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USER MANUAL

# NI USB-7855R OEM

R Series for USB Multifunction RIO with Kintex-7 70T FPGA

| Français | Deutsch | 日本語 | 한국어 | 简体中文 |
|---|---|---|---|---|
| ni.com/manuals | | | | |

This document provides dimensions, connectivity information, and pinouts for the National Instruments USB-7855R OEM device.

**Caution** National Instruments makes no product safety, electromagnetic compatibility (EMC), or CE marking compliance claims for NI USB-7855R OEM device. The end-product supplier is responsible for conformity to any and all compliance requirements.

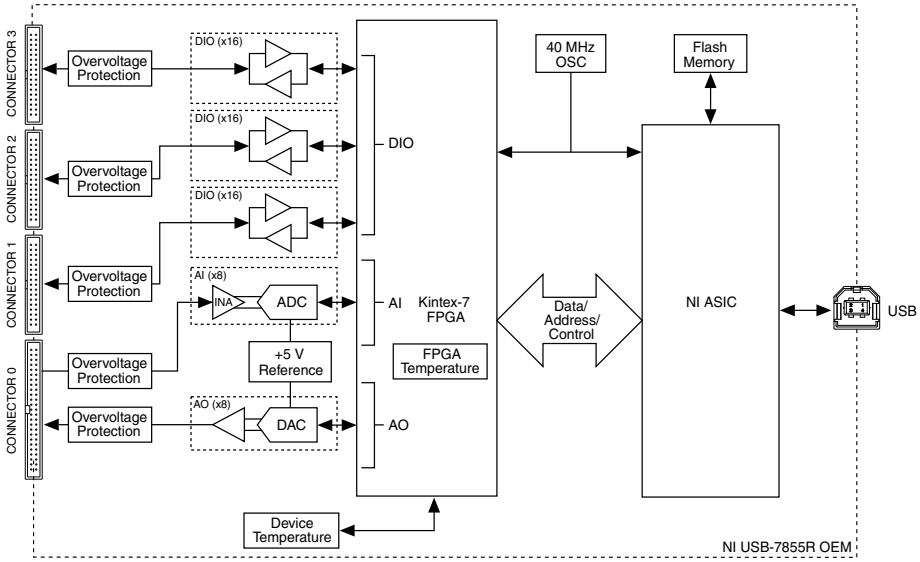
**Caution** Do not operate the NI USB-7855R OEM device in a manner not specified in this user manual. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to National Instruments for repair.

## Hardware Overview

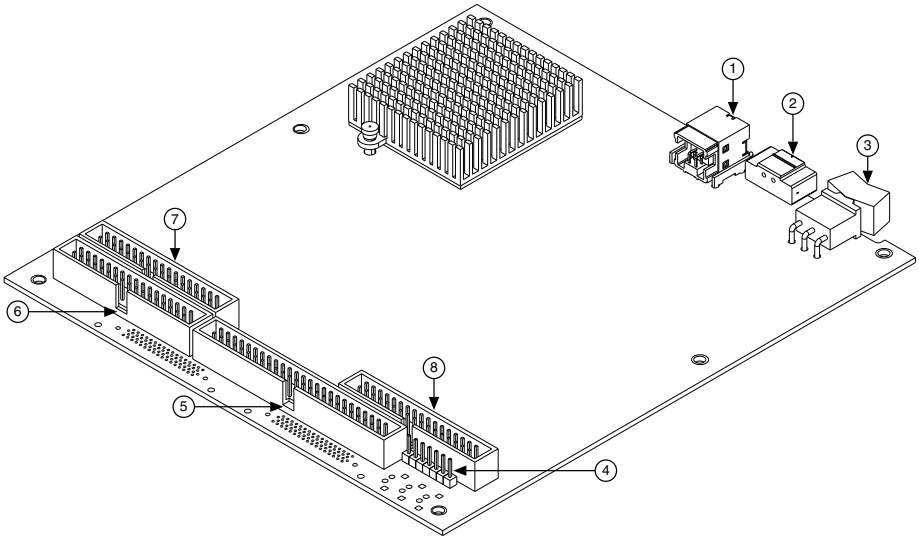
The following high-level block diagram represents the NI USB-7855R OEM device.

NATIONAL INSTRUMENTS

**Figure 1.** USB-7855R OEM Device Block Diagram



# Parts Locator




1. USB Connector
2. Power Supply Connector
3. Power Switch
4. External LED Attachments
5. Connector 0 (Analog)
6. Connector 1 (Digital)
7. Connector 2 (Digital)
8. Connector 3 (Digital)

# USB-7855R OEM Device Components

The following table lists the interfacing components on the NI USB-7855R OEM device and the component manufacturers.

**Table 1.** USB-7855R OEM Device Components

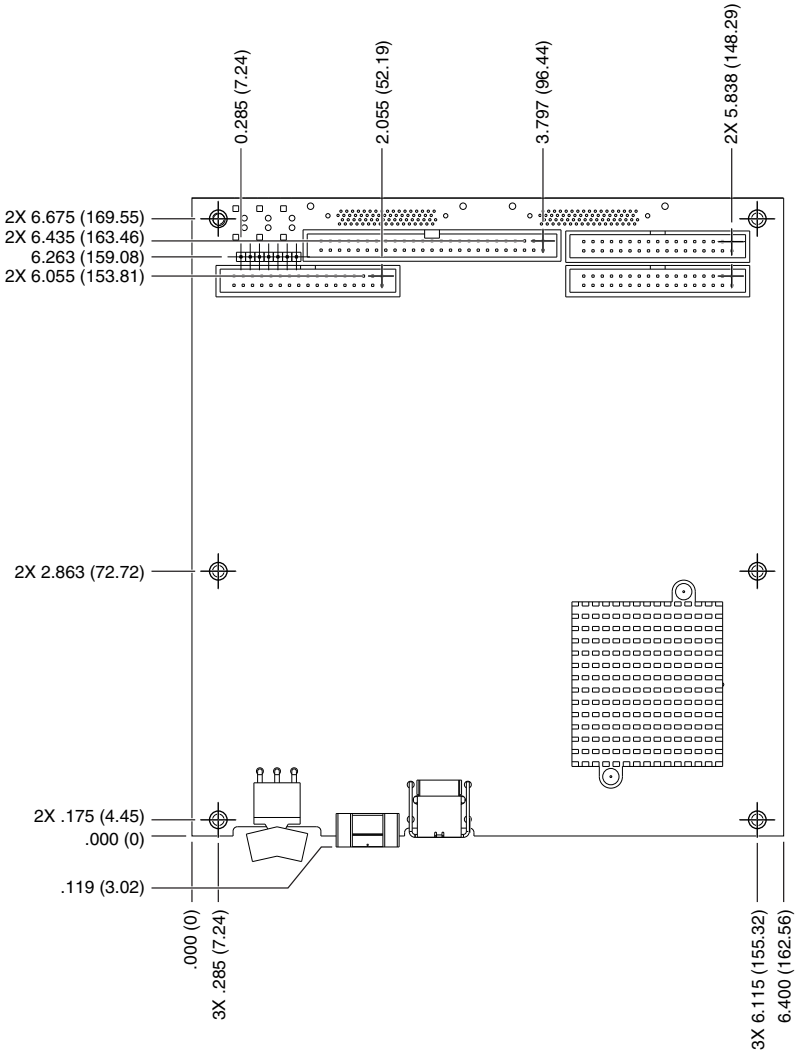
| Components | Reference Designator | Manufacturer |
|---|---|---|
| LEDs | DS2, DS5, DS7, DS8, DS10 | SunLED (XZBB54W-1TN) |
| | DS4 | Everlight Electronic (QTLP630C-2 T/R) |
| USB connector | J5 | Tyco (292304-1) |
| Power connector | J1, J2, & J9 | Phoenix Contact (1727566) |
| Power switch | SW2 | C&K (E101J1AQE2) |

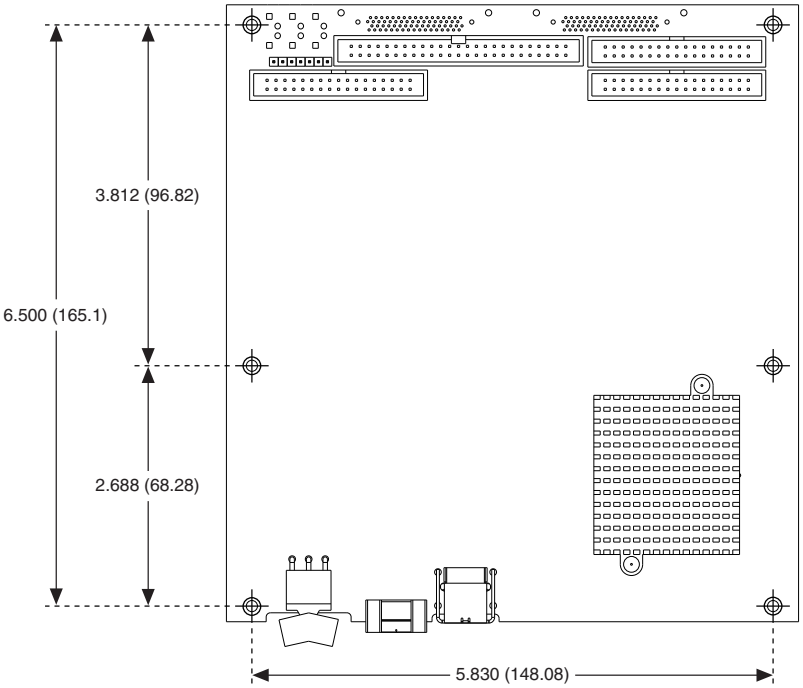
The following table lists and describes the I/O connectors on the NI USB-7855R OEM device. Refer to the connector manufacturer for information about using and matching these connectors.

**Table 2.** USB-7855R OEM Device Connectors

| Connector | Description | Reference Designator | Manufacturer |
|---|---|---|---|
| AI, AO | 50-position header | P2 | 3M (N2550-6002RB) |
| DIO | 34-position header | J9 | 3M (N2534-6002RB) |
| External LED | 7-position header | E1 | FCI 68000-107LF |

# Dimensions


0.285 (7.24)
2.055 (52.19)
3.797 (96.44)
2X 5.838 (148.29)
2X 6.675 (169.55)
2X 6.435 (163.46)
6.263 (159.08)
2X 6.055 (153.81)
2X 2.863 (72.72)
2X .175 (4.45)
.000 (0)
.119 (3.02)
.000 (0)
3X .285 (7.24)
3X 6.115 (155.32)
6.400 (162.56)



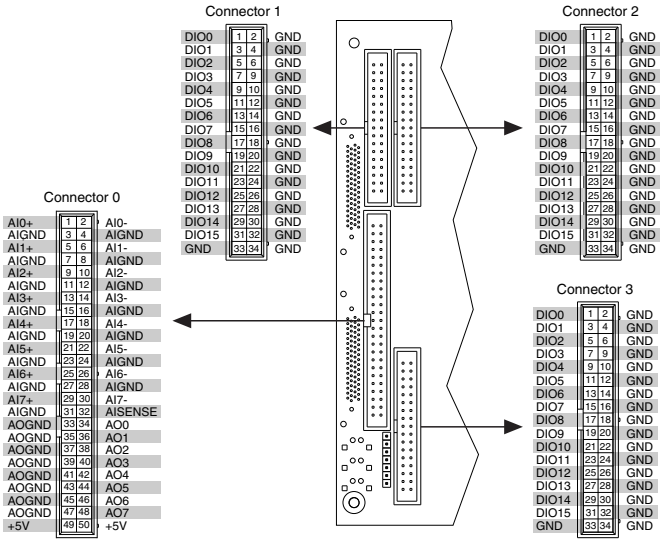

**Note** Visit `ni.com/dimensions` for more information about the dimensions of the NI USB-7855R OEM device, including two-dimensional drawings and three-dimensional models.

**Note** The NI USB-7855R OEM device has plated mounting holes that can act as chassis ground.

# Connecting the USB-7855R OEM Device

The NI USB-7855R OEM device provides connections for eight analog input (AI) channels, eight analog output (AO) channels, and forty-eight digital input/output (DIO) channels, as shown in Figure 2.

**Figure 2.** USB-7855R OEM Device Pinout



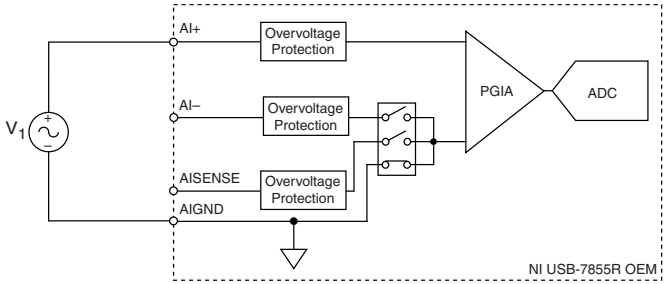

# Analog Input

The NI USB-7855R OEM device provides connections for eight AI channels. Each channel has an AI+ pin, AI- pin, and AIGND pin to which you can connect both single-ended or differential voltage signals. Use the AISENSE pin to connect non-referenced single-ended signals.

## Connecting Single-Ended Voltage Signals

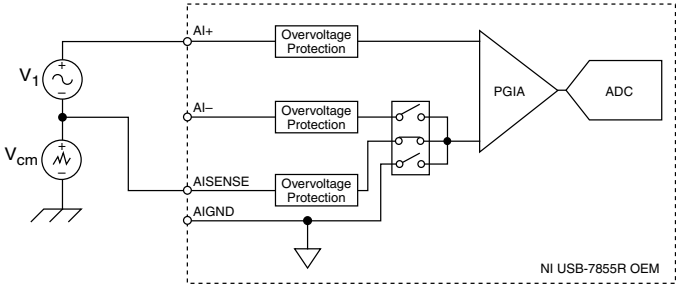
To connect referenced single-ended voltage signals to the NI USB-7855R OEM device, you must connect the voltage ground signal to AI GND in order to keep the common-mode voltage in the specified range, as shown in Figure 3.

**Figure 3.** Connecting Referenced Single-Ended Signals to the USB-7855R OEM Device



To connect non-referenced single-ended voltage signals to the NI USB-7855R OEM device, you must connect the voltage ground signal to AI SENSE in order to keep the common-mode voltage in the specified range, as shown in Figure 4.

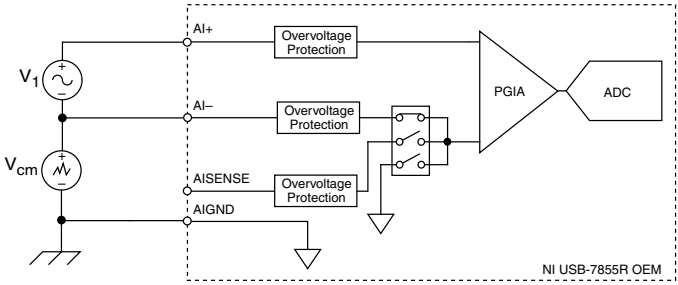
**Figure 4.** Connecting Non-Referenced Single-Ended Signals to the USB-7855R OEM Device




## Connecting Differential Voltage Signals

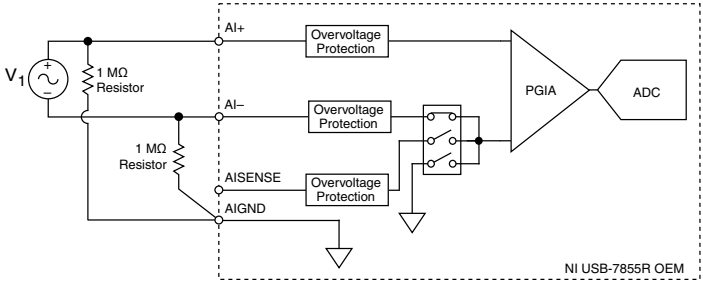
You can connect grounded or floating differential signal sources to the NI USB-7855R OEM device. Connect the positive voltage signal to the AI+ and the negative voltage signal to AI-. To connect grounded differential signals to the NI USB-7855R OEM device, you must also connect the signal reference to AI GND.

**Figure 5.** Connecting Grounded Differential Signals to the USB-7855R OEM Device




To connect floating differential signals to the NI USB-7855R OEM device, you must connect the negative and positive signals to AI GND through 1 MΩ resistors to keep the voltage within the common-mode voltage range. If the voltage source is outside the common-mode voltage range, the NI USB-7855R OEM device does not read data accurately.

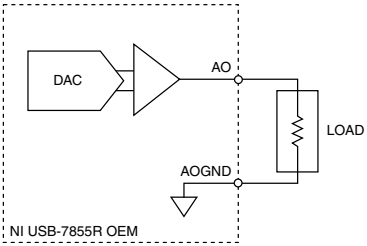
**Figure 6.** Connecting Floating Differential Signals to the USB-7855R OEM Device




# Analog Output

The NI USB-7855R OEM device provides connections for eight analog output channels. Each channel has an AO pin and AOGND pin to which you can connect a load.

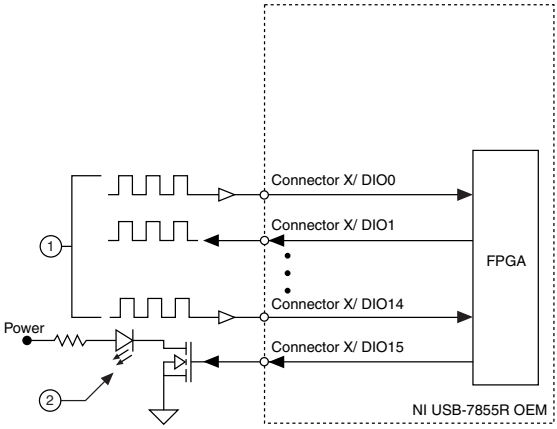
**Figure 7.** Connecting a Load




# Digital I/O

The NI USB-7855R OEM device provides connections for 48 digital input/output (DIO) channels. Connector 1, Connector 2, and Connector 3 contains 16 low-speed channels that can run up to 10 MHz signal frequencies. Each connector has selectable logic levels that you can configure as 1.2 V, 1.5 V, 1.8 V, 2.5 V, or 3.3 V. You can configure each channel as input or output.

**Figure 8.** Connecting to the DIO Channels




1. Low-speed signal frequencies up to 10 MHz with logic levels configured as 1.2 V, 1.5 V, 1.8 V, 2.5 V, or 3.3 V. Connectors 1 and 2 share the same voltage settings.
2. LED

The DIO channels connect to the FPGA through buffers, which have overvoltage and undervoltage protection as well as over current protection. Refer to the *NI USB-7855R OEM device Specifications* for more information about the maximum voltage and current.

When the system powers on, the DIO channels are set as input low with pull-down resistors. To set another power-on state, you can configure the NI USB-7855R OEM device to load a VI when the system powers on. The VI can then set the DIO lines to any power-on state.

National Instruments recommends performing signal integrity measurements to test the effect of signal routing with the cable and connection accessory for your application.

# LEDs

If you are putting the NI USB-7855R OEM device in an enclosure, you can either seat the optional lightpipes on the device or attach external LEDs, as described in the *Attaching External LEDs* section. When the lightpipes are attached, the top row is Error, USB Ready, and POWER LEDs, and the bottom row has the User LEDs.

The NI USB-7855R OEM device has six LEDs which reflect the device state.

**Table 3.** LED Descriptions

| LED | Description | Location |
|---|---|---|
| POWER | Solid blue when the power is on | 6 |
| USB READY | Solid blue when the USB is ready | 3 |

**Table 3.** LED Descriptions (Continued)

| LED | Description | Location |
|---|---|---|
| ERROR | Solid red for error cases | 2 |
| USER1 | Blue, user-defined | 1 |
| USER2 | Blue, user-defined | 4 |
| USER3 | Blue, user-defined | 5 |

# Attaching External LEDs

Seven connectors on the device in the E1 part —1, 2, 3, 4, 5, 6, and 7— allow you to connect an external LED circuit to the device, as shown in Figure 10.

For example, to connect an external USB READY LED, use 7 as the positive connection (+5 V) and 3 and the negative connection.

To connect the remaining LEDs, refer to Table 3.

National Instruments recommends that you limit the current to 10 mA per LED. You can limit this current by using external resistors, as shown in Figure 9.

**Figure 9.** External LEDs

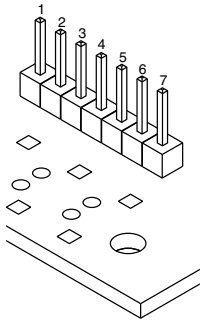
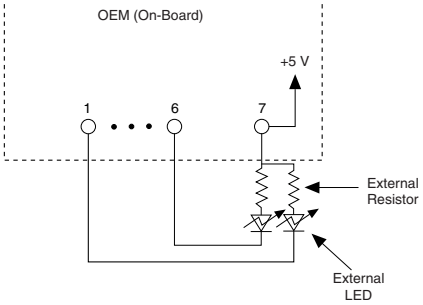


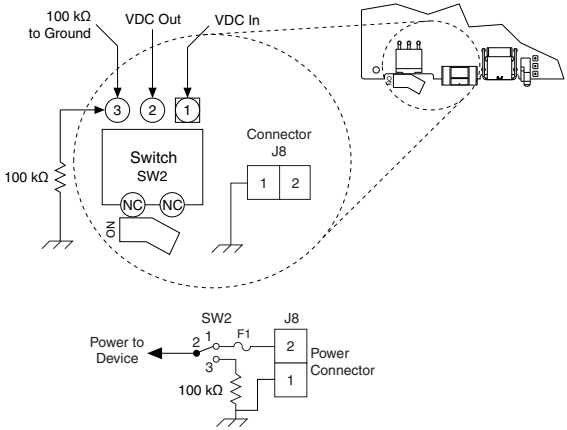
**Figure 10.** Attaching External LEDs




# Power Switch

Use the power switch to power the NI USB-7855R OEM device on and off. The following figure shows the pins on the power switch and power circuitry.

**Figure 11.** Power Switch (Shown in the On Position)




The following table lists the pin locations and signal descriptions.

**Table 4.** Power Switch Pin Descriptions

| Pin | Signal | Description |
|---|---|---|
| 1 | VDC In | Connects to VDC through a non-user replaceable fuse (reference designator F1). The VDC is the voltage provided by the power supply through pin 2 of the power connector (reference designator J8) and must be 9 V to 30 V, 20 W. |
| 2 | VDC Out | Provides power to the circuitry on the NI USB-7855R OEM device. When the switch is in the on position, the VDC power supply from pin 1 is routed to pin 2. |
| 3 | 100 kΩ to Ground | Connects pin 2 to ground through a 100 kΩ resistor when the switch is in the off position. |

# +5 V Power Source

Use the +5 V terminals on the I/O connector supply +5 V referenced to DGND to power external circuitry.

**Caution** Never connect the +5 V power terminals to analog or digital ground or any other voltage source on the NI USB-7855R OEM device or any other device. Doing so can damage the device and the computer. National Instruments is not liable for damage resulting from such a connection.

The power rating is 4.75 to 5.1 VDC at 0.5 A.

# Autonomous Mode

You can run the NI USB-7855R OEM device without a USB connection to a host computer using Autonomous Mode. To collect data the NI USB-7855R OEM device acquires in Autonomous Mode, you must reconnect the NI USB-7855R OEM device to a host computer.

**Caution** Data is lost and is not recoverable upon reconnection if a DMA FIFO overflows while the NI USB-7855R OEM device is disconnected from the host computer or if the NI USB-7855R OEM device loses power at any point.

Autonomous Mode includes the following capabilities.

**Table 5.** Autonomous Mode Capabilities

| Capability | Description |
|---|---|
| Use the Open/Close FPGA Reference VI functions to run an FPGA VI and then disconnect the USB cable. | Call the Close FPGA VI Reference Function without aborting or resetting the FPGA VI before you disconnect the USB cable.[1]<br>After you disconnect the USB cable, any VI running on the NI USB-7855R OEM device continues to run and collect data, which can later be retrieved by reconnecting the USB cable and re-opening the original FPGA reference. |
| Use Interactive Front Panel Communication to run an FPGA VI and then disconnecting the USB cable. | The front panel indicators stop updating.<br>After you disconnect the USB cable, any VI running on the NI USB-7855R OEM device continues to run. Restore the Interactive Front Panel Communication by reconnecting the USB cable. |
| Download the bitfile to flash memory and set it to run when loaded to FPGA. | Download the bitfile to flash memory and set it to run when loaded to FPGA. The bitfile automatically starts running whenever power is applied to the NI USB-7855R OEM device. To collect data, you must reconnect the NI USB-7855R OEM device to a host computer before powering off the device.<br>Refer to the *LabVIEW FPGA Module Help* for more information about downloading an FPGA VI to the flash memory. |

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[1] The Host VI errors out if you do not call the Close FPGA VI Reference Function without aborting or resetting the FPGA VI.

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