NI-6581/6581B Getting Started

2025-03-20

Contents

NI-6581/6581B Getting Started

Note Before you begin, complete the software and hardware installation instructions in the getting started guide for your FlexRIO FPGA module or Controller for FlexRIO.

The NI-6581/6581B is a FlexRIO adapter module designed to work in conjunction with FlexRIO FPGA modules and Controllers for FlexRIO.

This document explains how to install and configure the NI-6581/6581B.

Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits are designed to provide reasonable protection against harmful interference when the product is operated in the intended operational electromagnetic environment.

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any modifications to the product not expressly approved by NI could void your authority to operate it under your local regulatory rules.

Caution To ensure the specified EMC performance, operate this product only with shielded cables and accessories.

Caution To ensure the specified EMC performance, the length of all I/O cables must be no longer than 3 m (10 ft).

FlexRIO Documentation

Table 1. FlexRIO Documentation Locations and Descriptions

Document	Location	Description
Getting started guide for your FlexRIO FPGA module or Controller for FlexRIO	Available from the Start menu and at ni.com/manuals.	Contains installation instructions for your FlexRIO system.
Specifications document for your FlexRIO FPGA module or Controller for FlexRIO	Available from the Start menu and at ni.com/manuals.	Contains specifications for your FlexRIO FPGA module or Controller for FlexRIO.
Getting started guide for your adapter module	Available from the Start menu and at ni.com/manuals.	Contains signal information, examples, and CLIP details for your adapter module.
Specifications document for your adapter module	Available from the Start menu and at ni.com/manuals.	Contains specifications for your adapter module.
LabVIEW FPGA Module Help	Embedded in ***LabVIEW Help*** and at ni.com/manuals.	Contains information about the basic functionality of the LabVIEW FPGA Module.
Real-Time Module Help	Embedded in ***LabVIEW Help*** and at ni.com/manuals.	Contains information about real-time programming concepts, step-by-step instructions for using LabVIEW with the Real-Time Module, reference information about Real-Time Module VIs and functions, and information about LabVIEW features on real-time operating systems.
FlexRIO Help	Available from the Start menu and at ni.com/manuals.	Contains information about the FPGA module front panel connectors and I/O, controller for FlexRIO front panel connectors and I/O,

Document	Location	Description
		programming instructions, and adapter module component-level IP (CLIP).
LabVIEW Examples	Available in NI Example Finder. In LabVIEW, click **Help** » **Find Examples** » **Hardware Input and Output** » **FlexRIO**.	Contains examples of how to run FPGA VIs and Host VIs on your device.
IPNet	Located at ni.com/ipnet.	Contains LabVIEW FPGA functions and intellectual property to share.
FlexRIO product page	Located at ni.com/flexrio.	Contains product information and data sheets for FlexRIO devices.

FlexRIO Examples

FlexRIO includes several example applications for LabVIEW. These examples serve as interactive tools, programming models, and as building blocks in your own applications.

Accessing FlexRIO Examples

FlexRIO examples are available in LabVIEW's NI Example Finder. Complete the following steps to access the examples by task.

1. In LabVIEW, click **Help** » **Find Examples**.
2. In the NI Example Finder window that appears, click **Hardware Input and Output** » **FlexRIO**.

   Click on an example and refer to the Information window for a description of the example. Refer the Requirements window for a list of hardware that can run the example.

   You can also click the Search tab to search all installed examples by keyword. For example, search for `FlexRIO` to locate all FlexRIO examples.

Online examples are also available to demonstrate FlexRIO basics, such as using DRAM, acquiring data from adapter modules, and performing high throughput streaming. To access these examples, search `FlexRIO examples` in the **Search the community** field at ni.com/examples.

Verifying the System Requirements

To use the NI-6581/6581B, your system must meet certain requirements. For more information about minimum system requirements, recommended system, and supported application development environments (ADEs), refer to the readme, which is installed or available at ni.com/manuals.

Unpacking

> **Caution** To prevent ESD from damaging the devices, ground yourself using a grounding strap or by holding a grounded object, such as your computer chassis.

1. Touch the antistatic package to a metal part of the computer chassis.
2. Remove each module from the package and inspect it for loose components or any other sign of damage.

   > **Notice** Never touch the exposed pins of connectors.

   > **Note** Do not install a device if it appears damaged in any way.

3. Unpack any other items and documentation from the kit.

Store the devices in the antistatic package when they are not in use.

Preparing the Environment

Ensure that the environment where you are using the NI-6581/6581B meets the

following specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	0 °C to 55 °C
Operating humidity (IEC 60068-2-56)	10% to 90% RH, noncondensing
Pollution Degree	2
Maximum altitude	2,000 m at 25 °C ambient temperature

Indoor use only.

Note Clean the hardware with a soft, nonmetallic brush. Make sure that the hardware is completely dry and free from contaminants before returning it to service.

Related information:

- NI-6581 and NI-6581B Specifications

Installing the NI-6581/6581B

Refer to the getting started guide for your FlexRIO FPGA module or Controller for FlexRIO for instructions about how to install your FlexRIO system, including the NI-6581/6581B.

Connecting Cables

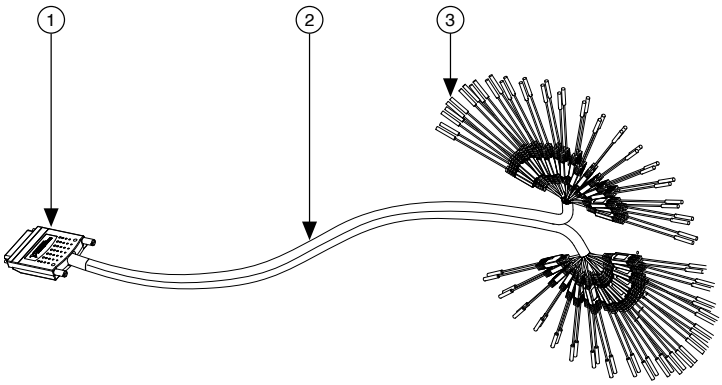
NI recommends that you use the following cables with the NI-6581/6581B:

- NI SHC68-C68-D4 cable (part number 196275-01)—Shielded cable designed for

single-ended, high-speed digital signal transmission. This cable has individual microcoaxial 50 Ω lines for each signal.
- NI C68-C68-D4 cable (part number 195949-01)—Unshielded, single-ended 50 Ω cable.
- NI SHC68-H1X38 cable (part number 192681-1R5)—Single-ended, 50 Ω cable that breaks out each single-ended signal into two 0.1 inch header receptacles, one receptacle each for the signal and ground. It provides an easy way to connect the NI-6581/6581B to various types of devices and circuits for interfacing, testing, or analysis.

This cable offers connectivity similar to that found on a typical logic analyzer, so you can use it in logic analyzer-type applications. Unlike a typical logic analyzer, however, this cable also allows for simultaneous pattern generation and acquisition so that you can use it in stimulus/response applications as well. The following figure shows the parts locator diagram for the single-ended digital flying lead cable.

Figure 1. NI SHC68-H1X38 Cable Parts Locator Diagram



1. 68-pin VHDCI Connector
2. Removable Sleeving
3. Lead Pairs

You can use the SHC68-C68-D4 or C68-C68-D4 cable with the following accessories:

- NI CB-2162—Single-ended digital I/O (DIO) accessory that can access the signals on the 68-pin DDC connector, terminate the DIO channels, and provide a platform for circuit prototyping and DUT testing.
- NI SMB-2163—Breakout box that offers coaxial SMB connectors for each channel on the DDC connector, providing an easy way to connect to other devices for testing and debugging.

Note When connecting to the CB-2162 or SMB-2163 accessories, NI-6581/6581B signals map in the following ways:

- P0.<0..7> map to DIO <0..7>
- P1.<0..7> map to DIO <8..15>
- P2.<0..7> map to DIO <16..23>
- GLOBAL CLOCK <0..1> map to STROBE

For information about connecting I/O signals, refer to the ***FlexRIO Help***, available from the Start menu and at ni.com/manuals.

Confirming that Measurement & Automation Explorer (MAX) Recognizes the Device

Use Measurement & Automation Explorer (MAX) to configure your NI hardware. MAX informs other programs about which devices reside in the system and how they are configured. MAX is automatically installed with FlexRIO Support.

1. Launch MAX by navigating to **Start** » **All Programs** » **National Instruments** » **NI MAX** or by clicking the NI MAX desktop icon.
2. In the Configuration pane, double-click **Devices and Interfaces** to see the list of installed devices. Installed devices appear under the name of their associated chassis.
3. (PXI and PXI Express devices only) Expand your **Chassis** tree item. MAX lists all devices installed in the chassis. Your default device names may vary.

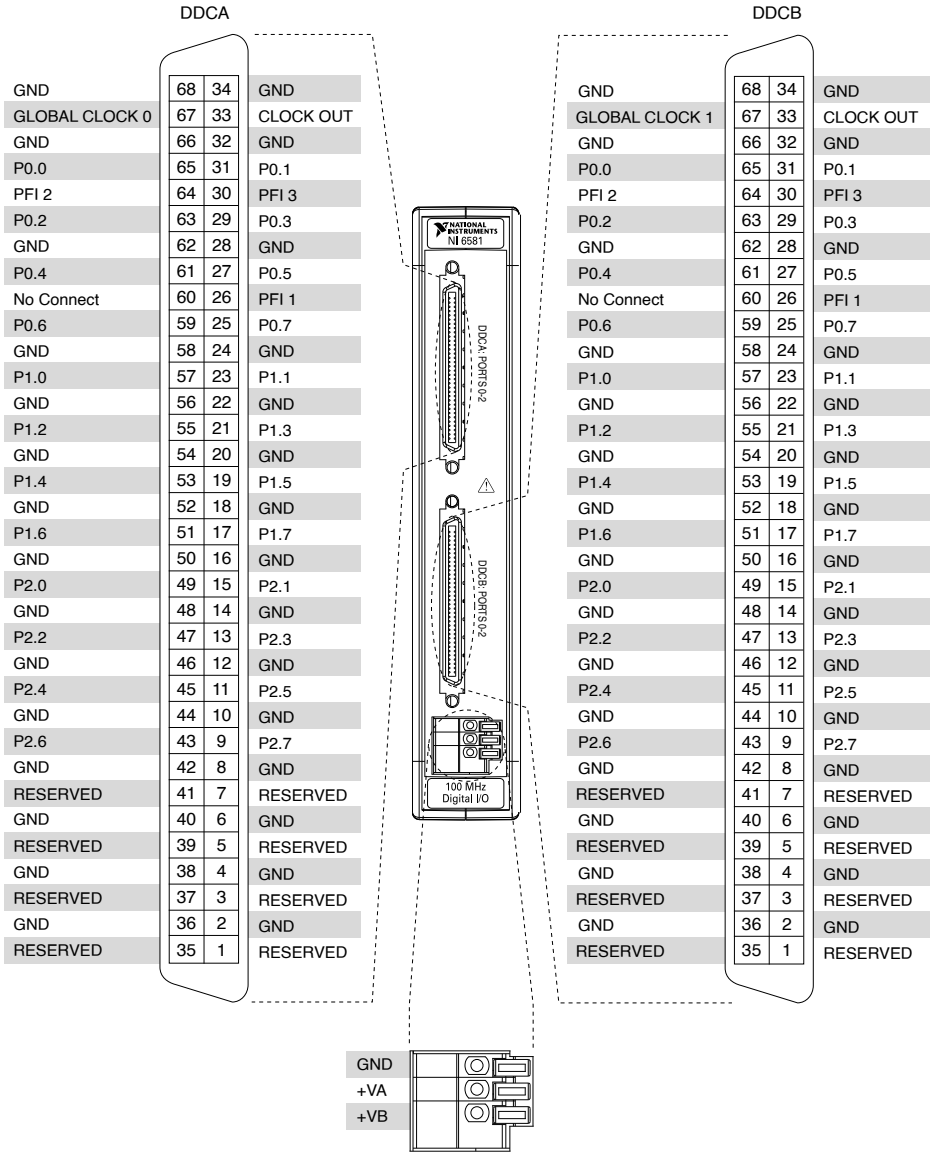
   Note If you do not see your hardware listed, press <F5> to refresh the list of installed devices. If the device is still not listed, power off the system, ensure the device is correctly installed, and restart.

4. (Controllers for FlexRIO only) Your device appears under the **Remote Devices** section.

Front Panel and Connector Pinouts

The following figure shows the digital data connector (DDC) pin assignments for the NI-6581/6581B. Refer to the ***NI 6581/6581B Specifications*** for signal information.

Figure 2. NI-6581/6581B Connector Pin Assignments



Caution Connections that exceed any of the maximum ratings of input or output signals on the NI-6581/6581B can damage the device and the chassis. NI is not liable for any damage resulting from such signal connections. For the maximum input and output ratings for each signal, refer to the ***NI 6581/6581B Specifications***.

Table 2. NI-6581/6581B DDC Connector Pins

Signal Name	Pin(s)	Signal Type	Signal Description
GLOBAL CLOCK 0	67 on DDCA	Control	Input terminal for the external Sample Clock source, which can be used for dynamic acquisition.
GLOBAL CLOCK 1	67 on DDCB		
P0.<0..7>	25, 27, 29, 31, 59, 61, 63, 65	Data/Control	Bidirectional Port 0 digital I/O data channels 0 through 7.
P1.<0..7>	17, 19, 21, 23, 51, 53, 55, 57	Data/Control	Bidirectional Port 1 digital I/O data channels 0 through 7.
P2.<0..7>	9, 11, 13, 15, 43, 45, 47, 49	Data/Control	Bidirectional Port 2 digital I/O data channels 0 through 7.
CLOCK OUT	33	Control	Output terminal for the exported Sample Clock.
PFI <1..3>	26, 30, 64	Control/Data	Bidirectional digital I/O channels 1 through 3.
GND	2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 28, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 62, 66	Ground	Ground reference for signals.
RESERVED	1, 3, 5, 7, 35, 37, 39, 41	N/A	These terminals are reserved for future use. Do not connect to these pins.
No Connect	60	N/A	Do not connect to this pin.

The following table contains external power connector terminal information for the NI-6581/6581B.

Table 3. NI-6581/6581B Power Connector Terminals

External Power Terminal Name	Terminal Description
GND	Ground reference for external power
+VA	External power terminal for DDCA connector.
+VB	External power terminal for DDCB connector.

The following table lists the NI-6581/6581B power supply control signals and the corresponding FlexRIO FPGA module signals.

Table 4. NI-6581/6581B Power Supply Control Signals and FlexRIO FPGA Module Signals

NI-6581/6581B Supply Control Signal Name	FlexRIO FPGA Module GPIO Out
BANK0_SUPPLY_SELECT	GPIO_32
BANK1_SUPPLY_SELECT	GPIO_32_n
PWR_SUPPLY_SEL_0	GPIO_65
PWR_SUPPLY_SEL_1	GPIO_65_n

Related information:

- NI-6581 and NI-6581B Specifications

Block Diagrams

Figure 3. P0.<0..7>, P1.<0..7>, P2<0..7> Data Port

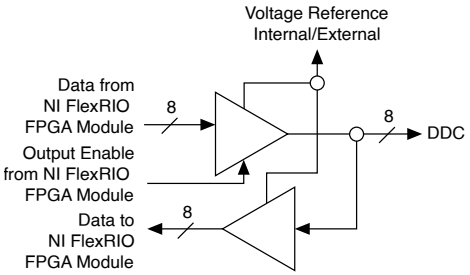
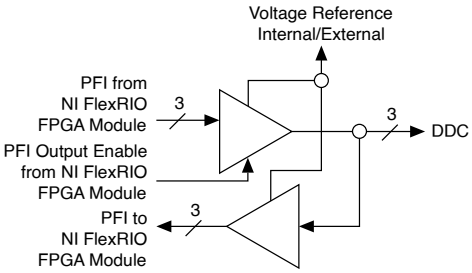
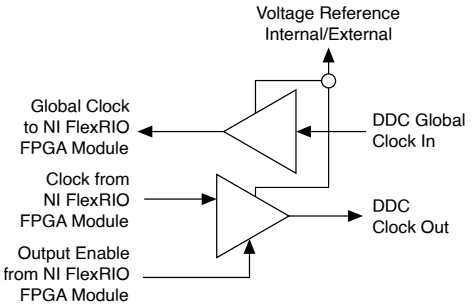


Figure 4. PFI <1..3> Port



Note Digital I/O signals, P0 <0..7>, P1 <0..7>, P2 <0..7>, and PFI <1..3>, appear on both connectors, DDCA and DDCB.

Figure 5. Clock Input and Output



Component-Level Intellectual Property (CLIP)

The LabVIEW FPGA Module includes component-level intellectual property (CLIP) for HDL IP integration. FlexRIO devices support two types of CLIP: user-defined and socketed.

- ***User-defined CLIP*** allows you to insert HDL IP into an FPGA target, enabling VHDL code to communicate directly with an FPGA VI.
- ***Socketed CLIP*** provides the same IP integration of the user-defined CLIP, but it also allows the CLIP to communicate directly with circuitry external to the FPGA. Adapter module socketed CLIP allows your IP to communicate directly with both the FPGA VI and the external adapter module connector interface.

The NI-6581/6581B ships with socketed CLIP items that add module I/O to the LabVIEW project.

Refer to ***Configuring Your Adapter Module Using LabVIEW FPGA*** in FlexRIO

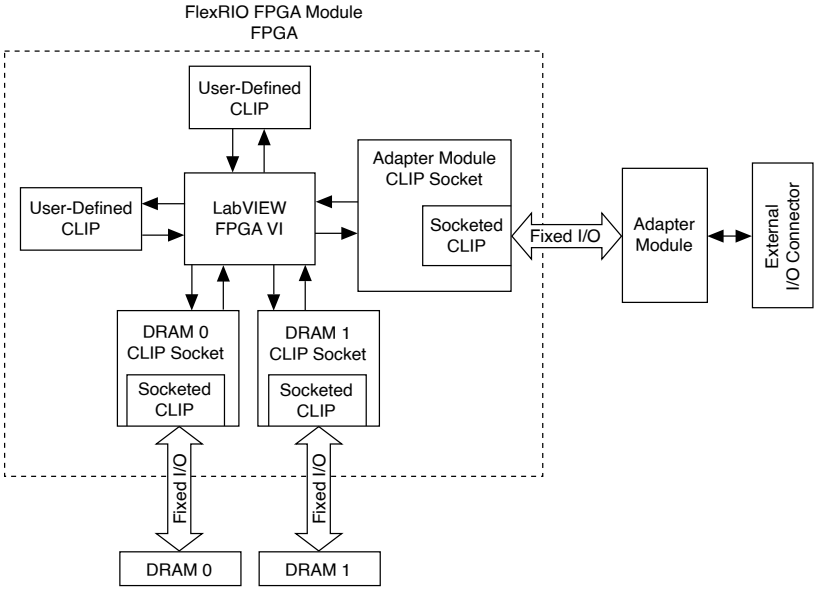
documentation for more information about CLIP.

CLIP and LabVIEW FPGA

The interface between the NI-6581/6581B CLIP and LabVIEW FPGA in the following figures.

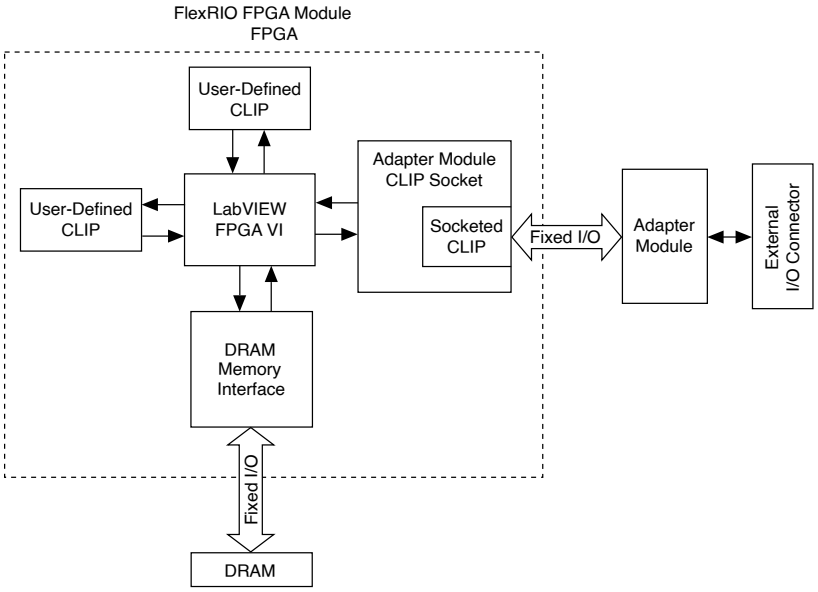
If you are using a FlexRIO FPGA module with a Virtex-5 FPGA, refer to the following figure, which shows the relationship between the CLIP and an FPGA VI configured for use with a Virtex-5 FPGA target.

Figure 6. CLIP and FPGA VI Relationship (Virtex-5)



If you are using a FlexRIO FPGA module or Controller for FlexRIO with a Kintex-7 FPGA, refer to the following figure, which shows the relationship between the CLIP and an FPGA VI configured for use with a Kintex-7 FPGA target.

Figure 7. CLIP and FPGA VI Relationship (Kintex-7)



NI 6581/6581B CLIP

The NI 6581/6581B ships with socketed CLIP that adds module I/O to the LabVIEW project. The NI-developed CLIP are as follows:

- **NI 6581 Channel CLIP**—

  This CLIP provides read/write access to all digital I/O (DIO) channels using a single channel-based interface. Each grouping of eight I/O channels has a write enable signal. In the LabVIEW FPGA Module, each DIO channel is accessed using a Boolean signal.

  This CLIP allows you to export a clock on each connector. LabVIEW generates this clock, which can be inverted before it is generated. Inverting this clock allows you to synchronize the output data to either the rising or falling edge of the clock. Setting the invert clock signal to FALSE synchronizes to the rising edge, and setting the invert clock signal to TRUE synchronizes to a falling edge.

- **NI 6581 Port CLIP**—

  This CLIP provides read/write access to all digital I/O (DIO) lines on each connector using an 8-pin port-based interface. Each connector is grouped into four 8-bit ports. Three of those ports contain the 24 DIO lines, and the fourth port contains

the three PFI lines dedicated to that connector. Each port has a write enable signal.

Signal direction is configured on a per-port basis. Using the DDCA_Portn_WE / DDCB_Portn_WE signals exposed by the CLIP, set the write enable signal to TRUE to drive the NI 6581 pins for that port. Set the write enable signal to FALSE to tristate the driver for those pins.

This CLIP allows you to export a clock on each connector. LabVIEW generates this clock, which can be inverted before it is generated. Inverting this clock allows you to synchronize the output data to either the rising or falling edge of the clock. Setting the invert clock signal to FALSE synchronizes to the rising edge, and setting the invert clock signal to TRUE synchronizes to a falling edge.

- **NI 6581B Channel CLIP**—

  This CLIP provides read/write access to all digital I/O (DIO) channels using a single channel-based interface. Each grouping of eight I/O channels has a write enable signal. In the LabVIEW FPGA Module, each DIO channel is accessed using a Boolean signal.

  This CLIP allows you to export a clock on each connector. LabVIEW generates this clock, which can be inverted before it is generated. Inverting this clock allows you to synchronize the output data to either the rising or falling edge of the clock. Setting the invert clock signal to FALSE synchronizes to the rising edge, and setting the invert clock signal to TRUE synchronizes to a falling edge.

- **NI 6581B Port CLIP**—

  This CLIP provides read/write access to all digital I/O (DIO) lines on each connector using an 8-pin port-based interface. Each connector is grouped into four 8-bit ports. Three of those ports contain the 24 DIO lines, and the fourth port contains the three PFI lines dedicated to that connector. Each port has a write enable signal.

  Signal direction is configured on a per-port basis. Using the DDCA_Portn_WE / DDCB_Portn_WE signals exposed by the CLIP, set the write enable signal to TRUE to drive the NI 6581B pins for that port. Set the write enable signal to FALSE to tristate the driver for those pins.

This CLIP allows you to export a clock on each connector. LabVIEW generates this clock, which can be inverted before it is generated. Inverting this clock allows you to synchronize the output data to either the rising or falling edge of the clock. Setting the invert clock signal to FALSE synchronizes to the rising edge, and setting the invert clock signal to TRUE synchronizes to a falling edge.

Refer to Knowledge Base `6NND5NOA` for a list of pin assignments to use when modifying the socketed CLIP used by an NI-6581/6581B.

Refer to ***FlexRIO Help*** for more information about FlexRIO CLIP items, configuring the NI 6581/6581B with a socketed CLIP, and a list of available socketed CLIP signals.

Related information:

- FlexRIO Help

Power Supply Control Signals

The following table lists the NI-6581/6581B power supply control signals and the corresponding FlexRIO FPGA module signals.

Table 5. NI-6581/6581B Power Supply Control Signals and FlexRIO FPGA Module Signals

NI-6581/6581B Supply Control Signal Name	FlexRIO FPGA Module GPIO Out
BANK0_SUPPLY_SELECT	GPIO_32
BANK1_SUPPLY_SELECT	GPIO_32_n
PWR_SUPPLY_SEL_0	GPIO_65
PWR_SUPPLY_SEL_1	GPIO_65_n

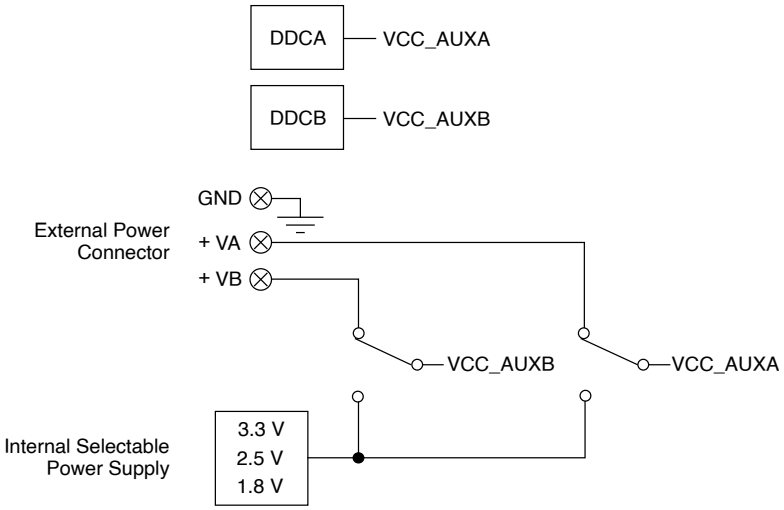
Power Options

You can power the NI-6581/6581B internally, or externally through a variable power supply.

The following diagram illustrates a power circuitry diagram with an external variable

power supply.

Figure 8. NI-6581/6581B Power Circuitry Diagram



Internal Power Options

You can use one of the internal power options shown in the following table to power one or both DDC connectors.

Table 6. Internal Power Supply Voltage Settings

Voltage	Setting in LabVIEW
3.3 V	0
2.5 V	1
1.8 V	2

Using External Power

Use the power connector to externally power the NI-6581/6581B. If you do not want to use the predefined internal voltages, you can select external power in software for one or both DDC connectors. Complete the following steps to wire a variable power supply to the power connector with 20–26 AWG wires.

1. Using wire strippers, carefully remove 11 mm(0.43 in.) of insulation from the signal wires.
2. Wire the voltage output of the power supply to the +VA terminal and/or +VB

terminal, depending which DDC connector(s) you want to power. Press a small flathead screwdriver on the spring terminal lever to open the terminal, and insert the wire into the spring terminal opening.

3. Wire the ground of the power supply to the GND terminal of the power connector.

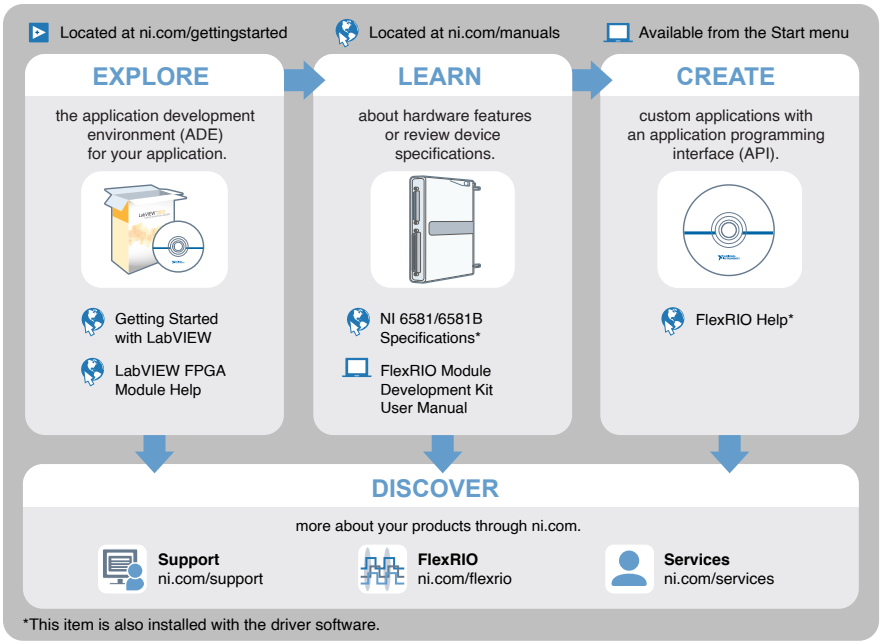
   The NI-6581/6581B external power connector ground connection references an external power supply to the PXI system. The external power connector does not provide any means of isolation; therefore, use care when connecting a non-isolated supply to the external power connector.

   Using a grounded power supply as the external power source may cause ground loops that increase noise on the power rails. NI recommends that you use a floating source that is ground referenced to the PXI chassis using the ground connection provided by the external power ground connector on the NI-6581/6581B.

For the maximum external power supply limit, refer to the ***NI-6581/6581B Specifications***, available from the Start menu and at ni.com/manuals.

Where to Go Next

Refer to the following figure for information about other product tasks and associated resources for those tasks.



NI Services

Visit ni.com/support to find support resources including documentation, downloads, and troubleshooting and application development self-help such as tutorials and examples.

Visit ni.com/services to learn about NI service offerings such as calibration options, repair, and replacement.

Visit ni.com/register to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

NI corporate headquarters is located at 11500 N Mopac Expwy, Austin, TX, 78759-3504, USA.

© 2025 National Instruments Corporation.