VirtualBench User Manual

2025-09-08

Contents

NI VirtualBench™ Help

January 2017, 371526G-01

This help file contains information about using the NI VirtualBench all-in-one instrument.

Connecting to VirtualBench Using USB

1. Plug in the power cable.
2. Connect the VirtualBench hardware to your computer using the USB cable.
3. The VirtualBench application starts automatically after 60 to 90 seconds. If the VirtualBench application does not start, refer to Why Doesn't the VirtualBench Application Start Automatically?.

Related information

What Are the Different Ways to Run the VirtualBench Application?
How Do I Install the VirtualBench Application?

Connecting to VirtualBench Using Wireless

You can establish a wireless connection to VirtualBench by configuring it as an access point, or by connecting VirtualBench to your wireless network. By default VirtualBench powers up in access point (AP) mode.

Connecting to VirtualBench as an Access Point

Connecting to VirtualBench Using an Existing Wireless Network

Connecting to VirtualBench as an Access Point

By default VirtualBench powers up in access point (AP) mode. Your computer must have wireless networking capability to establish a wireless connection.

1. Install the VirtualBench application on your computer.
2. Connect the antenna.
3. Plug in the power cable.
4. Connect the VirtualBench hardware to your computer using the USB cable.

   The VirtualBench application should start automatically. If it does not, refer to Why Doesn't the VirtualBench Application Start Automatically?.

5. In the application, create a new wireless network.
   1. Click the wireless icon to open **Network Configuration**.
   2. Select **Create new wireless network**.
   3. Fill in a **Network Name**, **Channel**, and **Security**.
   4. Click **Apply**.
6. Close the VirtualBench application.
7. Open your computer's network settings and connect to the VirtualBench device.
8. Disconnect the USB cable.
9. Launch the VirtualBench application from your **Start** menu. Click **Search for Device**. The VirtualBench should be listed in the **Select a device** window.

If you are still having trouble connecting to the VirtualBench hardware, try the following tips:

- Reset VirtualBench to the factory default mode.
  1. Close the VirtualBench application.
  2. Press and hold the reset button for five seconds or longer.

     After rebooting the device will default to VB80***xx***-***<serial number>*** as the access point name. Refer to Reset Button for additional information.

  3. Open your computer's network settings and connect, or verify your connection, to the VirtualBench device.
  4. Launch the VirtualBench application from your **Start** menu. Click **Search for Device**. The VirtualBench should be listed in the **Select a device** window.
- Disable your computer's firewall to make sure the firewall is not blocking the connection, or make sure your firewall settings allow for the network ports listed in the ***NI VirtualBench Specifications***.
- Disable any virtual machine network adapters such as VMWare. These adapters can route traffic incorrectly and cause the VirtualBench to not be discovered or used.
- Verify that the antenna is connected.

Related information

Why Doesn't the VirtualBench Application Start Automatically? How Do I Install the VirtualBench Application? What Are the Different Ways to Run the VirtualBench Application? Reset Button Wireless LED

Connecting to VirtualBench Using an Existing Wireless Network

Your computer must have wireless networking capability to establish a wireless connection.

1. Install the VirtualBench application on your computer.
2. Connect the antenna.
3. Plug in the power cable.

4. Connect the VirtualBench hardware to your computer using the USB cable.

   The VirtualBench application should start automatically. If it does not, refer to Why Doesn't the VirtualBench Application Start Automatically?.

5. In the application, connect VirtualBench to an existing wireless network.
   1. Click the wireless icon to open **Network Configuration**.
   2. Select **Connect to existing wireless network** and choose your preferred wireless network from the list. Some networks require a network security key or passphrase. Enter one if prompted.
   3. Click **Apply**.
6. Connect your computer to the same wireless network as the VirtualBench.
   1. In Windows, open **Connect to Network** by clicking on the network icon in the notification area.
   2. In the list of available networks, select the same network that you connected VirtualBench to. Click **Connect**.

      You must connect your computer to the same wireless network as the VirtualBench.

7. Disconnect the USB cable.
8. Launch the VirtualBench application from your **Start** menu. Click **Search for Device**. The VirtualBench should be listed in the **Select a device** window.

If you are still having trouble connecting to VirtualBench, try the following:

- Disable your computer's firewall to make sure the firewall is not blocking the connection, or make sure your firewall settings allow for the network ports listed in the ***NI VirtualBench Specifications***.
- Disable any virtual machine network adapters such as VMWare. These adapters can route traffic incorrectly and cause the VirtualBench to not be discovered or used.
- Verify that the antenna is connected.

Related information

What Are the Different Ways to Run the VirtualBench Application? Why Doesn't the VirtualBench Application Start Automatically? How Do I Install the VirtualBench Application? Reset Button Wireless LED

Connecting to VirtualBench Using Ethernet

Some models of VirtualBench hardware feature an Ethernet port as an additional connectivity option.

1. Install the VirtualBench application on your computer.
2. Plug in the power cable.
3. Connect the VirtualBench hardware to an Ethernet network or your computer using a shielded straight through Category 5 Ethernet cable. The Ethernet Connectivity LED turns on.

> **Note** You can use a shielded straight through Category 5 Ethernet cable or an Ethernet crossover cable to connect the VirtualBench to your computer.

4. Open the VirtualBench application on your computer.
5. Click **Search for Device**.
6. Select the VirtualBench device and click the **Use This Device** button.

If you are having trouble connecting to the VirtualBench hardware, try the following tips:

- Confirm that the Ethernet Connectivity LED on the front panel is lit, and the 10/100/1000 and LINK/ACT LEDs on the Ethernet connector on the back panel are lit.
- Ensure that the version of the VirtualBench application installed on your computer supports your VirtualBench. Refer to the What is the Earliest Supported Version of the VirtualBench Application for My VirtualBench? topic for the software version to install on your computer.
- If you cannot see your VirtualBench automatically in the VirtualBench application, this may be because it is on your network but on a different subnet. You can find your VirtualBench by clicking **Search for Device** and then directly typing the IPv4 address or the VirtualBench name in the **Add network device** field. The default host name of VirtualBench is VB80xx-<***serial number***>.
- VirtualBench can also be accessed through a web browser. Type the host name or IPv4 address of the VirtualBench in your web browser. The NI Network Browser, which can show you all the NI configurable hardware on your local subnet, can

also be accessed by going to **Start»All Programs»National Instruments»NI Network Browser**. The device can be accessed through the web on a host PC that does not have any NI software installed.

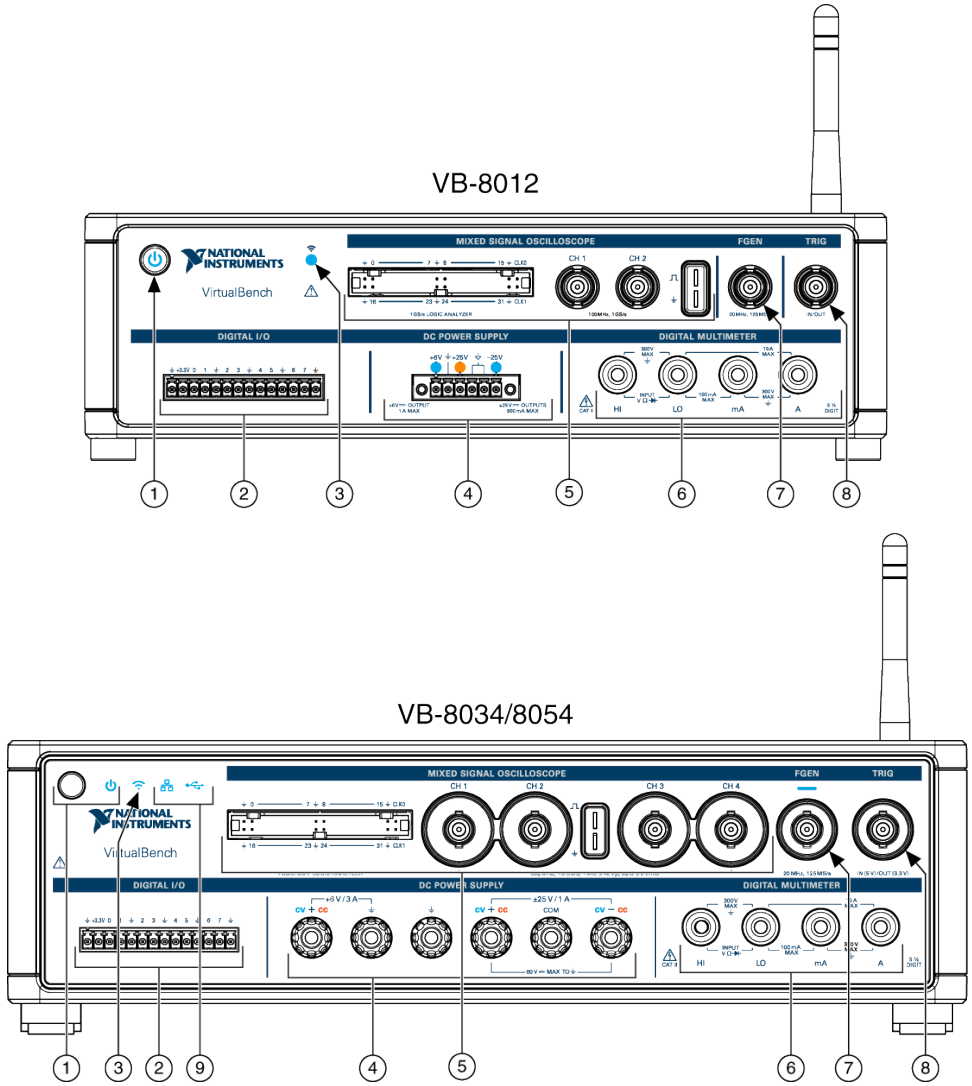
- IPv4 configuration can be set to automatically assign via the DHCP server on the host PC. Manually/statically setting the IPv4 address for the host computer may potentially put the VirtualBench on a separate subnet and therefore make it undiscoverable. Microsoft's web site explains how to change the IPv4 configuration in Windows; search for information about changing TCP/IP settings for your Windows version.
- If connecting VirtualBench directly to a host PC, make sure that the computer is either running a DHCP server or the network card is set to obtain an IP address automatically. VirtualBench always looks for a DHCP server first and if one is not available, it will default to a link local IP address. Link local IPv4 addresses are in the following range: `169.254.1.0` to `169.254.254.255` with the subnet mask `255.255.0.0`. Setting your computer to have a static IP address, `169.254.X.X`, with the subnet mask `255.255.0.0` will ensure that the device and your computer are on the same subnet.
- Connect the VirtualBench hardware to your computer using the USB cable. The VirtualBench application should start automatically. If it does not, refer to Why Doesn't the VirtualBench Application Start Automatically?. In the application, click the wireless icon and select **Ethernet**. View the network details by selecting **Automatic configuration** or change the network configuration by selecting **Manual configuration** and then enter configuration setttings. Click **Apply**. Close the VirtualBench application and open your computer's network settings and connect to the VirtualBench device. Then disconnect the USB cable and launch the VirtualBench application from your **Start** menu. Click **Search for Device**. The VirtualBench should be listed in the **Select a device** window.
- Disable your computer's firewall to make sure the firewall is not blocking the connection, or make sure your firewall settings allow for the network ports listed in the ***NI VirtualBench Specifications***.
- If using a proxy server, add the address of the VirtualBench to the list of exceptions. This setting can be found in Internet Options.
- Try disabling any antivirus software, it may be interfering with the discovery or configuration process.
- Disable any virtual machine network adapters such as VMware. These adapters can route traffic incorrectly and cause VirtualBench to not be discovered or used.
- If working through the previous tips do not result in finding your VirtualBench,

reboot VirtualBench by pressing the reset button as described in the Reset Button topic.

Related information

Ethernet LEDs Reset Button What is the Earliest Supported Version of the VirtualBench Application for My VirtualBench?

Front Panel Pinouts and Connections



1 Power Button and Power LED	6 Digital Multimeter (DMM)
2 Digital I/O	7 Function Generator (FGEN)
3 Wireless LED	8 External Trigger (TRIG)
4 DC Power Supply	9 Ethernet and USB Connectivity LEDs
5 Mixed Signal Oscilloscope (MSO)	

Power Button and Power LED

Refer to the Power Button and Power LED topic for information about using this button to enter and exit standby mode and understand Power LED behavior.

Wireless LED

Refer to the Wireless LED topic for information about the behavior of the bi-color wireless LED indicator.

Ethernet and USB Connectivity LEDs

Some models of VirtualBench also have connectivity LEDs for USB and Ethernet, indicating that a cable is plugged into a port on VirtualBench and a computer, hub, or network port.

Mixed Signal Oscilloscope (MSO)

Refer to the Mixed Signal Oscilloscope Pinouts and Connections topic for pinouts and signal descriptions of the oscilloscope and logic analyzer.

Function Generator (FGEN)

The FGEN BNC connector is the analog waveform output terminal from which standard functions and arbitrary waveforms are generated. The maximum output levels from this connector depend on the type of load termination.

Caution Exceeding the maximum output ratings, which are listed in the ***NI VirtualBench Specifications*** document, can damage the device and the computer. National Instruments is not liable for any damage resulting from such signal connections.

Refer to the FGEN LED topic for information about the FGEN LED on some models of VirtualBench.

External Trigger (TRIG)

The TRIG BNC connector provides an additional trigger input/output source. Any of the digital I/O signals can also act as trigger inputs or outputs. Refer to the What Can I Do with the Digital I/O? for information about trigger signals on the digital I/O connector.

⚠	**Caution** Exceeding the maximum input voltage ratings or maximum output ratings, which are listed in the ***NI VirtualBench Specifications*** document, can damage the device and the computer. National Instruments is not liable for any damage resulting from such signal connections.

Digital I/O

Refer to the Digital I/O Pinout and Connections topic for the digital I/O pinout and signal descriptions.

DC Power Supply

Refer to the VB-8012 DC Power Supply Connections and LEDs or VB-8034/8054 DC Power Supply Connections and LEDs topic for a pinout of DC power supply connections and behavioral information of the LEDs on your VirtualBench.

Digital Multimeter (DMM)

Refer to the Digital Multimeter Pinout and Connections topic for information about the different connections you can make to the DMM.

Power Button and Power LED

VirtualBench features a power button on the front panel of the device that puts the device in and out of standby mode. Standby mode is a low power mode that can also be used as an "emergency stop"—to disable any outputs on VirtualBench.

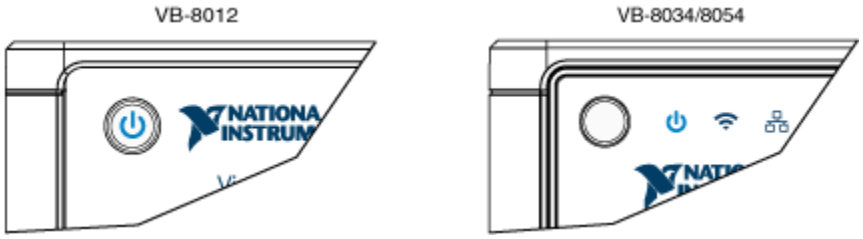
To put VirtualBench in standby mode, press the power button. In standby mode:

- The light on the button turns off indicating that the outputs have been disabled.

- VirtualBench is no longer accessible through USB or wireless.
- VirtualBench is no longer accessible through software.
- All VirtualBench instrument outputs are disabled.
- The DC power supply is disabled.
- The digital I/O signals change to inputs.
- The function generator (FGEN) changes to DC 0 V
- The fan may spin occasionally to keep the VirtualBench within its calibrated temperature range.

> **Note** VirtualBench automatically enters standby mode if the internal temperature of the processor exceeds 96 °C. When this happens, the fan works at full capacity until the device has cooled sufficiently. In this situation, standby mode can not be overridden by pressing the power button.

To exit standby mode, press the power button again. The Power LED turns on and the VirtualBench is accessible over both the wireless network and USB.



When exiting standby mode, you must re-enable the instruments, either through the VirtualBench application or LabVIEW. The VirtualBench instruments do not automatically resume their previous state.

Power LED Patterns

Pattern	Description
On	Operating normally
Off	VirtualBench is in standby mode
Blinking	Hardware issue

Related information

Why Is the Power LED Blinking?

Wireless LED

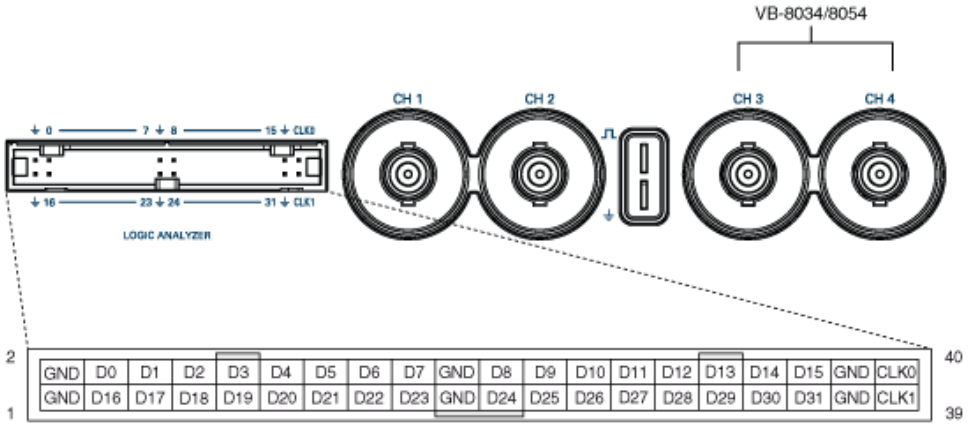
Bi-Color Wireless LED Patterns

Color	Pattern	Description
Orange	On	Wireless access available in AP mode (default startup mode).
Blue	Blinking	Device trying to establish wireless connection in client mode.
	On	Wireless connection established in client mode.
—	Off	Wireless disabled.

Mixed Signal Oscilloscope Pinouts and Connections

Caution Exceeding the maximum input voltage ratings, which are listed in the ***NI VirtualBench Specifications*** document, can damage the device and the computer. National Instruments is not liable for any damage resulting from such signal connections.

Mixed Signal Oscilloscope Connections



Logic Analyzer Cable Wire List

Pin	Signal	Wire Color		Pin	Signal	Wire Color
1	GND	Black		2	GND	Black
3	D16	Yellow		4	D0	Red

5	D17	Yellow		6	D1	Red
7	D18	Yellow		8	D2	Red
9	D19	Yellow		10	D3	Red
11	D20	Yellow		12	D4	Red
13	D21	Yellow		14	D5	Red
15	D22	Yellow		16	D6	Red
17	D23	Yellow		18	D7	Red
19	GND	Black		20	GND	Black
21	D24	Green		22	D8	Blue
23	D25	Green		24	D9	Blue
25	D26	Green		26	D10	Blue
27	D27	Green		28	D11	Blue
29	D28	Green		30	D12	Blue
31	D29	Green		32	D13	Blue
33	D30	Green		34	D14	Blue
35	D31	Green		36	D15	Blue
37	GND	Black		38	GND	Black
39	CLK1	White		40	CLK0	White

Mixed Signal Oscilloscope and Logic Analyzer Signal Descriptions

Pin	Connector	Description
CH <1..4>	Standard BNC connector	Analog input connection; digitizes data and triggers acquisitions
	Probe compensation tab	Probe compensation output; oscilloscope compensation square wave used to tune the probe to minimize over/undershoot
		Probe compensation/oscilloscope ground
D<0..31>	Logic analyzer	Digital input signals 0 to 31. Grouped into four ports of eight lines: • Port 0 (D0..7)

		• Port 1 (D8..15) • Port 2 (D16..23) • Port 3 (D24..31)
CLK0		State mode clock 0
CLK1		State mode clock 1
GND		Ground for digital signals

FGEN LED

(VB-8034/8054) The blue FGEN LED is located on the front panel above the FGEN connector.

FGEN LED Patterns

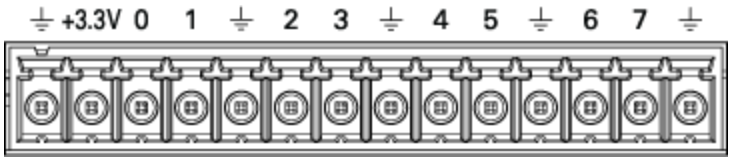
Pattern	Description
On	FGEN is generating a standard or arbitrary waveform
Off	FGEN is off or not generating an output
Blinking	Warning that voltage is being applied/backdriven to the FGEN

Note VB-8012 does not have an FGEN LED; if the VB-8012 power button is blinking, the reason could be a warning that voltage is being applied/backdriven to the FGEN.

Digital I/O Pinout and Connections

Caution Exceeding the maximum input voltage ratings or maximum output ratings, which are listed in the ***NI VirtualBench Specifications*** document, can damage the device and the computer. National Instruments is not liable for any damage resulting from such signal connections.

Digital I/O Pinout



Digital I/O Signal Descriptions

Signal Name	Direction	Description
⏚	—	Ground—The reference point for the digital signals and +3.3 V supply at the I/O connector.
+3.3V	Output	+3.3 V Power Source—Provides +3.3 V power output up to 20 mA.
dig/<0..7>	Input or Output	Digital I/O Channels 0 to 7. User selectable functions.

Caution Never connect the +3.3 V power terminal to analog or digital ground or to any other voltage source on VirtualBench or any other device. Doing so can damage the device and the computer. NI is not liable for damage resulting from such a connection.

Related information

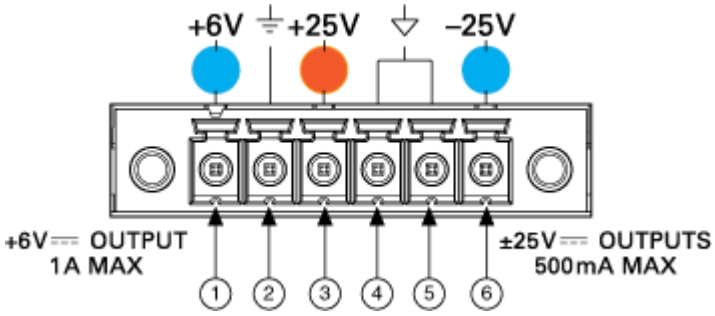
What Can I Do with the Digital I/O?

VB-8012 DC Power Supply Connections and LEDs

Caution Exceeding the maximum output ratings, which are listed in the ***NI VirtualBench VB-8012 Specifications*** document, can damage the device and the computer. National Instruments is not liable for any damage resulting from such signal connections.

The DC power supply has three LEDs that correlate to the three available voltages available on the connector.

Connections and LEDs



1 Channel +6V (0 to +6 V) and +6V LED	4 Common Floating GND
2 GND	5 Common Floating GND
3 Channel +25V (0 to +25 V) and +25V LED	6 Channel -25V (0 to -25 V) and -25V LED

Note The +25 V and -25 V channels are bank isolated from ground but not from each other.

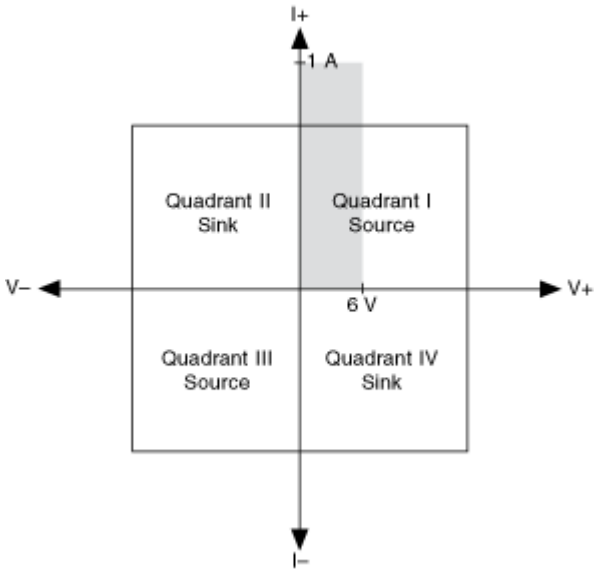
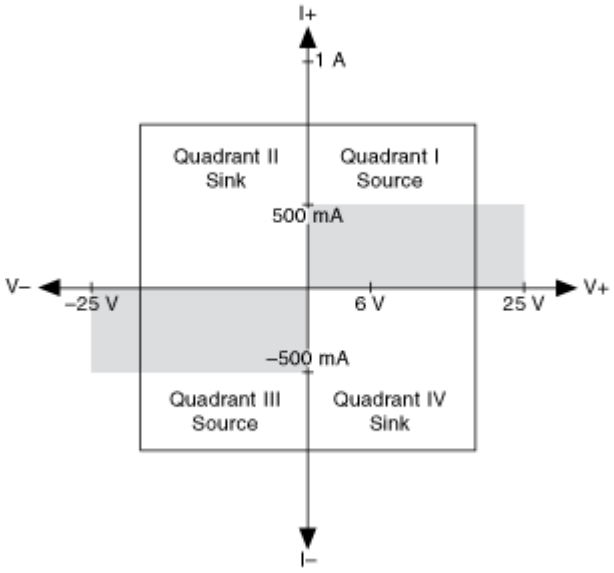
LED Patterns

LED	Color	Description
+6V	Blue	Constant 0 to +6 V voltage
	Orange	Constant 0 to 1 A current
+25V	Blue	Constant 0 to +25 V voltage
	Orange	Constant 0 to 500 mA current
-25V	Blue	Constant 0 to -25 V voltage
	Orange	Constant 0 to 500 mA current

Note The color of the LED matches the color of the CV and CC indicators in the VirtualBench application, blue and orange respectively.

VirtualBench has three, single-quadrant DC power supply channels. Each channel on the DC power supply can operate only within one quadrant (channels +6V and +25V operate only within Quadrant I, and channel -25V operates only within Quadrant III).

DC Power Supply Channel	Quadrant Operation

+6 V, +1 A	
+25 V, +500 mA -25 V, -500 mA	

Related Information

What Do CV and CC Indicate in the VirtualBench Application?

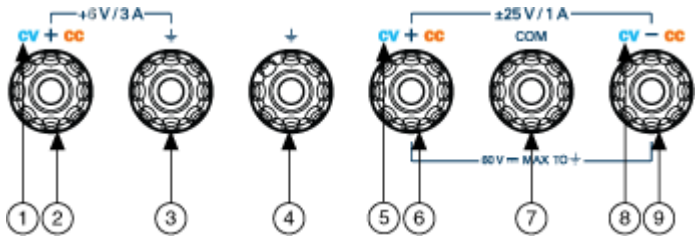
VB-8034/8054 DC Power Supply Connections and LEDs

⚠	**Caution** Exceeding the maximum output ratings, which are listed in the ***NI VirtualBench Specifications***, can damage the device and the computer. National Instruments is not liable

	for any damage resulting from such signal connections.

The DC power supply has six LEDs that correlate to the three available voltages available on the connector.

Connections and LEDs



1 +6V CV and CC LEDs	6 Channel +25V (0 to +25 V)
2 Channel +6V (0 to +6 V)	7 Common Floating GND
3 GND	8 -25V CV and CC LEDs
4 GND	9 Channel -25V (0 to -25 V)
5 +25V CV and CC LEDs	

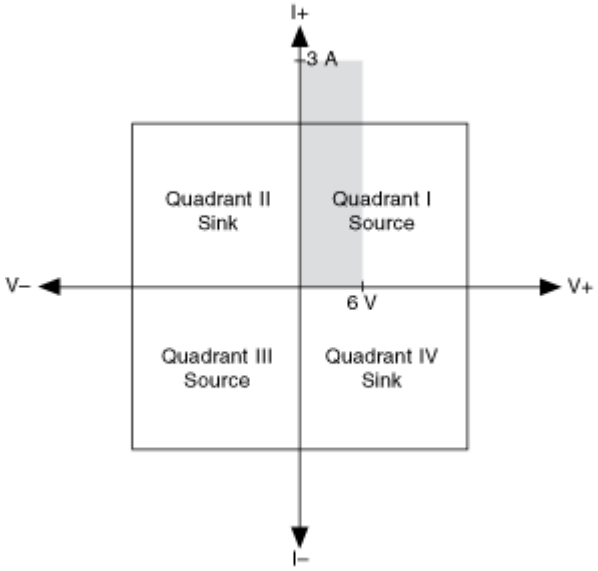
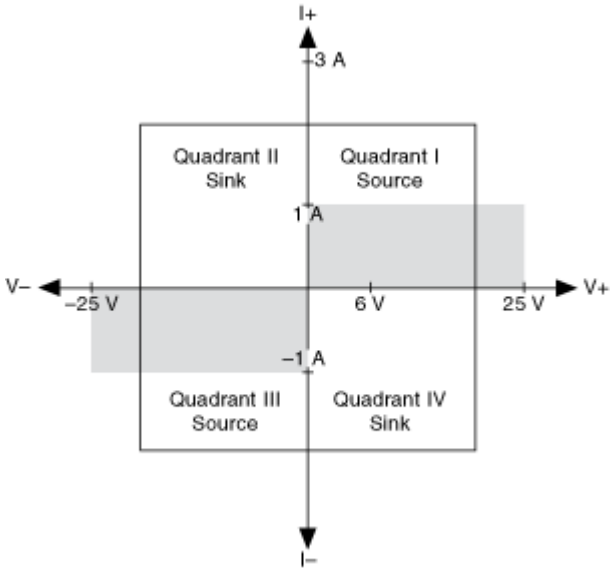
Note The +25 V and -25 V channels are bank isolated from ground but not from each other.

LED Patterns

LED	Color	Description
+6 CV	Blue	Constant 0 to +6 V voltage
+6 CC	Orange	Constant 0 to 3 A current
+25 CV	Blue	Constant 0 to +25 V voltage
+25 CC	Orange	Constant 0 to 1 A current
-25 CV	Blue	Constant 0 to -25 V voltage
-25 CC	Orange	Constant 0 to 1 A current

Note The color of the LED matches the color of the CV and CC indicators in the VirtualBench application, blue and orange respectively.

VirtualBench has three, single-quadrant DC power supply channels. Each channel on the DC power supply can operate only within one quadrant (channels +6V and +25V operate only within Quadrant I, and channel -25V operates only within Quadrant III).

DC Power Supply Channel	Quadrant Operation
+6 V, +3 A	
+25 V, +1 A -25 V, -1 A	

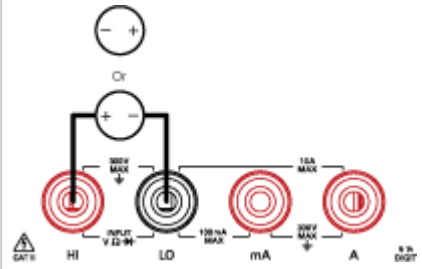
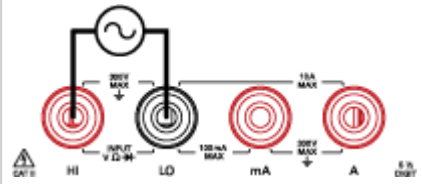
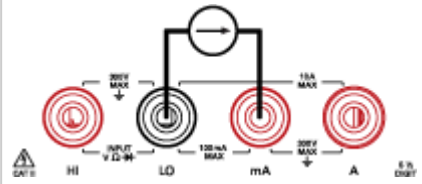
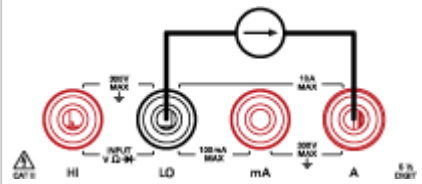
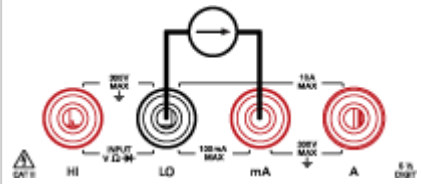
Related Information

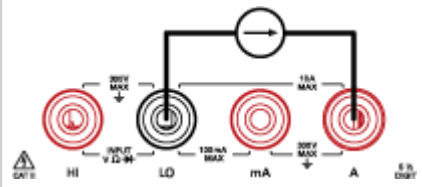
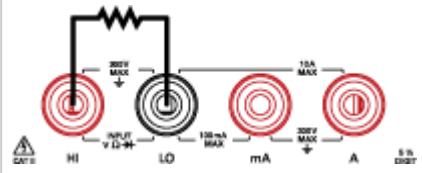
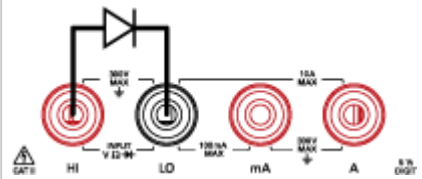
What Do CV and CC Indicate in the VirtualBench Application?

Digital Multimeter Pinout and Connections

> **Caution** Exceeding the maximum input voltage ratings, which are listed in the ***NI VirtualBench Specifications*** document, can damage the device and the computer. National Instruments is not liable for any damage resulting from such signal connections.

DMM Signal Connections

Measurement	Wiring Diagram	Range
DC Voltage		100 mV, 1 V, 10 V, 100 V, 300 V
AC Voltage		100 mVrms, 1 Vrms, 10 Vrms, 100 Vrms, 265 Vrms
DC Current ≤100 mA		10 mA, 100 mA
DC Current >100 mA to 10 A		1A, 10 A
AC Current ≤50 mArms		5 mArms, 50 mArms

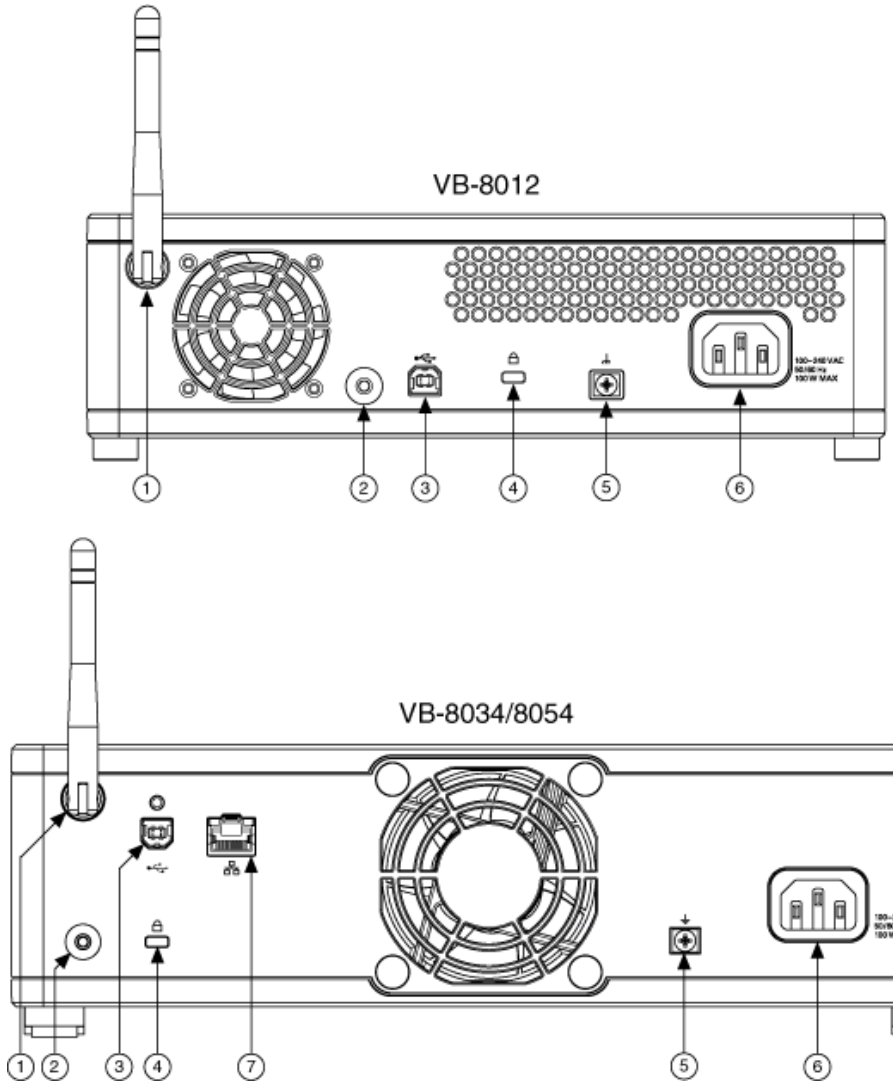
AC Current 500 mArms to 5 Arms		500 mArms, 5 Arms
2-Wire Resistance		100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ, 10 MΩ, 100 MΩ
Voltage Across a Diode		2 V

Note If the Digital Multimeter (DMM) always reads about 0.00 A or 0.00 mA when measuring current, the cause may be a blown fuse.

Related information

How Do I Test a Fuse? How Do I Replace a Fuse?

Back Panel Features



1 Antenna	5 Chassis Ground Screw
2 Reset Button	6 Power Connector
3 USB Port	7 Ethernet Port and LEDs
4 Security Cable Slot	

Antenna

Refer to the ***NI VirtualBench Specifications*** for information about the antenna on VirtualBench.

Reset Button

Refer to the Reset Button topic for information about using this button.

USB Port

Refer to the ***NI VirtualBench Specifications*** for information about the USB port on VirtualBench.

(Optional) You can provide strain relief for the USB cable by using the jackscrew on a locking USB cable (NI part number 198506-01) to securely attach the cable to the chassis.

Ethernet Port and LEDs

Refer to the ***NI VirtualBench Specifications*** for information about the Ethernet port on some models of VirtualBench.

Refer to the Ethernet LEDs topic for information about the 10/100/1000 and LINK/ACT LEDs on the Ethernet connector.

Security Cable Slot

The security cable slot allows you to attach an optional laptop lock to your VirtualBench. The security cable slot might not be compatible with all laptop lock cables.

	**Note** The security cable is designed to act as a deterrent, but might not prevent the device from being mishandled or stolen. For more information, refer to the documentation that accompanied the security cable.

Chassis Ground Screw

The chassis ground screw provides an additional access point to chassis ground for measurement accuracy so that all instruments are at the same potential.

Power Connector

Refer to the ***Power Requirements*** section in the ***NI VirtualBench Specifications*** for information about the power connector on VirtualBench.

Reset Button

The reset button is located on the back panel. Press and hold the reset button for five seconds or longer to reboot the device into factory default mode.

VirtualBench Factory Default Mode Settings

Attribute	Value
Network name	VB80xx-<***serial number***>
IP	Given by DHCP
NI Auth	User name = admin, Password = leave blank

During a reboot, saved configurations are deleted and the VirtualBench instruments reset to their factory default state.

Ethernet LEDs

Ethernet LED Patterns

LED	Color	Pattern	Description
10/100/1000	Yellow	On	Connected at 1000 Mbps
	Green	On	Connected at 100 Mbps

	—	Off	No Ethernet connection or 10 Mbps connection
LINK/ACT	Green	On	Ethernet link
		Off	No Ethernet connection
		Blinking	Ethernet activity

Mixed Signal Oscilloscope (MSO)

What Are Measurement Indicators?

Measurement indicators visually show the point and/or regions used in deriving the numeric value shown in the Measurements panel below the graph.

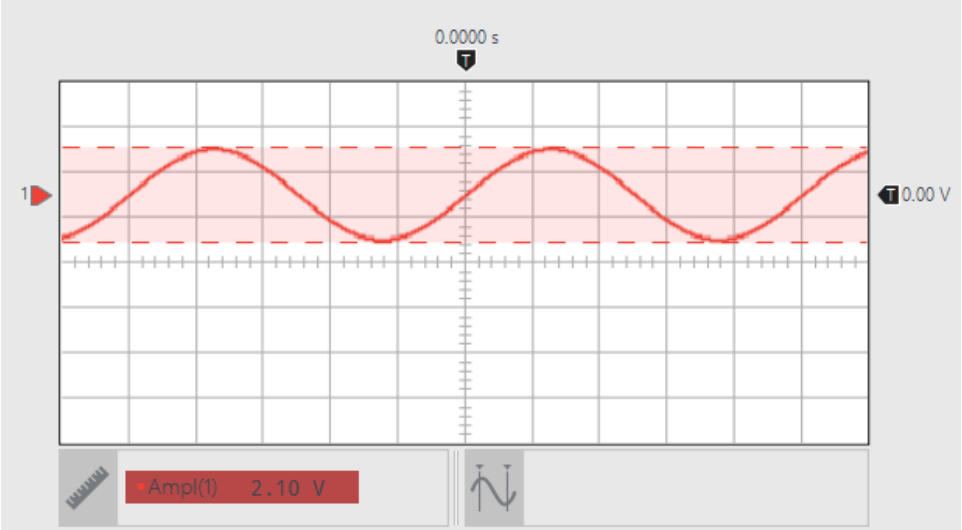
How Do I Show the Measurement Indicators?

To show the measurement indicators associated with a measurement, follow these

steps:

1. Select the desired measurement of an enabled channel by clicking on the measurement in the Measurement Settings window. The measurement is displayed in the Measurements panel.
2. Click the measurement in the Measurements panel to highlight the measurement.

The following image shows measurement indicators for a voltage amplitude measurement. The measurement is also highlighted in the Measurements panel below the graph.



What Does the Auto Setup on the Mixed Signal Oscilloscope Do?

When you perform auto setup, the mixed signal oscilloscope (MSO) senses the input signal and automatically chooses many of the instrument settings.

If a signal is detected on an analog channel, the software chooses the smallest available vertical range that is larger than the signal range, and an offset to center the waveform within that range. For example, if the signal is a 1.2 $V_{pk\text{-}pk}$ sine wave, the software will choose the 2 V vertical range for that channel. An analog channel is considered to have a signal present if the signal is at least 10% of the smallest vertical range available for that channel and vertical offset.

If a signal is detected on a digital channel, then the software enables that channel.

If a signal is detected on at least one analog channel, then the lowest-numbered analog channel with a signal will be used as the Analog Edge trigger, and the sample rate and acquisition time will be optimized for that channel.

If no signals are detected on analog channels but signals are detected on digital channels, then the digital channel with a signal with the fewest toggles will be used as a Digital Edge trigger, and the sample rate and acquisition time will be optimized for the digital channel with the most frequently toggling signal.

If no signal is detected on any analog or digital channels, all settings configured by Auto Setup are placed in the default configuration. If you are using LabVIEW, a warning is also returned.

Details

The following settings may be changed during an auto setup:

Analog Channels

- Channel Enabled: Changed by Auto Setup
- Vertical Coupling: Unchanged by Auto Setup
- Probe Attenuation: Unchanged by Auto Setup
- Vertical Offset: Changed by Auto Setup
- Vertical Range: Changed by Auto Setup

Digital Channels

- Channel Enabled: Changed by Auto Setup

Timing

- Sample Rate: Changed by Auto Setup
- Acquisition Time: Changed by Auto Setup
- Pretrigger Time: 50% of Acquisition Time
- Sampling Mode: Sample

Triggering

- Trigger Type: Analog Edge, Digital Edge, or Immediate (if no signal present)
  - Analog Edge (if Trigger Type is Analog Edge)
    - Trigger Source: Lowest numbered channel with signal present
    - Trigger Slope: Rising
    - Trigger Level: 50% of signal on trigger channel
  - Digital Edge (if Trigger Type is Digital Edge)
    - Trigger Source: Channel with fewest transitions greater than zero
    - Trigger Slope: Rising

Advanced Digital Timing

- Digital Sample Rate Control: Automatic
- Buffer Control: Automatic

Digital Threshold

- Threshold: Unchanged by Auto Setup

State Mode

- Enabled: False

What Sampling Modes Are Supported in VirtualBench?

The VirtualBench mixed signal oscilloscope (MSO) has three different sampling modes: sample, peak detect, and digital phosphor.

Sample Sampling Mode

In sample sampling mode, the MSO measures the signal at a fixed time interval, the sample rate.

Peak Detect Sampling Mode

In peak detect sampling mode, VirtualBench internally samples the instrument at its

maximum sample rate and saves the maximum and minimum value of the input signal within your configured sample interval. This may be useful to acquire for a longer time while being able to detect transients.

Digital Phosphor Sampling Mode

In digital phosphor sampling mode, the MSO measures the signal at a fixed time interval, as in the Sample Sampling Mode. However, instead of displaying a single record, the MSO aggregates many records into a single image to display all at once. This aggregation makes it easy to see trends and outliers in the signal.

You can adjust the intensity to focus on trends or outliers in the data.

Does VirtualBench Support Interleaving?

The VB-8034/8054 does not support interleaving.

The VB-8012 supports interleaving on both MSO analog channels. While both channels have an analog-to-digital converter that can operate at 500 MS/s, when a single channel is used, the two converters can be interleaved to sample at 1 GS/s.

Does VirtualBench Support Interpolation?

VirtualBench supports interpolation. This interpolation is performed automatically when the visible time/div is too small for acquisitions performed at the maximum sample rate. For example, when the sample rate is 1 GHz (1 sample per 1 nanosecond) and the time/div is 5 ns, only 5 samples are visible for every division, so interpolation is performed.

How Do I Use the Logic Analyzer?

The logic analyzer can be used to view and analyze digital signals. The Mixed Signal Oscilloscope menu, to the right of the graph, has panels that you can use to configure the logic analyzer:

- Digital
- Trigger

How Do I Configure Digital Lines?

1. Hover over the Digital panel and click , which opens the digital menu.
2. Enable a digital line source to view it on the graph and disable it to hide it.

How Can I Hide All the Digital Lines and Buses at Once?

Toggle the square button on the Digital panel to enable/disable all the enabled digital lines and buses at once.

How Do I Configure Buses?

1. Hover over the Digital panel and click , which opens the digital menu.
2. Click the Buses tab. You can add three types of buses: Parallel, I2C, and SPI.

How Do I Trigger Off the Logic Analyzer Lines?

You can select an Edge or Pattern trigger to trigger off the logic analyzer lines.

1. Hover over the Triggers panel and click , which opens the Trigger menu.
2. Select the Trigger type.
3. If you select a **Pattern** trigger, select group of digital lines in order to set a triggering pattern on the lines in that group. For each digital line in the group, select one of the following trigger states:
   - X (Ignore)
   - 0 (Low)
   - 1 (High)
   - R (Rising)
   - F (Falling)
   - E (Either)

Related information

What is a Pattern Trigger?

How Do I Use XY Time Mode?

The XY time mode can be used to plot the voltage of one channel against the voltage of another channel. Complete the following steps to configure XY time mode.

1. Click the ☰ icon in the upper right corner of the MSO.
2. Select **Time Mode** > **XY**.
3. In the XY settings panel to the right of the graph, select two channels to use as XY sources.
4. Configure the **Volts/Div** settings of the XY sources using your scroll wheel on the graph or the **Volts/Div** controls on the channel configuration panes.
   - Panning vertically on the graph changes the Y axis source's vertical offset.
   - Panning horizontally on the graph changes the X axis source's vertical offset.
5. Use the **Time/Div** control above the graph to adjust the acquisition window size.

How Do I Use XY Time Mode to Measure the Phase Offset of Two Analog Channels?

1. Turn on and configure XY time mode to use one of the two input channels as its X source and the other as its Y source.
2. Confirm that the XY plot that appears on the graph is in the shape of an ellipse.
3. Click on the Cursor Settings icon below the graph and select **Manual** cursors.

4. Use the cursors to measure and record the total width of the XY plot as A.
5. Use the cursors to measure and record the distance between the XY plot's two X intercepts as C.

If the top of the plotted ellipse is in the first quadrant, then the phase difference is:

$$\pm\sin^{-1}(C/A)$$

If instead the top of the plotted ellipse is in the second quadrant, then the phase difference is:

$$\pm[180^\circ - \sin^{-1}(C/A)]$$

How Do I Verify That the Mixed Signal Oscilloscope Probe is

Compensated Properly?

1. If you are using a switchable 1x/10x scope probe, set the oscilloscope probe slide switch to 10x.
2. Connect the oscilloscope probe to the compensation tabs noting which tab is signal and which is GND.
3. In the VirtualBench application, set the probe attenuation to 10x and look at the Mixed Signal Oscilloscope waveform. You should see a square wave. Use Auto Setup if necessary.
4. Using the adjustment tool (included in the VirtualBench oscilloscope probe kit), adjust the compensation screw that is in the housing of the oscilloscope probe until you see a perfectly square waveform without overshoot or undershoot.

Adjustment Tool

Your probe is now properly compensated.

What Are the Mixed Signal Oscilloscope Triggering Options on VirtualBench?

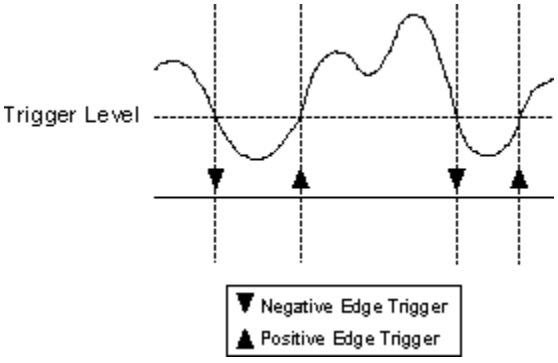
You can use several types of triggering with the mixed signal oscilloscope, including glitch, edge, and pattern. Depending on the trigger type, the trigger source could be any of the following signals:

- 34 logic analyzer inputs
- Eight digital I/O lines
- External trigger through the TRIG BNC
- 60 Hz/50 Hz AC line
- FGEN Start

Refer to the following topics for more information.

What is Analog Edge Triggering?

VirtualBench can generate a trigger on an analog signal. You must specify a source and an edge. An analog edge trigger occurs when a signal crosses a trigger threshold that you specify. You can specify the slope as either positive (on the rising edge) or negative (on the falling edge) to the trigger. Analog edge triggering is possible on all of the scope's analog input channels. The following figure shows edge triggering.

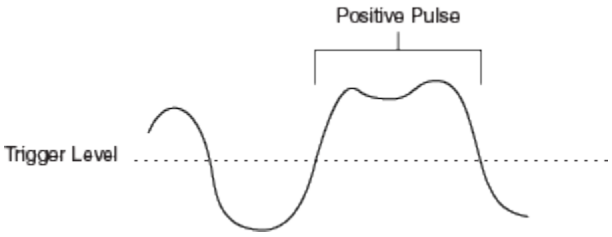


What Is Analog Pulse Width Triggering?

A positive analog pulse is when a signal crosses over a threshold that you specify, and

then back under that threshold. A negative analog pulse is when a signal crosses under a threshold that you specify, and then back over that threshold. An analog pulse width trigger occurs when the oscilloscope detects an analog pulse that fits the parameters that you specify.

- You can search for pulses shorter than a certain time.
- You can search for pulses longer than a given time.
- You can search for pulses within a given range of time.
- You can search for pulses outside a given range of time.

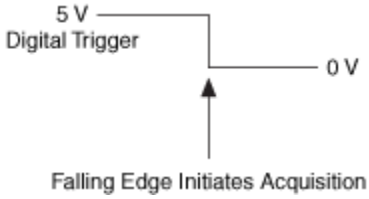


Pulse width triggering is supported in firmware version 15.2 or greater.

What Is Digital Edge Triggering?

VirtualBench can generate a trigger on a digital signal. You must specify a source and an edge.

A digital trigger is usually a TTL signal with two discrete levels: a high and a low level. When the signal moves from high to low or from low to high, a digital edge is created. A rising edge is a transition from a low logic level to a high logic level. A falling edge is a high-to-low transition. The following figure shows a falling-edge trigger.



The digital edge trigger source for the oscilloscope can be any of the following signals:

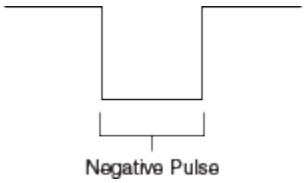
- 34 logic analyzer inputs

- Eight digital I/O lines
- External trigger through the TRIG BNC
- 60 Hz/50 Hz AC line
- FGEN Start

What Is Digital Pulse Width Triggering?

A positive digital pulse is measured from a rising edge to a falling edge on a signal. A negative digital pulse is measured from a falling edge to a rising edge on a signal. A digital pulse width trigger occurs when the oscilloscope detects a digital pulse that fits the parameters you specify.

- You can search for pulses shorter than a certain time.
- You can search for pulses longer than a given time.
- You can search for pulses within a given range of time.
- You can search for pulses outside a given range of time.



Pulse width triggering is supported in firmware version 15.2 or greater.

What Is a Pattern Trigger?

A pattern trigger acts like a combination lock. When you enter the correct combination, the lock opens. In the case of triggers, when the device matches the desired pattern, the pattern trigger is asserted. A pattern trigger allows you to configure the device to monitor the logic analyzer inputs for a specific pattern. When the device acquires this pattern, the device asserts the pattern trigger.

The pattern trigger source for the oscilloscope can be any of the following signals:

- 34 logic analyzer inputs
- Eight digital I/O lines
- External trigger through the TRIG BNC
- 60 Hz/50 Hz AC line
- FGEN Start

The digital pattern is specified using the following characters:

- X: ignore the channel
- 0: Match on a logic low level on the channel
- 1: Match on a logic high level on the channel
- R: Match on rising edge on the channel
- E: Match on either rising or falling edge on the channel
- F: Match on falling edge on the channel

To meet the trigger condition, the combination of specified trigger conditions must be met as follows:

- The level trigger conditions specified in a pattern (0 and 1) are logically ANDed together.
- The edge trigger conditions specified in a pattern (R, E, and F) are logically ORed together.
- The result of both of those operations are then logically ANDed together.

Example

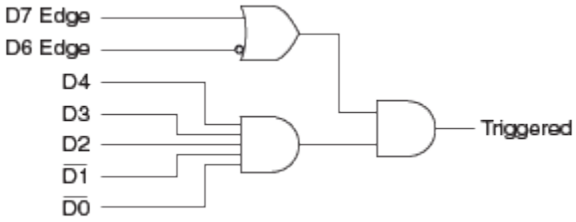
For example, if you specify a pattern of "RFX11100" for D7-D0, that pattern specifies these conditions:

Channel	Pattern Character	Description
D7	R	Match on rising edge on the channel
D6	F	Match on falling edge on the channel
D5	X	Ignore the channel
D4	1	Match on a logic high level on the channel
D3	1	Match on a logic high level on the channel

Channel	Pattern Character	Description
D2	1	Match on a logic high level on the channel
D1	0	Match on a logic low level on the channel
D0	0	Match on a logic low level on the channel

A pattern match occurs when channels D4, D3, D2 are logic high, AND lines D1, D0 are logic low, while D7 has a rising edge, OR D6 has a falling edge. D5 is ignored.

The Boolean logic is shown in the following illustration.

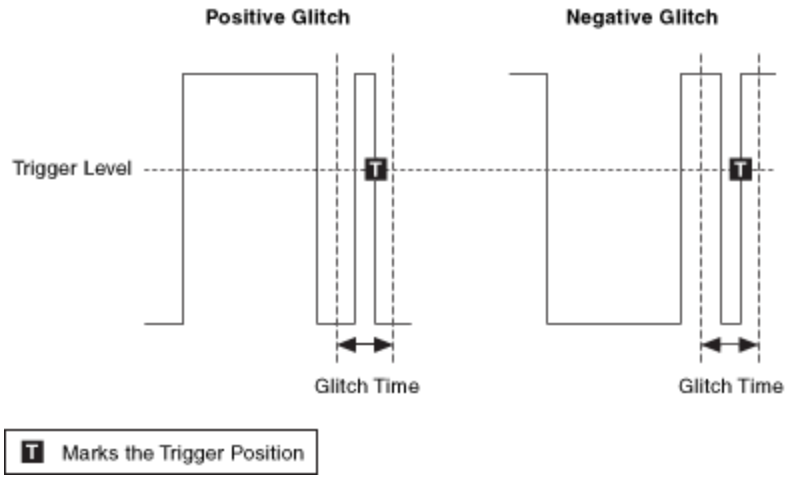


What Is a Glitch Trigger?

Glitch triggering is only available in the LabVIEW or C API. A glitch is a signal that has the same state at two different sample clock edges but transitioned in between. This is only possible to detect if your sample clock rate is less than 1 GHz. If your digital sample rate is 1 GHz, then a glitch trigger condition will never be met.

Since the signal maintains state during the sample period, a glitch is not visible in the data.

The following figure shows both positive and negative glitches.



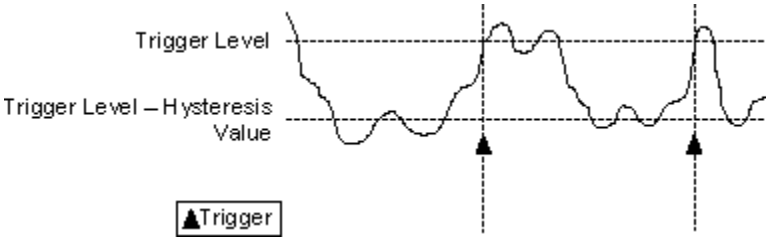
What Is Hysteresis?

Hysteresis eliminates incorrect triggers caused by noisy signals. For example, if your signal contains two rising edges of different amplitudes, you can use hysteresis to trigger on one of the edges. Although VirtualBench uses a default amount of hysteresis for edge triggering, which is typically 1.4% of the vertical range, you can increase that value for noisy signals.

In the Trigger configuration section, click to view or change the trigger level and hysteresis value.

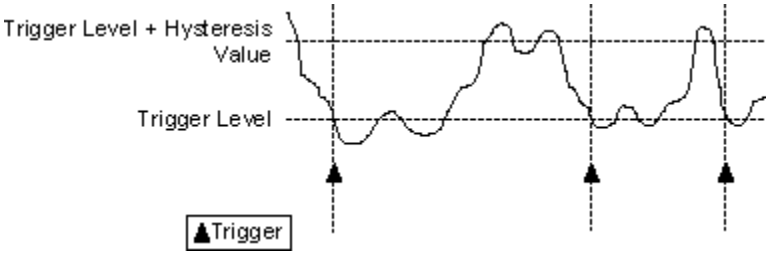
Hysteresis triggering is possible on both analog channels.

A rising edge trigger is generated when the signal crosses below the voltage specified by the trigger level setting minus the hysteresis value, and then crosses the trigger level.



A falling edge trigger is generated when a signal crosses above the voltage specified by

the trigger level setting plus the hysteresis value, and then crosses the trigger level.



What Is an Immediate Trigger?

The mixed signal oscilloscope triggers as soon as it has enough data to complete the acquisition without waiting on any other condition. Immediate triggering is only available in LabVIEW.

What Is the Trigger (TRIG) BNC Used For?

The trigger BNC can be used to bring triggers into VirtualBench for use with the mixed signal oscilloscope or to export a trigger from VirtualBench, such as a function generator (FGEN) start signal. When importing a trigger, the mixed signal oscilloscope (MSO) can display the signal present on the TRIG BNC as a digital channel as well as use it as a trigger for the acquisition. When exporting a trigger, these options are available:

- A pulse is sent every time the FGEN begins a new period of the signal being generated.
- A pulse is sent every time the MSO triggers.
- A pulse is sent at the frequency of the 60 Hz/50 Hz AC line.

What If the Data on My Graph or My MSO Measurement Is Not What I Expect?

The DC Offset Is Not What I Expect

My Signal Amplitude Is Not What I Expect

There Is a Lot of Noise in My Measurement

The Frequency of My Signal Is Not What I Expect

My Square Wave Edges Show Ringing, Overshoot, or Undershoot

My Digital and Analog Data Begin or End at Different Times

The DC Offset Is Not What I Expect

If you are using a switchable 1x/10x scope probe, make sure it is on the proper setting. Also, make sure that the channel is configured for that setting. Note that the scope input impedance for the VB-8012 is 1 MΩ. On the VB-8034/8054, you can use the VirtualBench application to set the input impedance to either 50 Ω or 1 MΩ. If you are measuring signals with very high output impedance, there may be a voltage drop across that source impedance causing a voltage error. Make sure that the scope is not in AC coupled mode. It should be DC coupled when the DC component is important.

My Signal Amplitude Is Not What I Expect

Oscilloscope Vertical Range

Make sure that the vertical range is appropriate for the signal being acquired. Use Auto Setup to select the proper range to display your signal, or use Vertical Setting to manually select the appropriate vertical range.

Oscilloscope Bandwidth

The oscilloscope that you are measuring with may not have the bandwidth to perform the measurement. Refer to the ***NI VirtualBench Specifications*** for the bandwidth specification for your VirtualBench. A signal at the specified bandwidth will have its amplitude reduced by 3 dB or 70.7% of the amplitude of much lower frequency signals.

Bandwidth Limit

You can configure VirtualBench to attenuate signals above either the specified bandwidth or the 20 MHz filter setting by setting the Bandwidth Limit. If the bandwidth limit is incorrectly configured for your signal, it may result in unexpected amplitudes. Refer to the ***NI VirtualBench Specifications*** for the bandwidth specification for your VirtualBench.

Probe Compensation

Make sure that the oscilloscope probe is compensated using the compensation tabs. Uncompensated probes will have an AC gain mismatch causing incorrect amplitudes.

Probe Specifications

Using a oscilloscope probe in 1x mode will have reduced bandwidth, which makes the signal amplitude look smaller at higher frequencies.

Note The VB-8012 ships with 1x/10x switchable oscilloscope probes. The VB-8034/8054 ships with 10x oscilloscope probes.

Oscilloscope Flatness

The oscilloscope that you are measuring with may not have adequate flatness over frequency to perform the measurement. Note that some small amplitude variations are acceptable over frequency.

There Is a Lot of Noise in My Measurement

For the lowest-noise measurements, use the slide-on spring clip to make a ground connection instead of the snap-on alligator clip. Ground your probe as close to the signal as possible. If you are using noisy power supplies in your circuit try to filter them.

The Frequency of My Signal Is Not What I Expect

Check the Timebase

The signal may be aliased to a lower frequency due to undersampling and decimation when a large timebase is displayed. Decrease the time per division to correct this by zooming in or using the Horizontal Setting. You can also use the Auto Setup function.

Check Bandwidth Filter Setting

By default, the mixed signal oscilloscope (MSO) displays frequencies up to the maximum bandwidth limit of the device. Refer to the ***NI VirtualBench Specifications*** for the bandwidth specification for your VirtualBench. Signals with frequencies much lower than the maximum limit may show unwanted high-frequency noise. Set the Bandwidth Limit to attenuate the noise.

My Square Wave Edges Show Ringing, Overshoot, or Undershoot

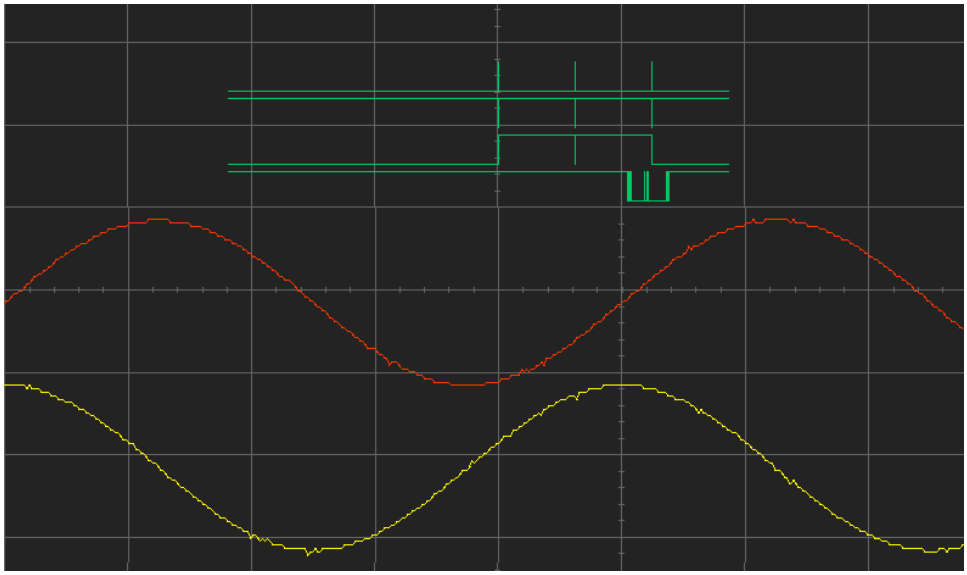
Make sure the mixed signal oscilloscope (MSO) probe is compensated. Connect the probe to the compensation tabs. Adjust the variable capacitor on the scope probe with the plastic adjustment tool (included with the scope probe) until the square wave edges are clean with no overshoot or undershoot.

The higher the frequency measured the more important it is to make a good ground connection. The scope probes come with two grounding options, the snap-on alligator clip or the slide-on spring clip. The spring clip creates a very small ground loop and is ideal for high frequency measurements (such as square waves with fast edges).

Related information

How Do I Verify That the Mixed Signal Oscilloscope Probe is Compensated Properly?

My Digital and Analog Data Begin or End at Different Times



Analog and digital data are captured differently by the VirtualBench mixed signal oscilloscope (MSO). Analog data is stored at a regular interval determined by the time/div setting on your MSO. Digital data is only stored when the data signals being acquired change values, so depending on the activity of the signals you are measuring, the total amount of time stored will vary and may be longer or shorter than the time stored for the analog data.

To get more digital data:

- Turn off any unconnected or unused logic analyzer channels. Noise on these channels can cause extra data to be stored and fill the available buffer faster.
- Remove very high frequency signals from the logic analyzer channels being acquired. High-frequency signals, such as clocks, fill the available buffer faster.
- Ensure that the **Maximum Digital Buffer Size** setting is set to a high enough value. The highest setting is 1 Million Transitions. The setting is located on the **Acquisition** submenu of the **Digital** channel configuration menu.

Why Can't I Sample at 1 GS/s with Two Channels (VB-8012)?

The VB-8012 has two 500 MS/s ADCs. To achieve a sample rate of 1 GS/s, both 500 MS/s ADCs are used. They sample at the maximum sampling rate, but are offset by a half clock period. The data is then interleaved to produce a waveform with a 1 GS/s sample rate for a single channel.

What Is a Reference Channel?

A reference channel is a snapshot of the state of an analog channel. A reference channel acts just like other analog channels but its data does not change after the snapshot is taken. Measurements, cursors, etc. can be used on reference channels.

Related information

Which Channels Can I Use as Data Sources for Reference Channels?

How Do I Save Reference Channels?

Which Channels Can I Use as Data Sources for Reference Channels?

You can use enabled analog channels and enabled math channels (excluding FFT) as data sources for reference channels. You cannot use digital channels, FFT channels, disabled channels, and other reference channels as data sources for reference channels.

How Do I Save Reference Channels?

To capture a reference channel, open the More Channels dialog, select the reference channel to use in the list on the left, select the source channel from the drop down on the right, and then click the **Capture** button.

Captured reference channels are saved automatically and load automatically the next time you launch the VirtualBench application on the same computer. However, reference channels are device specific, so that, for example, reference channels taken while using a VB-8012 will not load if you then connect to a VB-8034/8054. Reference channels can also be manually saved to or loaded from files using the More Channels dialog.

Function Generator (FGEN)

Why Is My DC Output Voltage Not What I Expect?

The output impedance for the FGEN is 50 Ω. The load impedance that you put on the output will cause a voltage divider with the 50 Ω output impedance and reduce the voltage compared to what you program. For example, if you have a 50 Ω load, you will see half the amplitude. If you have a 100 Ω load, you will see 2/3 the amplitude. If you have a high impedance load, such as a DMM, you will see 100% of the programmed value. The output is designed to drive a load ≥50 Ω. A smaller load may cause an unexpected error.

How Do I Output an Arbitrary Waveform?

1. On the FGEN panel, click on the ARB button.
2. Use the Browse button under Waveform Data File to open a data file.
3. Select an Output.
4. Adjust Gain and DC Offset if needed.

The following types of Waveform Data files are supported:

- Text (.txt) with one value per line. Values are in volts. Units are omitted. This type of file produces only one waveform. (sample.txt)
- CSV files (.csv) where each column has a value for each waveform. Values are in volts. Units are omitted. (sample.csv)
- CSV Pitch files (.csv) obtained from PhysioBank at physionet.org. (sample2.csv)

Why does the value of gain and offset change when I load a different data file or select a different output?

When you load a new data file, or select a different output, the gain and offset automatically reset to a gain of 1 and an offset of 0.

If the waveform has values outside the range ±12 V, the VirtualBench keeps offset at zero and uses the maximum gain possible to keep the output inside the range.

Why do gain and offset ranges vary from one data file to another?

The maximum output range supported by the device is ±12 V. In order to keep the output in range, VirtualBench considers the maximum and minimum values of the waveform loaded from the file. When deciding the range values for gain, VirtualBench considers the current value of the offset, and when deciding the range values for offset, VirtualBench considers the current value of the gain. A change in one affects the range of the other.

How Does VB-8054 Self-Calibration Work?

The VB-8054 FGEN supports self-calibration. This operation measures the output offset error and compensates for it for all functions. Calibration is useful if the offset error has drifted over time or if the unit is subject to an ambient temperature significantly different than the temperature previously used for calibration.

1. In the upper right corner of the FGEN panel of the application, click the ☰ icon and select **Self-Calibrate**.
2. Disconnect all loads from the function generator and click **Begin Self-Calibration**.

This operation should take less then 10 seconds. When the operation completes, your FGEN has calibrated its offset error.

Related Information

Calibration

How Can I Verify My FGEN Outputs?

Verifying DC Outputs

Use the digital multimeter (DMM) to verify DC outputs. A DMM has a high impedance input so the DC value measured should be 100% of the programmed value.

1. Attach the red probe to the DMM HI connector.
2. Attach the black probe to the DMM LO connector.
3. Launch the VirtualBench application.
4. Output a DC voltage from the FGEN in DC mode and turn the output on.
5. Configure the DMM for DC volts, auto range.
6. Simultaneously, touch the tip of the red probe to the center pin of the FGEN BNC connector and the tip of the black probe to the shield of the FGEN BNC.
7. The DMM should read the programmed voltage.

Verifying AC Outputs

Use the mixed signal oscilloscope (MSO) to verify AC outputs (sine, square, triangle waves). Make sure that the MSO has adequate bandwidth, otherwise you will see the amplitude decrease with frequency. Make sure that the oscilloscope probe is compensated properly.

1. Launch the VirtualBench application.
2. Plug the oscilloscope probe into an oscilloscope channel.
3. If you are using a switchable 1x/10x scope probe, move the slide switch on the probe to 10x.

Note Using the oscilloscope probe in 1x mode will have reduced bandwidth, which makes the signal amplitude look smaller at higher frequencies.

4. Ensure the probe attenuation setting for your channel is set to 10x
5. Connect the oscilloscope probe ground clip to the shield of the FGEN BNC connector.
6. Touch the tip of the oscilloscope probe to the center pin of the FGEN BNC.
7. Zoom in/out of the timebase and range to see the full signal on the oscilloscope channel you are verifying.

Tip You can also use the Auto Setup button.

8. Make sure the signal amplitude and frequency are what you expect.

Related information

How Do I Verify That the Mixed Signal Oscilloscope Probe is Compensated Properly?

Why Do My Square Wave Edges Show Ringing, Overshoot, or Undershoot?

You probably have an impedance mismatch. Make sure the system has matched impedances, 50 Ω impedance cables, and a 50 Ω load. Capacitive or inductive loads can cause undesirable square wave ringing, undershoot, or overshoot.

Why Are My Square Wave Edges Too Slow?

Refer to the rise/fall time specification in the ***NI VirtualBench Specifications*** for the expected rate. Edges will be slowed if driving a capacitive load. The 50 Ω output impedance along with the capacitive load causes a lowpass filter that can slow your edges.

Why Doesn't the FGEN Start Immediately Generate a Signal When the Output Is First Started?

The function generator start trigger fires at the end of each periodic buffer output. The FGEN must cycle through one period of a standard waveform before it will assert for the first time.

Digital I/O (DIO)

Can the Digital I/O lines Be Used for Static DIO?

Each of the VirtualBench digital lines can be used as a static DI or DO line. You can use static DIO lines to monitor or control digital signals. All samples of static DI lines and updates of DO lines are software-timed.

What Are the Power-On States for the Digital I/O Lines?

At system startup and reset, the hardware sets all DIO lines to high-impedance inputs. The device does not drive the signal high or low. All eight DIO lines have 10 kΩ pull-down resistors connected to them.

What Can I Do with the Digital I/O?

General-purpose I/O (GPIO)—You can individually configure each line as an input or output. Each of these lines has a 10 kΩ pull-down resistor when used for GPIO. Outputs can be driven high to 3.3 V or low to ground.

Exported signal output—Each line can export the MSO Trigger or FGEN Start signal. When importing a trigger, the mixed signal oscilloscope (MSO) can display the signal present on the digital I/O connector as a digital channel as well as use it as a trigger for the acquisition. When exporting a trigger, these options are available:

- A pulse is sent every time the function generator (FGEN) begins a new period of the

signal being generated.
- A pulse is sent every time the MSO triggers.
- A pulse is sent at the frequency of the 60 Hz/50 Hz AC line.

SPI bus mastering—You can use VirtualBench's digital I/O to interface to serial peripherals. When you configure a SPI bus, a set of lines are reserved for the bus and each line's direction is automatically configured.

spi/0 bus
dig/0: Clock output
dig/1: MOSI (Master Out Slave In)
dig/2: MISO (Master In Slave Out)
dig/3: CS (Chip Select) output

I2C bus mastering—You can use VirtualBench to master an I2C (Inter-Integrated Circuit) bus. When you configure an I2C bus, a set of lines are reserved for the bus and each line's direction is automatically configured. By default, all the GPIO lines have a 10 kΩ pull-down resistor connected. When used in I2C mode, they can be configured to have a pull-up instead. On the VB-8012, this pull-up has a value of 10 kΩ. On the VB-8034/8054, it is a value of 1.5 kΩ.

i2c/0 bus
dig/6: SCL (Serial Clock) output
dig/7: SDA (Serial Data) input/output

Related information

What Is a Pattern Trigger?
What Is Digital Edge Triggering?

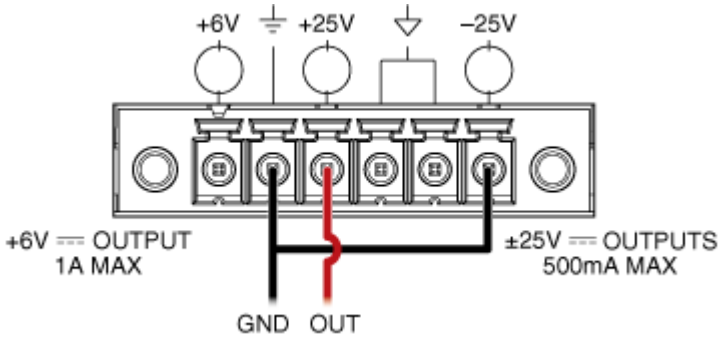
DC Power Supply

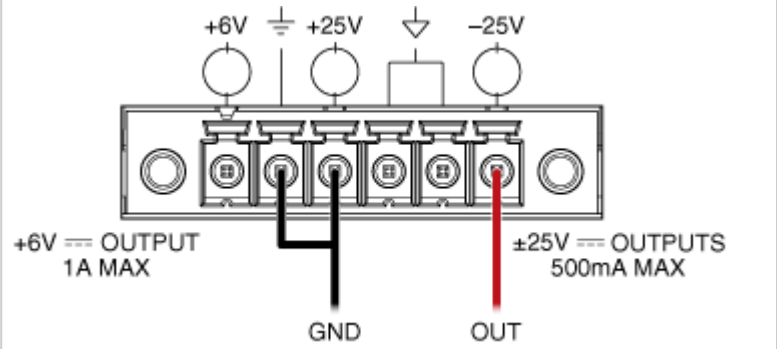
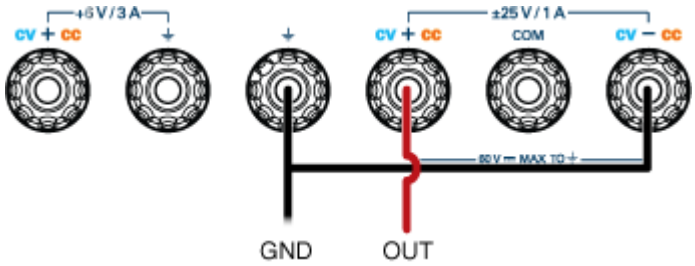
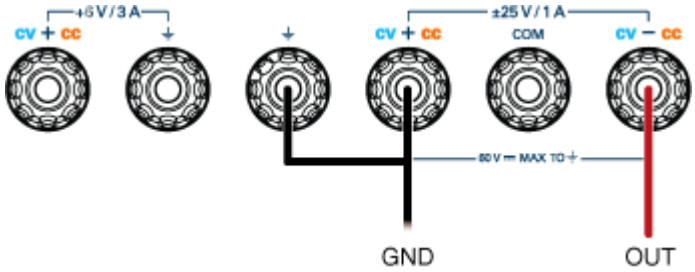
How Do I Combine Multiple Outputs of the DC Power Supply?

⚠	**Caution** Do not exceed 60 VDC from any terminal to ground when cascading power supplies.

You can cascade multiple channels in series to generate greater voltage because the +25 V and - 25 V channels on the DC power supply are isolated from ground. For safety reasons, all terminals must be <60 VDC from ground. Any terminal on the isolated channels can be connected to ground. When you cascade channels in series, the DC power supply can generate up to 50 V, as shown in the following table.

⚠	**Caution** The NI VirtualBench DC power supply does not provide isolation when using the +6V channel.

Cascading Multiple Channels in Series	Diagram
VB-8012: Up to +50 V, +500 mA	

VB-8012: Up to -50 V, -500 mA	
VB-8034/8054: Up to +50 V, +1 A	
VB-8034/8054: Up to -50 V, -1 A	

What If My DC Power Supply Is Not Reading Back the Correct Voltage or Current?

The VirtualBench DC power supply is a system of setpoint DACs and readback ADCs. Each setpoint and readback channel will have calibration accuracy and load regulation, as specified in the DC Accuracy table in the ***NI VirtualBench Specifications***. Under normal operation, the readback channels will differ from the setpoints within the accuracy window.

The DC power supply output stage is fault protected, described in the output channel protection specification in the ***NI VirtualBench Specifications***. In the event an output exceeds the maximum channel ratings or the temperature exceeds the environmental specifications, described in the ***NI VirtualBench Specifications***, the thermal protection circuitry will trip and limit available output power. Remove the load from the output channels and allow the device to cool sufficiently. Once cool, test

the channel in question as described below.

Validating an Output Channel

For the following procedure ensure no external load is connected to the DC power supply. Connect the Common Floating Ground terminal to the GND terminal. Refer to VB-8012 DC Power Supply Connections and LEDs or VB-8034/8054 DC Power Supply Connections and LEDs for the DC power supply connections on your VirtualBench. Open the VirtualBench application.

Validating Constant Voltage Mode:

1. Connect the VirtualBench Digital Multimeter (DMM) HI (red, Volts) to the output channel to test and LO (black) to ground.
2. Set the DMM to DCV, Auto Range or 100 V.
3. Set the DC power supply test channel to its maximum available output current.
4. Set the DC power supply test channel to a voltage to test.
5. Enable the DC power supply.

The DMM Volts and DC power supp voltage setpoint and voltage readback channels should agree within DC accuracy specifications, listed in the DC Accuracy table in the ***NI VirtualBench Specifications***. The current readback should be near zero within DC accuracy specifications. The DC power supply mode indicator should read CV.

Validating Constant Current Mode:

1. Connect the VirtualBench DMM A (red, Amps) to the output channel to test and LO (black) to ground.
2. Set the DMM to DCA, Auto Range or 10 A.
3. Set the DC power supply test channel to its maximum available output voltage.
4. Set the DC power supply test channel to a current to test.
5. Enable the DC power supply.

The DMM Amps and DC power supply current setpoint and current readback channels should agree within DC accuracy specifications, listed in the DC Accuracy table in the ***NI VirtualBench Specifications***. Voltage readback should be the burden voltage of the DMM 10 A range at the test current applied. The DC power supply mode indicator should read CC.

What Do CV and CC Indicate in the VirtualBench Application?

The CV and CC indicators on the DC Power Supply instrument display the mode of the output channels.

- CV indicates the power supply is operating in Constant Voltage mode. The supply operates in Constant Voltage mode if the load does not require more current than the channel current limit.
- CC indicates the power supply is operating in Constant Current mode. The supply operates in Constant Current mode if the load attempts to draw more current than the channel current limit.

The VirtualBench device has LEDs that indicate the mode of the three channels. The color of the LED matches the color of the CV and CC indicators in the application, blue and orange respectively.

Related Information

VB-8012 DC Power Supply Connections and LEDs

VB-8034/8054 DC Power Supply Connections and LEDs

Digital Multimeter (DMM)

How Does Null Offset Work?

Null Offset stores the current reading of the DMM and subtracts it from any future readings. The stored offset shows on the display. When enabled, the Null Offset value updates if the device, function, or range changes.

Why Does My Digital Multimeter Measurement Always Read 0 A Current?

If the Digital Multimeter (DMM) always reads about 0.00 A or 0.00 mA when measuring current, the cause may be a blown fuse.

Related information

How Do I Test a Fuse? How Do I Replace a Fuse?

General Information

Why Is the Fan Loud?

Why Is the Power LED Blinking?

Why Is There a Flag on the VirtualBench Application?

What Are the Different Ways to Run the VirtualBench Application?

VirtualBench is preloaded with VirtualBench application. You can run the software from the device, or you can install the software on your computer and run it from your **Start** menu.

Running the VirtualBench Application from the VirtualBench Hardware

VirtualBench uses Windows AutoPlay to launch the software automatically when VirtualBench is connected to a computer using a USB cable. If the software does not launch automatically, refer to Why Doesn't the VirtualBench Application Start Automatically?.

If you prefer to manually start the software, refer to Manually Start the VirtualBench Application.

Running the VirtualBench Application from Your Computer

Running the software from your computer can improve performance and allows you set up a wireless connection from your computer to the VirtualBench hardware. Refer to How Do I Install the VirtualBench Application?.

Once the software is installed, you can launch it from the Windows **Start** menu or (Windows 8.1/8) **NI Launcher**. To launch the software from the **Start** menu (Windows 7/Vista/XP), select **All Programs**»**National Instruments**»**NI VirtualBench**, or (Windows 10), select **All apps**»**NI VirtualBench**.

How Can I Monitor Instruments In Use by the API?

You can use the VirtualBench application to monitor instruments that are being controlled by the LabVIEW or C API. When you are actively controlling an instrument from the API, the corresponding instrument in the VirtualBench application enters monitor mode. While in monitor mode, the VirtualBench application continues to monitor the instrument as programmed by the API and receives both settings and data updates. The VirtualBench application cannot configure an instrument while it is controlled by the API. When the instrument is released by closing the API session, you can control it through the VirtualBench application. Monitor mode is supported in firmware version 1.2 or greater.

Note Instruments in monitor mode display in the VirtualBench application with the  icon in the instrument heading.

How Can I Save, Share, and Import VirtualBench Configurations?

You can save instrument configuration to a file that you can save for later use or share with colleagues or to the device for later reference.

1. Select **File»Export Configuration**.
2. Select **To Device** to save it to VirtualBench storage or **To Computer** to save it to your PC.

Use **File»Import Configuration** to reconfigure VirtualBench to previously saved configurations.

Note You can save up to 10 configuration files on VirtualBench storage.

How Can I Troubleshoot Wireless Network Problems?

If you are having trouble connecting to the VirtualBench device, try the following tips:

- Disable your computer's firewall to make sure the firewall is not blocking the connection, or configure your firewall to allow the following ports to be used:
  - 5353 UDP for device discovery.
  - 9090 TCP for instrument control.
- Disable any Virtual Machine network adapters such as VMWare. These adapters can route traffic incorrectly and cause the VirtualBench to not be discovered or used.
- Verify that the antenna is connected.

Related information

Connecting to VirtualBench Using an Existing Wireless Network Why Doesn't the VirtualBench Application Start Automatically? How Do I Install the NI VirtualBench Application on My computer? What Are the Different Ways to Run the NI VirtualBench Application? Reset Button Wireless LED

How Can I Troubleshoot Ethernet Network Problems?

If you are having trouble connecting to the VirtualBench hardware, try the following tips:

- Confirm that the Ethernet Connectivity LED on the front panel is lit, and the 10/100/1000 and LINK/ACT LEDs on the Ethernet connector on the back panel are lit.
- Ensure that the version of the VirtualBench application installed on your computer supports your VirtualBench. Refer to the What is the Earliest Supported Version of the VirtualBench Application for My VirtualBench? topic for the software version to install on your computer.
- VirtualBench can also be accessed through a web browser. Type the host name or IPv4 address of the VirtualBench in your web browser. The NI Network Browser, which can show you all the NI configurable hardware on your local subnet, can also be accessed by going to **Start»All Programs»National Instruments»NI Network Browser**. The device can be accessed through the web on a host PC that does not have any NI software installed.
- IPv4 configuration can be set to automatically assign via the DHCP server on the host PC. Manually/statically setting the IPv4 address for the host computer may potentially put the VirtualBench on a separate subnet and therefore make it undiscoverable. Microsoft's web site explains how to change the IPv4 configuration in Windows; search for information about changing TCP/IP settings for your

Windows version.

- If connecting VirtualBench directly to a host PC, make sure that the computer is either running a DHCP server or the network card is set to obtain an IP address automatically. VirtualBench always looks for a DHCP server first and if one is not available, it will default to a link local IP address. Link local IPv4 addresses are in the following range: `169.254.1.0` to `169.254.254.255` with the subnet mask `255.255.0.0`. Setting your computer to have a static IP address, `169.254.X.X`, with the subnet mask `255.255.0.0` will ensure that the device and your computer are on the same subnet.
- Connect the VirtualBench hardware to your computer using the USB cable. The VirtualBench application should start automatically. If it does not, refer to Why Doesn't the VirtualBench Application Start Automatically?. In the application, click the wireless icon and select **Ethernet**. View the network details by selecting **Automatic configuration** or change the network configuration by selecting **Manual configuration** and then enter configuration setttings. Click **Apply**. Close the VirtualBench application and open your computer's network settings and connect to the VirtualBench device. Then disconnect the USB cable and launch the VirtualBench application from your **Start** menu. Click **Search for Device**. The VirtualBench should be listed in the **Select a device** window.
- Disable your computer's firewall to make sure the firewall is not blocking the connection, or make sure your firewall settings allow for the network ports listed in the ***NI VirtualBench Specifications***.
- If using a proxy server, add the address of the VirtualBench to the list of exceptions. This setting can be found in Internet Options.
- Try disabling any antivirus software, it may be interfering with the discovery or configuration process.
- Disable any virtual machine network adapters such as VMware. These adapters can route traffic incorrectly and cause VirtualBench to not be discovered or used.
- If working through the previous tips do not result in finding your VirtualBench, reboot VirtualBench by pressing the reset button as described in the Reset Button topic.

Related information

Ethernet LEDs Reset Button What is the Earliest Supported Version of the VirtualBench Application for My VirtualBench?

How Do I Calibrate VirtualBench?

The VirtualBench analog inputs and outputs on the mixed signal oscilloscope (MSO), digital multimeter (DMM), DC power supply, and function generator (FGEN) have calibration circuitry to correct gain and offset errors. You can calibrate the device to minimize errors caused by time and temperature drift at run time.

Device calibration consists of verifying the measurement accuracy of a device and adjusting for any measurement error. Verification consists of measuring the performance of the device and comparing these measurements to the published specifications. During calibration, you supply and read voltage levels or other signals using external standards, then you adjust the device calibration constants. The new calibration constants are stored in the non-volatile onboard storage. These calibration constants are loaded from memory as needed to adjust for the error in the measurements taken by the device.

External calibration, which is typically performed by a metrology lab, requires using a high-precision voltage source to verify and adjust calibration constants. This procedure replaces all calibration constants in the non-volatile onboard storage and is equivalent to a factory calibration. Because the external calibration procedure changes all non-volatile stored constants, it invalidates the original calibration certificate. If an external calibration is done with a NIST-certified voltage source, a new NIST traceability certificate can be issued.

Calibrating VirtualBench requires installation on the calibration system of one of the following:

- NI-VirtualBench and NI LabVIEW—For a detailed calibration procedure, search for the ***NI VirtualBench Calibration Procedure*** at ni.com/calibration.
- Calibration Executive—The Calibration Executive integrated environment is used for verifying and adjusting NI measurement devices. No programming is required. Refer to the ***Calibration Executive Help*** at ni.com/manuals.

Related Information

How Does VB-8054 Self-Calibration Work?

How Do I Capture Data or Screenshots with VirtualBench?

You can capture data with VirtualBench in several ways.

Saving and Exporting a Snapshot as a PNG File

Complete the following steps to take a snapshot of your VirtualBench measurements.

1. Click the icon in the title bar.

	Tip You can also press Ctrl+Shift+S.

2. In the window that opens, select a file location for your PNG file and click **Save**. The snapshot is taken at this moment.

Saving a Screenshot to the Computer Clipboard

Complete the following steps to save a screenshot of the software to your computer clipboard.

1. Select **File»Copy.**
2. Paste the image to another application.

Saving and Exporting Data as a Spreadsheet

Complete the following steps to save a comma-separated values (CSV) file of datapoints of your VirtualBench measurement.

1. Click the icon in the title bar.

	Tip You can also press Ctrl+Shift+X.

2. In the window that opens, select a file location for your CSV file and click **Save**.

	Tip You can open CSV files in Microsoft Excel or Notepad.

Saving and Exporting With Hands-Free Smart Capture

When you enable Smart Capture, the application can automatically perform an action when it detects a stable, analog signal. You can configure Smart Capture to export a screenshot (png), export data (csv), or stop the MSO. Complete the following steps to enable Smart Capture.

1. Click the  icon in the title bar.
2. Configure the settings shown in the **Hands-Free Smart Capture** settings window.
3. Check **Enable Smart Capture**. Capturing begins immediately if the MSO has a stable signal.

How Do I Install the VirtualBench Application?

Installing the VirtualBench application on your computer can improve performance and allows you set up a wireless connection from your computer to the VirtualBench hardware.

You can download the VirtualBench application installer from ni.com/support. Follow the instruction in the installation wizard to install the software on your PC.

To learn about other ways to run the VirtualBench application, refer to What Are the Different Ways to Run the VirtualBench Application?.

How Do I Update the VirtualBench Firmware?

The VirtualBench application automatically checks for updates to the firmware at startup. A notification flag appears if a firmware update is available. Click the notification flag to open the firmware update dialog box. (If the update is critical, the dialog box opens automatically.) Follow the prompts in the dialog box to continue.

If you want to check if your firmware is up to date, select **Search for Firmware Update** from the **File** menu.

Related information

How Can I Password Protect VirtualBench Firmware Modifications?

How Can I Password-Protect VirtualBench Firmware Modifications?

In some environments, such as academia, it is beneficial to add a security measure to prevent firmware changes. You can password-protect your VirtualBench to prevent others from making firmware updates.

The VirtualBench application automatically checks for updates to the firmware at startup. The default username and password are stored in the application itself, so choosing to upgrade firmware automatically begins installing the update.

To change this behavior, you can change the default password in the web interface of the VirtualBench device.

1. Obtain the IP address of the VirtualBench by opening NI MAX on your computer and selecting your VirtualBench under **Devices and Interfaces**.
2. Click the **Settings** tab and view and copy the first IPv4 Address.
3. In a web browser, navigate to the IPv4 Address.
4. Log in with the default credentials of your VirtualBench: User name = admin, Password = leave blank.
5. Navigate to the security configuration screen and set a new password on the admin account. This will prevent firmware updates from being installed without a password.

Related information

Reset Button How Do I Update the VirtualBench Firmware?

How Do I Use LabVIEW with VirtualBench?

In addition to taking measurements with the VirtualBench application, you can also build custom software for your VirtualBench with LabVIEW and the NI VirtualBench application development software. LabVIEW uses graphical icons and wires that

resemble a flowchart, so you can graphically wire together function blocks to create your own applications for logging data, alarming, triggering, reporting, and performing real-time data analysis.

To use LabVIEW with the VirtualBench, complete the following steps.

1. Install LabVIEW from ni.com/support.
2. Install the NI VirtualBench application development software from ni.com/support.
3. To use LabVIEW over wireless or Ethernet, first configure the network connection using the VirtualBench application. Once the network is established, you can use LabVIEW with your VirtualBench over the network from then on.

Related information

Connecting to VirtualBench Using Wireless

Connecting to VirtualBench Using Ethernet

How Can I Monitor Instruments In Use by the API?

How Do I Use VirtualBench with My iPad

To use VirtualBench with your iPad, follow these steps:

1. Connect the power cable and antenna to the VirtualBench.
2. Install and open the VirtualBench app, available from the iTunes Store.
3. Follow the on-screen instructions.

What Cables and Accessories Can Be Used with VirtualBench?

Replacement Cables and Accessories

Cable/Accessory	Part Number	
	VB-8012	VB-8034/8054
Wireless Antenna	780704-01	
DMM Probes (set of 2)	783567-01	761000-01
MSO Logic Analyzer 40 Pin Input Cable	158292-01	154454-01
Oscilloscope Probes	783566-01 (150 MHz, set of 2)	784471-01 (500 MHz, set of 4)
USB Cable with Locking Screw, 2 m	780534-01	
VirtualBench Accessory Kit (contains instrument screw-terminal connectors and NI screwdriver)	783565-01	784470-01
VirtualBench Fuse Replacement Kit (contains two pairs)	784476-01*	784477-01*

*Not sold in Japan. See What Type of Fuses Does VirtualBench Use? for OEM alternatives.

Additional Cables and Accessories

Cable/Accessory	Part Number	
	VB-8012	VB-8034/8054
Desktop Mounting Kit	783569-01	—
Binding Post Adapter	783538-01	—
Soft Carrying Case	783537-01	784469-01
Accessory Pouch	783586-01	
Oscilloscope Probe, 200 MHz (1 probe)	780284-01	—
Set of 6 Logic Analyzer Grabbers	783539-01	
BNC Male to Micrograbber Cable, 31 cm	783812-01	
50 Ω BNC Cable, Male to Male, 2 m	159103-02	

Cable/Accessory	Part Number	
	VB-8012	VB-8034/8054
DMM Probe Set with Alligator Clips, Spade Connectors, and Spring Hooks	184698-01	
USB Cable with Locking Screw, 1 m	198506-01	
CAT-5E Ethernet Cable, 2/5/10 m lengths	—	151733-02/05/10

What Type of Fuses Does VirtualBench Use?

VirtualBench has two replaceable fuses that protect the device from overcurrent through the DMM current connectors. Two pairs of the fuses are included in the VirtualBench Fuse Replacement kit.

VirtualBench Replacement Fuses

Accessory	Part Number	
	VB-8012	VB-8034/8054
VirtualBench Fuse Replacement Kit (contains two pairs)	784476-01	784477-01

The VirtualBench Fuse Replacement Kit is not sold in Japan. The following table contains specifications for the fuses in the replacement kit. Fuses can also be ordered directly from the suppliers listed in the table.

VirtualBench	DMM Current Connector	Fuse
VB-8012	A	T 10A H 250V (5 x 20 mm) fuse (Bussmann part number S505H-10-R at www.cooperindustries.com)
	mA	T 1.25A H 250V (5 x 20 mm) fuse (Bussmann part number S505H-1.25-R at www.cooperindustries.com)
VB-8034/8054	A	F 11A 1000V (10.3 x 38 mm) fuse (SIBA part number 5019906.11 at www.siba-fuses.com)

	mA	T 1A H 400V (5 x 20 mm) fuse (Littelfuse part number 0477001.MXP at www.littelfuse.com)

Note If the Digital Multimeter (DMM) always reads about 0.00 A or 0.00 mA when measuring current, the cause may be a blown fuse.

Related information

How Do I Test the Fuse?How Do I Replace a Fuse?

How Do I Test the Fuse?

To test for a blown fuse, complete the following steps.

1. Using a DMM test probe, connect the HI (V) terminal and probe the DMM current (mA or A) connector on the hardware.
2. Launch the NI VirtualBench application.
3. In the Digital Multimeter (DMM) area, click the Ω icon to put the DMM in resistance mode.

If the fuse is blown, the display shows OVER Ω, OVER kΩ, or OVER MΩ, indicating a disconnected circuit path. Replace the fuse and complete the procedure again.

Related information

What Type of Fuses Does the VirtualBench Use? How Do I Replace a Fuse?

How Do I Replace a Fuse?

To replace a broken fuse, complete the following steps.

1. Power off and unplug the device.
2. Remove the USB cable, Ethernet cable, and all signal wires from the device.
3. On the underside of the device, remove the fuse housing cover with a #1 Phillips

head screwdriver.
4. Replace the broken fuse.
5. Replace the cover.

Related information

What Type of Fuses Does VirtualBench Use?

What Is the Earliest Supported Version of the VirtualBench Application for My VirtualBench?

VirtualBench	Earliest VirtualBench Application Version Support
VB-8012	VirtualBench 1.0
VB-8034	VirtualBench 15.1
VB-8054	VirtualBench 16.1

Why Doesn't the VirtualBench Application Start Automatically?

VirtualBench uses Windows AutoPlay to launch the software automatically when VirtualBench is connected to a computer. If no software launches after you plug in your device, AutoPlay may be disabled on your system. Here are some possible solutions to this problem:

- Enable AutoPlay
- Enable the AutoPlay Group Policy
- Laptop Docking/Undocking Issues
- Manually Select AutoPlay
- Manually Start the VirtualBench Application

Enable AutoPlay

Windows 10

1. Type AutoPlay in the search box.
2. Click **AutoPlay settings** in the search results.
3. Turn on **Use AutoPlay for all media and devices**.

Windows 8.1/8/7/Vista

1. Launch the Control Panel.
2. Type AutoPlay in the search box.
3. Click **AutoPlay** in the search results.
4. Select **Use AutoPlay for all media and devices**.

Windows XP

1. Click **My Computer** from the desktop or Start menu.
2. Right-click the VirtualBench device and select **Properties**.
3. On the **AutoPlay** tab, ensure that **Prompt me each time to choose an action** is selected for each content type.

Enable the AutoPlay Group Policy

Note Your IT department may have set the group policy for your computer, in which case they will have to enable it for you as described below.

If no AutoPlay option exists when you right-click the VirtualBench device, an existing group policy may have disabled this feature. The following instructions show how to turn it back on. Note that the instructions require Administrative access.

Windows 10/8.1/8

1. Open the Group Policy Editor by entering `gpedit.msc` in the **Run** app or Command Prompt (cmd.exe).
2. In the left pane, click **Local Computer Policy»Computer Configuration»Administrative Templates»Windows Components»AutoPlay Policies**.
3. In the right pane, double click **Turn off AutoPlay**.

4. In the dialog box that opens, click the **Disabled** radio button. This is negative logic. Disabling **Turn off AutoPlay** turns on AutoPlay.

Windows 7/Vista/XP

1. Open the Group Policy Editor by entering `gpedit.msc` in the **Start-Run** line.
2. In the left pane, click **Administrative Templates** under **Local Computer**.
3. Select **System** sub-heading.
4. In the right pane, double click **Turn off AutoPlay**.
5. In the dialog box that opens, click the **Disabled** radio button. This is negative logic. Disabling **Turn off AutoPlay** turns on AutoPlay.
6. In the **Turn off Autoplay on** drop-down menu, select **All drives**.

Laptop Docking/Undocking Issues

Some laptop docking systems automatically disable Windows AutoPlay functionality when docking or undocking your laptop. This prevents the unintentional launching of software from devices already plugged into the system, such as CD-ROM drives. However, because AutoPlay is temporarily disabled, the VirtualBench application may not launch correctly when plugging it in after docking or undocking your laptop. You can manually launch the application by manually selecting AutoPlay, or you can simply unplug and replug in the VirtualBench hardware to correct the problem.

Manually Select AutoPlay

Windows 10/8.1/8

Launch the File Explorer app. Locate the VirtualBench device in the navigation pane. Right-click the device and select **Open AutoPlay**.

Windows 7/Vista

Click **Computer** from the desktop or Start menu. Right-click the VirtualBench device and select **Open AutoPlay**.

Windows XP

Click **My Computer** from the desktop or Start menu. Right-click the VirtualBench device and select **AutoPlay**.

Manually Start the VirtualBench Application

To bypass AutoPlay and start the VirtualBench application manually, follow these steps:

1. On your desktop, double-click the Computer icon.
2. Double-click the VirtualBench device.
3. Double-click `VirtualBenchLauncher.exe`.

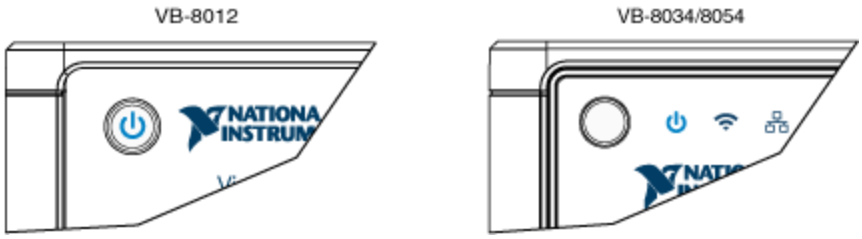
Why Is the Fan Loud?

Fan speed automatically adjusts according to operating conditions and ambient temperature. On the VB-8034/8054, the fan briefly runs at full capacity when the device is powered on or when the device reboots after a firmware update.

VirtualBench automatically enters standby mode if the internal temperature of the processor exceeds 96 °C. When this happens, the fan works at full capacity until the device has cooled sufficiently. Leave the device in standby for 15 minutes to allow the internal temperature to return to ambient temperature.

Why Is the Power LED Blinking?

VirtualBench's Power LED blinks if there is a hardware issue. You can get more information by launching the VirtualBench application and clicking the notification flag.



If the power LED is blinking but you cannot access the software on the device, VirtualBench has put itself in standby mode because the internal temperature is too hot. You cannot access the software when VirtualBench is in standby mode. Move VirtualBench to a cooler environment and then relaunch the VirtualBench application.

(VB-8012) If the power LED is blinking, the reason could be a warning that voltage is being applied/backdriven to the FGEN.

Related information

Power Button and Power LED

Why Is There a Flag on the VirtualBench Application?

The VirtualBench application sometimes shows a notification flag to alert you to issues such as available software upgrades or problems with the VirtualBench hardware.

Click the notification flag to view the notification.

Related information

How Do I Update the VirtualBench Firmware? How Can I Password Protect VirtualBench Firmware Modifications?

Safety and Compliance

Avoiding Damage when Unpacking and Handling

	**Caution** Never touch the exposed pins of connectors.

To avoid ESD damage in handling the device, ground yourself with a grounding strap or by touching a grounded object.

Unpacking

Remove VirtualBench from the package and inspect it for loose components or any other signs of damage. Notify NI if the device appears damaged in any way. Do not install a damaged device.

Cleaning

	**Caution** Always disconnect the power cable before cleaning or servicing the VirtualBench.

Clean the exterior surfaces of the VirtualBench with a dry lint-free cloth or a soft-bristle brush. If any dirt remains, wipe with a cloth moistened in a mild soap solution. Remove any soap residue by wiping with a cloth moistened with clear water. Do not use abrasive compounds on any part of the VirtualBench.

	**Caution** Avoid getting moisture inside the chassis during exterior cleaning. Use just enough

	moisture to dampen the cloth.

⚠	**Caution** Do not wash the front- or rear-panel connectors or switches. Cover these components while cleaning the chassis.

⚠	**Caution** Do not use harsh chemical cleaning agents; they may damage the VirtualBench. Avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

Regulatory Information

USA/FCC Radio Exposure

The radiated output power of this device is below the FCC radio frequency exposure limits. Nevertheless, this device should be used in such a manner that the potential for human contact during normal operation is minimized. This device has been evaluated for and shown compliant with the FCC RF Exposure limits under mobile exposure conditions (antennas are greater than 20cm from a person's body). This device cannot be co-located with any other transmitter unless approved by FCC.

This product does not contain any user serviceable components. Any unauthorized product changes or modifications will invalidate the warranty and all applicable regulatory certifications and approvals.

FCC Interference Statement

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the manufacturer's instruction manual, may cause interference with radio and television reception. This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may

cause undesired operation.

This wireless adapter generates, uses, and can radiate radio frequency energy. If the wireless adapter is not installed and used in accordance with the instructions, the wireless adapter may cause harmful interference to radio communications. There is no guarantee, however, that such interference will not occur in a particular installation. If this wireless adapter does cause harmful interference to radio or television reception (which can be determined by turning the equipment off and on), the user is encouraged to try to correct the interference by taking one or more of the following measures:

- Reorient or relocate the receiving antenna of the equipment experiencing the interference.
- Increase the distance between the wireless adapter and the equipment experiencing the interference.
- Connect the equipment to an outlet on a circuit different from which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Canada, Industry Canada (IC) Notices

This product complies with Industry Canada RSS-210.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Under Industry Canada regulations, the radio transmitter(s) in this device may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Canada, avis d'Industry Canada (IC)

Cet appareil est conforme aux norme RSS210 d'Industrie Canada.

Cet appareil est conforme aux normes d'exemption de licence RSS d'Industry Canada. Son fonctionnement est soumis aux deux conditions suivantes : (1) cet appareil ne doit pas causer d'interférence et (2) cet appareil doit accepter toute interférence, notamment les interférences qui peuvent affecter son fonctionnement.

Conformément aux réglementations d'Industry Canada, les émetteurs radio de cet appareil ne peuvent fonctionner qu'à l'aide d'une antenne dont le type et le gain maximal (ou minimal) pour ces émetteurs - transmetteurs sont approuvés par Industry Canada. Pour réduire le risque d'interférence éventuelle pour les autres utilisateurs, le type et le gain de l'antenne doivent être choisis de manière à ce que la puissance isotrope rayonnée équivalente (p.i.r.e.) minimale nécessaire à une bonne communication soit fournie.

Europe-EU Declaration of Conformity

Marking by a CE symbol on the label indicates compliance with the Essential Requirements of the Radio Equipment Directive 2014/53/EU. This equipment meets the following conformance standards: EN 300 328 and EN 301 489-17.

EU Regulatory Statements

cs Česky [Czech]	***National Instruments*** tímto prohlašuje, že tento VirtualBench je ve shodě se základními požiadavkami a dalšími příslušnými ustanoveními směrnice 2104/53/ES.
da Dansk [Danish]	Undertegnede ***National Instruments*** erklćrer herved, at fřlgende udstyr VirtualBench overholder de vćsentlige krav og řvrige relevante krav i direktiv 2104/53/EF.
de Deutsch [German]	Hiermit erklärt ***National Instruments***, dass sich das Gerät VirtualBench in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 2104/53/EG befindet.
et Eesti [Estonian]	Käesolevaga kinnitab ***National Instruments*** seadme VirtualBench vastavust direktiivi 2104/53/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
en English	Hereby, ***National Instruments***, declares that this VirtualBench is in compliance with the essential requirements and other relevant provisions of Directive 2104/53/EC.
es Español [Spanish]	Por medio de la presente ***National Instruments*** declara que el

	VirtualBench cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 2104/53/CE.
el Ελληνική [Greek]	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ ***National Instruments*** ΔΗΛΩΝΕΙ ΟΤΙ VirtualBench ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 2104/53/ΕΚ.
fr Français [French]	Par la présente ***National Instruments*** déclare que l'appareil VirtualBench est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 2104/53/CE.
it Italiano [Italian]	Con la presente ***National Instruments*** dichiara che questo VirtualBench è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 2104/53/CE.
lv Latviski [Latvian]	Ar šo ***National Instruments*** deklarē, ka VirtualBench atbilst Direktīvas 2104/53/EK būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.
lt Lietuvių [Lithuanian]	Šiuo ***National Instruments*** deklaruoja, kad šis VirtualBench atitinka esminius reikalavimus ir kitas 2104/53/EB Direktyvos nuostatas.
nl Nederlands [Dutch]	Hierbij verklaart ***National Instruments*** dat het toestel VirtualBench in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 2104/53/EG.
mt Malti [Maltese]	Hawnhekk, ***National Instruments***, jiddikjara li dan VirtualBench jikkonforma mal-htigijiet essenzjali u ma provvedimenti ohrajn relevanti li hemm fid-Dirrettiva 2104/53/EC.
hu Magyar [Hungarian]	Alulírott, ***National Instruments*** nyilatkozom, hogy a VirtualBench megfelel a vonatkozó alapvetõ követelményeknek és az 2104/53/EC irányelv egyéb elõírásainak.
pl Polski [Polish]	Niniejszym ***National Instruments***. oświadcza, że VirtualBench jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 2104/53/EC.
pt Português [Portuguese]	***National Instruments*** declara que este VirtualBench está conforme com os requisitos essenciais e outras disposições da Directiva 2104/53/CE.
sl Slovensko [Slovenian]	***National Instruments*** izjavlja, da je ta VirtualBench v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 2104/53/ES.
sk Slovensky [Slovak]	***National Instruments*** týmto vyhlasuje, že VirtualBench spĺňa základné požiadavkami a všetky príslušné ustanovenia Smernice 2104/53/ES.
fi Suomi [Finnish]	***National Instruments*** vakuuttaa täten että VirtualBench tyyppinen laite

	on direktiivin 2104/53/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
Svenska [Swedish]	Härmed intygar ***National Instruments*** att denna VirtualBench står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 2104/53/EG.
Íslenska [Icelandic]	Hér með lýsir ***National Instruments*** yfir því að VirtualBench er í samræmi við grunnkröfur og aðrar kröfur, sem gerðar eru í tilskipun 2104/53/EC.
Norsk [Norwegian]	***National Instruments*** erklærer herved at utstyret VirtualBench er i samsvar med de grunnleggende krav og øvrige relevante krav i direktiv 2104/53/EF.

Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Singapore

Complies with
IDA Standards
DA 105692

Taiwan R.O.C.

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2. este equipo debe aceptar cualquier interferencia, incluyendo la que pueda causar su propia operación no deseada.

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Where to Go from Here/Related Documentation

The following documents contain information that you may find helpful as you use this help file:

- The ***NI VirtualBench Quick Start*** packaged with your NI VirtualBench all-in-one instrument, describes how to install and configure NI VirtualBench and confirm it is operating properly.
- The ***NI VirtualBench VB-8012 Specifications***, ***NI VirtualBench VB-8034 Specifications***, and ***NI VirtualBench VB-8054 Specifications*** list the specifications for your VirtualBench. These specifications can be found at ni.com/virtualbench/datasheet.
- The VirtualBench getting started web page at ni.com/virtualbench/getting-started has getting started tutorials.