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USER GUIDE

NI CB-2162

Single-Ended Digital I/O Accessory

このドキュメントには、日本語ページも含まれています。

The NI CB-2162 is a connector block and prototyping board for National Instruments digital waveform generator/analyzer modules. The NI CB-2162 provides an easy way to complete the following tasks:

- Terminate digital I/O (DIO) and control channels
- Connect to other devices for testing and debugging
- Develop and interface to prototype circuits
- Probe DIO and control channels

This guide explains how to set up and use the NI CB-2162 single-ended DIO accessory.

Caution To ensure the specified EMC performance of the device connected to the NI CB-2162, this product must be installed in a shielded enclosure and used only with shielded cables and accessories. Do not use unshielded cables or accessories unless they are installed in a shielded enclosure with properly designed and shielded input/output ports and connected to the product using a shielded cable. If unshielded cables or accessories are not properly installed and shielded, the EMC specifications for the product are no longer guaranteed. Refer to *Mounting the NI CB-2162 in an Enclosure* for installation guidance.

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What You Need to Get Started

To set up and use the NI CB-2162, you need the following items:

- ☐ NI SHC68-C68-D2 or NI C68-C68-D4 cable assembly
- ☐ Compatible NI digital waveform generator/analyzer module installed in a PXI chassis, compact PCI chassis, or desktop PC
- ☐ CA-1000 (NI part number 777664-01), rack-mount side panels (NI part number 777665-01), and an NI CB-2162 CA-1000 mounting kit for mounting the NI CB-2162 in an enclosure

You also may need the following optional items:

- ☐ Resistors and 10-pin single-inline packaged resistor networks for pull-up/pull-down and series termination
- ☐ The NI CB-2162 ships populated with a 0 Ω resistor. A 50 Ω resistor also is included for optional STROBE/PFI 5 series termination.
- ☐ 30-gauge wire
- ☐ Wire-wrap tool
- ☐ 1 × 2 header receptacle(s)
- ☐ DC power supply for the prototyping area
- ☐ The documentation included with the digital waveform generator/analyzer module and the driver software included with your NI device

Related Documentation

National Instruments digital waveform generator/analyzer modules ship with several documents designed to familiarize you with different aspects of the module. The titles and location of the documents vary based on the instrument driver that supports the NI device, but you should have the following types of documentation:

- Getting Started Guide—This printed document should be the first thing you read. Its purpose is to guide you through setting up the digital waveform generator/analyzer module and configuring it to generate or acquire your first samples.
- Help—This online document provides more in-depth information about the hardware capabilities of the digital waveform generator/analyzer module, theory of operation discussion, and information on programming flow and software reference.
- Specifications—This printed document provides specifications for the NI hardware.

Visit `ni.com/manuals` for the most current documentation.

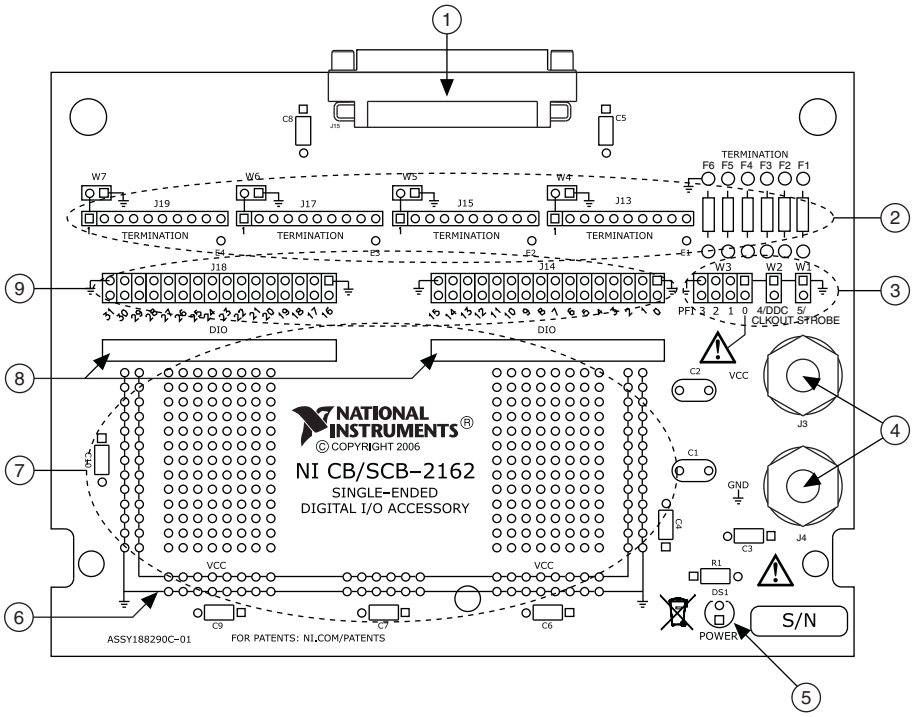
You also may have documentation for any application development environment (ADE) you are using.

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Parts Locator Diagram

Refer to Figure 1 to locate connectors and components on the NI CB-2162.

Figure 1. NI CB-2162 Parts Locator Diagram



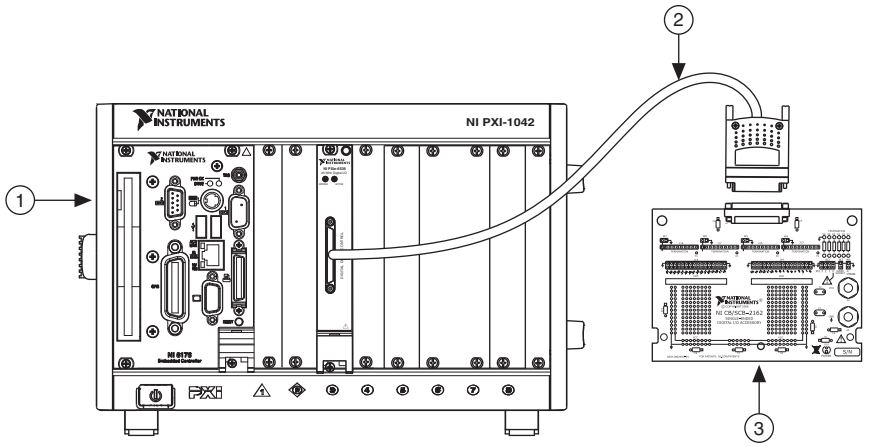
1	68-Pin Digital Data & Control (DDC) Connector	6	Prototyping Area Power and Ground Solder Pads
2	Termination Sockets	7	Prototyping Area
3	Control and Ground Header Pairs	8	Labeling Strips
4	Prototyping Area Power Connectors	9	DIO and Ground Header Pairs
5	Prototyping Area Power LED		

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Installing Cables

A cable connects the NI CB-2162 to the digital waveform generator/analyzer. Figure 2 shows how to install a cable.

Figure 2. Connecting a 68-Pin Digital Waveform Generator/Analyzer to the CB-2162



1	PXI Chassis with NI Digital Waveform Generator/Analyzer	2	Cable
		3	NI CB-2162 Accessory

Refer to Figure 2 as you complete the following steps to install the supported cable:

Caution *Before* connecting the cable, disconnect power from the module, accessory, and any other connected hardware to prevent damage to the hardware and personal injury. NI is *not* liable for damage resulting from improper connections.

1. Install NI-HSDIO or NI-DAQmx and the digital waveform generator/analyzer by following the installation procedure in the Getting Started Guide that shipped with your device.

Caution *Before* attaching any cables or accessories, install the digital waveform generator/analyzer. Refer to the Getting Started Guide that shipped with your device for instructions on installing the module.

2. Attach either end of the cable assembly to the DDC connector of the digital waveform generator/analyzer module and secure the cable with the captive screws on the cable connector.
3. Attach the other end of the cable assembly to the DDC connector of the NI CB-2162 and secure them together with the captive screws on the cable connector.

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Connecting Signals

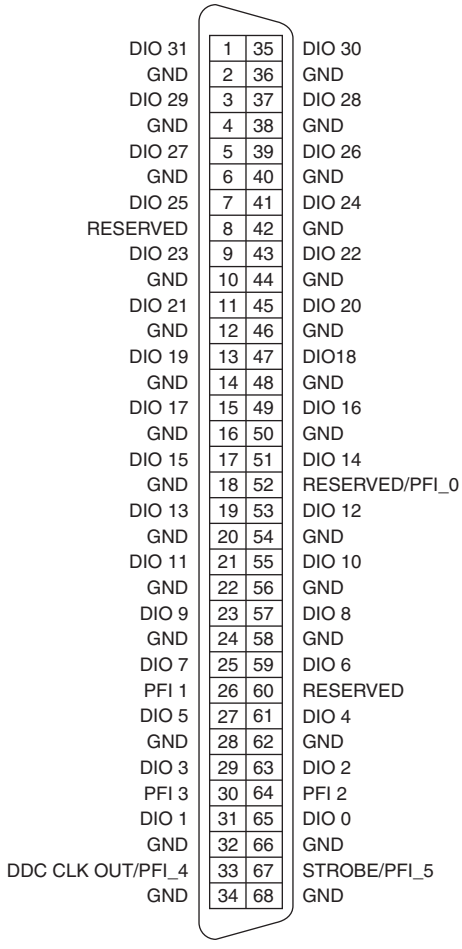
Each DIO, PFI, and clock channel of the digital waveform generator/analyzer connects to a corresponding pin on the NI CB-2162.

Refer to Figure 1 for the location of these pins on the NI CB-2162.

Caution *Before* powering down the digital waveform generator/analyzer module, remove power from the prototyping area of the NI CB-2162. NI is *not* liable for any damage resulting from improper signal connections.

Figure 3 shows the DDC connector pinout of the NI CB-2162.

Figure 3. NI CB-2162 DDC Connector Pinout



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Note Refer to the help file for your device for information about the number of available DIO channels on your device. DIO <20..31> or PFI_0 may not be applicable to your device. The function of DDC CLK OUT/PFI_4 and STROBE/PFI_5 may be unique to your device.

Table 1 describes the DDC signals shown in Figure 3.

Table 1. DDC Connector Pinout Descriptions

DDC Pin	Signal Description
DIO <0..31>	Bidirectional digital data channels 0 through 31.
STROBE/PFI_5	External sample clock source for pattern acquisition or general-purpose PFI*.
DDC CLK OUT/PFI_4	Exported sample clock signal or general-purpose PFI.
PFI <0..3>	Programmable functional interface (PFI) channels 0 through 3.
GND	Ground reference for signals.
RESERVED	These channels are reserved for system use. Do not connect signals to these channels.
* Refer to your device documentation for support.	

The NI CB-2162 provides connectivity to up to 32 of the single-ended DIO channels of an NI digital waveform generator/analyzer. The 32 DIO channels are divided into two bundles of 16 × 2 header pins. Each bundle is grouped by signal and ground pairs. The ground pins provide ground return paths for the DIO channels.

You can make connections to the DIO channels, the PFI channels, DDC CLK OUT/PFI_4, or STROBE/PFI_5 on the NI CB-2162 using a 1 × 2 header receptacle, ribbon cable, a wire-wrap technique, or by soldering directly to the pins. Examples of how to make these connections are provided in the following sections.

Caution Connections that exceed any of the maximum ratings for the NI CB-2162 or the NI digital waveform generator/analyzer module can damage the module and the computer. Maximum input ratings are provided in the *Specifications* section and in the specifications document that shipped with the digital waveform generator/analyzer. NI is *not* liable for any damage resulting from such signal connections.

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Using 1 × 2 Header Receptacles

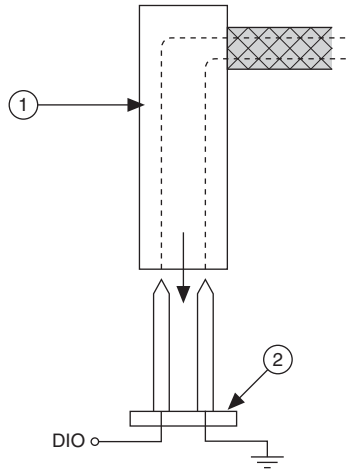
Each signal and ground header pair is labeled on the NI CB-2162 and in Figure 1. These header pairs are arranged so that you can make quick connections using a 1 × 2 header receptacle to a coaxial cable assembly.

Note Header receptacle assemblies are not included with the NI CB-2162, but you can create custom assemblies by purchasing parts from vendors such as 3M.

Connectivity is made by inserting the receptacle onto the appropriate header pair. Refer to the receptacle documentation to assure that proper connections are made to signal and ground.

Figure 4 shows how to make 1 × 2 header receptacle connections.

Figure 4. 1 × 2 Header Receptacle



1	1 × 2 Header Receptacle	2	Header Pin Pair

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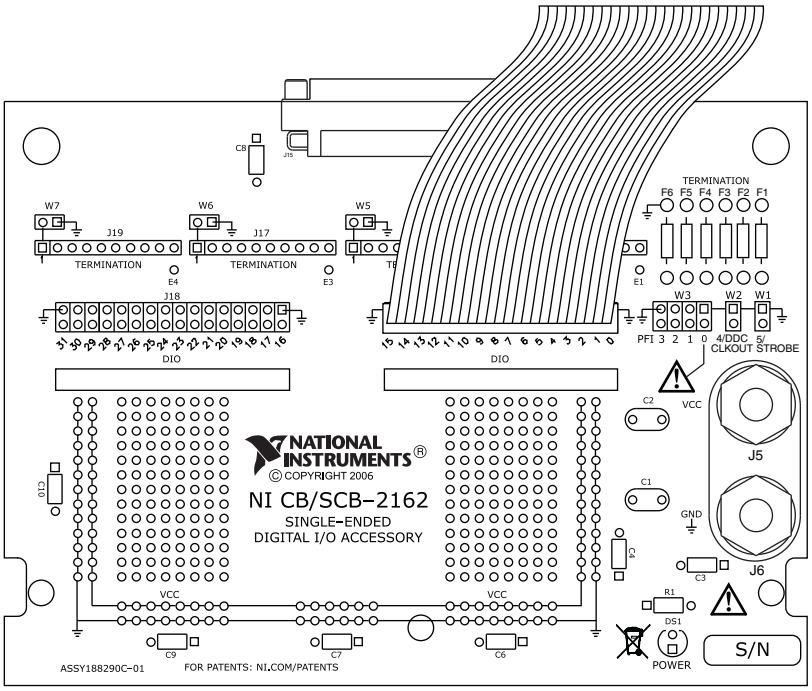
Using a Ribbon Cable

The header pairs on the NI CB-2162 are available for single wire probing. You also can use 32-pin ribbon cables to easily connect a large number of channels to other devices. Cable type and quality can dramatically affect how well the signal integrity is maintained. NI recommends using short twisted-pair ribbon cables.

Refer to the device or cable manufacturer for additional information on proper connectivity to the NI CB-2162 signal and ground connections.

Figure 5 shows how to connect a ribbon cable to the accessory.

Figure 5. Using a Ribbon Cable with the NI CB-2162



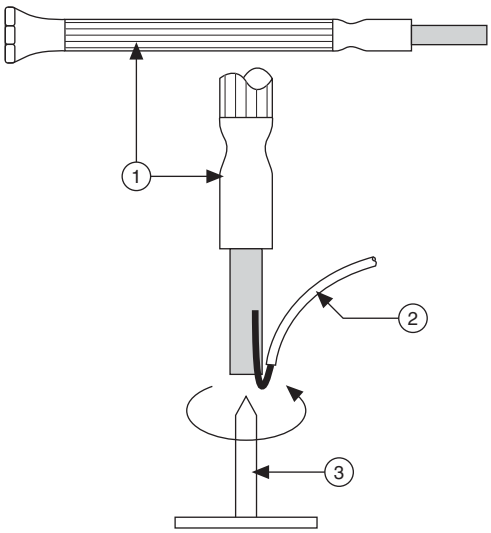
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Making a Wire-Wrap Connection

Make connections from the appropriate 1 × 1 header with a standard wire-wrap tool and 30-gauge or similar wire. Strip the wire and insert it into the receptacle end of the wire-wrap tool. Place the wire-wrap tool over the appropriate header pair pin, and twist the tool around the header post. You then can make connections to the device under test (DUT) as defined by the device manufacturer. Connect the DIO channel and ground header pins for each channel being used.

Figure 6 provides an illustration for making a wire-wrap connection.

Figure 6. Wire-Wrap Connections



1 Wire-Wrap Tool
2 Stripped Wire
3 Header Pin Receptacle

Terminating Signals

Termination of high-speed digital signals is necessary to prevent signal reflections and to force signal channels to a known state when no signal is present. Sockets for terminating resistors are connected to all DIO and control channels on the NI CB-2162. These sockets are labeled in Figure 1.

Note Proper termination needs are application-specific. For some special considerations for choosing resistor values, refer to the *Terminating Control Channel Signals* section.

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Minimizing the Effects of Stubs

Stubs are unterminated tributaries from the original signal path. Stubs decrease the signal quality of the system by adding reflections to the transmission channels. To minimize the effect of stubs, termination is placed at the end of the signal path.

If your signal transmission line ends on the NI CB-2162, you can use the provided termination socket. If your signal terminates somewhere other than the NI CB-2162, NI recommends terminating the transmission line at the final signal destination.

Note Refer to the help file for your device for more information about proper signal termination.

Terminating DIO Channel Signals

Table 2 shows the relationship between DIO channels and the termination sockets.

Table 2. DIO Termination Sockets

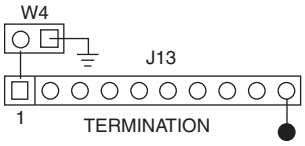
DIO Channels	Termination Socket
DIO <0..7>	J13
DIO <8..15>	J15
DIO <16..23>	J17
DIO <24..31>	J19

Note Refer to the help file for your device for information about the number of available DIO channels on your device. DIO <20..31> may not be applicable to your device.

You can use different resistor networks and jumper placements to terminate the DIO channels in multiple configurations.

Figure 7 shows the J13 connector as an example of this termination scheme.

Figure 7. Termination Connectivity

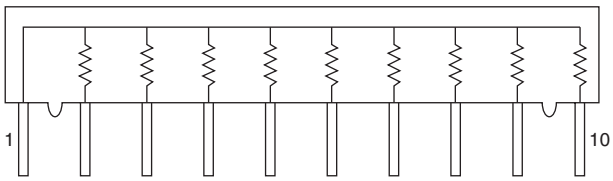


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Parallel Termination

Figure 8 shows a typical parallel resistor network.

Figure 8. Example of Parallel Resistor Network



You can implement a pull-up or pull-down termination using a parallel configuration. Insert the 10-pin parallel resistor network into the appropriate termination socket with the common pin of the resistor network (pin 1 in Figure 8) connected to pin 1 of the socket, as shown in Figure 7.

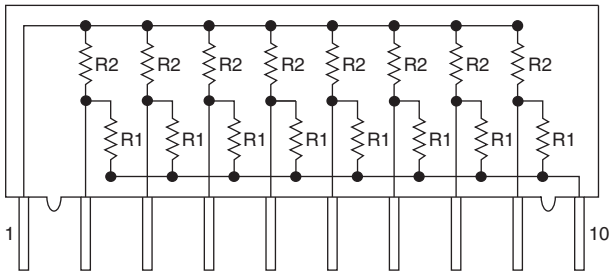
With jumpers W<4..7> in place, pin 1 of J13, J15, J17, and J19 are all pulled to ground. The signal can be alternately pulled up or terminated to a nonground voltage if you remove the jumpers and apply power to the jumper pin connected to pin 1 of the socket.

Alternatively, the common pin of the parallel resistor network shown in Figure 7 can be inserted into pin 10 of the socket shown in Figure 8. External power can then be applied to the connection point located below pin 10 of the socket to provide proper termination.

Thevenin (Dual) Termination

In some applications, you might need to provide a Thevenin (dual) termination or a pull-up and pull-down configuration. Figure 9 shows a typical dual-termination resistor network, which can accomplish this task.

Figure 9. Example of Dual-Termination Resistor Network



To implement this configuration, insert the 10-pin resistor network into the J connector corresponding to the desired DIO channel. Make connections to ground using a jumper to connect W4, W5, W6, and/or W7 with the pull-down configuration mentioned previously. This jumper effectively terminates the signal or pulls the signal to ground by a value provided by R2 of Figure 9.

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You can use the pull-up terminating resistance by connecting pin 10 of the resistor network to the solder pads connected to pin 10 of the socket, as shown in Figure 7. Connect external power to this solder point. Refer to the resistor network manufacturer documentation for information on proper pin labeling and resistor values.

Terminating Control Channel Signals

The control channel termination sockets are intended to accept standard through-hole resistors. Refer to Figure 1 for the termination socket locations. Table 3 lists the termination sockets for control channel termination resistors.

Table 3. Control Channel Termination

Control Channel	Termination Sockets	Termination Type
STROBE/PFI_5 (W1)	J1, J2 (F1)	Series
DDC CLK OUT/PFI_4 (W2)	J5, J6 (F2)	Parallel (pull-down)
RESERVED/PFI_0	(F3)	Parallel (pull-down)
PFI 1 (W3)	J7, J8 (F4)	Parallel (pull-down)
PFI 2 (W3)	J9, J10 (F5)	Parallel (pull-down)
PFI 3 (W3)	J11, J12 (F6)	Parallel (pull-down)

Notes Depending on the revision of your NI CB-2162, termination sockets may be alternately referred to as the name in parenthesis.

Refer to the help file for your device for information about the function of DDC CLK OUT/PFI_4 and STROBE/PFI_5.

The series termination socket for the STROBE/PFI_5 channel is intended for use when the originating source of the signal being applied to the STROBE/PFI_5 terminal of the DDC connector is near the 1 × 2 STROBE/PFI_5 control channel pin and has a source impedance of less than 50 Ω. In this case, you might want to add series resistance to raise the total source impedance to 50 Ω to minimize reflections. This socket is populated with a 0 Ω resistor before the NI CB-2162 is shipped.

Note To ensure proper high-speed operation, make sure that the connections from the DIO pins to your device under test are matched in length.

When inserting a resistor into any of the control channel termination sockets, first trim the leads of the resistor to an appropriate length and ensure that the resistor fits securely into the socket.

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Using the NI CB-2162 Prototyping Area

The NI CB-2162 prototyping area is designed to aid you in the following tasks:

- Prototyping and testing circuits—Use the NI CB-2162 in conjunction with an NI digital waveform generator/analyzer for prototyping, evaluating, and testing custom circuits and/or components.
- Creating custom interfaces—Use the NI CB-2162 for creating custom interfaces to other cables or devices. You can use the prototyping area to mount and interface the integrated circuits (ICs) or connectors required for your application.
- Prototyping a DUT load board—Use the NI CB-2162 as a simple DUT interface board or as a prototype of a custom DUT load board.

The prototyping area is labeled in Figure 1. Also labeled in this diagram are the erasable labeling strips for your notes as you use the prototyping area.

Connecting Power

Caution NI is *not* liable for any device damage or personal injury resulting from improper connections that exceed the maximum specifications of the NI CB-2162.

To provide power to the prototyping area, connect V_{CC} from a DC power supply to J3 (red terminal) and ground to J4 (black terminal). Refer to the *Specifications* section for the acceptable voltage ranges.

The green power LED is lit when a positive voltage is applied to the NI CB-2162. However, if negative voltage is applied, the Power LED does not light. The power connectors and LED for the prototyping area are labeled in Figure 1.

Prototyping Circuits

The prototyping area of the NI CB-2162 consists of 304 through-hole solder pads—208 isolated pads for component mounting and wire connections, 48 pads connected to V_{CC}, and 48 pads connected to ground—and space for attaching surface-mount components.

Refer to the *Specifications* section and to the NI digital waveform generator/analyzer modules specifications for information on the voltage limitations on circuits created in the prototyping area.

Replacing Components

The NI CB-2162 does not use replaceable fuses. If you need to replace the LED, choose a replacement that meets the specifications described in the *Specifications* section.

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Mounting the NI CB-2162 in an Enclosure

Mount the NI CB-2162 in an enclosure under the following circumstances:

- The connected device requires shielded cables and accessories to ensure its EMC performance specifications.
- You want to reduce radio interference.
- You want convenience when using the NI CB-2162 in a rack-mount system.

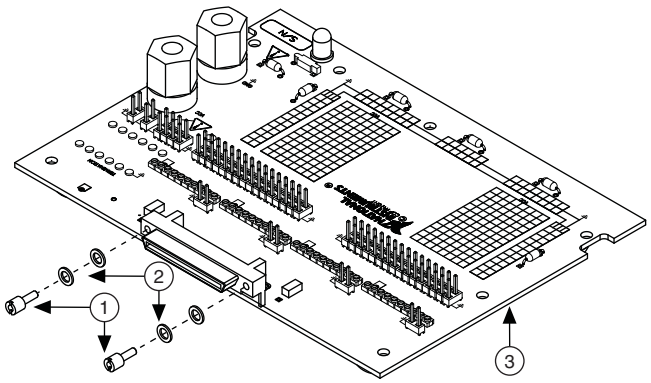
You can purchase a CA-1000 (777664-01) and an NI CB-2162 CA-1000 Mounting Kit (192065-01) for mounting your NI CB-2162 in an enclosure. The mounting kit contains a VHDCI panelette and three screws. The CA-1000 includes the standoffs that are required to attach the NI CB-2162 to the bottom of the CA-1000.

If you want to rack-mount the NI CB-2162 after it is installed in the CA-1000, you can purchase rack-mount side panels (777665-01).

To install the NI CB-2162 in the CA-1000, complete the following steps:

1. Remove the jackscrews and washers from the NI CB-2162 DDC connector, as shown in Figure 10.

Figure 10. Remove Jackscrews from DDC Connector



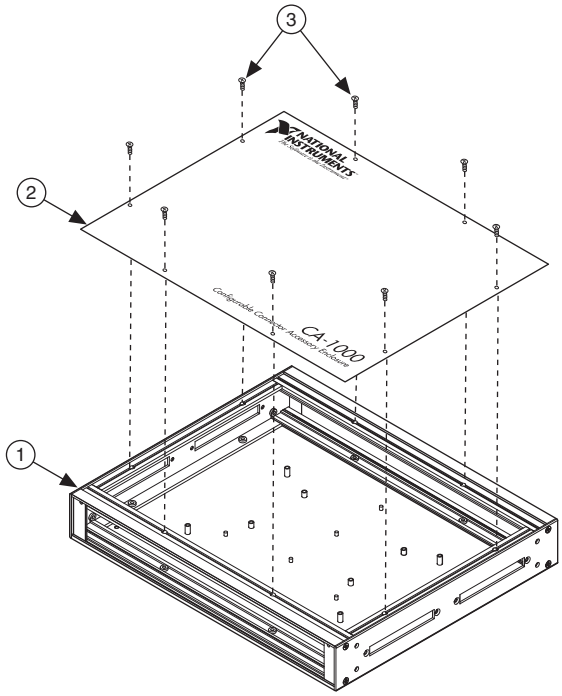
1 Jackscrews 2 Washers 3 NI CB-2162

Note You will not need the washers to mount the NI CB-2162 in the CA-1000. Save the washers in case you ever need to remove the NI CB-2162 from the CA-1000 and use the NI CB-2162 outside the enclosure.

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2. Remove the eight 4-40 × 1/4 in. flathead Phillips-head screws from the top cover of the CA-1000, as shown in Figure 11.
3. Remove the top cover.

Figure 11. Remove Cover from CA-1000 Enclosure



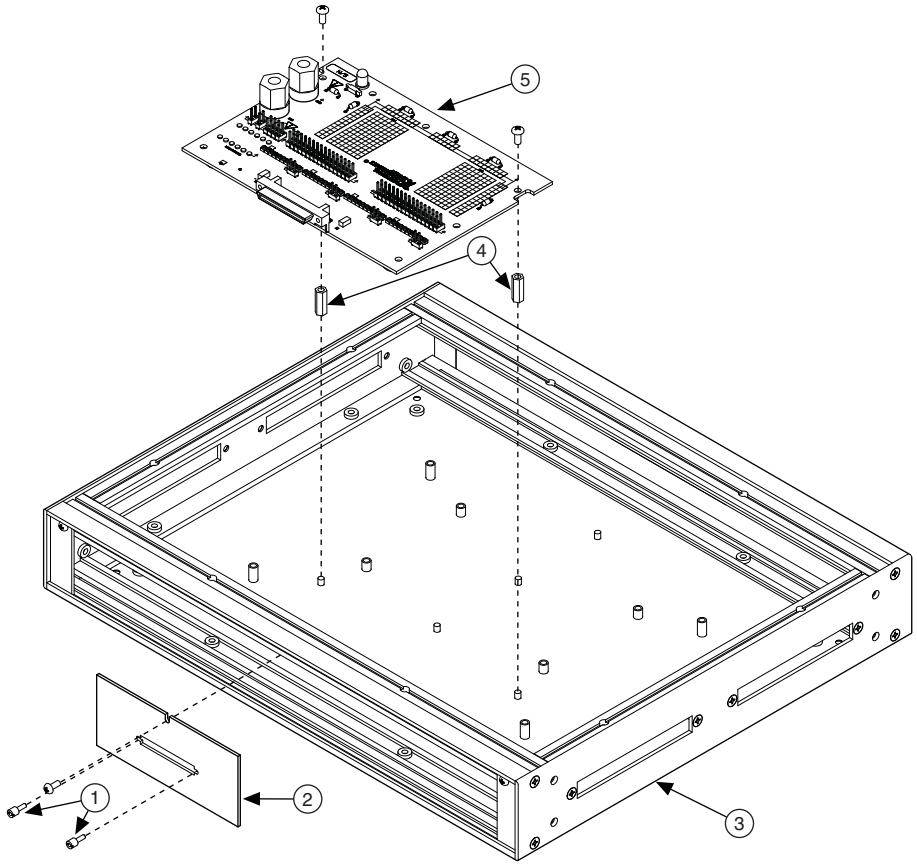
1	CA-1000 Enclosure	2	Top Cover	3	4-40 × 1/4 in. Screws

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Refer to Figure 12 as you complete the following steps.

4. Screw the standoffs onto the threaded screws in the locations shown in Figure 12.
5. Position the NI CB-2162 on the standoffs of the CA-1000.
6. Secure the NI CB-2162 in the bottom of the CA 1000 using two of the screws provided in the NI CB-2162 CA-1000 Mounting Kit.
7. Place the lower edge of the VHDCI panellete in the groove at the bottom of the enclosure opening.
8. Tilt the VHDCI panelette top back into the enclosure.
9. Secure the VHDCI panelette with one of the panhead screws included with the CA-1000 kit.
10. Reattach the DDC connector jackscrews through the opening in the I/O panelette.

Figure 12. Secure the NI CB-2162 and Attach the I/O Panelette

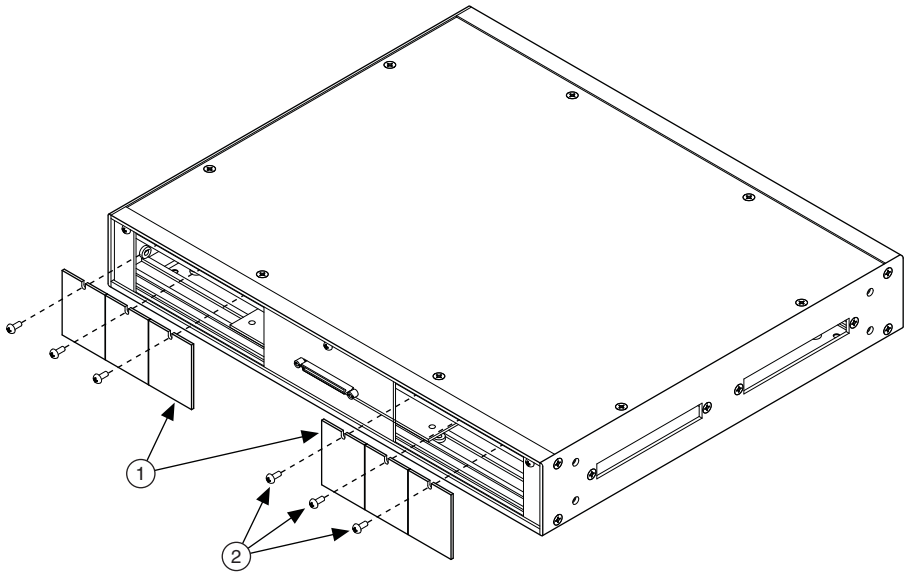


1	DDC Screws	3	CA 1000	5	NI CB-2162
2	VHDCI Panelette	4	Standoffs		

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11. Replace the top cover of the CA-1000 by replacing the screws you removed in step 2. Refer to Figure 11 for an illustration.
12. Install I/O panelettes in the unused panelette openings, as shown in Figure 13. The panelettes in the following figure are blank, but you can purchase many other types of I/O panelettes from NI. For more information on the other I/O panelettes, go to `ni.com` and search for `I/O Connector Panelettes`.

Figure 13. Install Blank I/O Panelettes



1 I/O Panelettes 2 Screws

The NI CB-2162 is now installed in the CA-1000 enclosure.

Specifications

Digital I/O

DIO channels ..... 32, single-ended

Control I/O channels..... 6, single-ended

Resistors

Number 2

LED

Type ..... 5 mm diffused LED, green,
10 mA forward current

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Prototyping Area

Dimensions ..... 4 × 9 cm (1.57 × 3.54 in.)

Solder pads ..... 208 unconnected, 48 ground, 48 V_{CC}

Traces

Type ..... Matched length to 100 mils

AC impedance ..... 50 Ω

Power

External DC power supply

Maximum ..... 12 V

Minimum ..... -5 V

Physical

Dimensions ..... 10 × 14 cm (3.94 × 5.51 in.)

I/O connectors ..... 68-pin DDC connector,
two banana-style connectors,
76 header pins,
4 termination sockets
(8 DIO per socket)

Weight ..... 82 g (2.9 oz)

Caution When connected to other test objects, this product may cause radio interference. In a residential environment, the user may be required to take adequate measures to reduce the radio interference.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit `ni.com/environment/weee`.

电子信息产品污染控制管理办法 （中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 `ni.com/environment/rohs_china`。 (For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)

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Where to Go for Support

The National Instruments website is your complete resource for technical support. At ni.com/support you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

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