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GETTING STARTED GUIDE

NI 5783

Four Channel Transceiver Adapter Module

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 5783 is a FlexRIO adapter module designed to work in conjunction with FlexRIO FPGA modules and Controllers for FlexRIO.

The NI 5783 is available in two variants. The NI 5783-01 variant is a 40 MHz Elliptic Filter (Frequency Domain). The NI 5783-02 variant is a 40 MHz Butterworth Filter (Time Domain). Unless otherwise specified, all descriptions in this document refer to both variants.

The NI 5783 features 4 analog input channels with 16-bit resolution and sample rates up to 100 MS/s, and 4 analog output channels with 16-bit resolution and sample rates up to 100 MS/s or 200 MS/s.

Note The NI 5783 is compatible only with NI PXIe-797xR and NI-793xR devices.

This document explains how to install and configure the NI 5783.

Contents

NATIONAL INSTRUMENTS™

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 National Instruments 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.

Table 1. FlexRIO Documentation Locations and Descriptions (Continued)

Document	Location	Description
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, programming instructions, and adapter module component-level IP (CLIP).
FlexRIO Adapter Module Development Kit User Manual	Available from the Start menu at **Start»All Programs» National Instruments»NI FlexRIO»NI FlexRIO Adapter Module Development Kit»Documentation**.	Contains information about how to create custom adapter modules for use with FlexRIO FPGA modules.
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.

Table 1. FlexRIO Documentation Locations and Descriptions (Continued)

Document	Location	Description
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.

Verifying the System Requirements

To use the NI 5783, 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 available on the software media or online at *ni.com/updates*.

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.

⚠ **Caution** 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 you are using the NI 5783 in 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 Refer to the *NI 5783 Specifications* at *ni.com/manuals* for complete specifications.

Caution 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.

Installing the NI 5783

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 5783.

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.

Recommended Cables

NI recommends using the following cables to connect signals to the NI 5783.

Cable	NI Part Number
HDBNC to SMA	769177-01
HDBNC to BNC	769028-01

Accessories

The NI 5783 can be used with the SCB-19 shielded desktop connector block.

Refer to the *SCB-19 User Guide* for information about how to connect and use the SCB-19 with the AUX I/O front panel connector on your NI 5783.

Related Information

AUX I/O Connector on page 8

Front Panel and Connector Pinouts

The following figure shows the front panel connectors for the NI 5783.

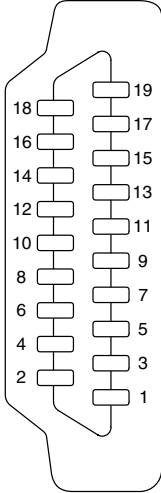| Device Front Panel	Connector	Signal Description
	AO 0	Analog input channel, 50 Ω, single-ended, DC-coupled
	AO 1	
	AO 2	
	AO 3	
	AI 0	Analog output channel, 50 Ω, single-ended, DC-coupled
	AI 1	
	AI 2	
	AI 3	
	CLK/REF IN	External Reference Clock or Sample Clock input
	TRIG	Trigger input and output channel
	AUX I/O	Digital I/O and PFI connector

⚠ **Caution** To avoid permanent damage to the NI 5783, disconnect all signals connected to the NI 5783 before powering down the module, and connect signals only after the adapter module has been powered on by the FlexRIO FPGA module or Controller for FlexRIO.

⚠ **Caution** Connections that exceed any of the maximum ratings of any connector on the NI 5783 can damage the device and the chassis. NI is not liable for any damage resulting from such connections.

AUX I/O Connector

Table 2. NI 5783 AUX I/O Connector Pin Assignments

AUX I/O Connector	Pin	Signal	Signal Description
	1	DIO Port 0 (0)	Bidirectional single-ended (SE) digital I/O (DIO) data channel.
	2	GND	Ground reference for signals.
	3	DIO Port 0 (1)	Bidirectional SE DIO data channel.
	4	DIO Port 0 (2)	Bidirectional SE DIO data channel.
	5	GND	Ground reference for signals.
	6	DIO Port 0 (3)	Bidirectional SE DIO data channel.
	7	DIO Port 1 (0)	Bidirectional SE DIO data channel.
	8	GND	Ground reference for signals.
	9	DIO Port 1 (1)	Bidirectional SE DIO data channel.
	10	DIO Port 1 (2)	Bidirectional SE DIO data channel.
	11	GND	Ground reference for signals.
	12	DIO Port 1 (3)	Bidirectional SE DIO data channel.
	13	PFI 0	Bidirectional SE DIO data channel.
	14	NC	No connect.
	15	PFI 1	Bidirectional SE DIO data channel.
	16	PFI 2	Bidirectional SE DIO data channel.
	17	GND	Ground reference for signals.
	18	+5 V	+5 V power (10 mA maximum).
	19	PFI 3	Bidirectional SE DIO data channel.

⚠ **Caution** The AUX I/O connector accepts a standard, third-party HDMI cable, but the AUX I/O port is not an HDMI interface. Do not connect the AUX I/O port on the

NI 5783 to the HDMI port of another device. NI is not liable for any damage resulting from such signal connections.
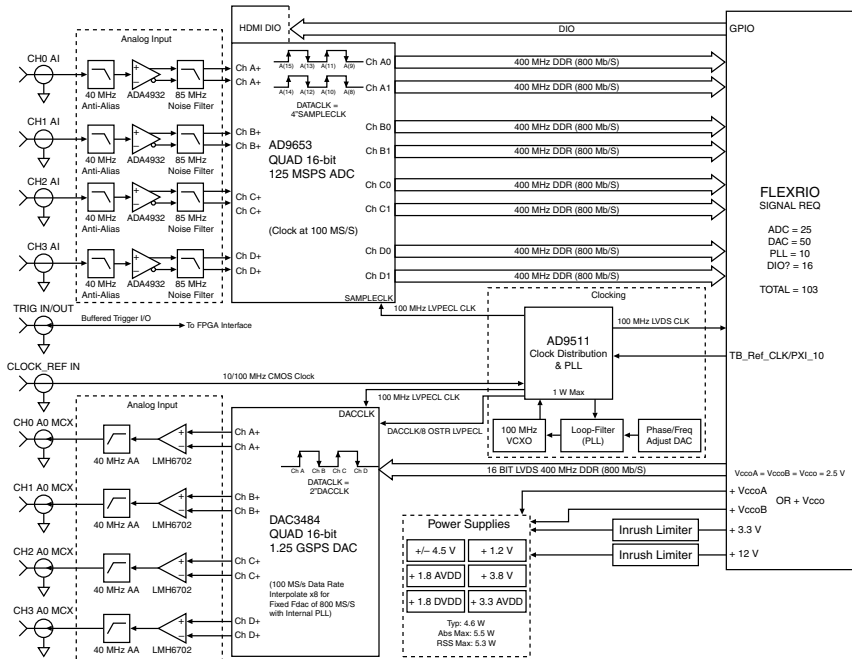
Related Information

Accessories on page 6

The NI 5783 can be used with the SCB-19 shielded desktop connector block.

Block Diagram

The following figure shows the NI 5783 block diagram and signal flow.

Figure 1. NI 5783 Block Diagram

HDMI DIO — DIO — GPIO

Analog Input

CH0 AI — 40 MHz Anti-Alias — ADA4932 — 85 MHz Noise Filter — Ch A+ / Ch A+ — Ch A0 / Ch A1 — A(15) A(13) A(11) A(9) / A(14) A(12) A(10) A(8) — 400 MHz DDR (800 Mb/S)

DATACLK = 4*SAMPLECLK

CH1 AI — 40 MHz Anti-Alias — ADA4932 — 85 MHz Noise Filter — Ch B+ / Ch B+ — Ch B0 / Ch B1 — 400 MHz DDR (800 Mb/S)

AD9653 QUAD 16-bit 125 MSPS ADC

CH2 AI — 40 MHz Anti-Alias — ADA4932 — 85 MHz Noise Filter — Ch C+ / Ch C+ — Ch C0 / Ch C1 — 400 MHz DDR (800 Mb/S)

(Clock at 100 MS/S)

CH3 AI — 40 MHz Anti-Alias — ADA4932 — 85 MHz Noise Filter — Ch D+ / Ch D+ — Ch D0 / Ch D1 — 400 MHz DDR (800 Mb/S)

SAMPLECLK — 100 MHz LVPECL CLK

TRIG IN/OUT — Buffered Trigger I/O — To FPGA Interface

FLEXRIO SIGNAL REQ
ADC = 25
DAC = 50
PLL = 10
DIO? = 16
TOTAL = 103

Clocking
AD9511 Clock Distribution & PLL — 1 W Max — 100 MHz LVDS CLK — TB_Ref_CLK/PXI_10

CLOCK_REF IN — 10/100 MHz CMOS Clock — 100 MHz LVPECL CLK

DACCLK — DACCLK/8 OSTR LVPECL — 100 MHz VCXO — Loop-Filter (PLL) — Phase/Freq Adjust DAC

Analog Input

CH0 A0 MCX — 40 MHz AA — LMH6702 — Ch A+ / Ch A+

CH1 A0 MCX — 40 MHz AA — LMH6702 — Ch B+ / Ch B+ — DATACLK = 2*DACCLK — 16 BIT LVDS 400 MHz DDR (800 Mb/S)

DAC3484 QUAD 16-bit 1.25 GSPS DAC

CH2 A0 MCX — 40 MHz AA — LMH6702 — Ch C+ / Ch C+

(100 MS/s Data Rate Interpolate x8 for Fixed Fdac of 800 MS/S with Internal PLL)

CH3 A0 MCX — 40 MHz AA — LMH6702 — Ch D+ / Ch D+

Power Supplies
+/– 4.5 V | + 1.2 V
+ 1.8 AVDD | + 3.8 V
+ 1.8 DVDD | + 3.3 AVDD
Typ: 4.6 W
Abs Max: 5.5 W
RSS Max: 5.3 W

Inrush Limiter
Inrush Limiter

VccoA = VccoB = Vcco = 2.5 V
+ VccoA
OR + Vcco
+ VccoB
+ 3.3 V
+ 12 V

Logic Diagram

The following diagram shows the NI 5783 logic layout.

Figure 2. NI 5783 Logic Layout
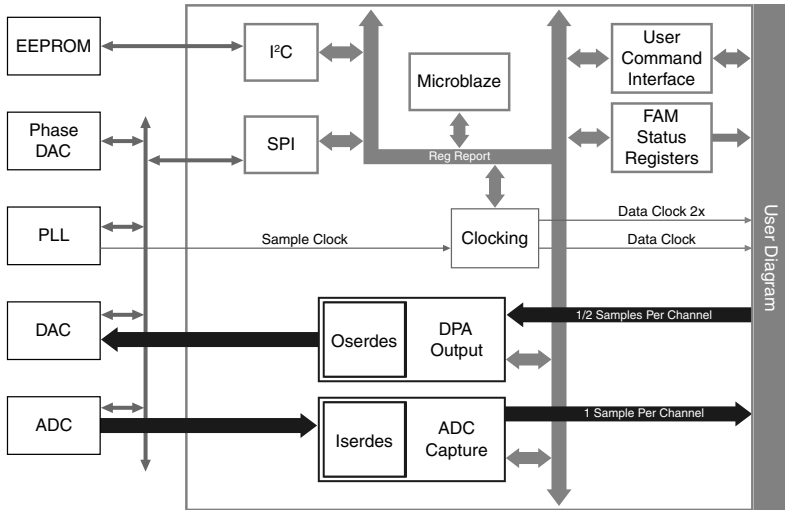
Component-Level Intellectual Property (CLIP)

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 FlexRIO adapter module ships with socketed CLIP items that add module I/O to the LabVIEW project.

NI 5783 CLIP

This CLIP provides access to four 16-bit 100 MS/s analog input channels, four 16-bit analog output channels (selectable between 100 MS/s and 200 MS/s), eight bidirectional DIO channels, four bidirectional PFI channels, and the front panel trigger.

The analog output channels can be written two samples at a time in the Data Clock domain with 4x interpolation, one sample at a time in the Data Clock domain with 8x interpolation, or one sample at a time in the Data Clock 2x domain with 4x interpolation, according to the clock mode selected.

This CLIP also provides a User Command Interface to configure the clock selection (Internal Sample Clock Free Running, Internal Sample Clock locked to an external Reference Clock through the CLK/REF IN connector, 60 to 100 MHz External Sample Clock through the CLK/REF IN connector, or Internal Sample Clock locked to an external Reference Clock through Sync Clock), read the CLIP version, reinitialize the adapter module, and send raw SPI and I^{2}C accesses to the adapter module for low-level configuration.

Related Information

Refer to the FlexRIO Help for more information about FlexRIO CLIP items, how to configure the NI 5783 with a socketed CLIP, and for a list of available socketed CLIP signals.

NI 5783 400 MSPS AO CLIP

This CLIP provides access to four 16-bit 100 MS/s analog input channels, two 16-bit 400 MS/s analog output channels, eight bidirectional DIO channels, four bidirectional PFI channels, and the front panel trigger.

The analog output channels can be written four samples at a time in the Data Clock domain with 2x interpolation, or two samples at a time in the Data Clock 2x domain with 2x interpolation. In addition, the two analog output channels are provided through channels 1 and 2 of the front panel.

This CLIP also provides a User Command Interface to configure the clock selection (Internal Sample Clock Free Running, Internal Sample Clock locked to an external Reference Clock through the CLK/REF IN connector, 60 to 100 MHz External Sample Clock through the CLK/REF IN connector, or Internal Sample Clock locked to an external Reference Clock through Sync Clock), and send raw SPI and I^{2}C accesses to the adapter module for low-level configuration.

Related Information

Refer to the FlexRIO Help for more information about FlexRIO CLIP items, how to configure the NI 5783 with a socketed CLIP, and for a list of available socketed CLIP signals.

Clocking

The following clock modes are available on the NI 5783.

- Internal Sample Clock Free Running
- Internal Sample Clock locked to an external Reference Clock through the CLK/REF IN front panel connector

- Internal Sample Clock locked to an external Reference Clock through Sync Clock
- 60 MHz to 100 MHz external Sample Clock through the CLK/REF IN front panel connector

Related Information

Refer to the FlexRIO Help for more information about NI 5783 clocks.

Worldwide Support and Services

The NI 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.

Visit *ni.com/services* for NI Factory Installation Services, repairs, extended warranty, and other services.

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

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting *ni.com/certification*. If your product supports calibration, you can obtain the calibration certificate for your product at *ni.com/calibration*.

NI corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. NI also has offices located around the world. For telephone support in the United States, create your service request at *ni.com/support* or dial 1 866 ASK MYNI (275 6964). For telephone support outside the United States, visit the *Worldwide Offices* section of *ni.com/niglobal* to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

Where to Go Next

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

EXPLORE

the application development
environment (ADE)
for your application.

🌐 Getting Started
with LabVIEW

🌐 LabVIEW FPGA
Module Help

LEARN

about hardware features
or review device specifications.

🌐 *NI 5783
Specifications**

🖥 *FlexRIO Module
Development Kit
User Manual*

CREATE

custom applications within
an application programming
interface (API).

🌐 *FlexRIO Help**

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*This item is also installed with the driver software.