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Cable Guide
For all PortServer[®] TS, Digi Connect[®],
and Digi One[®] Products

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General EIA-232 cable information

Use this information to determine the proper EIA-232 cable requirements for your application.

Physical cable characteristics

EIA-232 serial interface cables should be shielded, low capacitance cables, designed specifically for serial data transmission.

Grounding requirements

EIA-232 interface cables should have the shield grounded at both ends of the cable. Digi recommends Chassis Ground, available on the shell of Digi's DB-25 connectors, and pin 4 of a 10-pin RJ-45 connector.

Environmental requirements

While good shielding provides reasonable protection against "noise" (electromagnetic interference, or EMI), cables should still be routed away from noise sources wherever possible. Avoid laying cables in close proximity to transformers, generators, motors, fluorescent lights, etc.

Data rate information

The maximum data rate that can be used for EIA-232 connections is primarily determined by the quality and length of the interconnecting cable. The quality of the cable (for transmission purposes) is generally determined by the capacitance per foot rating of the cable.

The following table gives the recommended maximum cable length for a given data rate. Longer cables may be implemented at your discretion. Note that not all Digi products support all of the data rates listed below.

Data rate vs. cable length recommendations

| Data rate (bps) | Maximum cable length |
|-----------------|----------------------|
| 57,600 or less | 100 feet |
| 115,200 | 80 feet |
| 230,400 | 40 feet |
| 460,800 | 20 feet |
| 921,600 | 10 feet |

- The maximum length is the amount of cable that is connected to a Digi supplied interconnect device, such as Quad or Octa cables and boxes.
- The maximum length is based on a cable rated at the following:
 - 12.3 pF/foot, conductor to conductor
 - 22.4 pF/foot conductor to shield
- In situations where low-capacitance cable is unavailable, or very long cable runs are required, “short-haul” modems can be used to increase the effective range of the EIA-232 interface. Short-haul modems are similar to standard modems, except that they are connected directly to each other via a cable instead of going through a telephone circuit.
- Use only externally-powered short-haul modems with Digi products.

Resolving transmission errors

If transmission errors occur, follow this procedure to determine the cause of the problem:

1. Reduce the baud rate.
2. Reduce the cable length.
3. Use a cable with a lower capacitance per foot rating.

Digi DB-25 connector pin assignments

| Signal | Description | DTE use | Pin # |
|--------|---------------------|-----------|-------|
| GND | Chassis Ground | N/A | Shell |
| TxD | Transmitted Data | Output | 2 |
| RxD | Received Data | Input | 3 |
| RTS | Request to Send | Output | 4 |
| CTS | Clear to Send | Input | 5 |
| DSR | Data Set Ready | Input | 6 |
| SG | Signal Ground | reference | 7 |
| DCD | Data Carrier Detect | Input | 8 |
| DTR | Data Terminal Ready | Output | 20 |
| RI | Ring Indicator | Input | 22 |

DB-25 software handshaking (XON/XOFF) cable

The following three-wire cable is often sufficient for a terminal, printer, or other DTE device configured for software flow control.

Simple Terminal/Printer Cable

| DB-25 female (Digi end) | | | DB-25 male (peripheral) | |
|----------------------------|-------|---------------------------|----------------------------|--------|
| Signal | Pin | | Pin | Signal |
| TxD | 2 | connected to | 3 | RxD |
| RxD | 3 | connected to | 2 | TxD |
| SG | 7 | connected to | 7 | SG |
| GND | shell | connected to (via shield) | shell | GND |

This cable is a three-wire null modem cable. Transmitted data on one end of the cable is connected to received data at the other end, and vice versa. The male DB-25 end can be plugged directly into most serial terminals and printers without any adapters. The female DB-25 end plugs directly into any Digi DB-25 serial port.

DB-25 4-Wire hardware handshaking (DTR) cable

The following four-wire cable is often sufficient for an older terminal, printer, or other DTE device configured for DTR (hardware) flow control. However, some terminals and printers may use a signal other than DTR for flow control. In addition, some terminals and printers may have other cable requirements. Consult your terminal or printer manual for this information. For more universal compatibility, use a full-wired DB-25 terminal/printer cable.

Terminal/printer cable with DTR handshaking

| DB-25 female (Digi end) | | | DB-25 male (peripheral) | |
|----------------------------|----------|---------------------------|----------------------------|--------|
| Signal | Pin | | Pin | Signal |
| TxD | 2 | connected to | 3 | RxD |
| RxD | 3 | connected to | 2 | TxD |
| CTS | 5 | connected to | 20 | DTR |
| SG | 7 | connected to | 7 | SG |
| GND | Shell | connected (via shield) to | Shell | GND |
| | jumpered | 4+5 | RTS+CTS | |

Note: Some terminal or printer manufacturers may use different methods of flow control. Consult your documentation for specific wiring requirements.

DB-25 hardware handshaking (RTS/CTS) cable

A DB-25 hardware handshaking (RTS/CTS) cable is often sufficient for a terminal, printer, or other DTE device configured for RTS/CTS (hardware) flow control. However, some terminals and printers may have other cable requirements. Consult your terminal or printer manual for this information. For more universal compatibility, use a fully-wired DB-25 terminal/printer cable.

Terminal/printer cable with RTS/CTS handshaking

| DB-25 female (Digi end) | | | DB-25 male (peripheral) | |
|----------------------------|-------|---------------------------|----------------------------|---------|
| Signal | Pin | | Pin | Signal |
| TxD | 2 | connected to | 3 | RxD |
| RxD | 3 | connected to | 2 | TxD |
| RTS | 4 | connected to | 5 | CTS |
| CTS | 5 | connected to | 4 | RTS |
| DSR+DCD | 6+8 | connected to | 20 | DTR |
| SG | 7 | connected to | 7 | SG |
| DTR | 20 | connected to | 6+8 | DSR+DCD |
| GND | Shell | connected (via shield) to | Shell | GND |

Note: Some terminal or printer manufacturers may use different methods of flow control. Consult your documentation for specific wiring requirements.

DB-25 fully-wired terminal/printer cable

A DB-25 fully-wired terminal/printer cable with the following wiring supports most serial terminals or printers with either software or hardware handshaking. This cable is valid with any Digi DB-25 serial port.

Terminal/printer cable for software (XON/XOFF) or hardware (DTR) handshaking

| DB-25 (Digi end) | | | DB-25 male (terminal/printer) | |
|---------------------|-------|--------------|----------------------------------|---------|
| Signal | Pin | | Pin | Signal |
| RTS | 4 | connected to | 5 | CTS |
| GND | Shell | connected to | Shell | GND |
| TxD | 2 | connected to | 3 | RxD |
| RxD | 3 | connected to | 2 | TxD |
| SG | 7 | connected to | 7 | SG |
| CTS | 5 | connected to | 20 | DTR |
| DTR | 20 | connected to | 8+6 | DCD+DSR |
| DCD+DSR | 8+6 | connected to | 4 | RTS |

Note: Some terminal or printer manufacturers may use different methods of flow control. Consult your documentation for specific wiring requirements.

DB-25 modem cable

To connect a DB-25 equipped asynchronous adapter to a modem, use a standard “straight-through” cable. A straight-through cable has a DB-25 female connector at the Digi end, and a DB-25 male connector at the modem end. All 25 pins are connected, 1 to 1, 2 to 2, 3 to 3, etc. Use shielded cable, and connect pin 1 of each connector to the cable shield.

Cable-to-adapter cross-reference

The following cross reference table applies to Digi One, PortServer TS, PortServer II, and Multi-Port Adapters with RJ-45 connectors.

| RJ45 to --- | Male or Female | Straight or Crossover | Application | Cable or Adapter | Part Number | Cable Identifier |
|----------------|----------------|-----------------------|---|------------------|--|----------------------|
| DB9 | F | Crossover | Bay Accelar, Nortel and other DB9 DTE devices | Cable | 76000645 (4') | 61090048 |
| | | | | Adapter (4-Pack) | 76000697 | NA |
| DB9 | M | Crossover | DTE devices with DB9 Female Ports | Cable | 76000264 (4') | 61080048 |
| | | | | Adapter | none | NA |
| DB9 | F | Straight | Modems and other DCE devices with DB9 Male Ports | Cable | 76000200 (2') 76000201 (4') | 61070024 61070048 |
| | | | | Adapter | none | NA |
| DB9 | M | Straight | Modems and other DCE devices with DB9 Female Ports | Cable | 76000239 (2') 76000240 (4') | 61060024 61060048 |
| | | | | Adapter (4-Pack) | 76000701 | NA |
| | | | | | | |
| DB25 | M | Crossover | Sun Sparc, Sun Ultra, terminals, printers and other DTE devices with DB25 Female ports | Cable | 76000238 (4') | 61040048 |
| | | | | Adapter (4-Pack) | 76000698 | NA |
| DB25 | F | Crossover | Cisco, IBM and other DTE devices with DB25 Male ports | Cable | 76000644 (4') | 61050048 |
| | | | | Adapter (4-Pack) | 76000699 | NA |
| DB25 | M | Straight | Modems and other DCE devices with DB25 Female Ports | Cable | 76000129 (2') 76000195 (4') | 61020024 61020048 |
| | | | | Adapter (4-Pack) | 76000700 | NA |
| DB25 | F | Straight | Modems and other DCE devices with DB25 Male Ports | Cable | 76000198 (2') 76000199 (4') | 61030024 61030048 |
| | | | | Adapter | None | NA |
| DB25 | M | * Special * | For use with Printers. This cable utilizes the DTR signal (instead of RTS) for hardware flow control. | Cable | 76000643 (2') | 63000196-01 |
| | | | | Adapter (4-Pack) | 76000692 | NA |
| | | | | | | |
| RJ45 | M | * Special * | For use with Cisco and Sun RJ45 Console ports. | Cable | 76000631 (6') 76000632 (qty 8) 76000633 (qty 16) | 63000222-02 |
| | | | | Adapter | None | NA |

Digi RJ-45 connector pin assignments

10-pin RJ-45 plugs may be difficult to obtain in the retail market. Therefore, most Digi device driver software incorporates an optional feature called ALTPIN, which swaps the logical functions of DSR (Data Set Ready) with DCD (Data Carrier Detect).

When ALTPIN is enabled, DCD becomes available on pin 1 of an 8-pin RJ-45 connector (equivalent to pin 2 of a 10-pin connector).

| Signal | Description | DTE use | Pin # |
|-------------------------|--|-----------|-------|
| RI | Ring Indicator | Input | 1 |
| DSR (DCD ^a) | Data Set Ready (Data Carrier Detect ^a) | Input | 2 |
| RTS | Request to Send | Output | 3 |
| GND | Chassis Ground | N/A | 4 |
| TxD | Transmitted Data | Output | 5 |
| RxD | Received Data | Input | 6 |
| SG | Signal Ground | reference | 7 |
| CTS | Clear to Send | Input | 8 |
| DTR | Data Terminal Ready | Output | 9 |
| DCD (DSR ^a) | Data Carrier Detect (Data Set Ready ^a) | Input | 10 |

a. When ALTPIN is in effect.

RJ connector types

The following table shows the relationship of various RJ plugs to the Digi RJ-45 10-pin jack. The Digi 10-pin jack can accept any of the listed plug types. The wiring of each plug type corresponds to support of specific capabilities such as software handshaking, hardware handshaking, and the Digi ALTPIN feature.

| Digi 10-pin jack | Signal name | RJ-45 10-pin plug | RJ-45 8-pin plug | RJ-11 6-Pin plug | RJ-11 4-Pin plug |
|------------------|--|-------------------|------------------|------------------|------------------|
| 1 | RI | 1 | | | |
| 2 | DSR (DCD*) *When ALTPIN is in effect. | 2 | 1 | | |
| 3 | RTS | 3 | 2 | 1 | |
| 4 | GND | 4 | 3 | 2 | 1 |
| 5 | TxD | 5 | 4 | 3 | 2 |
| 6 | RxD | 6 | 5 | 4 | 3 |
| 7 | SG | 7 | 6 | 5 | 4 |
| 8 | CTS | 8 | 7 | 6 | |
| 9 | DTR | 9 | 8 | | |
| 10 | DCD (DSR*) *When ALTPIN is in effect. | 10 | | | |

Digi RJ-45 to DB-25/DB-9 cable adapters

RJ-45 to DB-25/DB-9 cable adapters can be purchased from Digi. These adapters consist of a 10-pin RJ-45 plug connected via a two- or four-foot cable to a DB-25 or DB-9 connector. The adapters are fully-wired and provide modem control.

Part numbers for RJ-45 to DB-25 cable adapters:

| Cable description | Order # | Number found on cable |
|--------------------------------------|----------|-----------------------|
| Cable RJ45 to DB25M (Male) DTE 24" | 76000129 | 61020024 |
| Cable RJ45 to DB25F (Female) DTE 24" | 76000198 | 61030024 |
| Cable RJ45 to DB25M (Male) DTE 48" | 76000195 | 61020048 |
| Cable RJ45 to DB25M (Male) DCE 48" | 76000238 | 61040048 |
| Cable RJ45 to DB25F (Female) DTE 48" | 76000199 | 63000205-01 |

Part numbers for RJ-45 to DB-9 cable adapters:

| Cable description | Order # | Number found on cable |
|-------------------------------------|----------|-----------------------|
| Cable RJ45 to DB9M (Male) DTE 24" | 76000239 | 61060024 |
| Cable RJ45 to DB9F (Female) DTE 24" | 76000200 | 61070024 |
| Cable RJ45 to DB9M (Male) DTE 48" | 76000240 | 61060048 |
| Cable RJ45 to DB9M (Male) DCE 48" | 76000264 | 61080048 |
| Cable RJ45 to DB9F (Female) DTE 48" | 76000201 | 61070048 |

Digi RJ-45 to RJ-45 cable adapters: 8-pin

RJ-45 to RJ-45 cable adapters can be purchased from Digi. These adapters consist of an 8-pin RJ-45 plug connected to another 8-pin RJ-45 plug with a crossover cable. These cables are used to connect the Digi devices to the serial console port of Cisco and Sun Netra devices. Pinout information and a graphic is included later in this chapter. See "RJ-45 8-pin crossover cable for Cisco and Sun Netra" on page 27 for pinout and graphic information.

Part numbers for RJ-45 to RJ-45 8-pin crossover cable for Cisco & Sun Netra:

| Cable Description | Order # | Number found on cable |
|--|----------|-----------------------|
| Cable RJ45 to RJ45 8-pin (single pack) | 76000631 | 63000222-02 |
| Cable RJ45 to RJ45 8-pin (bulk pack of 8) | 76000632 | 63000222-02 |
| Cable RJ45 to RJ45 8-pin (bulk pack of 16) | 76000633 | 63000222-02 |

RJ-11 software handshaking (XON/XOFF) cable

The following 3-wire cable is often sufficient for a terminal, printer or other DTE device configured for software flow control.

Simple software handshaking terminal/printer cable (RJ-11)

| RJ-11 (Digi end) | | | DB-25 male (peripheral) | |
|---------------------|-----|---------------------------|-------------------------|--------|
| Signal | Pin | | Pin | Signal |
| TxD | 2 | connected to | 3 | RxD |
| RxD | 3 | connected to | 2 | TxD |
| SG | 4 | connected to | 7 | SG |
| GND | 1 | connected (via shield) to | 1 (or shell) | GND |

This cable is a 3-wire null modem cable. Transmitted data on one end of the cable is connected to received data at the other end and vice-versa.

The RJ-11 plug fits into the center of the RJ-45 jack. The male DB-25 end can be plugged directly into most serial terminals and printers without any adapters.

An RJ-45 8-pin connector uses the same wiring with the center pins only—pins 3, 4, 5, and 6. See "RJ connector types" on page 18 for a comparison of various RJ connector types that work with the Digi 10-pin RJ-45 jack.

RJ-45 8-pin plug hardware handshaking (DTR) cable

When an 8-pin plug is used for connections for connecting a terminal, printer, or other DTE device configured for DTR (hardware) flow control, the following cable wiring is often sufficient. However, some terminals and printers may use a signal other than DTR for flow control. In addition, some terminals and printers may have other cable requirements. Consult your terminal or printer manual for this information. For more universal compatibility, use the RJ-45 10-wire terminal/printer cable or a Digi RJ-45 to DB-25 adapter.

Terminal/Printer Cable with DTR Handshaking

| RJ-45 (Digi end) | | | DB-25 male (peripheral) | |
|---------------------|----------|---------------------------|-------------------------|--------|
| Signal | Pin | | Pin | Signal |
| TxD | 4 | connected to | 3 | RxD |
| RxD | 5 | connected to | 2 | TxD |
| CTS | 7 | connected to | 20 | DTR |
| SG | 6 | connected to | 7 | SG |
| GND | 3 | connected (via shield) to | 1 (or shell) | GND |
| | jumpered | 4+5 | RTS+CTS | |

Note: Some terminal or printer manufacturers may use different methods of flow control. Consult your documentation for specific wiring requirements.

RJ-45 8-pin plug hardware handshaking (RTS/CTS) cable

Using an 8-pin plug, the following cable wiring is often sufficient for a terminal, printer, or other DTE device configured for RTS/CTS (hardware) flow control. However, some terminals and printers may have other cable requirements. Consult your terminal or printer manual for this information. For more universal compatibility, use the RJ-45 10-wire terminal/printer cable or a Digi RJ-45 to DB-25 adapter.

Terminal/printer cable with DTR handshaking

| RJ-45 (Digi end) | | | DB-25 male (peripheral) | |
|---------------------|-----|---------------------------|----------------------------|--------|
| Signal | Pin | | Pin | Signal |
| DSR | 1 | connected to | 20 | DTR |
| RTS | 2 | connected to | 5 | CTS |
| GND | 3 | connected (via shield) to | 1 (or shell) | GND |
| TxD | 4 | connected to | 3 | RxD |
| RxD | 5 | connected to | 2 | TxD |
| SG | 6 | connected to | 7 | SG |
| CTS | 7 | connected to | 4 | RTS |
| DTR | 8 | connected to | 8 | DCD |

Note: Some terminal or printer manufacturers may use different methods of flow control. Consult your documentation for specific wiring requirements.

RJ-45 8-wire ALTPIN terminal/printer cable

Using an 8-pin RJ-45 plug, the following cable wiring supports most serial terminals or printers with either software or hardware handshaking using the Digi ALTPIN option.

Most terminals and printers use Request to Send/Clear to Send (RTS/CTS) for hardware handshaking. The cable shown supports this method.

ALTPIN terminal/printer cable for software (XON/XOFF) or hardware (RTS/CTS) handshaking

| RJ-45 8-pin (Digi end) | | DB-25 male (terminal/printer) | | |
|---|-----|----------------------------------|-------|---------|
| Signal | Pin | | Pin | Signal |
| DCD* | 1 | connected to | 20 | DTR |
| * ALTPIN must be turned on for pin 1 to be DCD. When ALTPIN is enabled, DCD becomes available on pin 1 of an 8-pin RJ-45 connector (equivalent to pin 2 of a 10-pin connector). | | | | |
| RTS | 2 | connected to | 5 | CTS |
| GND | 3 | connected (via shield) to | Shell | GND |
| TxD | 4 | connected to | 3 | RxD |
| RxD | 5 | connected to | 2 | TxD |
| SG | 6 | connected to | 7 | SG |
| CTS | 7 | connected to | 4 | RTS |
| DTR | 8 | connected to | 6+8 | DSR+DCD |

Note: Some terminal or printer manufacturers may use different methods of flow control. Consult your documentation for specific wiring requirements.

RJ-45 fully-wired terminal/printer cable

Using a 10-pin RJ-45 plug, the following cable wiring supports most serial terminals or printers with either software or hardware handshaking. This cable is valid with any Digi RJ-45 serial port.

Most terminals and printers use Request to Send/Clear to Send (RTS/CTS) for hardware handshaking. The cable shown supports this method.

Terminal/printer cable for software (XON/XOFF) or hardware (RTS/CTS) handshaking

| RJ-45 10-pin (Digi end) | | | DB-25 male (terminal/printer) | |
|---|------|---------------------------|----------------------------------|-------------|
| Signal | Pin | | Pin | Signal |
| DSR+DCD* * ALTPIN must be turned off for DCD to be on pin 10 | 2+10 | connected to | 20 | DTR |
| RTS | 3 | connected to | 5 | CTS |
| GND | 4 | connected (via shield) to | Shell | GND |
| TxD | 5 | connected to | 3 | RxD |
| RxD | 6 | connected to | 2 | TxD |
| SG | 7 | connected to | 7 | SG |
| CTS | 8 | connected to | 4 | RTS |
| DTR | 9 | connected to | 6+8 | DSR+D CD |

Note: Some terminal or printer manufacturers may use different methods of flow control. Consult your documentation for specific wiring requirements.

RJ-45 8-pin to modem (ALTPIN option)

The following table shows how to build an 8-wire modem cable using an 8-pin RJ-45 plug. This cable supports the Digi ALTPIN option when plugged into a Digi RJ-45 serial port.

8-Wire modem cable supporting ALTPIN option

| RJ-45 (Digi end) | | | DB-25 male (modem end) | |
|---------------------|-----|---------------------------|---------------------------|--------|
| Signal | Pin | | Pin | Signal |
| DCD | 1 | connected to | 8 | DCD |
| RTS | 2 | connected to | 4 | RTS |
| GND | 3 | connected (via shield) to | 1 (or shell) | GND |
| RxD | 5 | connected to | 3 | RxD |
| TxD | 4 | connected to | 2 | TxD |
| SG | 6 | connected to | 7 | SG |
| CTS | 7 | connected to | 5 | CTS |
| DTR | 8 | connected to | 20 | DTR |

When ALTPIN is enabled, DCD becomes available on pin 1 of an 8-pin RJ-45 connector (equivalent to pin 2 of a 10-pin connector).

ALTPIN is not supported for the PortServer product under Windows NT. Use a full 10-wire modem cable in this case.

RJ-45 10-pin plug to DB-25 modem cable

The simplest way to connect a modem to a Digi RJ-45 jack is to use a Digi RJ-45 to DB-25 Cable Adapter. The following table shows how to apply the adapter wiring scheme to custom modem cables.

RJ-45 to DB-25 modem cable (10-wire)

| RJ-45 (Digi end) | | | DB-25 male (modem end) | |
|---------------------|-----|---------------------------|---------------------------|--------|
| Signal | Pin | | Pin | Signal |
| RI | 1 | connected to | 22 | RI |
| DSR | 2 | connected to | 6 | DSR |
| RTS | 3 | connected to | 4 | RTS |
| GND | 4 | connected (via shield) to | 1 (or shell) | GND |
| TxD | 5 | connected to | 2 | TxD |
| RxD | 6 | connected to | 3 | RxD |
| SG | 7 | connected to | 7 | SG |
| CTS | 8 | connected to | 5 | CTS |
| DTR | 9 | connected to | 20 | DTR |
| DCD | 10 | connected to | 8 | DCD |

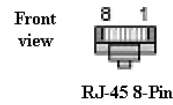
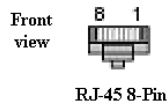
RJ-45 8-pin crossover cable for Cisco and Sun Netra

Below is the pinout information for an RJ-45 8-pin crossover cable for Cisco and Sun Netra serial console ports. Also included is a graphic detailing pin positions on the RJ-45 plug.

RJ-45 to RJ-45 8-pin crossover cable

| from RJ-45 port | Signal | | Signal | to Cisco/SunNetra RJ-45 port |
|-----------------|--------|--------------|--------|------------------------------|
| 4 | TxD | connected to | RxD | 6 |
| 5 | RxD | connected to | TxD | 3 |
| 6 | GND | connected to | GND | 4 |
| 8 | DTR | connected to | DSR | 7 |
| 1 | DSR | connected to | DTR | 2 |
| 2 | RTS | connected to | CTS | 8 |
| 7 | CTS | connected to | RTS | 1 |

Pin positions for RJ-45



RJ-45 8-Pin Crossover Cable

