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Serial Instrument Control

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Overview

Since 1976, National Instruments has maintained a longstanding commitment to supply a variety of quality instrument control and connectivity solutions that take advantage of the latest computer and network technology. In our first developments, we concentrated on the most popular bus for automated systems – GPIB. Since then, we added instrument control and connectivity solutions that include the popular RS-xxx serial buses as well as the latest computer buses, such as Ethernet, Universal Serial Bus (USB), and IEEE 1394 (FireWire).

We believe that true value comes from keeping pace with technological enhancements without sacrificing the development investments you made in the past. This idea shapes the development of our instrument controllers and driver software, regardless of the particular bus used. Today we offer you ways to control or connect to your existing GPIB or serial instruments through either GPIB or serial controllers, or through Ethernet, USB, and IEEE 1394. Furthermore, because the software investment is a crucial component of any automated instrumentation system, our software and hardware are always designed to handle various buses transparently, without changing your code, even when transferring to a completely new bus or architecture.

National Instruments has long been a leading supplier of instrumentation interface products for laboratory and benchtop instrumentation. Just as in lab and test environments, industrial applications require PCs and reliable, robust, and easy-to-use software and hardware tools that can communicate with devices, such as process instrumentation, programmable logic controllers (PLCs), and single-loop controllers. National Instruments offers a variety of hardware and driver software products for communication across serial buses (RS-232, RS-422, and RS-485) with laboratory, benchtop, and industrial devices.



Figure 1. USB-232

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Serial Instrument Control

Serial Communication

Many devices used in test and measurement and industrial applications adhere to EIA standards RS-232, RS-422, or RS-485 to connect to computers and to one another. (We use the term RS-xxx to generically refer to RS-232, RS-422, and RS-485.) A common misconception about these specifications is that they define specific software protocols. The ANSI/EIA RS-xxx standards specify only the electrical characteristics, not the software protocol. Table 1 summarizes the main features of these three serial interfaces as defined in their respective standards documents.

IBM-compatible PCs historically used RS-232 (ANSI/EIA-232 standard), most commonly to connect a mouse, printer, or modem, as well as test, measurement, and laboratory instrumentation. Because of improvements in line drivers and cables, applications often increase the performance of RS-232 beyond the distance and speed listed in the standard. RS-232 is limited to point-to-point connections between PC serial (COM) ports and devices.

RS-422 (EIA RS-422-A standard) uses a differential electrical signal, as opposed to the unbalanced signals referenced to ground with RS-232. Differential transmission, which uses two lines each to transmit and receive signals, results in greater noise immunity and longer distances which are big advantages in industrial environments.

	RS-232	RS-422	RS-485
Type of transmission lines	Unbalanced	Differential	Differential
Maximum number of drivers	1	1	32
Maximum number of receivers	1	10	32
Maximum cable length in meters (feet)	15.2 (50)	1.2 k (4,000)	1.2 k (4,000)

Table 1. Selected Specifications for RS-232, RS-422, and RS-485

RS-485 (EIA-485 standard) is an improvement compared to RS-422 because it increases the maximum number of devices from 10 to 32 and defines the electrical characteristics necessary to ensure adequate signal voltages under maximum load. With this enhanced multidrop capability, you can create networks of devices connected to a single RS-485 serial port. The noise immunity and multidrop capability make RS-485 the serial connection of choice in industrial applications requiring many distributed devices networked to a PC or other controller for data collection, HMI, and other operations.

Note that RS-xxx standards do not specify anything about the software used to communicate with devices. RS-485 specifies only that it can connect multiple electrical loads (devices) on a single set of wires. It does not say anything about how to address these loads. It is the job of a particular device's software protocol to describe how to communicate with a specific device. The most common solution is a set of ASCII strings that constitute commands to the device.

There are many industrial serial protocols more complex than simple ASCII commands, yet still compatible with standard RS-232 or RS-485 serial ports. Typical of these protocols are the networks used with PLCs. Examples of such protocols are Modbus and Optomux, two of the more widely used serial protocols. Documentation for these protocols is widely available.

NI Serial Interfaces

Introduction

National Instruments serial interfaces give you connectivity to the many serial devices available for test and measurement, industrial, manufacturing, and laboratory data acquisition. Many applications simply need more serial ports than a standard PC offers. In test and measurement and laboratory applications, many instruments, such as oscilloscopes, multimeters, chromatographs, and spectrometers, use RS-232 for a low-cost connection. In manufacturing applications, devices such as barcode readers and scales also use the serial port for communicating to a host computer. In industrial applications, devices such as PLCs, data loggers, and single-point I/O modules use RS-485 for long distance (up to 1.2 km) and multidrop capabilities. National Instruments serial interfaces give you the flexibility of software-configurable multiport capability to meet your exact application needs.

Hardware

All National Instruments serial interface devices are Plug and Play compatible. You do not need jumpers or DIP switches for configuring your device. You can perform configuration totally under the control of the operating system. Our RS-485 interfaces – PCI-485, PXI-8421, PXI-8423, PCMCIA-485, AT-485, ENET-485, and USB-485 – offer an advanced transceiver control mode, so you can reliably communicate with 2-wire devices. Most non-NI RS-485 interfaces access UART registers by way of software to control the alternation of transmit and receive enable signals required to communicate with 2-wire devices. Under Windows, software latencies make it difficult to reliably control this transmitter/receiver turnaround, resulting in lost data. In addition, when connecting the transmit and receive lines to one another, as required for 2-wire applications, you must handle the echoing of transmitted characters your interface board receives.

Serial Instrument Control

National Instruments RS-485 interfaces implement a hardware solution for 2-wire communications. Once configured for automatic 2-wire control, the RS-485 interface reliably controls the alternate enabling of transmitter and receiver. Because the board automatically controls the transmitters and receivers for you, your application does not lose data due to Windows latencies and does not need to handle echo characters.

Termination

In an RS-485 network, because each differential pair of wires is a transmission line, you must properly terminate the line to prevent reflections. A common method of terminating multidrop RS-485

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Serial Instrument Control

network is to install terminating resistors at each end of the multidrop network. If you daisy-chain several instruments together, you should use terminating resistors at the first and last instruments. The National Instruments DB-9 terminating connector contains embedded terminating resistors for easy termination of your RS-485 network and devices. There is no need to terminate an RS-232 network because RS-232 is a point-to-point connection.



Figure 2. NI PCI-232

Software

National Instruments PC serial interfaces are fully compatible with Windows Plug and Play. All serial interfaces include NI-Serial, an enhanced serial driver for full interrupt-driven, buffered I/O and reliable interrupt sharing between ports. NI-Serial maintains complete software compatibility with the standard Windows serial driver, so existing applications can seamlessly use the ports on any National Instruments serial interface without a special function library. In addition, NI-VISA handles the functionality of our serial boards, providing you with a single application programming interface (API) to program serial instruments as well as GPIB, VXI, PXI, Ethernet, and USB devices. Also, you can program all interfaces with LabVIEW, LabWindows/CVI, Measurement Studio for Microsoft Visual Studio, and Lookout, or any application package that uses the Microsoft serial driver interface.

Software Protocols

We designed all National Instruments serial interfaces for communication using asynchronous serial protocols. These protocols are typically ASCII based. You can communicate with most serial devices simply by sending strings to and reading strings from the serial port. This is a common scenario for single-point I/O modules, scales, multimeters, and many other instruments. Some software protocols require more data handling to deal with headers, checksums, and other features that ensure higher reliability of the communication connection. These protocols are commonly used with industrial devices, such as I/O modules and PLCs. We designed National Instruments serial interfaces for compatibility with standard serial port drivers for protocols such as Optomux and Modbus. (National Instruments serial interfaces do not include software drivers for these or other serial protocols.) Our serial interfaces are also compatible with the protocols used with National Instruments FieldPoint I/O.



Figure 3. NI ENET-232



Figure 4. NI PCMCIA-232

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USB Interfaces for RS-232 and RS-485

NI USB-232 Series, NI USB-485 Series

- Compatible with standard PC serial port
- 1, 2, and 4-port versions
- Handle RTS/CTS hardware handshake lines
- 128 B transmit and receive FIFOs
- 5,6,7, or 8 data bits

NI USB-485

- RS-485 or RS-422 interface
- 460.8 kb/s maximum transfer rate
- Communicates with up to 31 devices per port
- Automatic transceiver-control mode for 2-wire RS-485 devices
- Software-selectable biasing
- Cable lengths up to 1.2 km (4,000 ft)

NI USB-232

- RS-232 interface
- 230.4 kb/s maximum transfer rate
- Software-selectable DTE or DCE transceiver modes (2 and 4-port models only)

Operating Systems

- Windows 2000/XP

Recommended Software

- LabVIEW
- LabWindows/CVI
- Measurement Studio

Other Compatible Software

- C/C++
- Visual Basic
- Any package that uses the Microsoft Win32 Serial API

Driver Software (included)

- NI-Serial



Overview

The National Instruments USB-232 and USB-485 transform your Universal Serial Bus (USB) port into asynchronous serial ports for communication with serial devices. The NI USB-232 and USB-485 are available in either 1, 2, or 4-port versions and use standard RS-232, RS-422, or RS-485 communications. All products include driver software for Windows 2000/XP. You can install and use the USB-232 and USB-485 as standard serial ports from your existing applications or with applications written with NI-VISA.

Additionally, the USB-232 2 and 4-port versions feature software-selectable DTE or DCE transceiver modes, as well as an automatic transceiver detection mode, or Auto232. The USB-485 features software selectable biasing; therefore, you can turn biasing on and off for each port through software.

Development environments, such as Visual Basic, Visual C++, and Excel, as well as National Instruments LabVIEW, LabWindows/CVI and Measurement Studio, can access the serial ports using standard serial I/O functions.

Ordering Information

Model	Serial Port	Number of Ports	Part Number
NI USB-232	RS-232	1	778472-01
NI USB-232/2	RS-232	2	778473-02
NI USB-232/4	RS-232	4	778473-04
NI USB-485	RS-485/RS-422	1	778475-01
NI USB-485/2	RS-485/RS-422	2	778476-02
NI USB-485/4	RS-485/RS-422	4	778476-P4*

*External 12 VDC power supply included

P = Power Cord Type
0 = U.S. 120 VAC
2 = Swiss 220 VAC
3 = Australian 240 VAC
4 = Universal Euro 240 VAC
5 = North American 240 VAC
6 = United Kingdom

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Specifications

FIFO size	128 B
Maximum transfer rate	460.8 kb/s (RS-485); 230.4 kb/s (RS-232)
USB connector (1 port)	2 m captive cable with USB series A plug
USB connector (2 and 4 port)	USB standard series B connector
Serial connectors	DB-9
Noise emissions	Class A

Power Requirements

5 VDC (from USB)	USB-232 (100 mA typ, 200 mA maximum), USB-232/2 (200 mA typ, 500 mA maximum), USB-232/4 (300 mA typ, 500 mA maximum), USB-485 (175 mA typ, 500 mA maximum) USB-485/2 (300 mA typ, 500 mA maximum),
+12 VDC (from supply furnished)	USB-485/4 (225 mA typ, 500 mA maximum)

Operating Environment

Ambient temperature	0 to 70 °C
Relative humidity	10 to 90%, noncondensing

Storage Environment

Ambient temperature (1 port)	-40 to 80 °C
Ambient temperature (2 and 4 port)	-40 to 85 °C
Relative humidity	5 to 95%, noncondensing

Electrostatic Discharge Protection

Case contact and air discharge	±4 kV
RS-232 and RS-435 data lines	±15 kV (HBM)

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Ethernet Serial Device Servers for RS-232 and RS-485

NI ENET-232 Series, NI ENET-485 Series

- Ethernet TCP/IP interfaces
  - 100BaseTX (100 Mb/s)
  - 10BaseT (10 Mb/s)
- Compatible with PC serial port
- 2 and 4 ports
- RTS/CTS hardware handshake lines
- 128 B transmit and receive FIFOs
- DHCP or manual IP address assignment

ENET-232
- RS-232 interface
- 230.4 kb/s maximum transfer rate
- 15.6 m (50 ft) cable length, maximum

ENET-485
- RS-485 or RS-422 interface
- 460 kb/s maximum transfer rate
- 31 devices per port, maximum
- Automatic transceiver-control mode for 2-wire RS-485 devices
- 1.2 km (4,000 ft) cable length, maximum

Operating Systems
- Windows 2000/NT/XP
- Linux
- Solaris

Recommended Software
- LabVIEW
- LabWindows/CVI
- Measurement Studio
- Lookout

Other Compatible Software
- C/C++
- Visual Basic
- Any package that uses the Microsoft Windows Serial (COM) port interface

Driver Software (included)
- NI-SDS (Windows only)
- NI-VISA



Overview

The National Instruments ENET-232 and ENET-485 serial device servers connect either 100BaseTX (100 Mb/s) or 10BaseT (10 Mb/s) Ethernet networks to asynchronous serial ports for communication with serial devices. You can buy serial device servers with either 2 or 4-port options and use standard RS-232, RS-422, or RS-485 communications. All products are shipped with driver software for Windows 2000/NT/XP. You can install and use these serial device servers as standard serial ports from your existing applications or with applications written with NI-VISA. Development environments, such as Visual Basic, Visual C++, and Excel, as well as National Instruments LabVIEW, LabWindows/CVI, Measurement Studio, and Lookout application software products, can access the add-in serial ports using standard serial I/O functions.

Description

The TCP/IP communication protocol, which handles all communication between the serial device server and the host PC, runs on embedded firmware in the serial device server. A configuration utility configures the IP address of the serial device server and exposes all additional serial ports to the operating system for immediate use by any application software package using standard Microsoft Windows Serial (COM) port interface.

Ordering Information

Model	Serial Port	Number of Ports	Part Number
ENET-232/2	RS-232	2	778064-P2*
ENET-232/4	RS-232	4	778064-P4*
ENET-485/2	RS-485/RS-422	2	778065-P2*
ENET-485/4	RS-485/RS-422	4	778065-P4*

*External 12 VDC power supply included

P = Power Cord Type
0 = U.S. 120 VAC
2 = Swiss 220 VAC
3 = Australian 240 VAC
4 = Universal Euro 240 VAC
5 = North American 240 VAC
6 = United Kingdom 240 VAC

Dual rack-mount kit 187322-02
DIN rail mounting kit 777972-01

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Specifications

FIFO size	128 B
Maximum transfer rate	460 kb/s
Ethernet connector	RJ-45
Serial connectors	DB-9
Noise emissions	Class A

Power Requirements

+9 VDC	600 mA typical, 1.0 A maximum
Dimensions	21.0 by 12.4 by 3.7 cm (8.25 by 4.89 by 1.44 in.)

Operating Environment

Ambient temperature	0 to 70 °C
Relative humidity	10 to 90%, noncondensing

Storage Environment

Ambient temperature	-40 to 85 °C
Relative humidity	5 to 95%, noncondensing

Electrostatic Discharge Protection

Case contact and air discharge	±4 kV
RS-232 and RS-485 data lines	±15 kV (HBM)

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PCI, PXI, PCMCIA, and ISA Interfaces for RS-232 and RS-485

PCI, PXI, PCMCIA, and ISA Interfaces

- Compatible with PC serial (COM) port
- Full Windows Plug and Play compatibility
- 2, 4, 8, and 16 ports
- RTS/CTS hardware handshake lines
- 921.6 kb/s maximum transfer rate
- 64 B transmit and receive FIFOs
- 2,000 V isolation

NI PCI-485, NI PXI-8421, NI PXI-8423, NI PCMCIA-485, NI AT-485

- RS-485 or RS-422 interfaces
- 31 devices per port, maximum
- 4 transceiver-control modes, including automatic mode for 2-wire RS-485 devices
- 1.2 km (4,000 ft) cable length, maximum

NI PCI-232, NI PXI-8420, NI PXI-8422, NI PCMCIA-232, NI AT-232

- RS-232 interfaces
- 15.6 m (50 ft) cable length, maximum

Operating Systems

- Windows 2000/NT/XP/Me/9x

Recommended Software

- LabVIEW
- LabWindows/CVI
- Measurement Studio
- Lookout

Other Compatible Software

- C/C++
- Visual Basic
- Any package that uses the Microsoft Win32 Serial API

Driver Software (included)

- NI-Serial



Overview

National Instruments offers serial interface devices for PCI, PXI, PCMCIA, and ISA. They are asynchronous interfaces for communicating with instruments via serial ports. Depending on the platform, interfaces are available with up to 16 ports and full Windows 2000/NT/XP/Me/9x Plug and Play compatibility, which gives you the benefit of automatic configuration for easier installation and maintenance. You can install and use these devices as standard serial ports from your existing applications or with applications written with NI-VISA. Development environments, such as Visual Basic, Visual C++, and Excel, as well as NI LabVIEW, LabWindows/CVI, Measurement Studio, and Lookout application software products, can access the add-in serial ports using standard serial I/O functions. All interface devices include an enhanced serial driver for improved performance, reliable interrupt sharing between ports, and access to the advanced transceiver control modes of the RS-485 interface devices.

Isolation

Ground loops are a common problem in many industrial applications – current flowing through the ground line when ground voltage levels differ between connected devices. On RS-485, this problem results in a common-mode voltage produced by the difference in ground levels or by noise induced on both lines. Isolation of serial ports eliminates this problem and protects the computer system in harsh industrial environments. The National Instruments PCI, PXI, and AT serial devices are available with optical isolation up to 2,000 V for such applications.

Cabling

Our 2 and 4-port serial devices are not shipped with serial interface cables. The 2-port versions have DB-9 male connectors with standard pin assignments for RS-485 and RS-232 connectors (see Figure 1). The 4-port devices use 10-position modular phone jacks, so all four connectors can exist on a single back panel (see Figure 2). When purchasing a 4-port serial device, you must order cables that convert the phone jacks to either DB-9 or DB-25 male connectors with standard pin assignments. In general, you should order four converter cables per 4-port serial device. Note that a converter cable is not designed to go the full distance from a 4-port serial interface directly to your instruments. Our most popular converter cables convert the 10-pin phone jack on a 4-port device to the same DB-9 male connector found on a typical PC serial port. The connection from this converter to your serial device uses the standard cables used with the PC serial port.

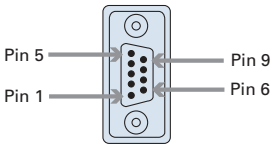


Figure 1. DB-9 Connector Pin Locations

As an exception to the previous description, National Instruments ships cables with all isolated ISA and PCI 4-channel serial boards to ensure isolation. The 4-channel PXI serial modules, which do not require special isolated cables to ensure isolation, do not include cables.

All 8-port serial interfaces include an adapter cable that connects to the SCSI 68-pin connector on the device and terminates in eight standard DB-9 male connectors (see Figure 3).

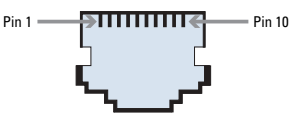


Figure 2. 10-Position Modular Jack Pin Locations

All 16-port RS-232 serial interfaces include a breakout

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PCI, PXI, PCMCIA, and ISA Interfaces for RS-232 and RS-485

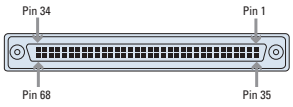


Figure 3. SCSI 68-Pin Connector Locations

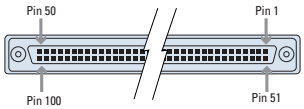


Figure 4. SCSI 100-Pin Connector Locations

box that connects to the SCSI 100-pin connector on the device and terminates in 16 standard DB-9 male connectors (see Figure 4).

PCMCIA serial cards are shipped with interface cables that provide one, two, or four DB-9 male connectors. These DB-9 male connectors provide standard pin assignments for RS-485 and RS-232 connections. Note that these cables are not designed to go the full distance from a PCMCIA serial card to your instrument. The cables provide the same DB-9 male connectors found on a typical PC serial port.

Ordering Information

Model	Serial Port	Bus	Number of Ports	FIFO Size (B)	Max Transfer Rate (kb/s)	Isolation	DB-9 Adaptor(s) Included	Part Number
PCI								
NI PCI-232/2	RS-232	PCI	2	64	115.2	–	–	777642-02
NI PCI-232/4	RS-232	PCI	4	64	115.2	–	–	777642-04
NI PCI-232/8	RS-232	PCI	8	64	115.2	–	✓	777642-08
NI PCI-232/16	RS-232	PCI	16	64	115.2	–	✓	777642-16
NI PCI-232I/2	RS-232	PCI	2	64	115.2	✓	–	777854-02
NI PCI-232I/4	RS-232	PCI	4	64	115.2	✓	✓	777854-04
NI PCI-485/2	RS-485/422	PCI	2	64	460.8	–	–	777641-02
NI PCI-485/4	RS-485/422	PCI	4	64	460.8	–	–	777641-04
NI PCI-485/8	RS-485/422	PCI	8	64	460.8	–	✓	777641-08
NI PCI-485I/2	RS-485/422	PCI	2	64	460.8	✓	–	777853-02
NI PCI-485I/4	RS-485/422	PCI	4	64	460.8	✓	✓	777853-04
PXI								
NI PXI-8420/2	RS-232	PXI	2	64	115.2	–	–	777733-02
NI PXI-8420/4	RS-232	PXI	4	64	115.2	–	–	777733-04
NI PXI-8420/8	RS-232	PXI	8	64	115.2	–	✓	777733-08
NI PXI-8420/16	RS-232	PXI	16	64	115.2	–	✓	777733-16
NI PXI-8421/2	RS-485/422	PXI	2	64	460.8	–	–	777735-02
NI PXI-8421/4	RS-485/422	PXI	4	64	460.8	–	–	777735-04
NI PXI-8421/8	RS-485/422	PXI	8	64	460.8	–	✓	777735-08
NI PXI-8422/2	RS-232	PXI	2	64	115.2	✓	–	777736-02
NI PXI-8422/4	RS-232	PXI	4	64	115.2	✓	–	777736-04
NI PXI-8423/2	RS-485/422	PXI	2	64	460.8	✓	–	777737-02
NI PXI-8423/4	RS-485/422	PXI	4	64	460.8	✓	–	777737-04
PCMCIA								
PCMCIA-232	RS-232	PCMCIA	1	16	921.6	–	✓	777379-01
PCMCIA-232/2	RS-232	PCMCIA	2	16	921.6	–	✓	777379-02
PCMCIA-232/4	RS-232	PCMCIA	4	64	115.2	–	✓	777379-04
PCMCIA-485	RS-485/422	PCMCIA	1	16	921.6	–	✓	777378-01
PCMCIA-485/2	RS-485/422	PCMCIA	2	16	921.6	–	✓	777378-02
ISA								
AT-232/2	RS-232	ISA	2	16	115.2	–	–	777312-02
AT-232/4	RS-232	ISA	4	16	115.2	–	–	777312-04
AT-232I/2	RS-232	ISA	2	16	115.2	✓	–	777500-02
AT-232I/4	RS-232	ISA	4	16	115.2	✓	✓	777500-04
AT-485/2	RS-485/422	ISA	2	16	115.2	–	–	777311-02
AT-485/4	RS-485/422	ISA	4	16	115.2	–	–	777311-04
AT-485I/2	RS-485/422	ISA	2	16	115.2	✓	–	777501-02
AT-485I/4	RS-485/422	ISA	4	16	115.2	✓	✓	777501-04

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PCI, PXI, PCMCIA, and ISA Interfaces for RS-232 and RS-485

Specifications

Model	Power Requirement (from PCI, PXI, PCMCIA, or ISA Channel) +5 VDC Typical Current	+5 VDC Maximum Current	+12 VDC Typical Current	+12 VDC Maximum Current	I/O Connectors	Noise Emissions (FCC Class Verified)	2,000 V Optical Isolation	Signal Compatibility All Signals	Signal Compatibility Only RXD, TXD, GND,RTS, and CTS	Data Line ESD Protection (HBM)
PCI										
PCI-232/2	50 mA	100 mA	20 mA	200 mA	DB-9 male	A	–	✓	–	15 kV
PCI-232/4	70 mA	150 mA	40 mA	400 mA	10-position jack	A	–	✓	–	15 kV
PCI-232/8	100 mA	180 mA	80 mA	800 mA	SCSI 68-pin female	A	–	✓	–	15 kV
PCI-232/16	500 mA	1.0 A	–	–	SCSI 100-pin female	A	–	Ports 1-8	Ports 9-16	15 kV
PCI-232I/2	400 mA	650 mA	–	–	DB-9 male	A	✓	–	✓	15 kV
PCI-232I/4	500 mA	750 mA	–	–	10-position jack	A	✓	–	✓	15 kV
PCI-485/2	350 mA	750 mA	–	–	DB-9 male	A	–	–	✓	2 kV
PCI-485/4	700 mA	1.3 A	–	–	10-position jack	A	–	–	✓	2 kV
PCI-485/8	1.1 A	2.0 A	–	–	SCSI 68-pin interface	A	–	–	✓	2 kV
PCI-485I/2	800 mA	1.3 A	–	–	DB-9 male	A	✓	–	✓	15 kV
PCI-485I/4	1.0 A	1.5 A	–	–	10-position jack	A	✓	–	✓	15 kV
PXI										
PXI-8420/2	100 mA	150 mA	20 mA	200 mA	DB-9 male	A	–	✓	–	15 kV
PXI-8420/4	125 mA	200 mA	40 mA	400 mA	10-position jack	A	–	✓	–	15 kV
PXI-8420/8	150 mA	250 mA	80 mA	800 mA	SCSI 68-pin male	A	–	✓	–	15 kV
PXI-8420/16	500 mA	1.0 A	–	–	SCSI 100-pin female	A	–	Ports 1-8	Ports 9-16	15 kV
PXI-8421/2	350 mA	750 mA	–	–	DB-9 male	A	–	–	✓	2 kV
PXI-8421/4	700 mA	1.3 A	–	–	10-position jack	A	–	–	✓	2 kV
PXI-8421/8	1.1 A	2.0 A	–	–	SCSI 68-pin female	A	–	–	✓	2 kV
PXI-8422/2	400 mA	650 mA	–	–	DB-9 male	A	✓	–	✓	15 kV
PXI-8422/4	500 mA	750 mA	–	–	10-position jack	A	✓	–	✓	15 kV
PXI-8423/2	800 mA	1.3 A	–	–	DB-9 male	A	✓	–	✓	15 kV
PXI-8423/4	1.0 A	1.5 A	–	–	10-position jack	A	✓	–	✓	15 kV
PCMCIA										
PCMCIA-232	40 mA	150 mA	–	–	DB-9 male	A	–	✓	–	2 kV
PCMCIA-232/2	60 mA	250 mA	–	–	DB-9 male	A	–	✓	–	2 kV
PCMCIA-232/4	60 mA	200 mA	–	–	DB-9 male	A	–	✓[1]	–	15 kV
PCMCIA-485	110 mA	225 mA	–	–	DB-9 male	A	–	–	✓	2 kV
PCMCIA-485/2	150 mA	400 mA	–	–	DB-9 male	A	–	–	✓	2 kV
ISA										
AT-232/2	260 mA	340 mA	–	–	DB-9 male	B	–	✓	–	2 kV
AT-232/4	340 mA	450 mA	–	–	10-position jack	B	–	✓	–	2 kV
AT-232I/2	160 mA	200 mA	–	–	DB-9 male	A	✓	–	✓	15 kV
AT-232I/4	280 mA	320 mA	–	–	10-position jack	A	✓	–	✓	15 kV
AT-485/2	390 mA	510 mA	–	–	DB-9 male	B	–	–	✓	2 kV
AT-485/4	600 mA	780 mA	–	–	10-position jack	B	–	–	✓	2 kV
AT-485I/2	220 mA	260 mA	–	–	DB-9 male	A	✓	–	✓	15 kV
AT-485I/4	300 mA	360 mA	–	–	10-position jack	A	✓	–	✓	15 kV

[1]Ports 3 and 4 include all signals except RI.

Dimensions

PCI ..... 10.7 by 17.5 cm (4.2 by 6.9 in.)
PXI ..... 16.0 by 10.0 cm (6.3 by 3.9 in.)
(not including connectors)
PCMCIA ..... Type II PC Card
ISA ..... 10.7 by 16.5 cm (4.2 by 6.5 in.)

Operating Environment

Ambient temperature
ISA ..... 0 to 70 °C
PCI, PXI, PCMCIA ..... 0 to 55 °C
Relative humidity ..... 10 to 90%, noncondensing

Storage Environment

Ambient temperature
PCI, PXI, ISA ..... -20 to 70 °C
PCMCIA ..... -40 to 125 °C
Relative humidity ..... 5 to 95%, noncondensing

Electrostatic Discharge Protection

Case contract and air discharge ..... ±4 kV
RS-232 and RS-435 data lines ..... See specification table

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Serial Cables



Figure 1. RS-232 Straight-Through Cable



Figure 2. RS-232 Straight-Through 9-25 pin Cable



Figure 3. 1-Port DB-9, PCMCIA



Figure 4. 4-Port DB-9, PCMCIA



Figure 5. 1-Port DB-9, Nonisolated

Serial Cables

RS-232 Null-Modem Cable

9-pin female D-Sub to 9-pin female D-Sub.

1 m.....182238-01
2 m.....182238-02
4 m.....182238-04

RS-232 Straight-Through Cable (See Figure 1)

9-pin female D-Sub (DTE) to 9-pin male D-Sub (DCE).

1 m.....183045-01
2 m.....183045-02
4 m.....183045-04

RS-232 Straight-Through 9-25 pin Cable (See Figure 2)

9-pin female D-Sub to 25-pin male D-Sub.

1 m.....181074-10

RS-485 Null-Modem Cable

9-pin female D-Sub to 9-pin female D-Sub.

1 m.....183283-01
2 m.....183283-02
4 m.....183283-04

1-Port DB-9, PCMCIA (See Figure 3)

PCMCIA (1 and 2-port) serial interface cable.

0.3 m.....183905-0R3

4-Port DB-9, PCMCIA (See Figure 4)

PCMCIA (4-port) serial interface cable.

1 m.....188399-01

1-Port DB-9, Nonisolated (See Figure 5)

Nonisolated converter cable for 4-port boards 10-position RJ-45 modular jack to DB-9.

1 m.....182845-01
2 m.....182845-02
3 m.....182845-03

1-Port DB-25, Nonisolated

Nonisolated converter cable for 4-port boards 10-position RJ-45 modular jack to DB-25.

1 m.....182846-01

1-Port DB-9, Isolated

Isolated converter cable for 4-port boards (AT and PCI) 10-position RJ-45 modular jack to DB-9.

1 m.....184428-01

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Serial and Ethernet Cables and Accessories

8-Port DB-9, RS-232 (See Figure 6)
SCSI-68 to 8-port DB-9 for RS-232.
1 m 185196-01

8-Port DB-9, RS-485 (See Figure 7)
SCSI-68 to 8-port DB-9 for RS-485.
1 m 185845-01

16-Port DB-9, Breakout Box, RS-232 (See Figure 8)
SCSI-100 to 16-port DB-9 breakout box.
1 m 186936-01

RS-485 DB-9 Terminator (See Figure 9)
DB-9 terminating connector for RS-485 182844-01

Ethernet Cables and Accessories

E1 Cable

Twisted-pair (CAT5) cable for Ethernet serial device servers for connection through an Ethernet hub.
1 m 182219-01
5 m 182219-05
10 m 182219-10

E4 Cable

Twisted-pair (CAT5) crossover cable for Ethernet serial device servers, for direct connection to a computer.
1 m 187375-01
5 m 187375-05
10 m 187375-10

E5 Cable

Twisted-pair (CAT5) shielded cable for Ethernet serial device servers.
1 m 189174-01
5 m 189174-05
10 m 189174-10

Rack-Mount Kit for Ethernet Serial Device Servers and USB-232/485

Single/dual case 187322-02

DIN Rail/Wall-Mount Kit for Ethernet Serial Device Servers, USB-232/485, and, 16-Port DB-9 Breakout Box.

Single unit 777972-01

Refer to page 706 for pictures of Ethernet cables and accessories.



Figure 6. 8-Port DB-9, RS-232



Figure 7. 8-Port DB-9, RS-485



Figure 8. 16-Port DB-9, Breakout Box, RS-232



Figure 9. RS-485 DB-9 Terminator

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