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NI PCI-5640R Software Defined Radio IF Transceiver

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Overview

The National Instruments PCI-5640R is a cost-effective IF Transceiver with power and flexibility that make it ideally suited for teaching and research involving software defined radio and other communications applications. The PCI-bus board installs into a desktop PC and is fully programmable with intuitive LabVIEW graphical programming. It offers multiple options for processing received signals or preparing signals for transmission. You can engage an on-board Xilinx® Virtex-II Pro FPGA for in-line processing or choose host-based processing by streaming signals to and from the host PC.

Table of Contents

1. Key Features
2. Hardware
3. Software
4. Software Requirements
5. More Information

1. Key Features

- 250 kHz to FM analog input and output frequency range
- Dual synchronized input channels
  - Up to 20-MHz real-time bandwidth
  - 14-bit analog to digital converters
  - Built-in digital downconversion
- Dual synchronized output channels
  - Up to 20-MHz real-time bandwidth
  - 14-bits digital to analog converters
  - Built-in digital upconversion
- Inline and host-based options for processing using simplified graphical programming with NI LabVIEW
  - Xilinx® Virtex II Pro P30 FPGA for inline processing
  - Direct Memory Access (DMA) for data streaming



2. Hardware

The analog front end of the PCI-5640R offers two IF inputs (receivers) and two IF outputs (transmitters). A/D and D/A converters back these channels and include built-in digital up- and down-converters that offload computational requirements by allowing processing to occur at baseband. Signal samples can be processed or prepared for transmission with the on-board Xilinx® Virtex-II Pro FPGA. The PCI-bus board sports four DMA channels that allow you to stream signal samples to and from host memory for host-based processing.

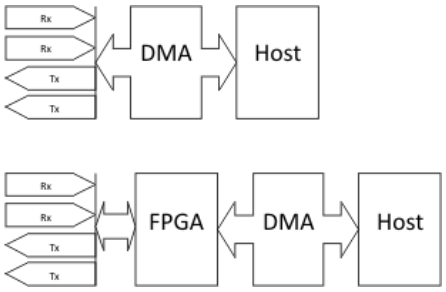
For detailed hardware specifications, please click here.

With external hardware, you can extend the frequency span of the inputs and outputs of the NI PCI-5640R. This document describes how to extend the input frequency span to 2.3-2.5GHz.

3. Software

The PCI-5640R offers different programming alternatives tailored for host- or FPGA-based processing. For host-based processing, you can work with NI LabVIEW and use the NI-5640R instrument driver offers functions and examples for configuration and control over the input and output channels to enable streaming data to and from host memory.

Optionally, you can install LabVIEW FPGA to program the on-board FPGA for inline processing with intuitive LabVIEW graphical programming without prior knowledge of HDL or other traditional FPGA programming languages.



NI-5640R Instrument Driver

The NI-5640R instrument driver API features a set of operations and attributes that exercise all the functionality of the device, including configuration, control, and other device-specific functions. With the NI-5640R API you program the NI PCI-5640R with its default personality—two synchronized input and two synchronized output channels.

Follow this link, to download the NI-5640R Instrument Driver.

LabVIEW FPGA Module

Using the LabVIEW FPGA module, you can configure the behavior of the FPGA core in the NI PCI-5640R to closely match the requirements of your system. The behavior of the NI PCI-5640R is fully user defined and can be implemented as a VI, creating an application-specific I/O device. While you gain full access and develop more powerful applications, the programming time required to create an application using the LabVIEW FPGA module also increase when compared with the standard NI-5640R instrument driver and more advanced programming skills are required.

Programming Methods Comparison Table

	Host-only Processing	FPGA- and/or Host-based Processing

Transmitter / Receivever Configuration	Synchronized I/O, fixed digital edge triggering	Bit-level manipulation, programmable acq / gen clocks, custom triggering
Acquired Data Type	Applications return calibrated IQ data	Applications return raw, unscaled data
Processing	Host-only	FPGA and/or Host
	Floating-point data representation	Integer / fixed-point data representation
	Frame-based	Point-by-point (pipelined)

4. Software Requirements

	Host-only	**FPGA- and/or host-based**
Required Software	LabVIEW 8.2	LabVIEW 8.2 LabVIEW FPGA 8.2
	NI-5640R Instrument Driver	
Recommended Software	Modulation Toolkit 3.2 (or higher) Digital Filter Design Toolkit 8.2 (or higher)	

5. More Information

- Purchase information: See online pricing and ordering information.
- NI-5640R Instrument Driver: Download the NI-5640R Instrument Driver.
- Detailed hardware specifications: See detailed hardware specifications.
- NI LabVIEW: You can work with NI LabVIEW graphical programming to control the NI PCI-5640R.
- NI LabVIEW FPGA: With the LabVIEW FPGA Module you can use graphical programming to leverage the onboard signal processing capability of the NI PCI-5640R.
- NI Modulation Toolkit: The NI Modulation Toolkit extends LabVIEW with tools for communications that can be used for host-based processing of signals to transmit or receive with the NI PCI-5640R.
- NI Digital Filter Design Toolkit: You can design and deploy digital filters for use on the NI PCI-5640R
- Extend the Tx/Rx Frequency Span: Read a tutorial that describes how to extend the frequency span of the Tx / Rx of the NI PCI-5640R to 2.3GHz to 2.5 GHz.

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