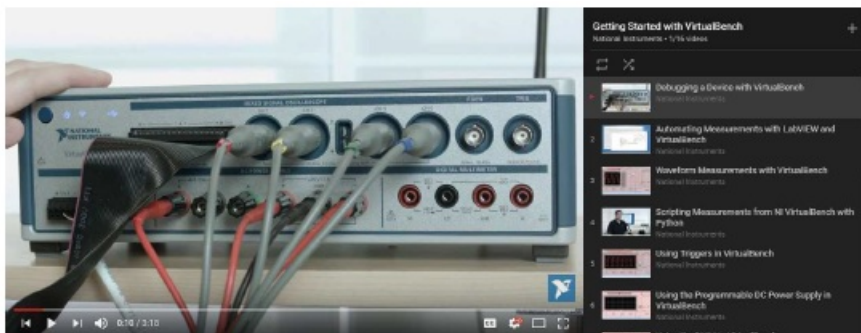


Figure 6: Example LabVIEW code to take an oscilloscope measurement on the VirtualBench.

Learn More About VirtualBench

To learn more about the capabilities of VirtualBench, you can watch the series of instructional videos linked through the image below.



Hardware Services

All NI hardware includes a one-year warranty for basic repair coverage, and calibration in adherence to NI specifications prior to shipment. PXI Systems also include basic assembly and a functional test. NI offers additional entitlements to improve uptime and lower maintenance costs with service programs for hardware. Learn more at ni.com/services/hardware.

	Standard	Premium	Description
Program Duration	3 or 5 years	3 or 5 years	Length of service program
Extended Repair Coverage	●	●	NI restores your device's functionality and includes firmware updates and factory calibration.
System Configuration, Assembly, and Test ¹	●	●	NI technicians assemble, install software in, and test your system per your custom configuration prior to shipment.
Advanced Replacement ²		●	NI stocks replacement hardware that can be shipped immediately if a repair is needed.
System Return Material Authorization (RMA) ¹		●	NI accepts the delivery of fully assembled systems when performing repair services.
Calibration Plan (Optional)	Standard	Expedited ³	NI performs the requested level of calibration at the specified calibration interval for the duration of the service program.

1. This option is only available for PXI, CompactRIO, and CompactDAQ systems.
2. This option is not available for all products in all countries. Contact your local NI sales engineer to confirm availability. 3Expedited calibration only includes traceable levels.

PremiumPlus Service Program

NI can customize the offerings listed above, or offer additional entitlements such as on-site calibration, custom sparring, and life-cycle services through a PremiumPlus Service Program. Contact your NI sales representative to learn more.

Technical Support

Every NI system includes a 30-day trial for phone and e-mail support from NI engineers, which can be extended through a Software Service Program (SSP) membership. NI has more than 400 support engineers available around the globe to provide local support in more than 30 languages. Additionally, take advantage of NI's award winning online resources and communities.

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Documents / Resources



[NATIONAL INSTRUMENTS VirtualBench All-in-One Instrument](#) [pdf] User Guide
VB-8012, VB-8034, VB-8054, VirtualBench All-in-One Instrument, VirtualBench Instrument, All-in-One Instrument, VirtualBench, Instrument

References

-  [pyVirtualBench - Controlling Five Instruments from a Single Python Application](#)
-  [NI VirtualBench™ - labStore](#)
-  [Electronic Components Characterization Lab based on NI VirtualBench - labStore](#)
-  [Fault Detection and Correction Lab based on NI VirtualBench - labStore](#)
-  [Electrical Measurements Lab based on NI VirtualBench - labStore](#)
-  [Engineer Ambitiously - NI](#)
-  [Product Documentation - NI](#)
-  [Hardware Services - NI](#)
-  [NI Driver Downloads - NI](#)
-  [SwingArm for VirtualBench - NI](#)
-  [Engineer Ambitiously - NI](#)
-  [NI Community - National Instruments](#)
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-  [Software Services - NI](#)
-  [Support - NI](#)
-  [How-To Automate VirtualBench in LabVIEW - NI](#)
-  [Getting Started With VirtualBench - NI](#)
-  [VB-8012 National Instruments VirtualBench All-in-One Instrument | Apex Waves](#)