ANEXO D:
Datos técnicos del tratamiento de señal
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1 FPGA

**R Series Intelligent DAQ with Onboard Processing**

**NI R Series NEW!**
- Intelligent DAQ devices with programmable onboard decision making and digital signal processing
- Precise I/O synchronization, triggering, and control with 25 ns resolution configured with the LabVIEW FPGA Module
- 1M or 3M gate FPGA chips
- Up to 8 analog input channels, 16-bit resolution, 200 kHz simultaneous-sampling rate
- Up to 8 analog output channels, 16-bit resolution, 1 MHz simultaneous update rate, ±10 V
- Up to 160 high-speed digital lines configurable at rates up to 40 MHz for input, output, counter, or custom functionality
- Implement custom control logic or digital communication protocols

**Operating Systems**
- Windows 2000/XP
- LabVIEW Real-Time (ETS and RTX)

**Recommended Software**
- LabVIEW
- LabVIEW Real-Time Module
- LabVIEW FPGA Module
- LabVIEW code compiler for FPGAs
- Emulated debugging mode

**Driver Software (included)**
- NI-BIIO

**Calibration Certificate Available**

<table>
<thead>
<tr>
<th>Product</th>
<th>FPGAsize</th>
<th>Input/Output</th>
<th>Max Sampling</th>
<th>Analog Input</th>
<th>Max Update</th>
<th>Digital I/O</th>
<th>Trigging</th>
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<tr>
<td>NI 7893R</td>
<td>1M</td>
<td>16</td>
<td>4</td>
<td>208</td>
<td>±10</td>
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<td>Analog/Digital</td>
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<td>4</td>
<td>208</td>
<td>±10</td>
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<td>208</td>
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<td>58</td>
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<td>-</td>
<td>-</td>
<td>Digital</td>
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<tr>
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<td>-</td>
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Table 1. R Series Selection Guide

**Overview**
National Instruments R Series devices are equipped with reconfigurable input/output (I/O) hardware technology featuring onboard digital signal processing. The core of I/O is an FPGA (field-programmable gate array), which is configurable with the National Instruments LabVIEW FPGA Module. These intelligent DAQ devices literally rewrite their internal gate array circuitry based on your LabVIEW FPGA program. You can customize the behavior of the device, providing capabilities such as:
- Complete control over synchronization and timing of all operations with 25 ns resolution
- User-defined, onboard decision making and triggering with loop rates up to 40 MHz
- Ability to individually configure digital lines as input, output, counter/timer, pulse-width modulator (PWM), encoder inputs, or user-defined communication protocols
- Simultaneous analog input at up to 200 kHz and simultaneous analog output at up to 1 MHz
- Multirate analog and discrete control

Because of these capabilities, R Series devices and the LabVIEW FPGA Module extend the National Instruments platform and can address applications including:
- High-speed, deterministic analog or discrete control
- Hardware-in-the-loop (HIL) simulation
- Rapid control prototyping (RCP)

**Key Features**
Through programming in LabVIEW FPGA, you can control each of the I/O signal lines independently or synchronize a line with other lines. You can configure the digital I/O lines as custom counter/counters, PWM channels, or ports for user-defined protocols. All NI 7893x R Series devices have dedicated analog-to-digital converters/digital-to-analog converters on every analog I/O channel, making it possible to sample/update all channels simultaneously or at different rates. You can sample every analog input channel on an R Series device simultaneously at rates up to 200 kHz, and you can program every analog output on an R Series device to update simultaneously at rates up to 1 MHz. You can also store your user-defined LabVIEW FPGA configuration in flash memory on any R Series device providing for automatic loading and/or execution of the user program at power up.
2 Chasis

CompactRIO
R Series Expansion Chassis

NI cRIO-9151  NEW!

- High-performance industrial I/O for any PCI or PXI R Series device
- Converts FPGA digital port into multifunction I/O port with plug-in modules for ±80 mV to 250V<sub>max</sub>
- Provides additional I/O hardware for your desktop, PXI/CompactPCI, and industrial PC systems
- Combine with plug-in data acquisition, motion control, vision, or CAN devices to complete your application
- Use your LabVIEW programming skills to perform hardware design engineering
- Add multiple 4-slot expansion chassis to a single R Series device
- Automatically synthesize an optimized high-performance electrical circuit implementation of your application using the LabVIEW FPGA Module
- RIO FPGA core executes LabVIEW control logic at rates up to 40 MS/s using single-cycle timed loops
- Create any timing, triggering, and synchronization scheme with 25 ns resolution

Overview

The CompactRIO R Series Expansion Chassis connects directly to a PXI or PCI R Series device such as the PXI-7831R, PXI-7811R, or PCI-7831R. In this configuration, the FPGA resides on the R-Series device and the CompactRIO I/O modules provide industrial I/O, isolation, and signal conditioning. The Windows host CPU or Real-Time controller provides high-performance processing for analog control, analysis, or hardware-in-the-loop (HIL) simulations. The R Series RIO device and CompactRIO chassis provide high speed signal conditioned input, output, communication, and control capabilities and offer unprecedented flexibility and optimization.

CompactRIO is an advanced reconfigurable embedded system development platform that offers low-level access to reconfigurable hardware resources. Application developers can use CompactRIO to rapidly develop sophisticated embedded control or acquisition systems that match or exceed the performance and optimization of custom-designed hardware devices. CompactRIO employs a user-programmable FPGA core that automatically synthesizes an optimized custom hardware circuit implementation of your LabVIEW FPGA application to implement any input, output, communication, or control design. The reconfigurable I/O (RIO) core has built-in data transfer mechanisms to pass data to a host processor for real-time analysis, post-processing, data logging, or display in a real-time or Windows host application.

With the PXI-7831R or PCI-7831R, you can connect up to two R Series Expansion Chassis for a maximum of eight I/O modules per R Series device. With the PXI-7811R, you can connect up to four R Series Expansion Chassis for a maximum of 16 I/O modules per R Series device.

Visit ni.com/compactrio for up-to-date information on module availability, example programs, application notes, and other developer tools.

For ordering information, see page 381.

Note: Use only the SH8-G1B-5 digital cable with the cRIO-9151 chassis.

For more information, see page 379.
3 Cartuchos

C Series Digital Output and Relay Modules

NI 9401, NI 947x, NI 948x

- High and low-speed 24 V sourcing logic (IEC 1131-2), 5 V TTL, or 240 VAC SPST (Form A) electromechanical, or 60 VDC solid-state relay outputs
- Up to 100 ns output rate for ultrahigh-speed control, pulse-width modulation (PWM), or digital communication
- Isolation up to 2,300 VAC (withstand), up to 250 VAC (continuous)
-externally powered with high-current-switching capacity (up to 8 A per module) for direct control of a wide array of industrial actuators
- Short-circuit-proof outputs available to protect from damage caused by current surges

<table>
<thead>
<tr>
<th>Product</th>
<th>Compatibility</th>
<th>Logic</th>
<th>Channels</th>
<th>Sink/Source</th>
<th>I/O Relay Time</th>
<th>Signal Levels</th>
<th>Output Current per Channel</th>
<th>Isolation</th>
<th>Connector Options</th>
</tr>
</thead>
<tbody>
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<td>NI 9461</td>
<td>✔️</td>
<td>High</td>
<td>8</td>
<td>Sink/Source</td>
<td>100 ms</td>
<td>5 V</td>
<td>2 mA</td>
<td>✔️</td>
<td>Screw Terminal, D-Sub</td>
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<tr>
<td>NI 9472</td>
<td>✔️</td>
<td>High</td>
<td>8</td>
<td>Source</td>
<td>100 µs</td>
<td>6 to 30 V</td>
<td>750 mA</td>
<td>✔️</td>
<td>Screw Terminal, D-Sub</td>
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<td>NI 9474</td>
<td>✔️</td>
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<td>8</td>
<td>Source</td>
<td>100 µs</td>
<td>5 to 30 V</td>
<td>1 A</td>
<td>✔️</td>
<td>Screw Terminal, D-Sub</td>
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<tr>
<td>NI 9478</td>
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<td>High</td>
<td>32</td>
<td>Source</td>
<td>600 µs</td>
<td>6 to 36 V</td>
<td>250 mA</td>
<td>✔️</td>
<td>D-Sub</td>
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<tr>
<td>NI 9477</td>
<td>✔️</td>
<td>High</td>
<td>32</td>
<td>Sink</td>
<td>6 µs</td>
<td>5 to 60 V</td>
<td>625 mA</td>
<td>✔️</td>
<td>D-Sub</td>
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<tr>
<td>NI 9481</td>
<td>✔️</td>
<td>Form A</td>
<td>4</td>
<td>Sink/Source</td>
<td>10 ms</td>
<td>60 VDC, 250 VAC</td>
<td>2 A (30 VDC)</td>
<td>✔️</td>
<td>Screw Terminal</td>
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<tr>
<td>NI 9485</td>
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<td>SSR</td>
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<td>Sink/Source</td>
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<td>750 mA</td>
<td>✔️</td>
<td>Screw Terminal</td>
</tr>
</tbody>
</table>

Table 3: C Series Digital Output and Relay Module Selection Guide

Overview
High-performance digital output switching modules for National Instruments CompactRIO embedded systems, R Series expansion chassis, and NI CompactDAQ systems provide extended voltage ranges and high-current-switching capacity for direct control of a wide array of industrial and automotive actuators. Each module features an integrated connector junction box with screw-terminal or cable options for flexible, low-cost signal wiring. All modules feature the NI CompactRIO Extreme Industrial Certifications and Ratings.

System Compatibility
You can use NI C Series modules in two types of systems depending on available software. Please see Table 1 for CompactRIO and NI CompactDAQ module compatibility because not all modules work with both systems. Many of the advanced features described apply only to reconfigurable I/O systems and not to NI CompactDAQ.

Advanced Features
When used in CompactRIO, C Series digital output modules connect directly to reconfigurable I/O (RIO) FPGA hardware to create high-performance embedded systems. The reconfigurable FPGA hardware within CompactRIO provides a variety of options for timing, triggering, synchronization, digital waveform generation, or digital communication.

For instance, with CompactRIO you can implement a circuit to generate pulse-width modulation (PWM) outputs for controlling motors, heaters, or fans, as well as perform pulse code modulation encoding (PCM) for wireless telemetry applications.

Key Features
- High-performance digital output switching for any CompactRIO embedded system, R Series expansion chassis, or NI CompactDAQ system
- Screw-terminal, strain relief, high-voltage, cable, solder-cup backshell, and other connectivity options
- Channel-to-earth ground double-isolation barrier for safety and noise immunity
- NI CompactRIO Extreme Industrial Certifications and Ratings

Visit ni.com/compactrio or ni.com/compactdaq for up-to-date information on module availability, example programs, application notes, and developer tools.

Typical certifications — Actual specifications vary from product to product. Visit ni.com/certification for details.