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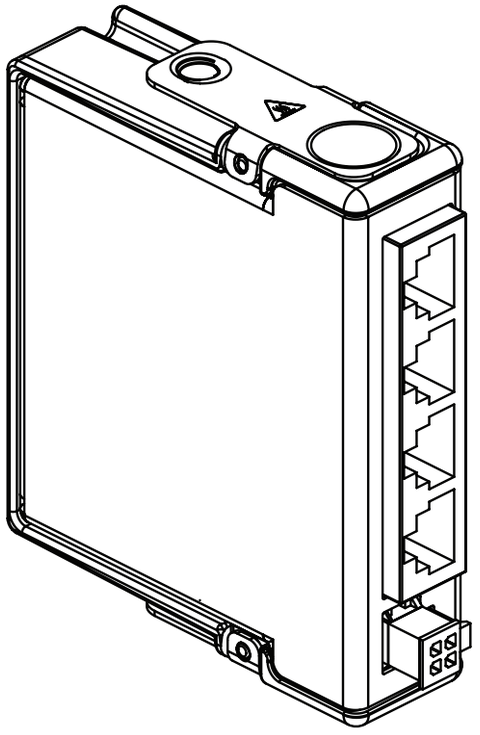
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Find the *National Instruments NI 9870* at our website: ***Click HERE***

OPERATING INSTRUCTIONS AND SPECIFICATIONS

NI 9871

4-Port, RS485/RS422 Serial Module



NATIONAL INSTRUMENTS™

This document describes how to use the National Instruments 9871 and includes specifications and pin assignments for the NI 9871. Visit `ni.com/info` and enter `rdsoftwareversion` to determine which software you need for the modules you are using. For information about installing, configuring, and programming the system, refer to the system documentation. Visit `ni.com/info` and enter `cseriesdoc` for information about C Series documentation.



Note The safety guidelines and specifications in this document are specific to the NI 9871. The other components in the system might not meet the same safety ratings and specifications. Refer to the documentation for each component in the system to determine the safety ratings and specifications for the entire system. Visit `ni.com/info` and enter `cseriesdoc` for information about C Series documentation.

Safety Guidelines

Operate the NI 9871 only as described in these operating instructions.



Hot Surface This icon denotes that the component may be hot. Touching this component may result in bodily injury.

Safety Guidelines for Hazardous Locations

The NI 9871 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class I, Zone 2, AEx nA II T4 and Ex nA II T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the NI 9871 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 Zone 2 applications, install the CompactRIO system in an enclosure rated to at least IP 54 as defined by IEC 60529 and EN 60529.

Caution For Zone 2 applications, install a protection device between the RS485/RS422 signal cables and the NI 9871 RJ-50 jacks (ports 1–4). The device must prevent the RS485/RS422 signal-to-signal or signal-to-COM voltage from exceeding 23 V if there is a transient overvoltage condition.

Caution For Zone 2 applications, install a protection device between the external power supply and the NI 9871 V_{sup} and COM pins. The device must prevent the V_{sup}-to-COM voltage from exceeding 39 V if there is a transient overvoltage condition.

Special Conditions for Hazardous Locations in Europe

This equipment has been evaluated as Ex nA IIC T4 equipment under DEMKO Certificate No. 07 ATEX 0626664X. Each module is marked ⟨Ex⟩ II 3G and is suitable for use in Zone 2 hazardous locations. If you are using the NI 9871 in Gas Group IIC hazardous locations or in ambient temperatures of –40 °C ≤ Ta ≤ 70 °C, you must use the device in an NI chassis or controller that has been evaluated as EEx nC IIC T4, Ex nA IIC T4, or Ex nL IIC T4 equipment.

Special Conditions for Marine Applications

Some modules are Lloyd's Register (LR) Type Approved for marine applications. To verify Lloyd's Register certification, visit `ni.com/certification` and search for the LR certificate, or look for the Lloyd's Register mark on the module.

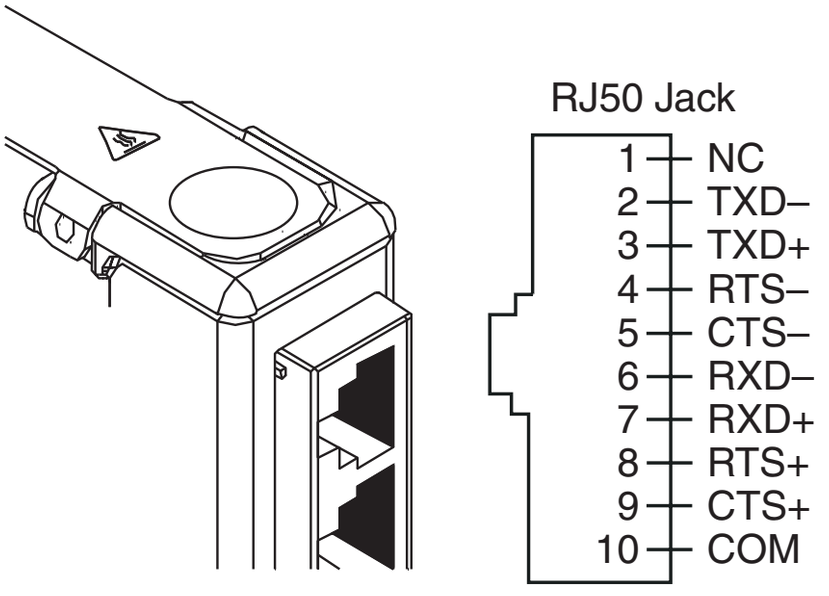


Caution To meet radio frequency emission requirements for marine applications, use shielded cables and install the system in a metal enclosure. Suppression ferrites must be installed on power supply inputs near power entries to modules and controllers. Power supply and module cables must be separated on opposite sides of the enclosure and must enter and exit through opposing enclosure walls.

Wiring the NI 9871

The NI 9871 has four RJ-50 receptacles that provide connections for four RS485/RS422 devices.

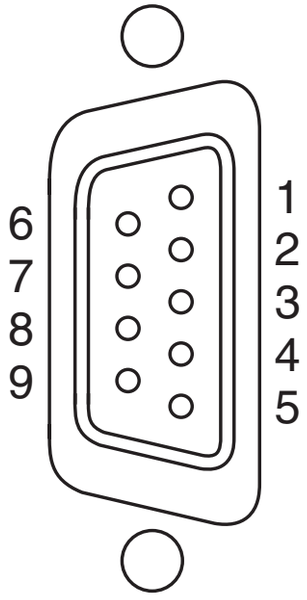
Table 1. RS485/RS422 Port Pinout

	RJ-50 Pin	Signal Name*
	1	No Connect
	2	TXD–
	3	TXD+
	4	RTS–
	5	CTS–
	6	RXD–
	7	RXD+
	8	RTS+
	9	CTS+
	10	GND

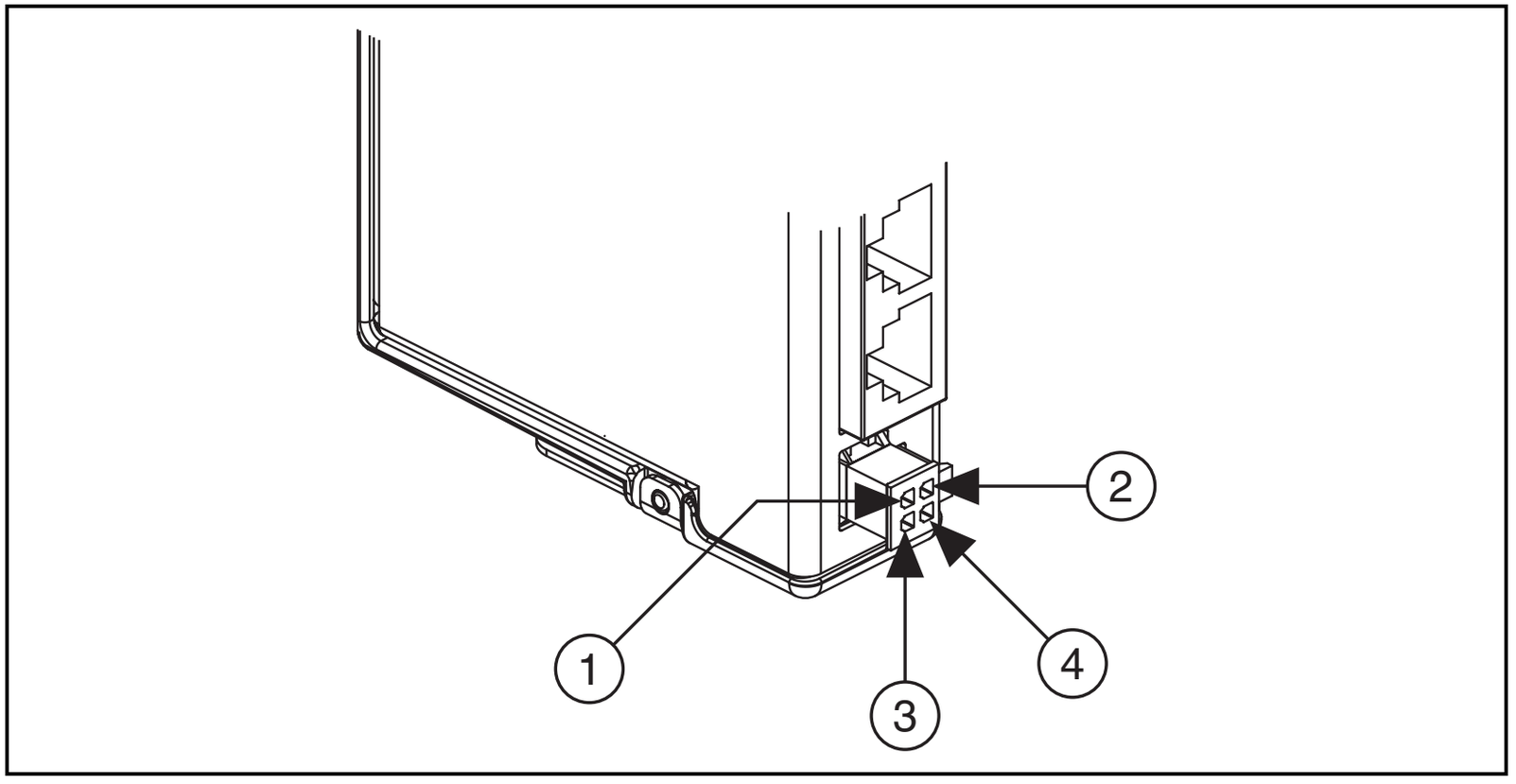
* These signals are shared by all four RJ-50 connectors on the NI 9871.

The cables included with your kit convert the RJ-50 pinout to the standard NI pinout, as shown in Table 2.

Table 2. Pin Assignments for RS485/RS422 DB-9 Male Connector

Connector	Pin	Signal
	1	GND
	2	CTS+
	3	RTS+
	4	RXD+
	5	RXD–
	6	CTS–
	7	RTS–
	8	TXD+
	9	TXD–

You must connect an external power supply to the NI 9871. This power supply provides the power for the RS485/RS422 transceivers on the module. You can use the included female four-position pigtail to connect to an external voltage source. Figure 1 lists the connections between an external voltage source (of +8 V to +28 V) and the NI 9871.



1	V_{SUP}	2	V_{SUP}	3	COM	4	COM

Figure 1. Four-Position External Power Connector

Figure 2 shows the method of power connection to the NI 9871 module. Attach an isolated power supply to the V_{sup} and COM terminals using the included pigtail.

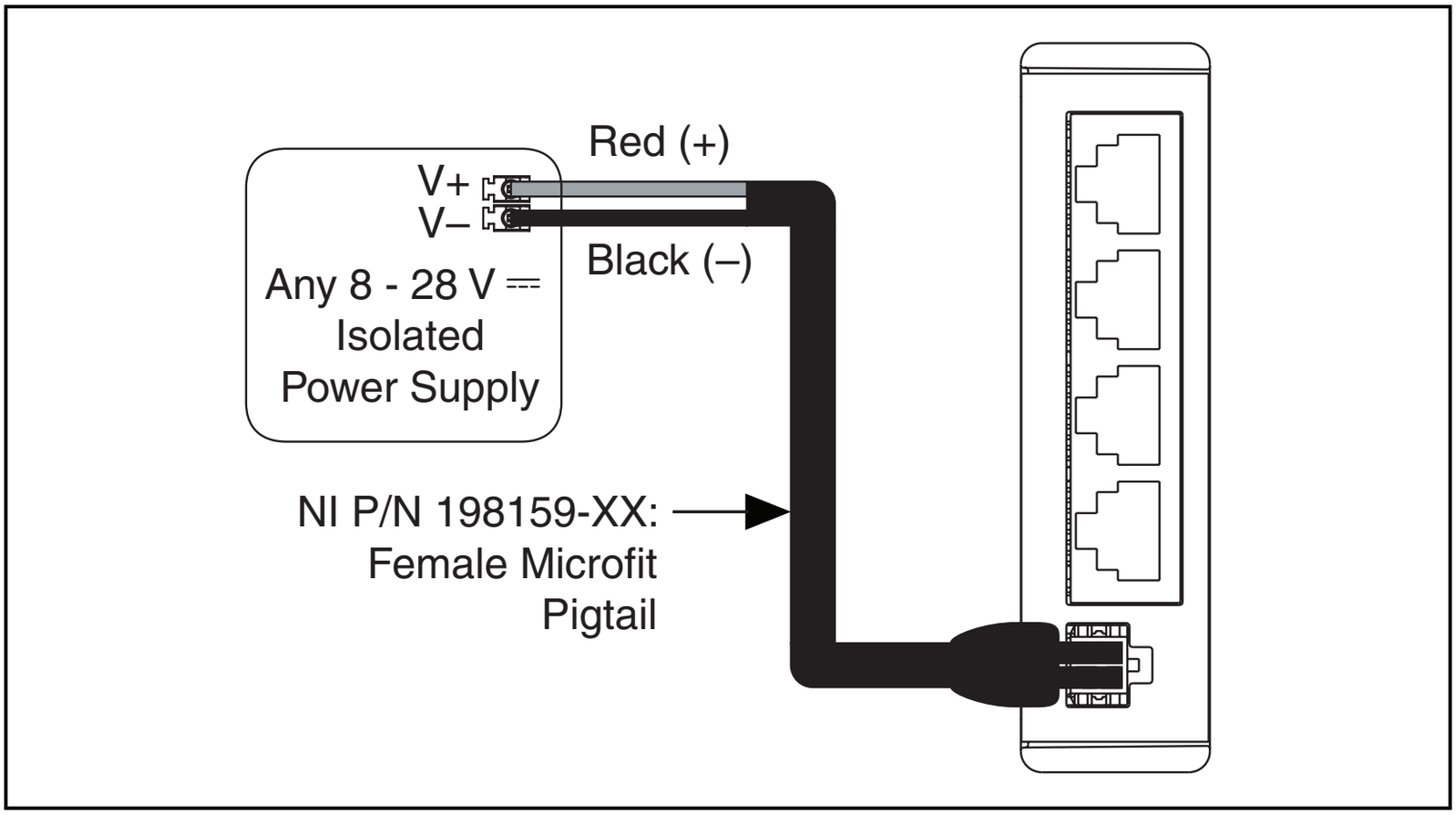


Figure 2. Powering the NI 9871 from an Isolated Power Source

Figure 3 shows how to use the optional y-adapter (available at `ni.com/serial`) to connect power to more than one module using the same power source. One y-adapter is needed for each

additional module. Ensure that the power supply can handle maximum power requirements for all modules connected.

Caution All connections must be made before power is applied.

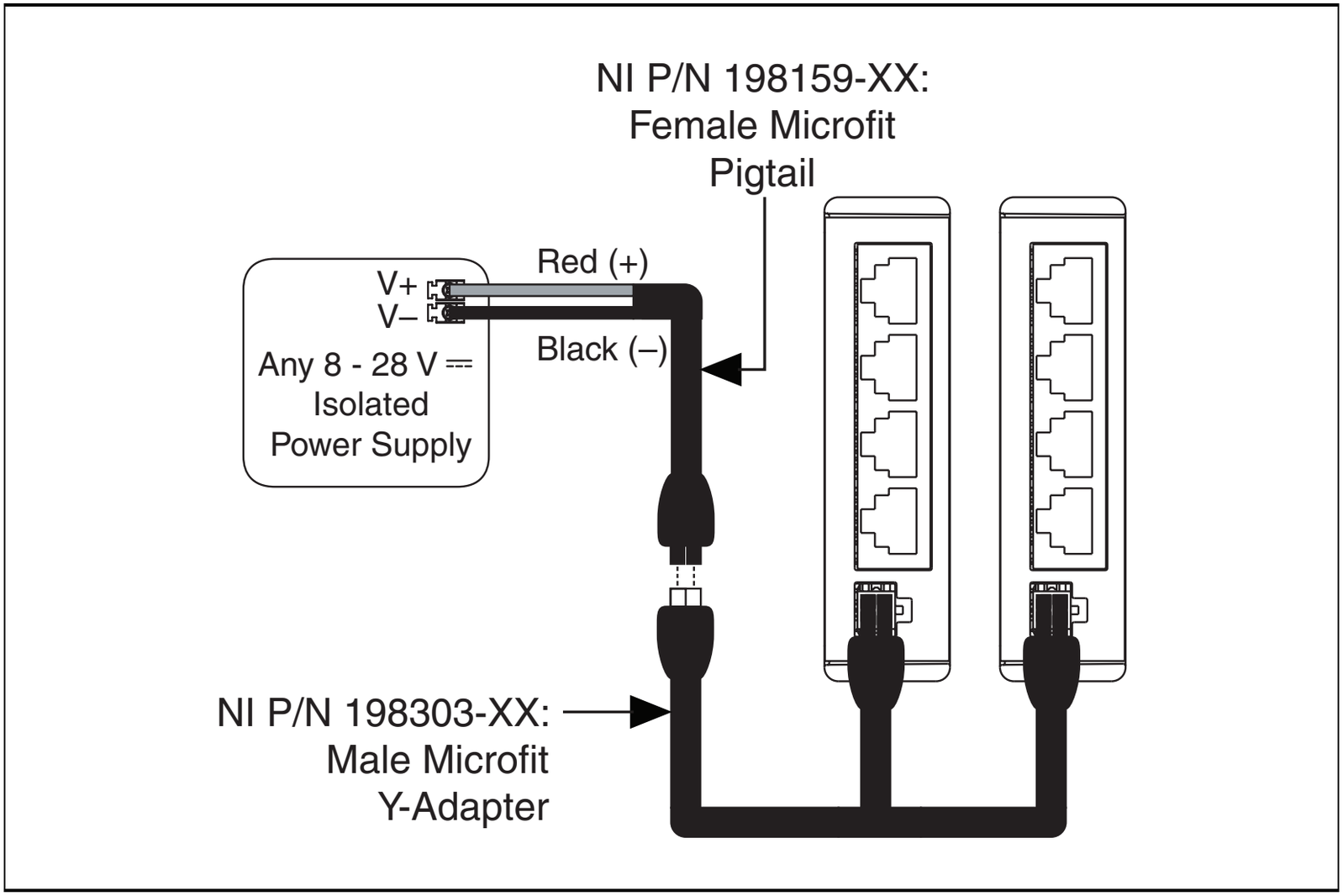


Figure 3. Powering Multiple Modules from a Single Power Supply

RS485 Bus Topology and Termination

Refer to Figure 4 and Figure 5 for an overview of 4-wire and 2-wire RS485 bus topologies and termination.

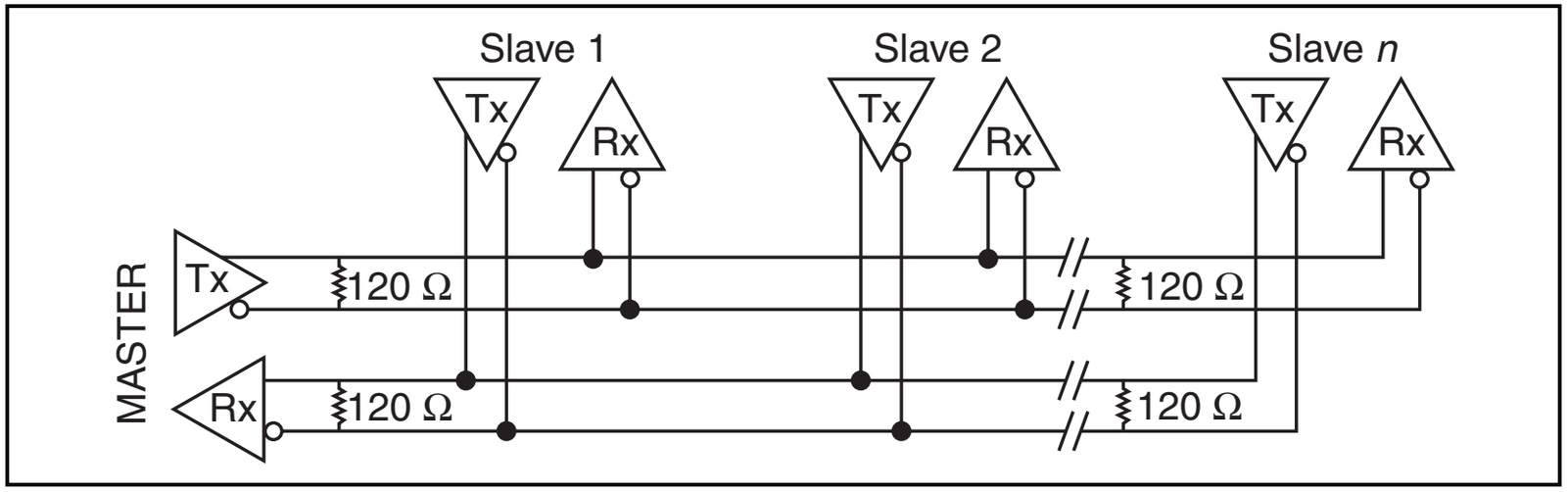


Figure 4. 4-Wire Full-Duplex Multidrop Network Using Terminating Resistors

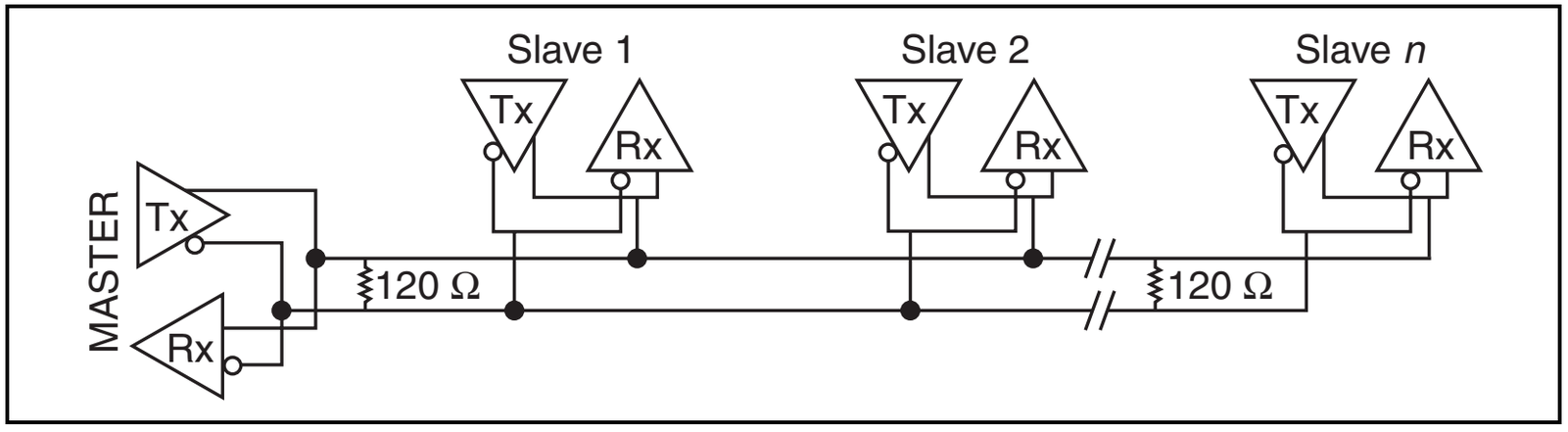


Figure 5. 2-Wire Multidrop Network Using Terminating Resistors

RS485 terminators are available at `ni.com/serial`.

RS485 Transceiver Control

Refer to Table 3 for a listing of TX and RX enable conditions for the different RS485 transceiver control modes.

Table 3. Transceiver Control Pin Conditions

Enable	4-Wire	2-Wire		
		DTR/Echo	DTR/No Echo	Auto
TX	On	DTR	DTR	TX
RX	On	On	DTR#	TX#

NI 9871 Hardware Overview

The NI 9871 has four independent RS485/RS422 ports that are isolated from the other modules in the system. Each port is fully compatible with the ANSI/EIA/TIA-485 standard.

Sleep Mode (CompactRIO Only)

You can enable sleep mode for the CompactRIO system in software. In sleep mode, the system consumes less power and may dissipate less heat. Typically, when a system is in sleep mode, you cannot communicate with the modules. Refer to the *Specifications* section for more information about power consumption and thermal dissipation.

Specifications

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

Maximum baud rate ..... 3.6864 Mbps

Maximum cable length ..... 1.2 km (4,000 ft.)

Data line ESD protection
(human body model) ..... ±15 kV

MTBF ..... 514,016 hours at 25 °C;
Bellcore Issue 6, Method 1,
Case 3, Limited Part Stress
Method

Note Contact NI for Bellcore MTBF specifications at other temperatures or for MIL-HDBK-217F specifications.

Power Requirements

Power consumption from chassis

- Active mode ..... 0.5 W max
- Sleep mode ..... 50 µW max

Thermal dissipation (at 70 °C)

- Active mode ..... 1.5 W max
- Sleep mode ..... 55 mW max

Required external supply voltage range (V_{SUP}) ..... +8 to +28 VDC

Power supply consumption from external supply V_{SUP}

- Typical ..... 1 W
- Maximum ..... 3.5 W

Physical Characteristics

If you need to clean the module, wipe it with a dry towel.

Weight ..... Approx. 153 g (5.4 oz)

Safety

Maximum Voltage[1]

Connect only voltages that are within these limits.

RS485/RS422 Port-to-COM..... –8 to +13 VDC max,
Measurement Category I

V_{SUP}-to-COM ..... ±28 V max,
Measurement Category I

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as *MAINS* voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.



Caution Do not connect to signals or use for measurements within Measurement Categories II, III, or IV.

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[1] The maximum voltage that can be applied or output without creating a safety hazard.

Isolation Voltages

Port-to-earth ground

Withstand..... 1000 V_{rms}, verified by a dielectric withstand test, 5 s

Continuous ..... 60 VDC, Measurement Category I

Hazardous Locations

U.S. (UL) ..... Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx nA II T4

Canada (C-UL) ..... Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, Ex nA II T4

Europe (DEMKO)..... Ex nA IIC T4

Safety Standards

The NI 9871 is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1



Note For UL and other safety certifications, refer to the product label, or visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

Emissions	EN 55011 Class A at 10 m FCC Part 15A above 1 GHz
Immunity	Industrial levels per EN 61326-1:1997 + A2:2001, Table A.1
EMC/EMI	CE, C-Tick, and FCC Part 15 (Class A) Compliant

Note For the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.

Note For EMC compliance, operate this device with shielded cabling.

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

Low-Voltage Directive (safety)..... 2006/95/EC

Electromagnetic Compatibility
Directive (EMC) 2004/108/EC

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 module 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 CompactRIO system.

Operating vibration,
random (IEC 60068-2-64) ..... 5 g_{rms}, 10 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

Operating vibration,
sinusoidal (IEC 60068-2-6) ..... 5 g, 10 to 500 Hz

Environmental

CompactRIO modules are intended for indoor use only. For outdoor use, mount the CompactRIO system in a suitably rated enclosure. Refer to the installation instructions for the chassis you are using for more information about meeting these specifications.

Operating temperature ..... –40 to 70 °C

Storage temperature ..... –40 to 85 °C

Ingress protection..... IP 40

Operating humidity ..... 10 to 90% RH, noncondensing

Storage humidity ..... 5 to 95% RH, noncondensing

Maximum altitude ..... 2,000 m

Pollution Degree (IEC 60664) 2

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 *NI and the Environment* 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 their life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit `ni.com/environment/weee.htm`.

电子信息产品污染控制管理办法 （中国 RoHS）



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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:

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Finland 358 (0) 9 725 72511, France 01 57 66 24 24,
Germany 49 89 7413130, India 91 80 41190000,
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Norway 47 (0) 66 90 76 60, Poland 48 22 3390150,
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