

100 MHz Digital Adapter Module for NI FlexRIO

NI 6581 **NEW!**

- 100 MHz maximum clock rate
- 54 single-ended digital I/O channels
- Selectable voltages of 1.8, 2.5, 3.3, and 5.0 V or external reference voltage (1.8 to 5.5 V)
- Mates with an NI FlexRIO FPGA module for reliable and deterministic control of digital communication and tests

Operating Systems

- Windows Vista/XP/2000
- LabVIEW Real-Time

Required Software

- LabVIEW
- LabVIEW FPGA Module

Recommended Software

- LabVIEW Real-Time Module

Driver Software (included)

- NI-RIO



Overview

Applications
Digital Interfacing
Mixed-signal design validation and test
Digital electronics
Aerospace/Defense
Subsystem emulation
Bit error rate tester (BERT)
Communications
Custom protocol emulation and testing
Multimedia chipset emulation
Consumer Electronics
CMOS and CCD imaging sensors
Digital display tests

The NI 6581 is a 100 MHz digital adapter module for NI FlexRIO field-programmable gate array (FPGA) modules. This adapter module features 54 single-ended digital I/O lines with software-selectable voltages of 1.8, 2.5, and 3.3 (5 V tolerant). You can combine it with an NI FlexRIO FPGA module to create an NI FlexRIO digital instrument (NI PXI-6581R) for a wide

variety of applications from high-speed communication with a device under test to custom protocol emulation. You can also use this adapter module with an NI FlexRIO FPGA module for the following:

- Customized semiconductor testing
- Electronics testing
- Implementation and testing of standard protocols such as SPI and I²C, both as a master or slave

In addition, you can configure the digital I/O lines as custom counter/timers, pulse-width modulation (PWM) channels, or communication buses for user-defined protocols or applications requiring serial triggering. You can even customize the communications with the onboard DRAM for optimized streaming operations.

Features

At sampling rates of 100 MHz, you can program the banks of I/O lines independently to implement read or write operations or synchronize multiple banks. You can configure the NI 6581 module for 1.8, 2.5, 3.3, or 5 V (TTL) logic. You also can use an external source (such as a PXI programmable power supply) as a voltage reference (1.8 to 5.5 V), for each connector independently, to create custom voltage references.

Programmable Onboard FPGA

NI FlexRIO FPGA modules for PXI include user-programmable FPGAs for onboard processing and flexible I/O operation. You can implement customizable features such as hardware compare, waveform linking/looping, and other hardware-based algorithms inside the onboard FPGA through the LabVIEW FPGA programming environment or through VHDL.

The NI 6581 adapter module with the NI FlexRIO FPGA modules can perform truly parallel data processing on the FPGA, which would otherwise be too processor- and time-intensive in software. This instrument is programmable with the NI-RIO driver and LabVIEW FPGA Module for not only high-speed digital acquisition and generation but also hardware-implemented signal processing and control.

The new Virtex-5 FPGA architecture is optimized to execute faster and more efficiently using single-cycle timed loops in LabVIEW FPGA. This means you can optimize more LabVIEW FPGA code to fit within Virtex-5 FPGAs and execute more operations per clock cycle.

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Graphical Programming with LabVIEW FPGA

The LabVIEW FPGA Module uses LabVIEW embedded technology to extend LabVIEW graphical development and target FPGAs on NI reconfigurable I/O (RIO) hardware. LabVIEW is distinctly suited for FPGA programming because it clearly represents parallelism and data flow. With the LabVIEW FPGA Module, you can create custom measurement and control hardware without low-level hardware description languages or board-level design. You can use this custom hardware for unique timing and triggering routines, ultrahigh-speed control, interfacing to digital protocols, digital signal processing (DSP), and many other applications requiring high-speed hardware reliability and tight determinism.

Connectivity Options

The NI 6581 adapter module has two VHDCI connectors. Each connector has 24 general-purpose digital I/O lines, three PFI lines, one clock-out line, and one clock-in line. You can connect the NI 6581 using an NI SHC68-C68-D4 shielded single-ended cable to a terminal block such as the NI SMB-2163 for SMB connectivity or the NI CB-2162 for direct termination. The pinout of the NI 6581 is the same as the pinout of NI high-speed digital instruments such as NI 654x devices.



Figure 1. The NI 6581 has two VHDCI connectors for connecting to terminal boxes such as the NI SMB-2163.

Required Software

NI FlexRIO products require Version 8.6 or later of LabVIEW and the LabVIEW FPGA Module as well as NI-RIO Version 3.1 or later driver software.

Ordering Information

NI 6581780565-01

NI FlexRIO FPGA Modules

NI PXI-7951R780560-01

NI PXI-7952R.....780561-01

NI PXI-7953R.....780562-01

NI PXI-7954R.....780563-01

Cables

NI SHC68-C68-D4 (shielded single-ended cable)196275-01

NI C68-C68-D4 (unshielded 1 m cable)195949-01

NI SHC68-H1X38 (flying lead 1.5 m cable)192681-1R5

Terminal Blocks

NI CB-2162 (terminal block with pin headers).....778592-01

NI SMB-2163 (SMB breakout box).....778747-01

Header jumper kit.....199101-01

Connectors

Dual-stacked VHDCI connector, 68-pin, right-angle780390-01

VHDCI connector, 68-pin, vertical780389-01

VHDCI connector, 68-pin, right-angle.....778914-01

BUY NOW!

For complete product specifications, pricing, and accessory information, call 800 813 3693 (U.S.) or go to ni.com/flexrio.

100 MHz Digital Adapter Module for NI FlexRIO

Specifications

This document lists the specifications of the NI 6581 adapter module for NI FlexRIO. Pair these specifications with your NI FlexRIO FPGA module specifications. Refer to the *Getting Results with the NI PXI-6581R* document for instructions on how to install and configure the NI PXI-6581R. These specifications are typical at 25 °C unless otherwise noted. For detailed specifications, see *NI 6581 Specifications* at ni.com/manuals.

Channel Specifications per Connector

Number of DDC connectors 2, DDCA and DDCB
 Number of digital I/O channels 54 total (48 data, 6 PFI)
 27 per DDC connector

Direction control of data channels

P0.<0..7> Per 8-bit port
 P1.<0..7> Per 8-bit port
 P2.<0..7> Per 8-bit port

Direction control of PFI channels

CLOCK OUT/PFI 0 Output only
 PFI <1..3> All input or output,
 per port per connector

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

Generation voltage levels (P0.<0..7>, P1.<0..7>, P2.<0..7>, PFI <1..3>, and CLOCK OUT/PFI 0)

Voltage	Low-Voltage Levels		High-Voltage Levels	
	Guaranteed ¹	Typical	Guaranteed ¹	Typical
5 V ²	0.55 V	0 V	3.8 V	5 V
3.3 V	0.55 V	0 V	2.4 V	3.3 V
2.5 V	0.30 V	0 V	1.9 V	2.5 V
1.8 V	0.45 V	0 V	1.2 V	1.8 V

¹ Voltage levels guaranteed by design through the digital buffer specification.

² 5 V only available through an external power supply.

Note: Each connector can be referenced to external or internal power supply.

Acquisition voltage levels (P0.<0..7>, P1.<0..7>, P2.<0..7>, PFI <1..3>, and GLOBAL CLOCK <0..1>)

Voltage	Guaranteed Low-Voltage Levels ¹	Guaranteed High-Voltage Levels ¹
5 V ²	1.5 V	3.5 V
3.3 V	0.8 V	2.0 V
2.5 V	0.7 V	1.7 V
1.8 V	0.6 V	1.2 V

¹ Voltage levels guaranteed by design through the digital buffer specification.

² 5 V only available through an external power supply.

Note: Each connector can be referenced to external or internal power supply.

Note: The I/O buffer performance on the NI 6581 is similar to the buffer performance specifications for the TI SN74LVC8T245 transceiver. The performance is correlated to supply voltage. I/O timing performance degrades as supply voltage decreases.

P0.<0..7>, P1.<0..7>, P2.<0..7>, and PFI <1..3>

Output impedance (nominal) 50 Ω series
 Maximum input leakage ±6 μA
 Characteristic impedance 50 Ω traces
 Power-on state Drivers disabled
 Absolute maximum input range -0.5 to 6.5 V

CLOCK OUT/PFI 0

Output impedance (nominal) 50 Ω
 Maximum output voltage range 1.8 to 5.5 V, output only
 Maximum toggle rate 100 MHz at ≥3.3 V

GLOBAL CLOCK <0..1>

Direction Input into device

Note: Clock is connected to NI FlexRIO FPGA module global clock inputs.

Maximum input leakage ±4 μA
 Characteristic impedance 50 Ω traces
 Power-on state Drivers disabled
 Absolute maximum input range -0.5 to 6.5 V
 Maximum toggle rate 100 MHz at ≥3.3 V

100 MHz Digital Adapter Module for NI FlexRIO

Pinout and Signal Information

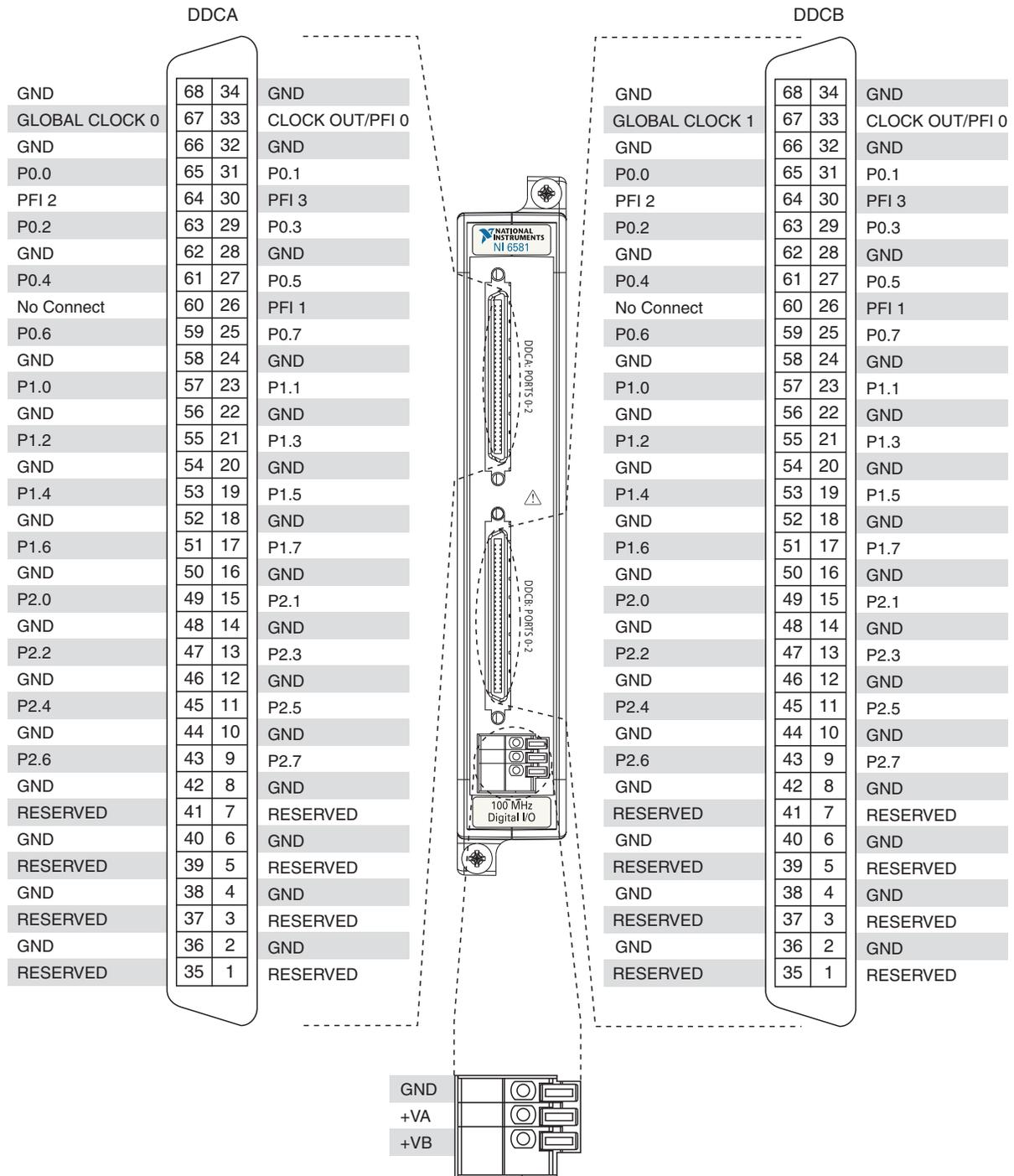


Figure 2. NI 6581 Pinout

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

100 MHz Digital Adapter Module for NI FlexRIO

NI 6581 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/PFI 0	33	Control	Output terminal for the exported sample clock.
PFI <1..3>	26, 30, 64	Data/Control	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.

Table 1. Pin Location and Signal Information for the NI 6581

NI 6581 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

Table 2. External Power Connector Terminal Information for the NI 6581

Power

Internal power source

Power requirements from the NI FlexRIO FPGA module

+3.3 V	200 mA, maximum
+12 V	250 mA, maximum

External power source

Voltage range	1.8 to 5.5 V
Current	0.7 A at 3.3 V driving a 1 k load, all channels toggling with a PRBS pattern at full rate

Power dissipation

VA power + VB power	<5 W, maximum
Capacitance on +VA and +VB	50 µF per rail

Note: With higher voltages, it is possible to exceed the power dissipation limit.

Maximum DC drive strength

5 V	32 mA
3.3 V	24 mA
2.5 V	8 mA
1.8 V	4 mA

Note: You must wait at least 10 ms after changing the power supply to allow the rails to settle to their new voltage before acquiring or generating data.

Physical

Dimensions.....	12.9 by 2.0 by 12.1 cm (5.1 by 0.8 by 4.7 in.)
Weight.....	284 g (10 oz)
Front panel connectors	Two 68-pin VHDCI connectors
Spring-terminal wiring.....	18 to 28 AWG copper conductor wire with 7 mm (0.28 in.) of insulation stripped from the end

Environmental

The NI 6581 is intended for indoor use only.

Operating environment	0 to 55 °C (tested in accordance with IEC-60068-2-1 and IEC-60068-2-2)
Relative humidity range.....	10 to 90%, noncondensing (tested in accordance with IEC-60068-2-56)
Storage environment	
Ambient temperature range	-20 to 70 °C (tested in accordance with IEC-60068-2-1 and IEC-60068-2-2)
Relative humidity range.....	5 to 95%, noncondensing (tested in accordance with IEC-60068-2-56)

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

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Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note: For UL and other safety certifications, refer to the product label or visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 (IEC 61326): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note: For EMC compliance, operate this product according to the documentation.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

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.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the NI and the Environment Web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers: At the end of their life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit ni.com/environment/weee.htm.

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，请查看 ni.com/environment/rohs_china。 [For information about China RoHS compliance, go to ni.com/environment/rohs_china.]

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Hardware Services

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NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at ni.com/advisor to find a system assurance program to meet your needs.

Calibration Services

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