sbRIO-9687 Getting Started

2024-04-26

Contents

Overview

This document describes how to install and begin using the sbRIO-9687 GPIC Universal Interface Board.

Safety Guidelines

Caution Do not operate the sbRIO-9687 in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to NI for repair.

Caution NI makes no product safety, electromagnetic compatibility (EMC), or CE marking compliance claims for the sbRIO-9687. The end-product supplier is responsible for conformity to any and all compliance requirements.

Caution Exercise caution when placing the sbRIO-9687 inside an enclosure. Auxiliary cooling may be necessary to keep the device under the maximum ambient temperature rating for the sbRIO-9687. Refer to the **sbRIO-9687 Specifications** for more information about the maximum ambient temperature rating.

Caution The sbRIO-9687 is designed for non-hazardous live signals. You must ensure that all signals connected to the sbRIO-9687 are isolated from hazardous live circuits and no unsafe voltages are present at the sbRIO-9687 inputs. Voltages that exceed the specifications could result in damage to the sbRIO-9687.

Caution Use the sbRIO-9687 with only sbRIO-9683 or sbRIO-9684 devices. The sbRIO-9687 is not electrically or mechanically compatible with other NI devices.

Caution The sbRIO-9683 or sbRIO-9684 simultaneous sampled isolated AI's common ground is short circuited to the main ground on the sbRIO-9687 interface board when assembled, defeating the channel-to-common isolation ratings of these circuits.

Unpacking the Kit

Notice To prevent electrostatic discharge (ESD) from damaging the device, 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 the device from the package and inspect the device for loose components or any other sign of damage.

   Notice 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 device in the antistatic package when the device is not in use.

Verifying the Kit Contents

Verify the following components are in your kit.

- sbRIO-9687
- sbRIO power cable assembly, 9.5 in.
- (QTY 2) 10-pin flat data cable

- 2-pin power plug
- 2-pin plug for display power
- 6-pin signal plug
- 12-pin signal plug
- (QTY 3) 24-pin signal plug
- (QTY 3) 26-pin signal plug
- (QTY 2) 36-pin signal plug
- Aluminum mounting plate
- (QTY 2) Handles
- (QTY 4) 8-32 × 3/8 in. panhead screws (for handles)
- (QTY 9) Standoffs and screws, I/F PCB to Panel, M3 × 43.36 mm M-F, 6 mm Hex, M3 x 5 mm panhead screws
- (QTY 4) Standoffs and screws, RMC to I/F PCB, M3 x 11.12 mm M-F, 6 mm Hex, M3 x 5 mm panhead screws

Also included is an OEM kit with an sbRIO-9607 CompactRIO Single-Board Controller, an sbRIO-9683 or sbRIO-9684 General Purpose Inverter Controller (GPIC), and mounting hardware:

- sbRIO-9607 controller
- sbRIO-9683 or sbRIO-9684 GPIC
- (QTY 4) Standoffs and screws, M3 × 43.36 mm M-F, 4.5 mm Hex, M3 × 5 mm panhead screws[1]
- (QTY 4) Standoffs, RMC to Panel, M3 × 29.81 mm M-F, 4.5 mm Hex (no screws)
- (QTY 4) Standoffs and screws, M3 × 11.12 mm M-F, 4.5 mm Hex, M3 × 5 mm panhead screws[1]
- (QTY 4) Standoffs and screws, sbRIO to RMC, M3 × 9.65 mm M-F, 4.5 mm Hex, M3 × 5 mm panhead screws
- sbRIO power cable assembly, mini-fit pigtail, 2C, 12 in.[1]
- **NI 9683 User Manual and Specifications** or **NI 9684 User Manual and Specifications**
- sbRIO Thermal Kit:

- Heat spreader
- Gap pad
- (QTY 4) Standoff, M3 × 16 mm, M-F, 4.5 Hex
- (QTY 2) Standoff, M3 × 18 mm, M-F, 4.5 Hex[1]
- (QTY 6) M3 × 8 mm panhead screws[1]
- **Thermal Kit for NI sbRIO-9607/9627/9637 Installation and Specifications Manual**

Hardware Overview

The sbRIO-9687 is intended to be used together with the sbRIO-9683 or sbRIO-9684 General Purpose Inverter Controller and the sbRIO-9607 CompactRIO Single-Board Controller. These boards are designed to be stacked with board-to-board connectors.

The following figure shows the components of the sbRIO-9687.

Figure 1. sbRIO-9687 Components

1. Power connector
2. Inverter connectors
3. Thermistor connector
4. Display RS232 connector
5. Display power connector
6. AO breakout connector

7. AI connectors
8. RS232 input
9. Expansion board connectors
10. HB signals breakout connector
11. DI breakout connector
12. CAN input
13. sbRIO-9607 power
14. Relay outputs
15. Feedback connectors
16. DO breakout connector

Dimensions

The following figures show the board dimensions and connector height for the sbRIO-9687. For detailed dimensional drawings and 3D models, visit ni.com/dimensions and search for 9687.

Figure 2. Primary Side Dimensions, Millimeters (Inches)

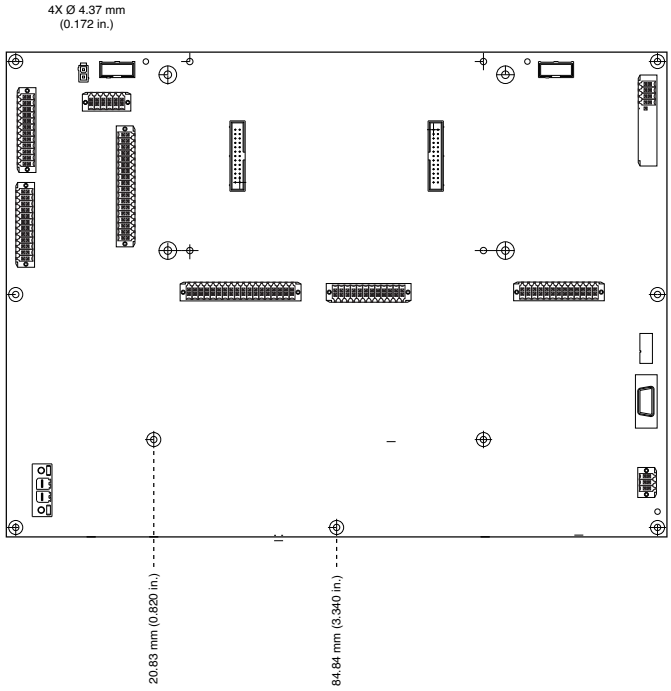
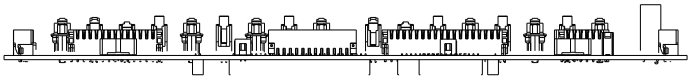


Figure 3. Height of Expansion Board Connectors, Millimeters (Inches)



Power

Input voltage (+24 V)

Typical	+24 V
Maximum	+28.8 V
Minimum	+19.2 V
Maximum DC input current	8 A
F4 Fuse	10 A, 250 VAC, Fast Acting, .25 in. × 1.25 in.
Onboard current consumption	0.1 A max
GPIC current consumption	0.75 A max

Preparing the Environment

Ensure that the environment in which you are using the sbRIO-9687 meets the following specifications.

Operating temperature[1] (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 85 °C
Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 85 °C
Operating humidity (IEC 60068-2-78)	10% RH to 90% RH, noncondensing
Storage humidity (IEC 60068-2-78)	5% RH to 95% RH, noncondensing
Pollution degree	2
Maximum altitude	2,000 m

Indoor use only.

Note Refer to the device specifications on ni.com/manuals for complete specifications.

Mounting the Hardware

Before you mount the sbRIO-9687, the thermal kit, sbRIO-9607 controller, and sbRIO-9683 or sbRIO-9684 GPIC must be mounted to a thermally conductive surface at least 3 mm thick. The thermally conductive surface acts as a heat spreader for the sbRIO-9607; ensure a good thermal contact.

Required Tools

The following tools are required for mounting the sbRIO-9687:

- Screwdriver, Phillips #1
- Socket driver, 4.5 mm
- Socket driver, 6 mm
- Thermal interface material

Note Eight M3 nuts are included with sbRIO-9684 mounting hardware. These M3 nuts are provided to secure the board assembly for temporary mounting configurations where holes are not tapped into the mounting surface. To prevent possible damage to the device, use caution when installing the M3 nuts.

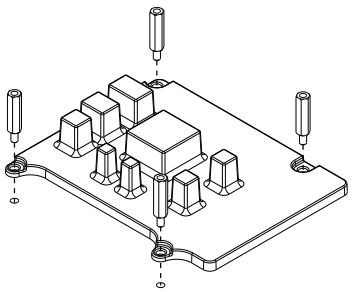
Installing the Thermal Kit and the sbRIO-9607

Complete the following steps to install the sbRIO Thermal Kit and the sbRIO-9607.

1. Prepare the mounting surface by tapping holes according to the Surface Mounting Dimensions.
2. Install the heat spreader to the mounting surface or use the aluminum plate to mount the heat spreader.
    a. Apply a thermal interface material, such as grease, to the flat side of the heat spreader.
    b. Align the heat spreader with the tapped holes for the sbRIO-9607. Refer to Figure 5, Installing the sbRIO-9607, for orientation.
    c. Fasten the four M3×16 mm, M-F standoffs through the heat spreader to the tapped holes for the sbRIO-9607.

Tip Tighten all standoffs and screws to a maximum torque of 0.56 N · m(5 lb · in.).

Figure 4. Mounting the Heat Spreader



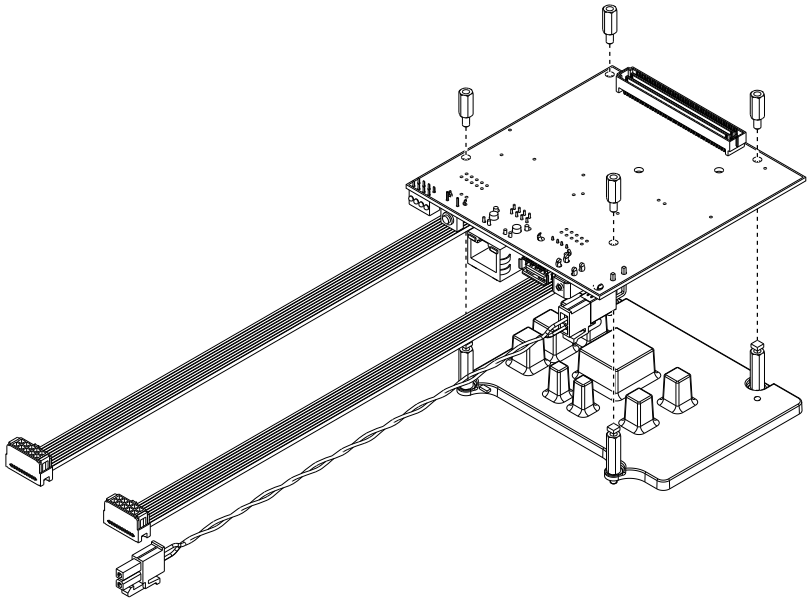
3. Attach cables to the sbRIO-9607.
    a. Attach a data cable to the sbRIO-9607 RS232 connector.

b. Attach a data cable to the sbRIO-9607 CAN connector.
c. Attach the power cable to the sbRIO-9607 power connector.

4. Apply the gap pad to the sbRIO-9607. Refer to the **Thermal Kit for NI sbRIO-9607/9627/9637 Installation and Specifications Manual** for information about gap pad placement.
5. Align the sbRIO-9607 with the heat spreader.
6. Fasten the four M3×9.65 mm, M-F standoffs through the sbRIO-9607 to the M3×16 mm, M-F standoffs.

> **Caution** The gap pad is a viscoelastic material and compressing it too quickly places a large amount of stress on board components. If you must use an automatic screwdriver, fasten these screws at a rate less than 4.23 mm/s (10 in./min.) to prevent damage during assembly.

Figure 5. Installing the sbRIO-9607

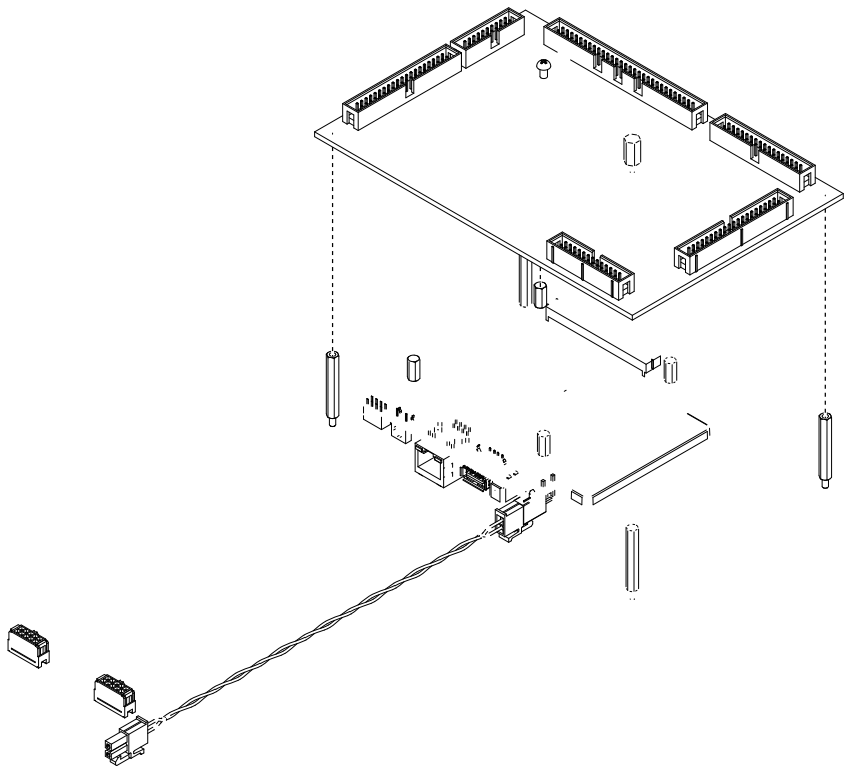


Mounting the sbRIO-9683 or sbRIO-9684

Once the sbRIO-9607 and Thermal Kit are installed, the next step is to install the sbRIO-9683 or sbRIO-9684 mezzanine board.

1. Install the M3 × 29.81 mm, M-F standoffs to the tapped holes for the sbRIO-9683 or sbRIO-9684 .
2. Align the sbRIO-9683 or sbRIO-9684 with the M3 × 29.81 mm, M-F standoffs and the sbRIO-9607.
3. Seat the mezzanine card connectors on the sbRIO-9683 or sbRIO-9684 and the sbRIO-9607 to connect the boards.
4. Fasten the M3 × 11.12 mm, M-F, 6 mm Hex standoffs through the sbRIO-9683 or sbRIO-9684 to the M3 × 29.81 mm, M-F standoffs.
5. Insert four M3 × 5 mm panhead screws through the sbRIO-9683 or sbRIO-9684 to the M3 × 9.65 mm, M-F standoffs.

Figure 6. Mating the sbRIO-9683 or sbRIO-9684 to the sbRIO-9607



Mounting the sbRIO-9687

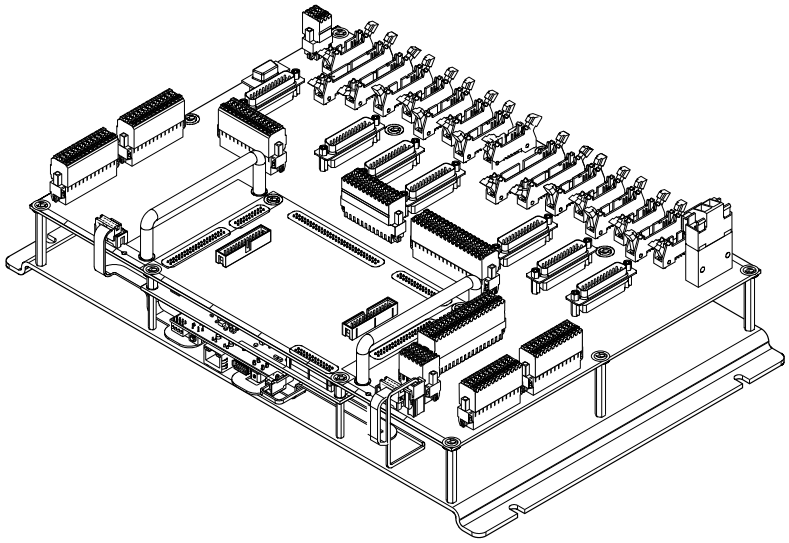
1. Install the sbRIO-9687 handles.
    a. Align the handles with the dedicated fixing holes on the sbRIO-9687.
    b. Insert two 8-32 × 3/8 in. panhead screws for each handle through the sbRIO-9687.
2. Install the sbRIO-9687.
    a. Install the M3 x 43.36, M-F 6 mm Hex standoffs (x9) in the tapped holes for the sbRIO-9687.

b. Align the sbRIO-9687 with the M3 x 43.36, M-F standoffs and the four M3 x 11.12, M-F standoffs.
c. Seat the sbRIO-9687 connectors and the sbRIO-9683 or sbRIO-9684 connectors to connect the boards.
d. Insert and tighten M3 x 5 panhead screws through the sbRIO-9687 to the installed M3 x 43.36, M-F standoffs and to the M3 x 11.12, M-F standoffs.
e. Connect the CAN input cable and the RS232 input cable to sbRIO-9687 connectors J1 and J2, respectively.
f. Connect the power cable between the sbRIO-9687 and the sbRIO-9607.

Figure 7. Mating the sbRIO-9687 to the sbRIO-9683 or sbRIO-9684

The following figure shows the completed assembly of the sbRIO-9607 controller, sbRIO-9683 or sbRIO-9684 mezzanine board, and the sbRIO-9687 GPIC universal interface board.

Figure 8. Complete Assembly



Surface Mounting Dimensions

The following figures depict the mounting dimensions for the sbRIO-9687.

Figure 9. Mounting Plate, Inches (Millimeters)

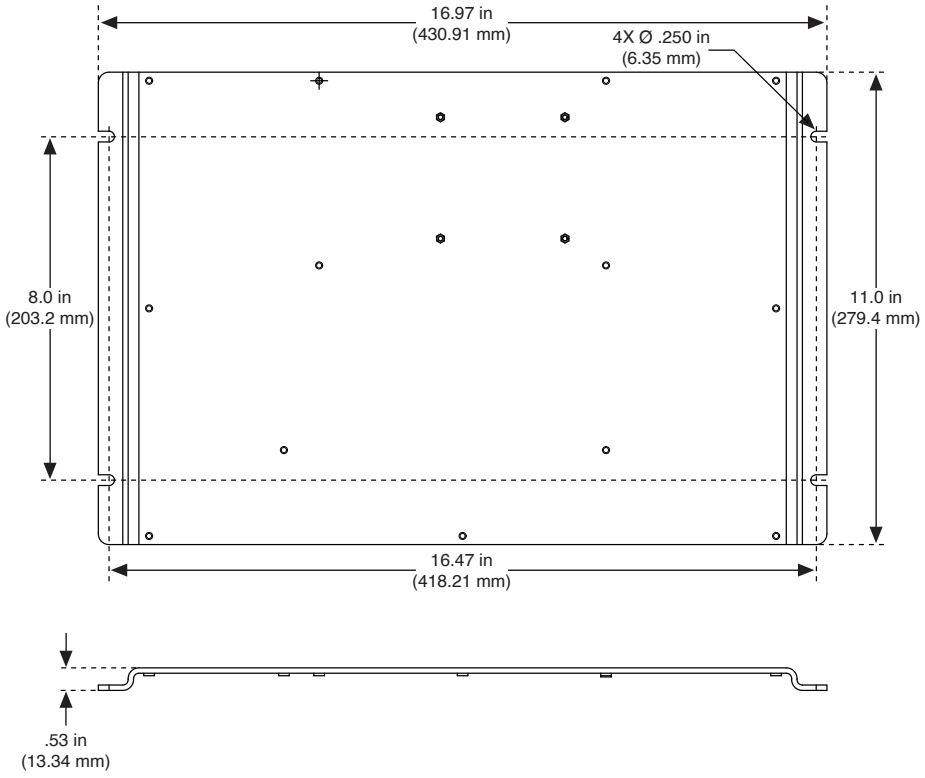
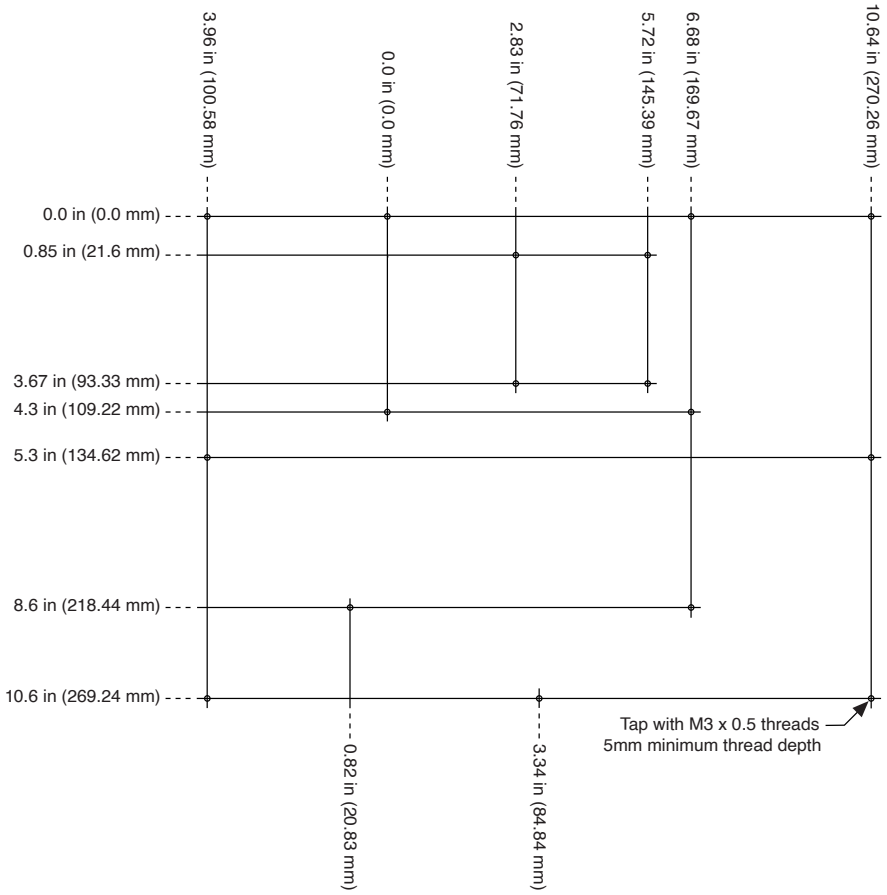


Figure 10. Standoffs, Inches (Millimeters)



Connecting the sbRIO-9687

The top side of the PCB is the primary side of the sbRIO-9687 and contains connectors for inverter modules, simultaneous AI, scanned AI and AO, feedback inputs, digital inputs, digital outputs, relay outputs, display interface, expansion board, and power.

The bottom of the PCB, secondary side of the sbRIO-9687, contains the connectors for interfacing with the sbRIO-9683 or sbRIO-9684 GPIC controller.

Connecting the Power

The sbRIO-9687 requires a 24 V DC power supply.
The power supply should have a maximum output current higher than the current consumption of the interface board and attached inverters. Refer to the **sbRIO-9687 Specifications** for the sbRIO-9687 maximum current consumption.

Complete the following steps to connect a power supply to the device.

Caution Do not mate or unmate the power supply connectors while power is applied.

1. Ensure that the power supply is powered off.
2. Insert the power connector plug into the power connector receptacle of the sbRIO device until the connector latches into place.
3. Turn on the power supply.

Powering on the sbRIO-9687

The sbRIO-9687 turns ON immediately after the input power is present. One green LED is always ON when power is present.
The sbRIO-9607 is powered through sbRIO-9687. The sbRIO-9607 runs a power-on self test (POST) when it is powered on. During the POST, the Power and Status LEDs activate. The Status LED turns off when the POST is complete. If the LEDs do not behave in this way when the system powers on, refer to Troubleshooting.

Connecting the sbRIO-9607 to the Host Computer

Complete the following steps to connect the sbRIO-9607 to the host computer using the RJ-45 Ethernet port.

1. Power on the host computer.
2. Connect the sbRIO-9607 to the host computer using a standard Category 5 (CAT-5) or better shielded, twisted-pair Ethernet cable.

Caution To prevent data loss and to maintain the integrity of your Ethernet installation, do not use a cable longer than 100 m.

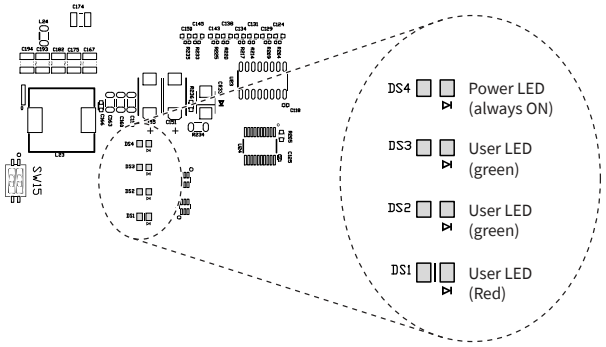
The first time you power up the device, it attempts to initiate a DHCP network connection. If the device is unable to initiate a DHCP connection, it connects to the network with a link-local IP address with the form 169.254.x.x. After the device has powered up, you must install software on the device and configure the network settings in MAX.

Note Installing software may change the network behavior of the device. For information about network behavior by installed software version, visit ni.com/info and enter the code ipconfigcrio.

Troubleshooting

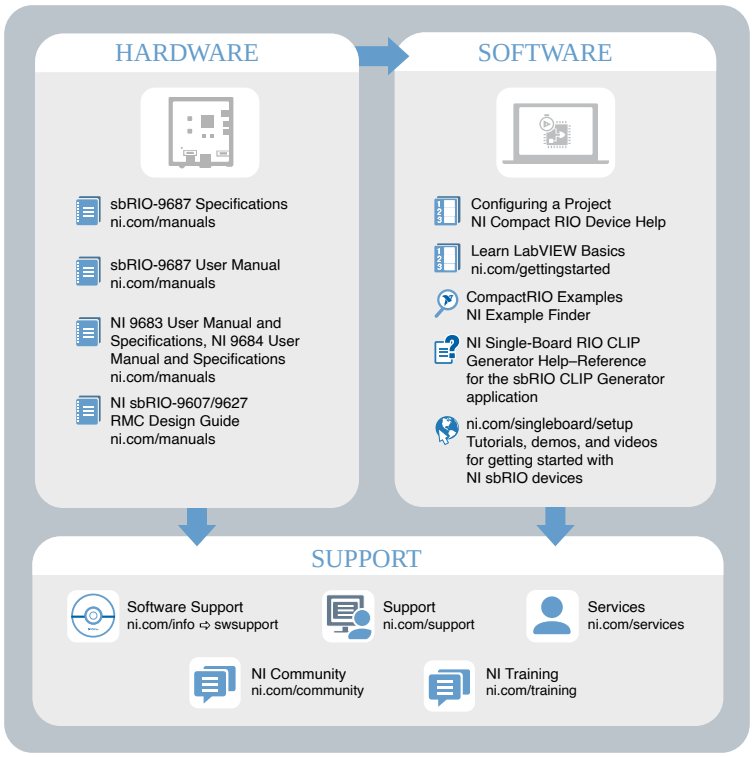
When the sbRIO-9687 is operating, the onboard power LED is ON. If the power LED is OFF, check if the input power is present and has the correct polarity.
The following figure shows the LEDs on the sbRIO-9687.

Figure 11. sbRIO-9687 LEDs



For details about troubleshooting the sbRIO-9607 or the sbRIO-9683 or sbRIO-9684 , consult the related documentation.
If an issue persists after you complete a troubleshooting procedure, contact NI technical support or visit ni.com/support.

Where to Go Next



Related Documentation

For additional information, refer to the following documents.

- **sbRIO-9687 Specifications**
- **sbRIO-9687 User Manual**
- **NI sbRIO-9607 Getting Started Guide**
- **Thermal Kit for NI sbRIO-9607/9627/9637 Installation and Specifications Manual**
- **NI sbRIO-9607/9627 RIO Mezzanine Card Design Guide**
- **NI 9683 User Manual and Specifications**
- **NI 9684 User Manual and Specifications**

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