NI sbRIO-9632/9642 Verification Procedure

This document contains information about verifying the National Instruments sbRIO-9632/9642. This document does not contain information about programming techniques or compiler configuration.

Conventions

The following conventions appear in this manual:

»	The **»** symbol leads you through nested menu items and dialog box options to a final action. The sequence **Options»Settings»General** directs you to pull down the **Options** menu, select the **Settings** item, and select **General** from the last dialog box.
bold	Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names and hardware labels.
Italic	Italic text denotes variables, emphasis, a cross-reference, or an introduction to a key concept. Italic text also denotes text that is a placeholder for a word or value that you must supply.
`monospace`	Monospace text denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.

NATIONAL INSTRUMENTS

Software Requirements

Performing verification on the NI sbRIO-9632/9642 requires LabVIEW, LabVIEW Real-Time, LabVIEW FPGA, and the NI-RIO driver. For information about the minimum software versions for these devices, go to `ni.com/info` and enter the Info Code `rdsoftwareversion`. For information about setting up and configuring the devices, refer to the *NI sbRIO-961x/963x/964x and NI sbRIO-9612XT/9632XT/9642XT User Guide*, available at `ni.com/manuals`.

Documentation

You may find the following documentation helpful as you write the verification procedure:

- *NI sbRIO-961x/963x/964x and NI sbRIO-9612XT/9632XT/9642XT User Guide*—This document describes how to use the NI sbRIO-9632/9642 and includes specifications and terminal assignments. The limits you use to verify the accuracy of the devices are based on the specifications found in this document. You can download the latest version of this document from `ni.com/manuals`.

- *NI CompactRIO Setup and Services*—This Web page contains a step-by-step guide to installing software on and configuring CompactRIO systems. The information about installing software and configuring IP settings applies to Single-Board RIO as well as to CompactRIO. Go to `ni.com/info` and enter the Info Code `rdcriostartup` to use this resource.

Test Equipment

National Instruments recommends that you use the following equipment for verifying the NI sbRIO-9632/9642.

Table 1. Recommended Equipment

Equipment	Recommended Model	Requirements
Voltage Source	NI 6120	If this instrument is unavailable, use a voltage source with an accuracy of at least 400 ppm.
DMM	NI 4070	If this instrument is unavailable, use a DMM with an accuracy of at least 100 ppm.

Test Conditions

Follow these guidelines to optimize the connections and the environment:

- Keep connections to the device as short as possible. Long cables and wires act as antennae, picking up extra noise that can affect measurements.

- Use shielded copper wire for all cable connections to the device.

- Use twisted-pair wire to eliminate noise and thermal offsets.

- Maintain an ambient temperature of 23 ±5 °C. The device temperature will be greater than the ambient temperature.

- Keep relative humidity below 80%.

- Allow a warm-up time of at least 30 minutes to ensure that the measurement circuitry is at a stable operating temperature.

Initial Setup

You must configure the network settings of the sbRIO device and install software on it before you can perform the verification procedure. Refer to the *Configuring Your CompactRIO System so You Can Communicate with It* section and the *Installing Software on the CompactRIO Controller* section of the *NI CompactRIO Setup and Services* Web page.

Verification Procedure

Verification determines whether the device is operating within specifications. The NI sbRIO-9632/9642 has 32 16-bit analog inputs and 4 16-bit analog outputs. You can verify any or all of them, depending upon your desired test coverage.
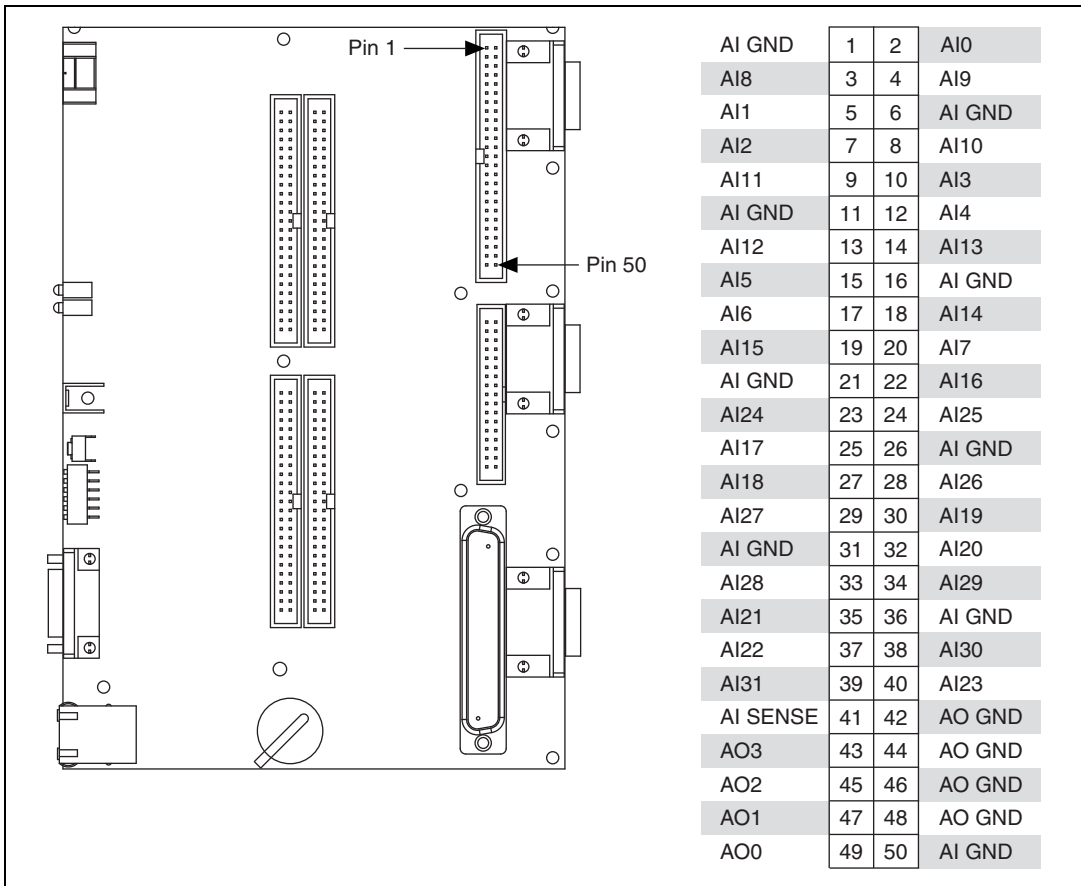
You can verify the measurement accuracy of the analog inputs and the output voltage accuracy of the analog outputs.

Measurement Accuracy Verification

Complete the following steps to test the measurement accuracy of the device:

1. Create a LabVIEW project and add the NI sbRIO-9632/9642 to the project. On the C Series Module Properties dialog box for the NI 9205 module, configure the NI 9205 to take differential voltage measurements and output calibrated data.

2. Connect the voltage source to the channel you want to verify. Connect the positive lead to AIx and the negative lead to AI GND. If the

calibrator has a guard connection that is not internally connected, connect that terminal to AI GND. Refer to Figure 1 for the pin assignments.

AI GND	1	2	AI0
AI8	3	4	AI9
AI1	5	6	AI GND
AI2	7	8	AI10
AI11	9	10	AI3
AI GND	11	12	AI4
AI12	13	14	AI13
AI5	15	16	AI GND
AI6	17	18	AI14
AI15	19	20	AI7
AI GND	21	22	AI16
AI24	23	24	AI25
AI17	25	26	AI GND
AI18	27	28	AI26
AI27	29	30	AI19
AI GND	31	32	AI20
AI28	33	34	AI29
AI21	35	36	AI GND
AI22	37	38	AI30
AI31	39	40	AI23
AI SENSE	41	42	AO GND
AO3	43	44	AO GND
AO2	45	46	AO GND
AO1	47	48	AO GND
AO0	49	50	AI GND

Figure 1. Pinout of I/O Connector J7, Analog I/O

3. Set the output voltage of the voltage source to the first Test Point value indicated in Table 2.

4. Create a LabVIEW VI that measures the analog input voltage for one input range on AI*x*. Take 100 measurements at 10 μs intervals.

5. Average the 100 acquired voltage values and compare the resulting average to the Upper Limit and Lower Limit values listed in Table 2. If the result is between those values, the device is operating within specifications.

6. Repeat steps 3 through 5 for all Test Point values.

7. Repeat steps 1 through 6 for all input channels.

8. Disconnect the voltage source from the device.

Analog Output Voltage Accuracy

1. Create a LabVIEW project and add the NI sbRIO-9632/9642 to the project. On the C Series Module Properties dialog box for the NI 9263 module, configure the NI 9263 to output calibrated data.

2. Connect the DMM to the analog output channel you want to verify. Connect the positive lead to AO*x* and the negative lead to a COM terminal. Refer to Figure 1 for the pin assignments of the NI sbRIO-9632/9634.

3. Create a LabVIEW VI to output a constant voltage equal to the first test point.

4. Take 100 measurements at 20 μs intervals.

5. Average the 100 values and compare the resulting average to the Upper Limit and Lower Limit values listed in Table 3. If the result is between those values, the device is operating within specifications.

6. Repeat steps 3 through 5 for all test points.

7. Repeat steps 2 through 6 for all output channels.

8. Disconnect the DMM from the device.

Analog Voltage Accuracy Tables and Formulas

The test limits in Table 2 were derived from the accuracy specifications in the *NI sbRIO-961x/963x/964x and NI sbRIO-9612XT/9632XT/9642XT User Guide*.

Table 2. Analog Input Voltage Values

Full-Scale Range (V)	Test Point		Two-Year Limits	
	Location	Value (V)	Lower Limit	Upper Limit
±10	Max	9.98000	9.94340	10.01660
±10	Mid	0.00000	–0.02308	0.02308
±10	Min	–9.98000	–10.01660	–9.94340
±5	Max	4.99000	4.97143	5.00857
±5	Mid	0.00000	–0.01177	0.01177
±5	Min	–4.99000	–5.00857	–4.97143
±1	Max	0.99800	0.99373	1.00227
±1	Mid	0.00000	–0.00290	0.00290

Table 2. Analog Input Voltage Values (Continued)

Full-Scale Range (V)	Test Point		Two-Year Limits	
	Location	Value (V)	Lower Limit	Upper Limit
±1	Min	−0.99800	−1.00227	−0.99373
±0.2	Max	0.19960	0.19823	0.20097
±0.2	Mid	0.00000	−0.00109	0.00109
±0.2	Min	−0.19960	−0.20097	−0.19823

The test limits in Table 3 were derived from the Calibrated, max (–40 to 85 °C) Gain Error and Offset Error in the *NI sbRIO-961x/963x/964x and NI sbRIO-9612XT/9632XT/9642XT User Guide*.

Table 3. Analog Output Voltage Values

Full-Scale Range (V)	Test Point		Two-Year Limits	
	Location	Value (V)	Lower Limit	Upper Limit
±10	Max	9.50000	9.3865	9.6135
±10	Mid	0.00000	−0.08025	0.08025
±10	Min	−9.50000	−9.6135	−9.38650

Device Test Limits

Using the Table

The following definitions describe how to use the information in Tables 2 and 3.

Range

Range refers to the minimum or maximum voltage range of an input signal.

Test Point

The *Test Point* is the voltage value that is input or output for verification purposes. This value is broken down into two columns—*Location* and *Value*. *Location* refers to where the test value fits within the test range. *Value* refers to the voltage value to be verified. *Max* refers to maximum value, *Min* refers to minimum value, and *Mid* refers to mid-scale.

Two-Year Limits

The *Two-Year Limits* column contains the *Upper Limits* and *Lower Limits* for the test point value. When the device is within its two-year calibration interval, the test point value should fall between these upper and lower limit values.

Where to Go for Support

The National Instruments Web site 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.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world to help address your support needs. For telephone support in the United States, create your service request at `ni.com/support` and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

Australia 1800 300 800, Austria 43 662 457990-0,
Belgium 32 (0) 2 757 0020, Brazil 55 11 3262 3599,
Canada 800 433 3488, China 86 21 5050 9800,
Czech Republic 420 224 235 774, Denmark 45 45 76 26 00,
Finland 358 (0) 9 725 72511, France 01 57 66 24 24,
Germany 49 89 7413130, India 91 80 41190000, Israel 972 3 6393737,
Italy 39 02 41309277, Japan 0120-527196, Korea 82 02 3451 3400,
Lebanon 961 (0) 1 33 28 28, Malaysia 1800 887710,
Mexico 01 800 010 0793, Netherlands 31 (0) 348 433 466,
New Zealand 0800 553 322, Norway 47 (0) 66 90 76 60,
Poland 48 22 328 90 10, Portugal 351 210 311 210,
Russia 7 495 783 6851, Singapore 1800 226 5886,
Slovenia 386 3 425 42 00, South Africa 27 0 11 805 8197,
Spain 34 91 640 0085, Sweden 46 (0) 8 587 895 00,
Switzerland 41 56 2005151, Taiwan 886 02 2377 2222,
Thailand 662 278 6777, Turkey 90 212 279 3031,
United Kingdom 44 (0) 1635 523545