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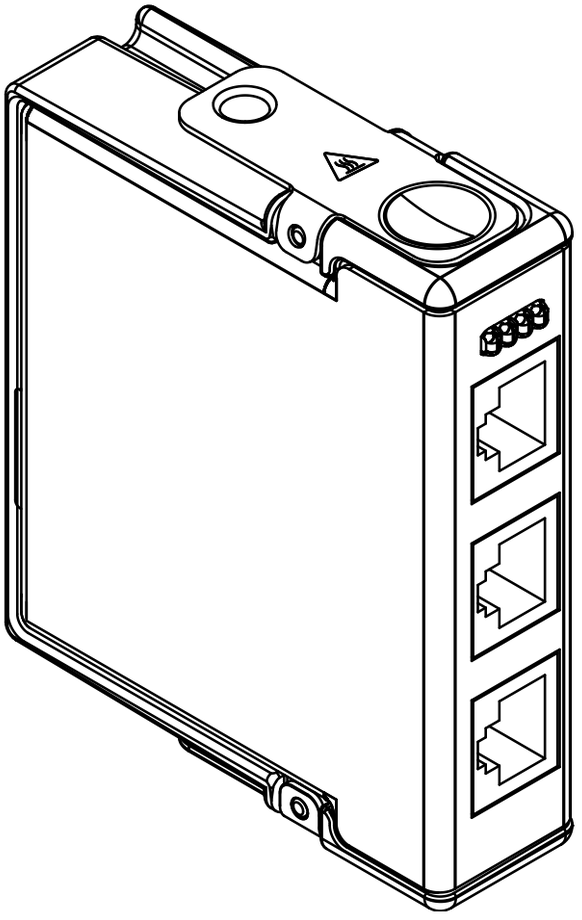
GETTING STARTED GUIDE

NI 9469

Synchronization Module



NATIONAL INSTRUMENTS™

This document explains how to connect to the NI 9469.

Note Before you begin, complete the software and hardware installation procedures in your chassis documentation.

Note The guidelines in this document are specific to the NI 9469. The other components in the system might not meet the same safety ratings. Refer to the documentation for each component in the system to determine the safety and EMC ratings for the entire system.

Safety Guidelines

Operate the NI 9469 only as described in this document.

Caution Do not operate the NI 9469 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.

Safety Guidelines for Hazardous Locations

The NI 9469 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class I, Zone 2, AEx nA IIC T4 and Ex nA IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the NI 9469 in a potentially explosive environment. Not following these guidelines may result in serious injury or death.

Caution Do not disconnect I/O-side wires or connectors unless power has been switched off or the area is known to be nonhazardous.

Caution Do not remove modules unless power has been switched off or the area is known to be nonhazardous.

Caution Substitution of components may impair suitability for Class I, Division 2.

Caution For Division 2 and Zone 2 applications, install the system in an enclosure rated to at least IP54 as defined by IEC/EN 60079-15.

Caution For Division 2 and Zone 2 applications, install a protection device between the external power supply and the Vsup pin. The device must prevent the Vsup-to-COM voltage from exceeding 50 V if there is a transient overvoltage condition.

Special Conditions for Hazardous Locations Use in Europe and Internationally

The NI 9469 has been evaluated as Ex nA IIC T4 Gc equipment under DEMKO Certificate No. 07 ATEX 0626664X and is IECEx UL 14.0089X certified. Each NI 9469 is marked Ex II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of -40 °C ≤ Ta ≤ 70 °C. If you are using the NI 9469 in Gas Group IIC hazardous locations, you must use the device in an NI chassis that has been evaluated as Ex nC IIC T4, Ex IIC T4, Ex nA IIC T4, or Ex nL IIC T4 equipment.

Caution You must make sure that transient disturbances do not exceed 140% of the rated voltage.

Caution The system shall only be used in an area of not more than Pollution Degree 2, as defined in IEC 60664-1.

Caution The system shall be mounted in an ATEX/IECEx-certified enclosure with a minimum ingress protection rating of at least IP54 as defined in IEC/EN 60079-15.

Caution The enclosure must have a door or cover accessible only by the use of a tool.

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 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 changes or 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.

Special Conditions for Marine Applications

Some products are Lloyd's Register (LR) Type Approved for marine (shipboard) applications. To verify Lloyd's Register certification for a product, visit *ni.com/certification* and search for the LR certificate, or look for the Lloyd's Register mark on the product.

Caution In order to meet the EMC requirements for marine applications, install the product in a shielded enclosure with shielded and/or filtered power and input/output ports. In addition, take precautions when designing, selecting, and installing measurement probes and cables to ensure that the desired EMC performance is attained.

NI 9469 Overview

The NI 9469 is a synchronization module for C Series platforms. It has a configurable multi-port interface that enables distribution of triggers and clocks from a host chassis, and an onboard DDS and PLL for clock generation and synchronization capabilities.

Connecting the NI 9469

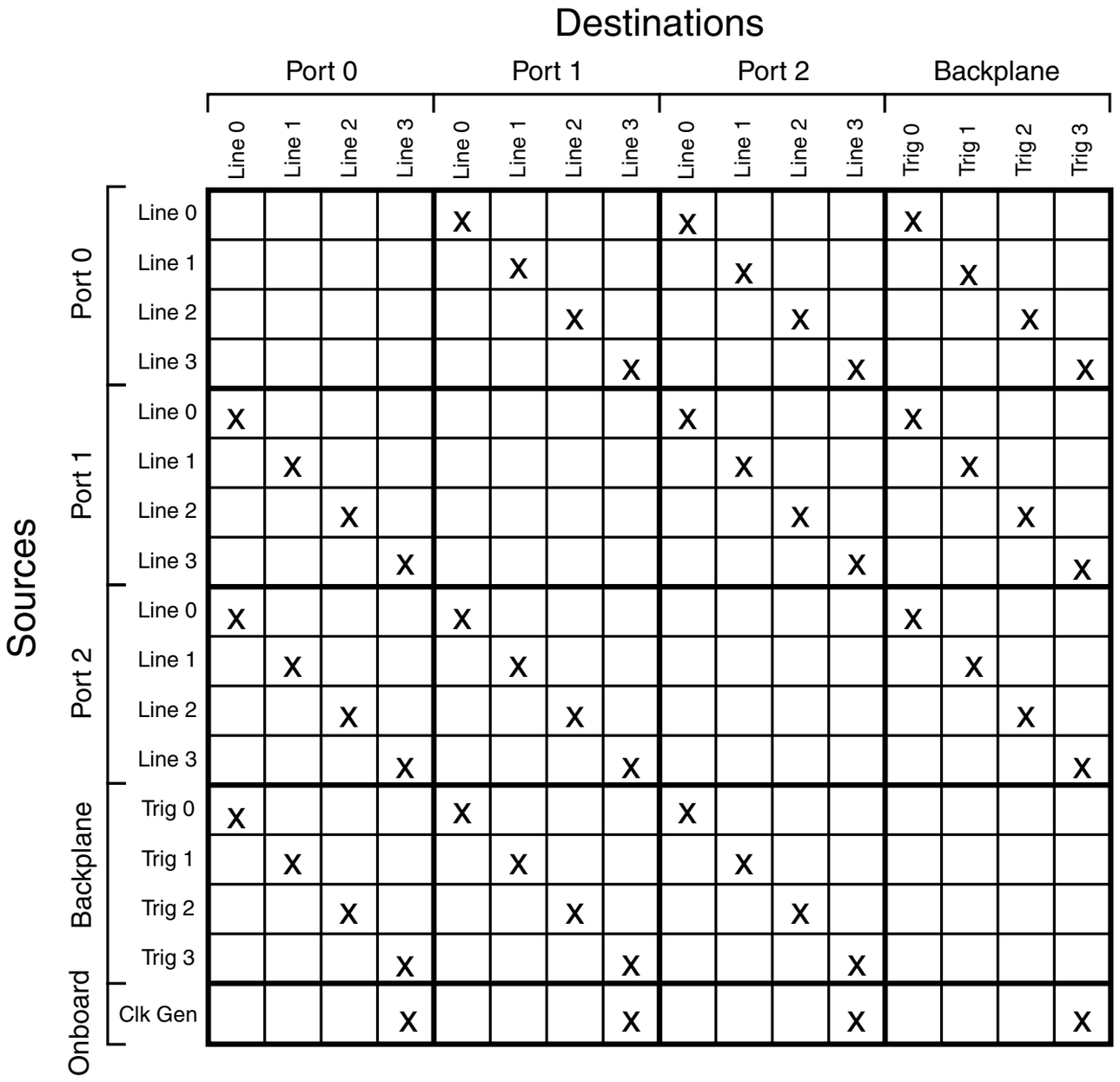
The NI 9469 has three RJ45 connectors on the front panel labeled Port 0, 1, and 2. These connectors use standard straight through CAT 5e Ethernet cabling to provide connection to other NI 9469 modules only . Each port is software configurable to drive or receive four differential signals through the cable, which are referred to as Line 0 to 3. Each port can carry either four triggers, or three triggers and one clock, in which Line 3 is dedicated to carry the clock.

Routing the NI 9469

The NI 9469 features a configurable crosspoint switch. You can control the routing of signals and the onboard clock generator between each front port and the trigger lines in the backplane. However, the crosspoint switch is not a full routing matrix. You can connect only the same Line or Trig number. For example, Line 0 to Trig 0, but not Line 0 to Trig 2. However, you can route clock signals on only Line 3 or Trig 3. The following figure details the crosspoint switch's routing capabilities.

Note You can set only eight of the 12 total port lines as outputs due to power constraints.

Figure 1. Routing Capabilities of the Crosspoint Switch



Note The preceding figure details hardware routing capability only. Software imposed limitations may prevent certain routing or input/output functions from being realized. For more information, refer to the documentation for your specific software platform.

NI 9469 Application

In a basic application, a single NI 9469 module is inserted into each host C Series chassis. One module is set as master, the remainder as slaves, and all modules are connected with a tree topology. Figure 2 shows a tree topology example. More advanced and customizable options create a flexible topological network of NI 9469 modules. Refer to the *Topologies* section for examples of various topological networks.

Based on user needs, you may desire certain topologies over others due to application or timing requirements. Because signals are physically propagated over cabling, the module cannot compensate for inherent cable delays and skew. For example, if all slave modules must receive triggers at the same time with minimal skew and delay, a star topology with short length-

matched cables is preferred. Refer to Figure 3 for a star topology configuration example.

If maximum separation distance is required, connect the modules using a daisy chain topology with maximum cable length per hop, as shown in Figure 4. Refer to the *Cable* section for information about maximum cable length.

Topologies

Figure 2. Tree Topology

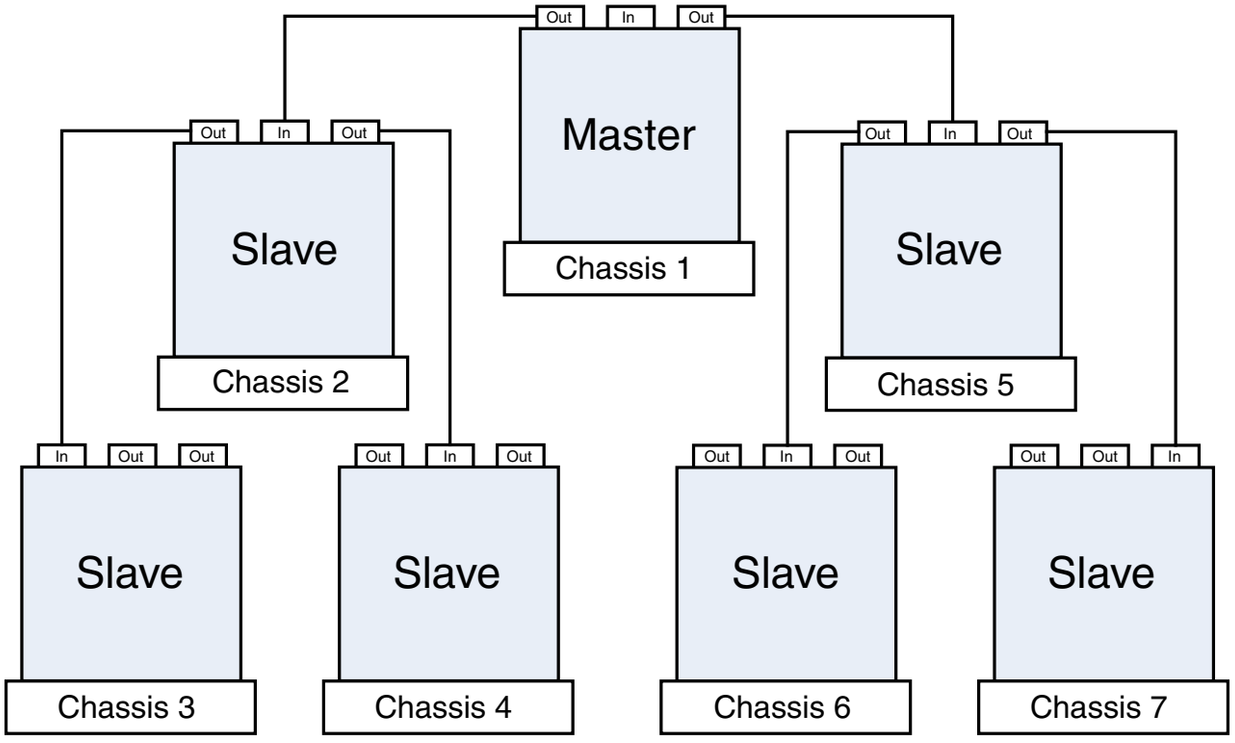


Figure 3. Star Topology

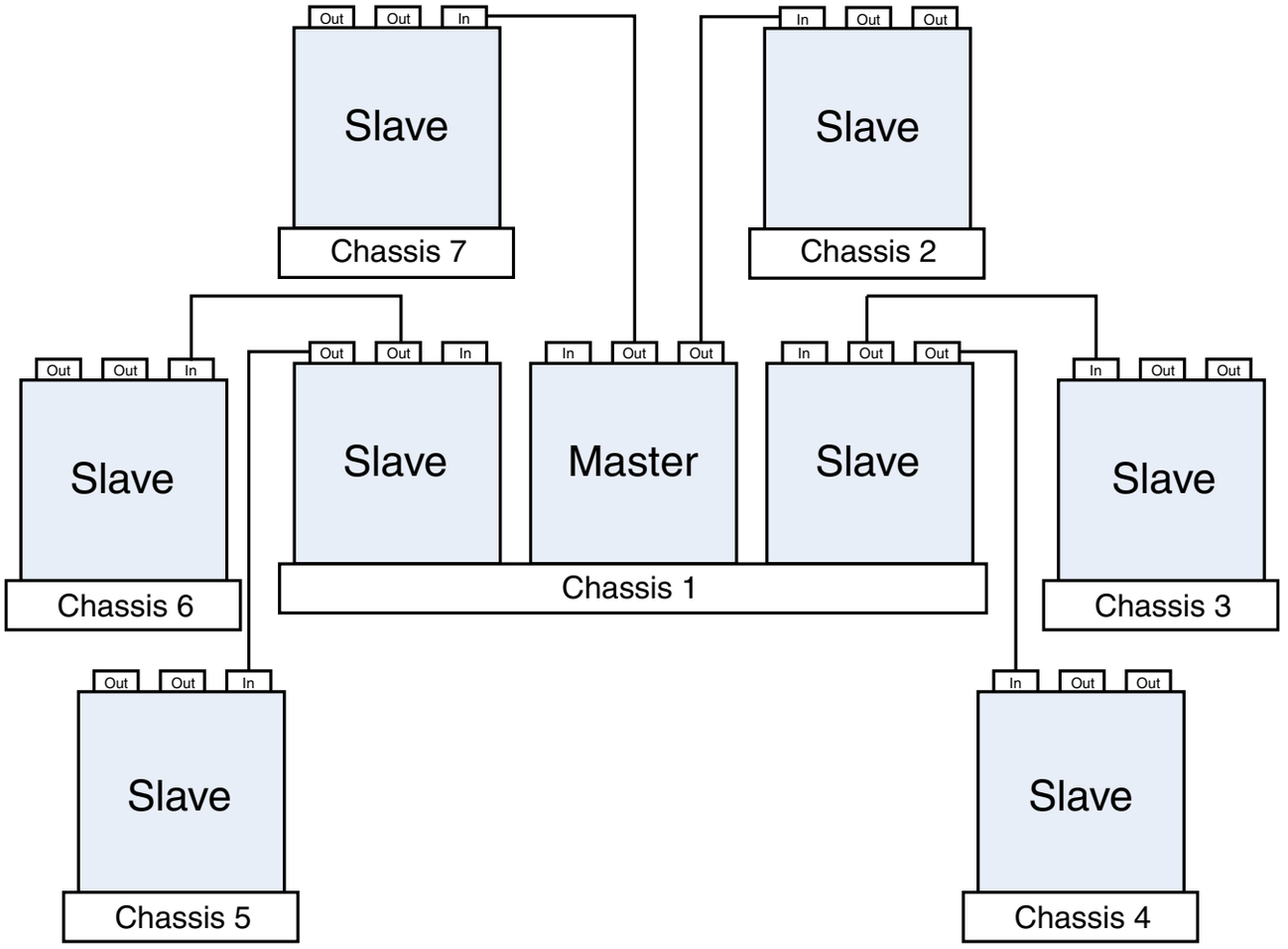


Figure 4. Daisychain Topology

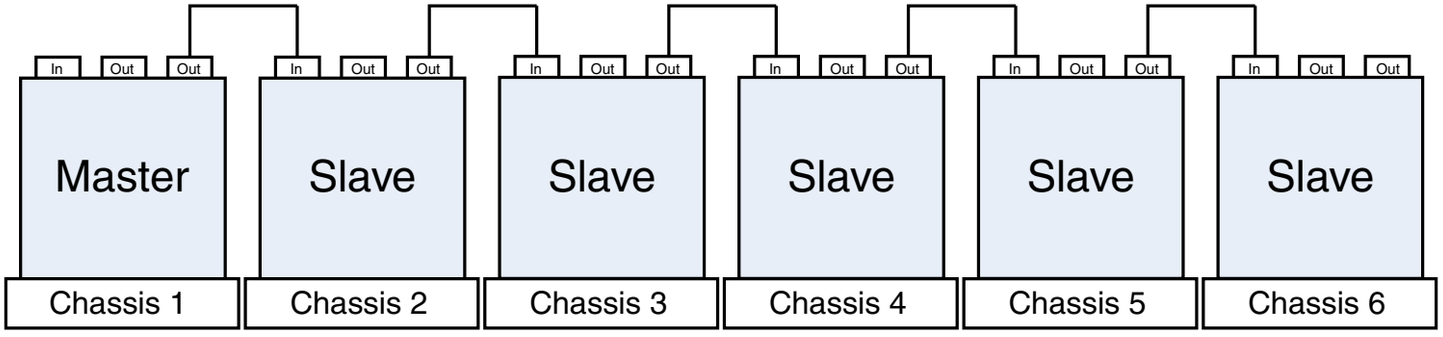
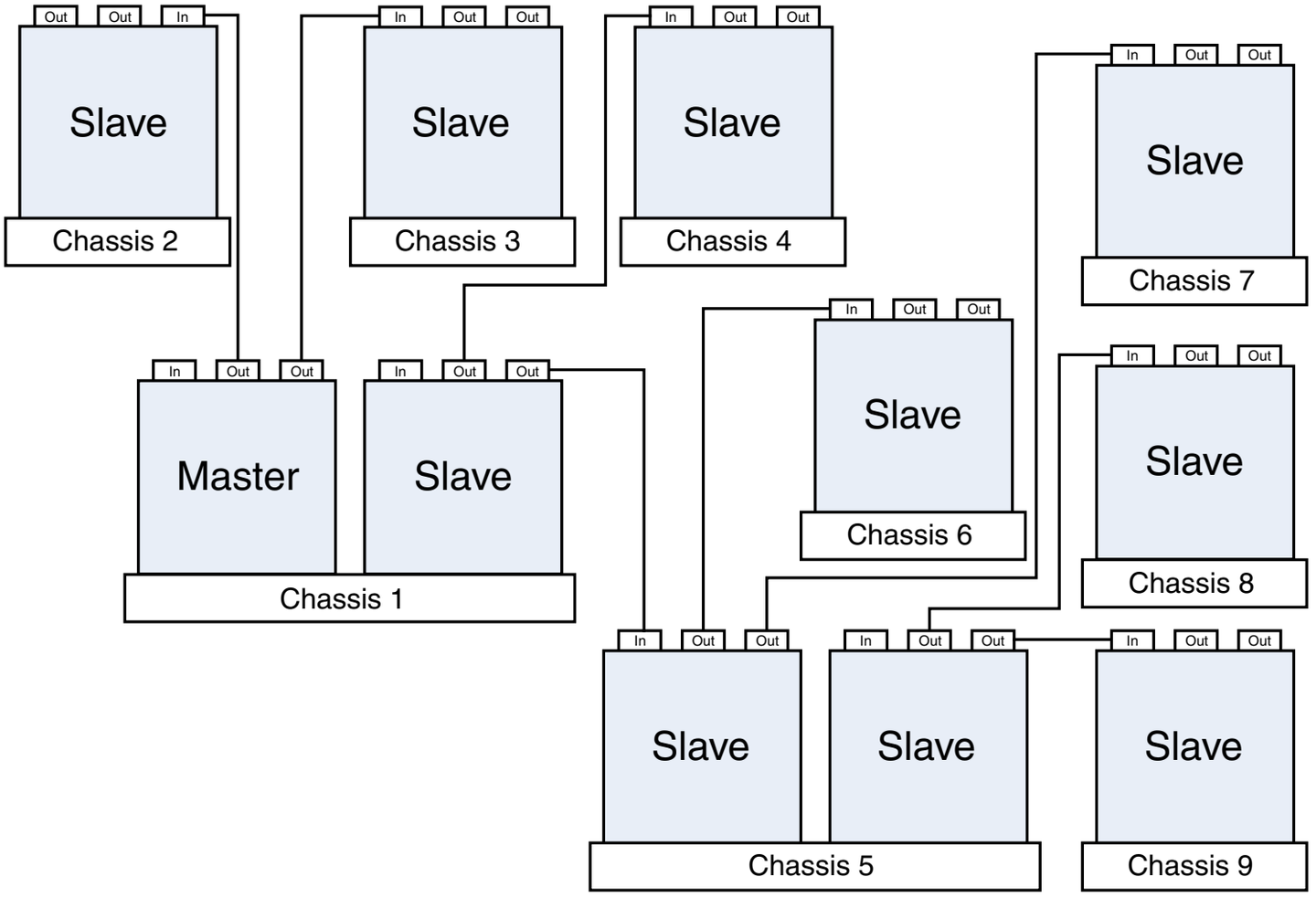


Figure 5. Hybrid Topology



Activity LEDs

The NI 9469 has four front panel LEDs labeled Trig 0, Trig 1, Trig 2, and Trig 3/Clk. The LEDs blink when activity is detected on the corresponding line to or from the carrier.

Sleep Mode

This module supports a low-power sleep mode. Support for sleep mode at the system level depends on the chassis the module is plugged into. Refer to the chassis manual for information about support for sleep mode. If the chassis supports sleep mode, refer to the software help for information about enabling sleep mode. Visit *ni.com/info* and enter `cseriesdoc` for information about C Series documentation.

Typically, when a system is in sleep mode, you cannot communicate with the modules. In sleep mode, the system consumes minimal power and may dissipate less heat than it does in normal mode. Refer to the *Specifications* section for more information about power consumption and thermal dissipation.

Notice that when the NI 9469 is in sleep mode, the clock generation settings (if used) must be reconfigured when the module exits sleep mode and power is restored.

NI 9469 Specifications

The following specifications are typical for the range -40 °C to 70 °C unless otherwise noted.

I/O Characteristics

Front panel connectors	Shielded RJ45 receptacle
Front panel indicators	4 green LEDs
Number of ports	3 (Port 0, 1, and 2)
Number of input/output signals	4 (Line 0, 1, 2, and 3) per port, 12 total
Signal type	Differential

Maximum simultaneous outputs	8
Number of I/O triggers to backplane	4 (Trig 0, 1, 2, and 3)
Clock generation (DDS)	
Frequency	12.8 MHz or 13.1072 MHz
Accuracy	±3.5 ppm typical

Cable

Type[1]	CAT 5e (Shielded Twisted Pair) (straight-through)
Maximum propagation delay[2]	4.98 ns/m
Maximum length	100 m

1 Refer to the *I/O Characteristics* section for more information.

2 As specified for CAT 5e in TIA/EIA-568 Standard.

Power Requirements

Power consumption from chassis	
Active mode	1 W max
Sleep mode	25 µW
Thermal dissipation (at 70 °C)	
Active mode	1 W max
Sleep mode	25 µW

Physical Characteristics

To clean the module, wipe it with a dry towel.

Weight	148 g (5.2 oz)

Safety Voltages

Isolation	
Channel-to-channel	None
Channel-to-earth ground	None

Safety and Hazardous Locations Standards

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1
- EN 60079-0:2012, EN 60079-15:2010
- IEC 60079-0: Ed 6, IEC 60079-15; Ed 4
- UL 60079-0; Ed 5, UL 60079-15; Ed 3
- CSA 60079-0:2011, CSA 60079-15:2012

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Hazardous Locations

U.S. (UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx nA IIC T4
Canada (C-UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, Ex nA IIC T4
Europe (DEMKO)	Ex nA IIC T4 Gc

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Industrial immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.

Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.

Note For EMC declarations and certifications, and additional information, refer to the *Online Product Certification* section.

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 94/9/EC; Potentially Explosive Atmospheres (ATEX)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit *ni.com/certification*, search by model number or product line, and click the appropriate link in the Certification column.

Shock and Vibration

To meet these specifications, you must panel mount the system.

Operating vibration	
Random (IEC 60068-2-64)	5 g_{rms}, 10 Hz to 500 Hz
Sinusoidal (IEC 60068-2-6)	5 g, 10 Hz to 500 Hz
Operating shock (IEC 60068-2-27)	30 g, 11 ms half sine; 50 g, 3 ms half sine; 18 shocks at 6 orientations

Environmental

Refer to the manual for the chassis you are using for more information about meeting these specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 70 °C
Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 85 °C

Ingress protection	IP40
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.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *Minimize Our Environmental Impact* web page at *ni.com/environment*. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit *ni.com/environment/weee*.

电子信息产品污染控制管理办法（中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令(RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

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.

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