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Installation Guide

**Digi C/X System
Digi AccelePort C/X System**

**C/CON-8, C/CON-16, C/CON-16 Rack
Concentrators**

90027300 Rev F

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Approvals and Notices

C/CON-16, C/CON-8 Concentrators

Federal Communications Commission (FCC) Statement

Radio Frequency Interference (RFI)

(FCC 15.105)

This equipment has been tested and found to comply with the limits for Class A digital devices pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Labeling Requirements

(FCC 15.19)

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Modifications

(FCC 15.21)

Changes or modifications to this equipment not expressly approved by Digi may void the user's authority to operate this equipment.

Cables

(FCC 15.27)

Shielded cables *must* be used to remain within the Class A limitations.

Industry Canada Compliance Statement

This Class A digital apparatus meets the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Union EMC Directive

This product has been tested and found to comply with the following European Union standards:

- EN 55022 Class A
- EN 50082-1

Safety

This product complies with the following safety standards:

- UL 1950
- CSA 22.2 No. 950
- EN 60950

C/CON-16 Rack Concentrator

FCC ID Number: MCQRACK16

Federal Communications Commission (FCC) Statement

Radio Frequency Interference (RFI) (FCC 15.105)

This equipment has been tested and found to comply with the limits for Class B digital devices pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Labeling Requirements (FCC 15.19)

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Modifications (FCC 15.21)

Changes or modifications to this equipment not expressly approved by Digi may void the user's authority to operate this equipment.

Cables (FCC 15.27)

Shielded cables *must* be used to remain within the Class B limitations.

Industry Canada Compliance Statement

This Class B digital apparatus meets the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Union EMC Directive

This product has been tested and found to comply with the following European Union standards:

- EN 55022 Class B
- EN 50082-1

Safety

This product complies with the following safety standards:

- UL 1950
- CSA 22.2 No. 950
- EN 60950

C/CON-16, C/CON-8 and C/CON-16 Rack Concentrator when Connected to a PCI Host Adapter

FCC Class B Self Certified per Docket 96-208

Federal Communications Commission (FCC) Statement

Radio Frequency Interference (RFI)

(FCC 15.105)

This equipment has been tested and found to comply with the limits for Class B digital devices pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Labeling Requirements

(FCC 15.19)

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Modifications

(FCC 15.21)

Changes or modifications to this equipment not expressly approved by Digi may void the user's authority to operate this equipment.

Cables

(FCC 15.27)

Shielded cables *must* be used to remain within the Class B limitations.



Declaration Of Conformity

(in accordance with FCC Dockets 96-208 and 95-19)

Manufacturer's Name: Digi International
Corporate Headquarters: 11001 Bren Road East
Minnetonka MN 55343

Digi International declares that the product:

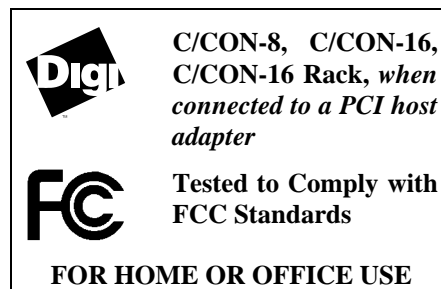
Product Name: **C/CON-8, C/CON-16 and C/CON-16 Rack Concentrators
when connected to a PCI host adapter**

Model Numbers: 50000293, 50000294, 50000295, 50000296, 50000430-01,
50000325, 50000431-01, 50000584-01, 50000585-01,
50000598-01, 55000598-01

to which this declaration relates, meets the requirements specified by the Federal Communications Commission as detailed in the following specifications:

- Part 15, Subpart B, for Class B Equipment
- FCC Docket 96-208 as it applies to Computers and Peripherals

The product listed above has been tested at an External Test Laboratory certified per FCC rules and has been found to meet the FCC, Part 15, Class B, Emission Limits. Documentation is on file and available from the Digi International Homologation Department.



Industry Canada Compliance Statement

This Class B digital apparatus meets the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Union EMC Directive

This product has been tested and found to comply with the following European Union standards:

- EN 55022 Class B
- EN 50082-1

Safety

This product complies with the following safety standards:

- UL 1950
- CSA 22.2 No. 950
- EN 60950

Introduction

The Digi C/X System

The Digi C/X system is a cluster controller system consisting of two major sub-systems: the C/X host adapter, which plugs into a slot in your computer's interface bus, and one or more concentrators (C/CON-16, C/CON-8 or C/CON-16 Rack), which are connected to the host adapter via a high-speed EIA-422 synchronous serial interface. Each concentrator is equipped with eight or sixteen EIA-232 asynchronous serial ports. Most Digi device driver software supports up to eight concentrators per host adapter and up to seven host adapters per system, for a total of up to 896 EIA-232 ports.

Note!

The Digi C/X system is also known as the Digi AccelePort C/X system. In AccelePort systems, the concentrators are known as AccelePort C/CON-16, AccelePort C/CON-8 and AccelePort C/CON-16 Rack. The C/X system and AccelePort C/X systems are functionally identical.

Accessories

C/CON concentrators are shipped with these accessories:

- Daisy chain cable (see pages 10 and 54)
- Terminator plug (see pages 8 and 54)
- Diagnostic loopback plug (see pages 43 and 54)

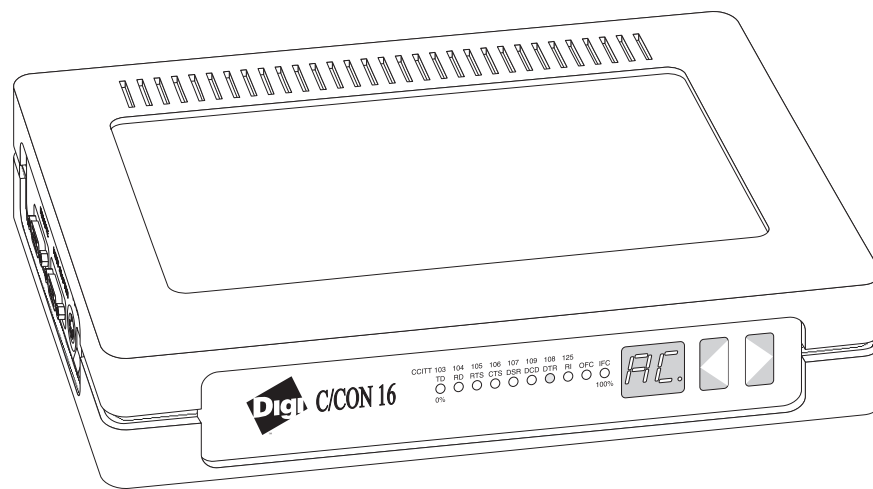
C/CON-16 Concentrator

The Digi C/CON-16 concentrator is a complete subsystem with its own 80C186 microprocessor, 128K of RAM and 16K of EPROM, 16C554 quad UARTs for the sixteen EIA-232 asynchronous serial ports, and a high-speed 85C30 serial communications controller with full duplex DMA support for communication with the host adapter and other concentrators. The concentrator receives packets of data from the host adapter at data rates of up to 1.2 megabaud, then distributes the data, as appropriate, to the sixteen EIA-232 ports. Data received by the EIA-232 ports is similarly packetized and sent to the host adapter over the high-speed synchronous line. The EIA-232 ports operate at data rates of up to 115,200 baud. Multiple concentrators may be daisy chained together, and with standard wiring, concentrators may range up to 300 meters (1000 feet) from the host adapter.

By using high-speed synchronous modems, remote concentrators may be located virtually anywhere in the world.

The C/CON-16 concentrator features a front panel which is comprised of two push-button switches, ten LED indicators and two seven-segment LED displays. The LED indicators can be used to reflect the activity of each of the EIA-232 lines and flow control status for a given channel. They can also be set to act as a bar-graph to show CPU utilization and the activity level of the EIA-422 synchronous channel. The seven-segment LED displays indicate which channel is currently selected, the various operating modes, or diagnostic information.

Figure 1 **C/CON-16 Concentrator**



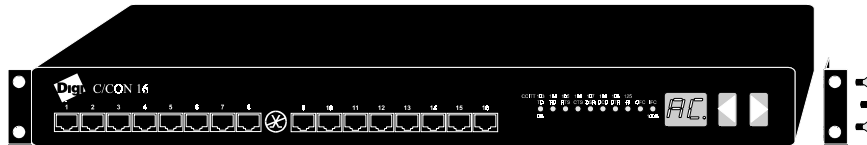
C/CON-8 Concentrator

The C/CON-8 concentrator is an eight-port version of the C/CON concentrator. It is functionally identical to the C/CON-16 concentrator, is available with either RJ-45 modular connectors or DB-25 connectors and is completely software-compatible. In this manual, all references to the C/CON-16 concentrator apply equally to the C/CON-8, unless otherwise noted.

C/CON-16 Rack Concentrator

The C/CON-16 Rack concentrator is the rack-mount version of the C/CON-16 concentrator. It is electronically identical to the C/CON-16 concentrator, and completely software-compatible. In this manual, all references to C/CON concentrators apply equally to the C/CON-16 Rack concentrator, unless otherwise noted. The C/CON-16 Rack concentrator is available only with RJ-45 modular connectors.

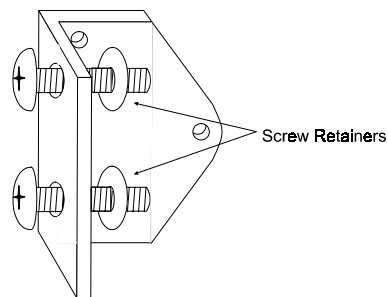
Figure 2 **C/CON-16 Rack Concentrator**



Note:

The rack “ears” must be installed by the user. Remove the three screws on the side of the concentrator near the front panel, and save them. To attach the ears (see Figure 2), use the flat-head screws provided with the ears. To aid in rack mounting, screw retainers have been provided (see Figure 3) to keep the mounting screws in place while positioning the concentrator in the rack.

Figure 3 **Screw Retainers for Rack Ears**



Surge Protection

Digi concentrators are equipped with surge protection circuitry to prevent damage to the concentrators in the case of transients or other fluctuations on the serial interface lines.

In extreme cases (for example, where a ground loop is experienced), the synchronous lines can be totally isolated by the use of the Digi C/X-FL fiber optic link option. Optical fiber is impervious to electrical noise, ground loops, etc. The C/X-FL option also permits synchronous cable runs of up to 2000 meters (1.2 miles). Note that the C/X-FL supports only the 1.2 megabaud rate, and is therefore not recommended for use with remote concentrators connected to the host adapter via synchronous modems.

Fault Tolerance

Digi C/CON concentrators are assigned *physical* node numbers (set by the operator during installation—see page 21). The node number is used by the host adapter to route data to and from a specific concentrator. If a particular concentrator is turned off or removed from the daisy chain, the sixteen channels on that concentrator become unavailable to the system, but the rest of the system remains unaffected. Since the concentrator's "Host Adapter" and "Remote" ports are of opposite gender, a concentrator can be removed from the middle of a daisy chain by plugging the cables together so that the chain remains unbroken. To remove the last concentrator, simply plug the terminator plug into the end of the daisy chain cable.

Earlier versions of the C/CON-16 concentrator (identifiable by their metal case) are assigned sequential *logical* node numbers (beginning with Node 1) by the operating software each time the system is booted up. Removal of an old-style concentrator from the daisy chain changes the node numbers of any remaining old-style concentrators (and consequently their port names).

If an older version of the C/CON-16 concentrator is turned off or fails, the daisy chain is broken, and the entire system fails. New concentrators can be turned off, and data will still pass through to other concentrators.

Compatibility

C/CON concentrators can be connected either to C/X host adapters or EPC/X host adapters, and may be “mixed” with EPC/CON concentrators on a host adapter synchronous line. When connecting a C/CON concentrator to an EPC/X host adapter, the maximum synchronous data rate for that line is limited to 1.2 megabaud; for this reason, if both C/CON and EPC/CON concentrators are to be used on a single host adapter, Digi recommends installing all C/CON concentrators on one synchronous line and all EPC/CON concentrators on the other line. This will allow the EPC/CON concentrators to operate at their optimum data rate of 10 megabaud.

Installation

Installation of the Digi C/X system consists of installing and configuring the host adapter in your computer, connecting the C/CON concentrator(s) and installing the device driver software. This manual covers the C/CON concentrator installation—installation of the host adapter and device driver software are described in separate manuals.

The C/X host adapter has two identical EIA-422 synchronous serial interface ports to which a number of concentrators may be connected. Current versions of Digi's device driver software support up to eight concentrators per host adapter, which may be distributed in any combination between the two EIA-422 ports.

Multiple concentrators are connected to a single EIA-422 line in *daisy chain* fashion—that is, the first concentrator is connected directly to one of the host adapter's EIA-422 lines, the second concentrator is connected to the first, and so on.

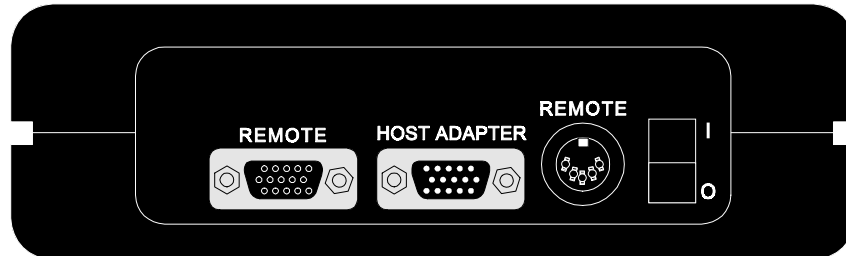
C/CON concentrators can be connected to a C/X or EPC/X host adapter, and to each other, in a variety of ways, including twisted pair cable, fiber optic cable, synchronous modems, and combinations of these methods.

For local applications, where the work groups will not be located more than 300 meters (1000 feet) from the host computer, C/CON concentrators can be connected to a host adapter via four or eight-conductor twisted pair cable. With the eight-conductor cable, data is transferred between concentrators and the host adapter at rates of up to 1.2 megabaud. With four-wire cable, the maximum synchronous data rate is 460K baud. In most cases, when the concentrators are used to connect terminals and printers, the reduced synchronous data rate on a four-wire cable will not affect the performance of the system. For moderate to heavy loads, however, the eight-wire connection is recommended.

When concentrators must be located more than 1000 feet from the host adapter, a fiber optic link option, the Digi C/X-FL option, is available. With the C/X-FL option, concentrators may be located up to 2000 meters (1.2 miles) from the host adapter or other concentrators. Note that the C/X-FL supports only the 1.2 megabaud rate, and is therefore not recommended for use with remote concentrators connected to the host adapter via synchronous modems.

Still greater distances can be achieved by using high-speed synchronous modems between the host adapter and concentrators. By using modems, a remote concentrator can be located anywhere in the world where there is phone service.

Figure 4



Termination

Concentrators always receive input data via their “Host Adapter” ports, and always transmit output data from their “Remote” ports. When multiple concentrators are daisy chained together, data travels in a circular fashion—thus, if there are four concentrators connected to a host adapter synchronous port, data from the host adapter to concentrator #4 must pass through concentrators #1, #2 and #3 before reaching concentrator #4. At the same time, data from concentrator #1 to the host adapter must travel the full circle through concentrators #2, #3 and #4 before being returned to the host adapter (see the flow diagram in Figure 5, on page 9).

To make the loop complete, a *terminator plug* must be installed on the “Remote” port of the *last* concentrator in the daisy chain (see Figures 5 and 6, on page 9). This plug ties all of the “Remote” port’s output signals back to their corresponding input signals (TxD to RxD, TxC to RxC, RTS to CTS, etc). The concentrator’s “Remote” port *input* signals are hard-wired to its “Host Adapter” port *output* signals, so once any concentrator’s output data reaches the terminator plug on the last concentrator, it is passed back through all of the concentrators until it is ultimately received by the host adapter. Note that if only one concentrator is installed, it is by default the last one, and needs to have a terminator plug installed.

Figure 5 Data Flow Between Host Adapter and Concentrators

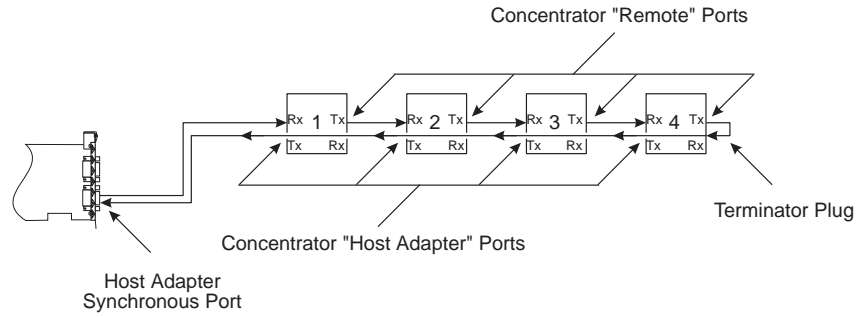
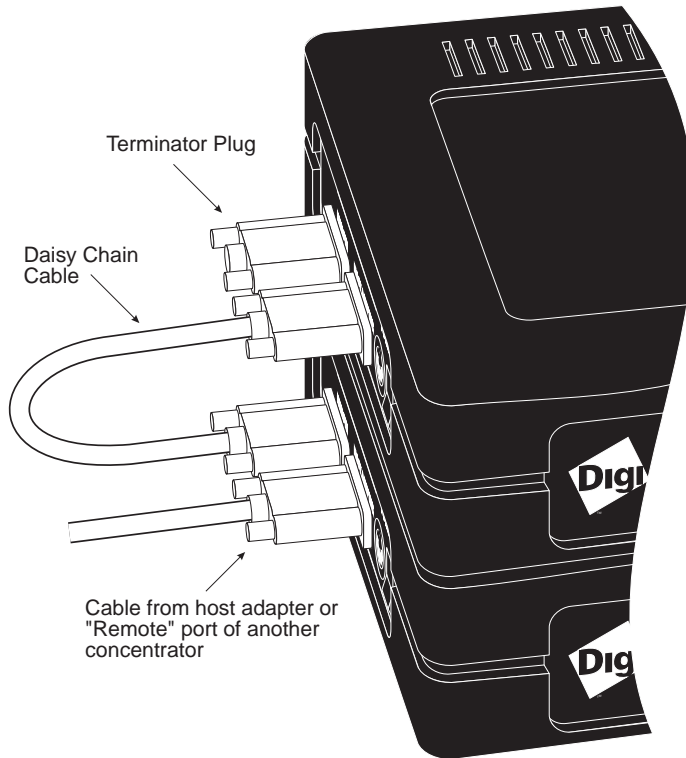


Figure 6 Daisy Chained Concentrators; Terminator Plug Installed



Connecting the Concentrators to the Host Adapter

A single Digi C/X host adapter can have up to eight concentrators attached to it in a variety of configurations, for a total of up to 128 asynchronous serial ports per host adapter. A Digi EPC/X host adapter supports up to 14 concentrators, for a maximum of 224 ports per host adapter.

To connect a concentrator to the host adapter, use the daisy chain cable furnished with the concentrator, or build your own custom cable. The cable should be a shielded twisted pair cable, terminated with HD-15 (high-density DB-15) connectors, one male and one female, and wired as shown in Figures 9 or 10 on the following pages. The shield should be connected to the connector shell at both ends.

Important!

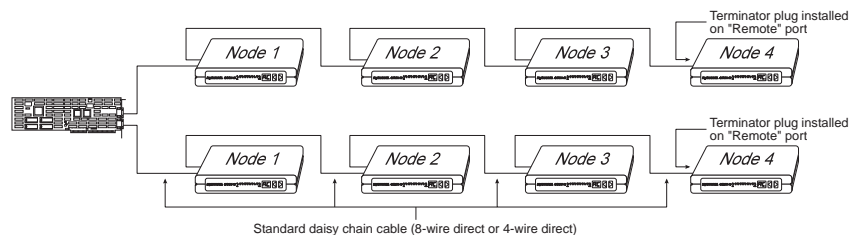
Do not connect wires to pins 12 (Signal Ground) or 13 (+5V) in a standard daisy chain cable. This would connect the concentrator's power supply to the computer's power supply, with unpredictable results.

Never use VGA extension cables or any other cable that has all 15 pins wired.

Connect the male end of the cable to one of the host adapter synchronous line connectors (if only one host adapter synchronous line is to be used, it must be Line 1—the bottom connector), and connect the female end of the cable to the concentrator port marked “Host Adapter”.

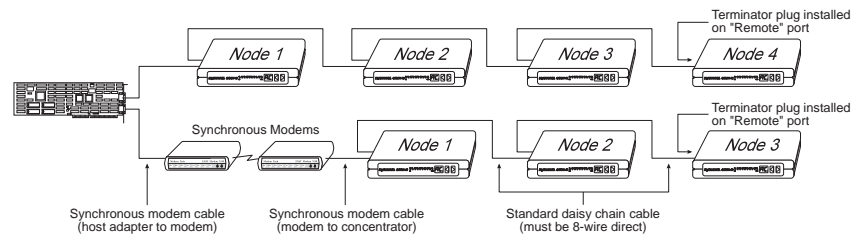
The same cable configuration should be used for interconnecting (daisy chaining) multiple concentrators. Connect the male end of the cable to the port marked “Remote” on the first concentrator and the female end to the “Host Adapter” port on the second, and so on (up to eight concentrators can be daisy chained in this fashion). Be sure to install a terminator plug on the “Remote” port of the last concentrator in the chain (see *Termination*, on page 8).

Figure 7 **Eight Concentrators Connected Locally**



To connect a concentrator to the host adapter via modems, use the cables shown in Figures 11 or 12 (pages 15 and 16), depending upon your modem type (EIA-232 or EIA-422). Connect additional concentrators with Eight-Wire Direct cables (or the standard daisy chain cables shipped with the unit). Be sure to install the terminator plug on the "Remote" port of the last concentrator.

Figure 8 Local and Remote Concentrators

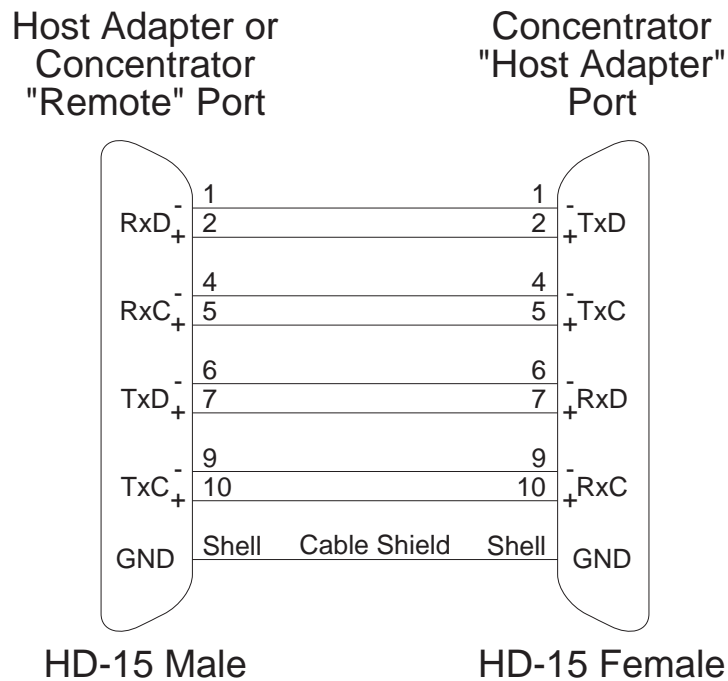


There are three basic wiring modes for connecting concentrators to a host adapter or to each other: Eight-Wire Direct; Four-Wire Direct (also called Four-Wire Self-Clocking) and Eight-Wire Synchronous Modem (or Eight-Wire Externally Clocked).

Eight-Wire Direct Wiring

Eight-Wire Direct is the standard method for connecting concentrators to host adapter synchronous lines, and to other concentrators. It provides transmit and receive data signals plus discrete clock signals for transmit and receive data. This permits synchronous data rates of up to 1.2 megabaud, which results in the maximum data throughput under moderate to heavy loads. The synchronous cables provided with the concentrators are Eight-Wire Direct cables. The Eight-Wire Direct cable is a twisted pair cable with a male HD-15 (high-density DB-15) connector at one end and a female HD-15 at the other end. The cable should be shielded, and the shield must be connected to the HD-15 connector shell at both ends. The maximum recommended *cumulative* cable length (between host adapter and all concentrators on a single EIA-422 line) for a 1.2 megabaud connection is 1000 feet (see note on page 14).

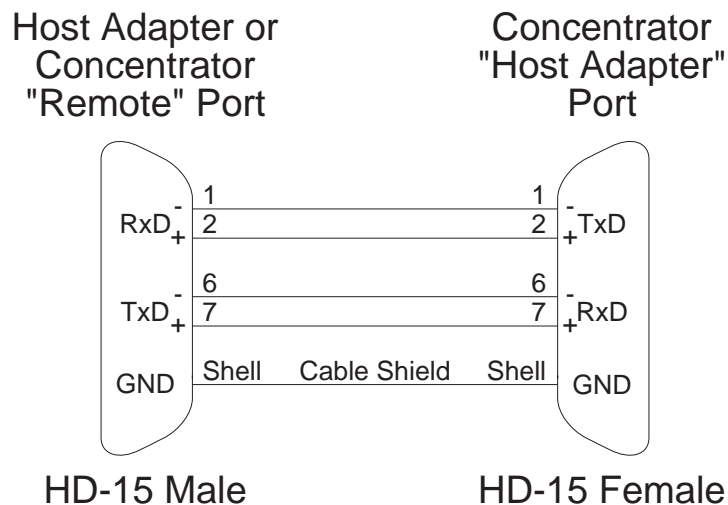
Figure 9 Eight-Wire Direct Daisy Chain Cable Wiring



Four-Wire Direct Wiring

Four-Wire Direct wiring can be used to connect concentrators where longer synchronous cable runs are necessary. While not as fast as Eight-Wire connections (the maximum data transfer rate is 460K baud), this wiring method is more economical, and is sufficient in all but the most demanding high-performance applications (terminal users should see no degradation in performance). In the Four-Wire Direct wiring mode, the clock signals are encoded with the receive and transmit data signals, so only two twisted pairs are required. The Four-Wire Direct cable is a twisted pair cable with a male HD-15 (high-density DB-15) connector at one end and a female HD-15 at the other end. The cable should be shielded, and the shield must be connected to the HD-15 connector shell at both ends. The maximum recommended *cumulative* cable length (between host adapter and all concentrators on a single EIA-422 line) is 1000 feet (see note on page 14).

Figure 10 Four-Wire Direct Daisy Chain Cable Wiring



Restrictions on Daisy Chain Cable Lengths

The maximum length of a daisy chain is dependent upon the synchronous data rate. Table 1, below, lists the maximum *cumulative* daisy chain cable lengths for various baud rates. For example, to run a synchronous line at 1.2 megabaud, the total length of all daisy chain cables for that synchronous line may not exceed 1000 feet. Thus, a single concentrator could be placed 1000 feet from the host adapter, or five concentrators could be spaced at 200 foot intervals and still operate at 1.2 megabaud.

Table 1 **Daisy Chain Cable Length vs. Baud Rate**

| Baud Rate | Maximum Cable Length (24AWG Twisted Pair, 12 pF/foot) |
|------------------|---|
| 0 - 460K | 2000 feet |
| 0 - 1.2M | 1000 feet |

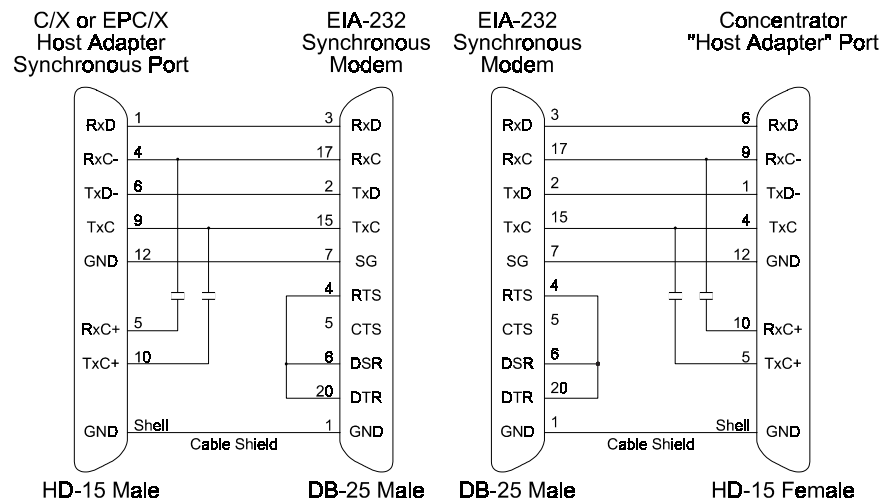
These figures represent our maximum *recommended* configurations, and are intended for general guidelines only. Configurations in excess of our recommendations may be used, but be aware that loss of data integrity and possible hardware failures may occur, depending on your particular operating environment.

Eight-Wire Synchronous Modem Wiring

Eight-Wire Synchronous Modem wiring allows concentrators to be installed in remote locations and connected to the host adapter via EIA-232 or EIA-422 synchronous modems, DSUs/CSUs, frame relay adapters, fractional T1s or ISDN terminal adapters.

C/X and EPC/X host adapters and C/CON concentrators have been designed so that the synchronous ports can support either EIA-422 or EIA-232 line levels. To connect host adapters and concentrators to EIA-232 synchronous modems, use the special cables shown in the diagram below.

Figure 11 EIA-232 Synchronous Modem Cables



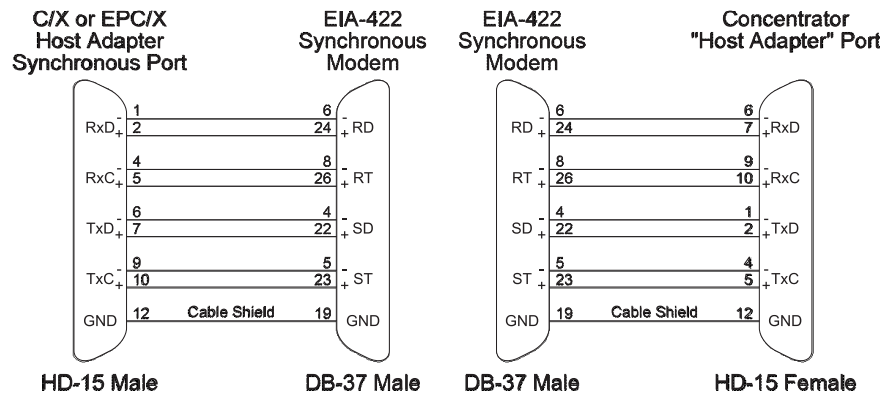
These cables may be purchased ready-made from your Digi supplier. The part numbers are 76000211 for the host adapter to EIA-232 modem cable, and 76000212 for the EIA-232 modem to concentrator cable.

Note:

The EIA-232 wiring feature is not supported by device driver software released prior to 9/1/92. Older releases support only EIA-422 wiring.

EIA-422 synchronous modems can also be used with the Digi C/X system. The required cables are shown below.

Figure 12 EIA-422 Synchronous Modem Cables



The EIA-422 Synchronous Modem cables are twisted pair cables, each having an HD-15 (high-density DB-15) connector at one end and a DB-37 connector at the other end. The cable should be shielded, and the shield must be connected as shown in the above diagram.

These cables may be purchased ready-made from your Digi supplier. The part numbers are 76000213 for the host adapter to EIA-422 modem cable, and 76000214 for the EIA-422 modem to concentrator cable.

V.35 Wiring

V.35 wiring allows concentrators to be installed in remote locations and connected to the host adapter via V.35 DSUs/CSUs, frame relay adapters, fractional T1s or ISDN terminal adapters.

To connect host adapters and concentrators to V.35 devices, use the special cables shown in the diagram below.

Figure 13 V.35 Synchronous Cables (Winchester Connectors)

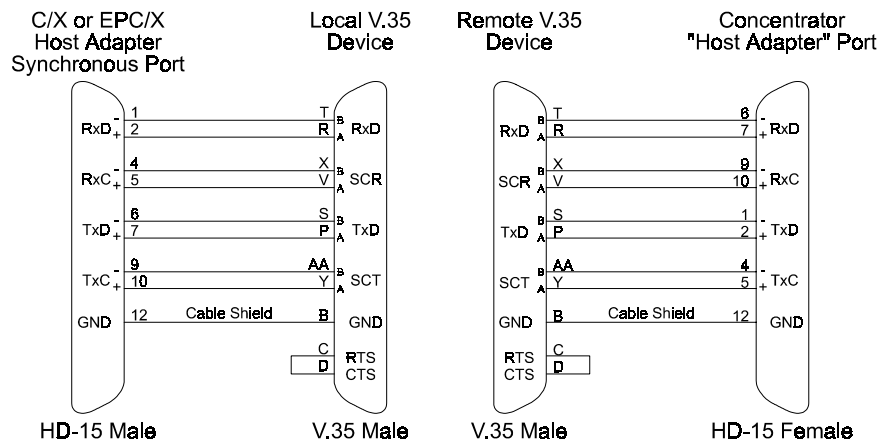
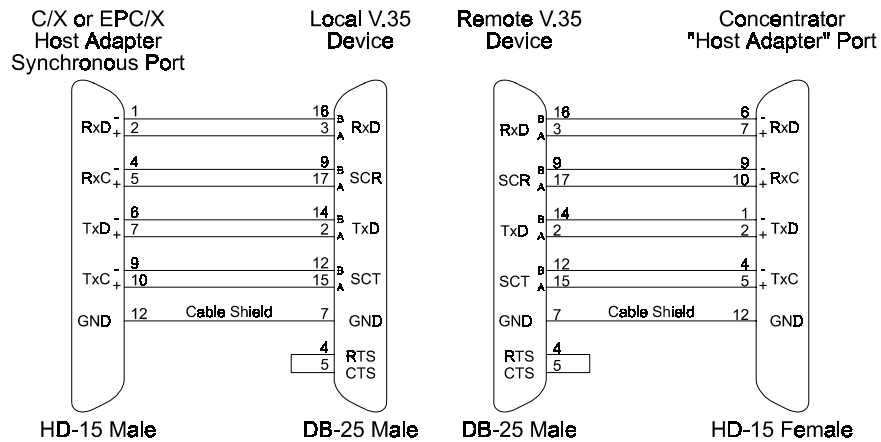


Figure 14 V.35 Synchronous Cables (DB-25 Connectors)



Connecting the Power Supply

C/CON Concentrators

The C/CON concentrator requires an external power supply (provided with the unit). In the USA and Canada, a domestic 60 Hz linear power supply (Digi part number 10000481) is provided. For other countries, a universal 50/60 Hz, 90 to 270 volt switching power supply (Digi part number 10000985) is provided.

1. Make sure the Power switch on the concentrator is in the OFF (“O”) position.
2. Plug the AC connector of the power supply into a standard grounded wall outlet. Plug the DIN connector into the receptacle labeled “Power” on the concentrator.
3. Turn the concentrator’s Power switch to the ON (“I”) position. The lights on the front panel should flash as the concentrator executes its Power-On Self Test (POST) sequence, and the seven-segment LED display will eventually display “P1” to indicate that the POST sequence passed.

(If you have already connected the concentrator to a host adapter and installed the device driver software, the display will show “AC” to indicate that it is on-line and has received instructions from the host adapter.)

Important!

DO NOT stack power supplies on top of each other! This can lead to thermal damage to the power supply. Place power supply at least 4 inches from other power supplies or heat sources. In a forced cooling environment (30 CFM minimum), power supplies may be placed 2 inches apart.

C/CON Rack 16 Concentrators

The C/CON Rack 16 concentrator has an internal universal input (50-60 Hz, 90 to 250 volt) switching power supply.

1. Make sure the Power switch on the concentrator is in the OFF (“**O**”) position.
2. Connect the power cord to the concentrator and plug it into a standard grounded wall outlet.
3. Turn the concentrator’s Power switch to the ON (“**I**”) position. The lights on the front panel should flash as the concentrator executes its Power-On Self Test (POST) sequence, and the seven-segment LED display will eventually display “**PI**” to indicate that the POST sequence passed.

(If you have already connected the concentrator to a host adapter and installed the device driver software, the display will show “**AC**” to indicate that it is on-line and has received instructions from the host adapter.)

Note!

Concentrators sold in North America are shipped with a standard power cord. Units sold outside of North America are shipped without a power cord. If the power cord needs to be replaced, or if you need to purchase an original power cord, use only a cord that meets the following specifications:

Type: SJT or SVT flexible power cord, compatible with an IEC320 appliance inlet.

Safety Approvals:

The cord must bear the mark of the agency in your country (i.e. UL, CSA, VDE, SEMKO, etc.)

Temperature Rating:

75°C minimum

Voltage Rating:

125 Volts minimum (North America)

Current Rating:

6 Amps minimum

Conductor Size:

3 x 18 AWG or 3 x 0.75 mm, or larger

For power cord selection in Germany, use only a H05VV-F, <HAR>, VDE, PVC, 3 x 0.75mm power cord.

Für gebrauch in Deutschland muß ein Netzkabel des typs H05VV-F, <HAR>, gröÙe, 3 x 0.75mm verwendet werden.

Rack Installation

- Rack mounted equipment is often subjected to higher operating temperatures due to enclosed racks or reduced ventilation of individual units. The recommended maximum external ambient operating temperature of the unit is 50° C. The C/CON Rack 16 concentrator is cooled by convection; for maximum life of the unit, be sure that the vents on the top and bottom of the unit are not blocked, and no more than four units should be stacked together without providing some means of regulating the ambient temperature of the middle units. This regulation can be accomplished by providing additional space or air flow between stacked units to allow heated air to dissipate.
- The C/CON Rack 16 concentrator should be mounted in a rack chassis such that an unbalanced or otherwise hazardous condition is not created.
- The C/CON Rack 16 concentrator is rated at 1 Amp of current draw from a 125 V AC supply. Due to the nature of the internal switching power supply, the power rating of the AC supply circuit should be derated to 80% of its rated capacity (i.e. a 15 Amp circuit should be derated to 12 Amps) when calculating how many units can be connected to the AC supply.
- The C/CON Rack 16 concentrator should be used only with earth grounded outlets. The earth ground connection of the three prong cord should be maintained even when not connecting the unit directly to the AC supply line (i.e. through a power strip).

Configuration

Node Numbers

The host adapter identifies C/CON concentrators by their *node numbers*. Each concentrator in a daisy chain must have a unique node number, which must be set during installation. The node numbers must be assigned in ascending order with the lowest number assigned to the concentrator closest to the host adapter. It is permissible to skip node numbers (to facilitate insertion of additional concentrators at a later date), as long as the ascending sequence is maintained.

Setting the Node Number

Turn the concentrator on and wait for the POST (Power On Self Test) to complete. When “**P1**” is displayed on the front panel 7-segment LED display, press the right-hand button once. The current node number will be displayed (“**1n**”, for Node 1, if the concentrator has just been unpacked). Press the left-hand button to advance the node number through the eight possible settings (**1n-8n**). Once “**8n**” has been reached, the numbers start over at “**1n**”. When the desired node number is displayed, press the right-hand button again to select the number. The display should now read “**Pn**” (indicating a “pass” condition). If there was an error, the display will read “**Fn**”.

If you are adding concentrators to an existing system which has an older version of the C/CON-16 (these have a metal case), the node numbers of the new concentrators must begin with a number that is greater than the total number of older concentrators connected to that EIA-422 synchronous line (see *Adding Concentrators to an Existing System*, on page 23).

In the case of duplicate node numbers, the concentrator farther from the host adapter will display “**En**”, instead of “**AC**” when the system is booted up.

Important!*Remote Concentrators*

When setting up remote concentrators, the node number of the *last* concentrator on a sync line must be the same as the total number of concentrators that will be configured in the device driver software for that line. This is because the clocking mode for the last concentrator is set by the device driver software for synchronous modem clocking. If the device driver has been configured for six concentrators on a sync line, the node number of the last concentrator must be set to 6, regardless of the actual number of concentrators that are physically present on that line.

Similarly, fault tolerance is not effective if the last concentrator of a remote string fails, because the software only programs that concentrator, by its node number, for synchronous modem clocking. The other concentrators are all set for regular (8-wire direct) clocking. If the last concentrator in a remote string fails or is removed for any reason, you must either reconfigure the device driver software for one less concentrator, or change the node number of the next to last concentrator to the number of the concentrator that was removed. If you change a concentrator's node number, be sure to reboot the concentrator (power off and then on) so that the host system can reinitialize it properly.

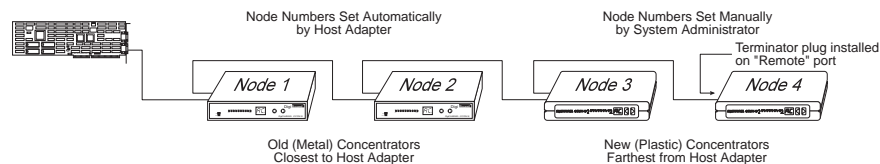
Remote concentrators must all be of one type: either all older (metal case) or all newer (plastic case) concentrators.

Adding Concentrators to an Existing System

C/CON-8, C/CON Rack 16 and newer models of the C/CON-16 concentrator (identifiable by their plastic case) can be installed in systems comprised of older concentrators (which have a metal case). When mixing old and new concentrators the old concentrators must be electrically closest to the host adapter, and the new concentrators must follow the old ones. This is because the older concentrators are assigned node numbers by the host, each time the software is booted. The first concentrator in the daisy chain is always Node 1, the second is always Node 2, etc. The C/CON-8, C/CON Rack 16 and new C/CON-16 concentrators' node numbers are assigned by the system administrator during installation (see page 21), and remain fixed until changed via the front panel.

Also remember to remove the terminating jumpers (or set the "LAST/INLINE" switch to "INLINE") from the last old-style concentrator when installing additional concentrators in a daisy chain.

Figure 15 **Mixed Older and Newer C/CON Concentrators**



Note!

When connecting concentrators to the host adapter via synchronous modems, all concentrators must be of one type—either all newer or all older concentrators.

Important!

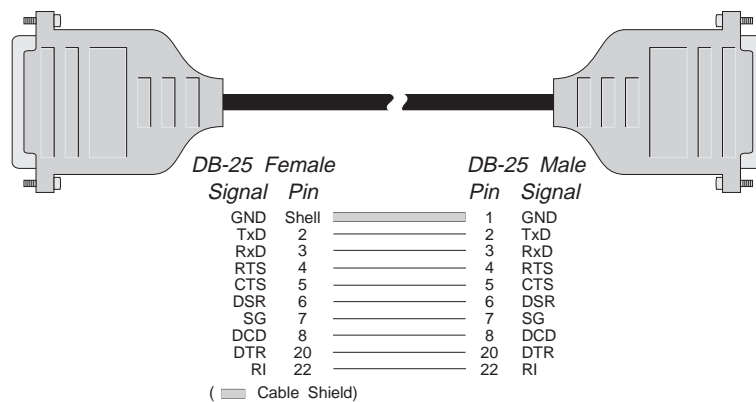
The last concentrator in a daisy chain must have a terminator plug installed on its "Remote" port. Individual concentrators are not shipped with terminator plugs (terminator plugs are shipped with C/X host adapters only). To obtain a terminator plug, free of charge, contact Digi Technical Support. See the enclosed card for phone numbers.

Connecting Peripherals

Connecting to a Modem

DB-25 Equipped Concentrators

Figure 16 **DB-25 to DB-25 Modem Cable**



To connect a DB-25 equipped concentrator to a modem, use a standard “straight-through” cable (see Figure 16) to connect the modem to one of the DB-25 connectors on the rear of the concentrator.

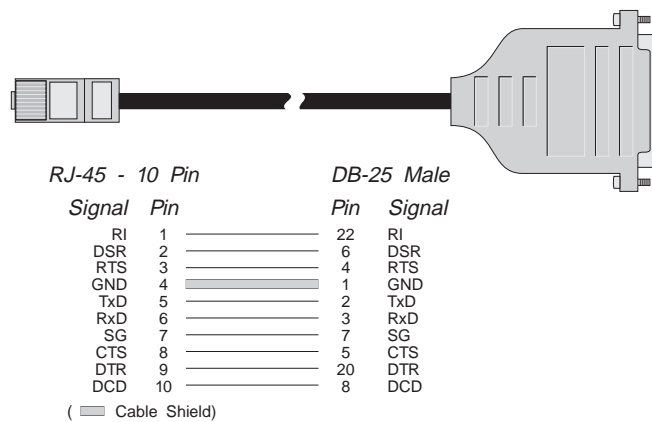
Important!

Shielded cable must be used to remain in compliance with Part 15 of FCC rules.

RJ-45 Equipped Concentrators

The simplest way to connect a modem to a concentrator with RJ-45 connectors is to use RJ-45 to DB-25 “Cable Legs”, available from Digi (see page 41 for a description and part numbers). These adapters use 10-pin RJ-45 plugs, and therefore provide full modem support (Ring Indicator and Data Carrier Detect are only available on 10-pin RJ-45 connectors).

Figure 17 **RJ-45 to DB-25 Modem Cable (10 Wire)**



If you wish to build your own modem cable, follow the diagram in Figure 17.

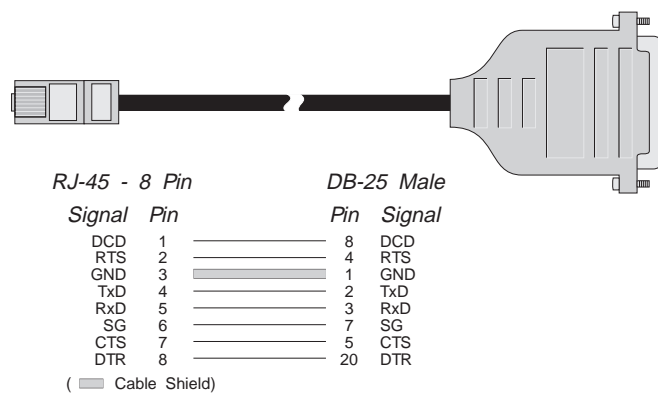
Important!

Shielded cable must be used to remain in compliance with Part 15 of FCC rules.

ALTPIN Modem Wiring (RJ-45 Versions)

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 (see your device driver software reference manual for instructions), DCD becomes available on pin 1 of an 8-pin RJ-45 connector (equivalent to pin 2 of a 10-pin connector).

Figure 18 8-Wire Modem Cable for use with ALTPIN Configuration



If you wish to build an 8-wire modem cable for an RJ-45 equipped board, use an 8-pin RJ-45 plug wired as shown in Figure 18.

Important!

Shielded cable must be used to remain in compliance with Part 15 of FCC rules.

Connecting to a DTE Device

A DTE device is a terminal, serial printer, another computer's serial port, etc. To connect the C/CON concentrator (which is also a DTE device) to another DTE device, you need a *null modem* cable or adapter.

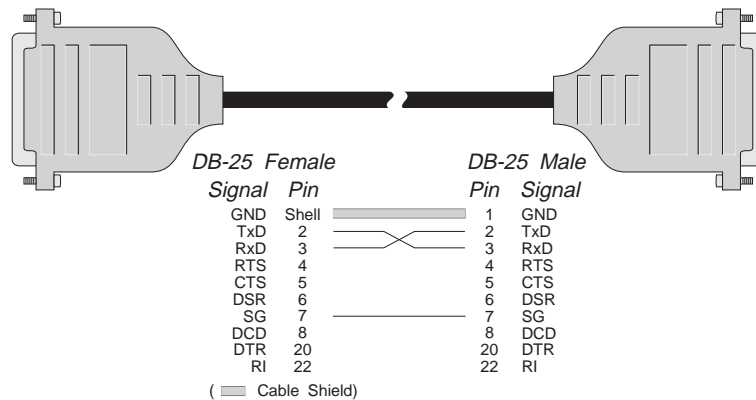
DB-25 Equipped Concentrators

Software Handshaking (XON/XOFF)

In most cases, serial terminals and printers need only a “three-wire” connection to the concentrator. Digi device driver software supports XON/XOFF (software) handshaking, so the only signal lines necessary are Transmitted Data (TxD), Received Data (RxD) and Signal Ground (SG). It may be necessary to disable DCD (Data Carrier Detect) sensing through a software command—see the Digi device driver manual for instructions. Cables must be shielded to remain in compliance with FCC certification requirements, and the shield should be connected to Chassis Ground (GND) at both ends of the cable run.

A simple cable for connecting a terminal or a printer to a DB-25 equipped concentrator is shown in Figure 19.

Figure 19 **Simple Terminal/Printer Cable (DB-25)**



Important!

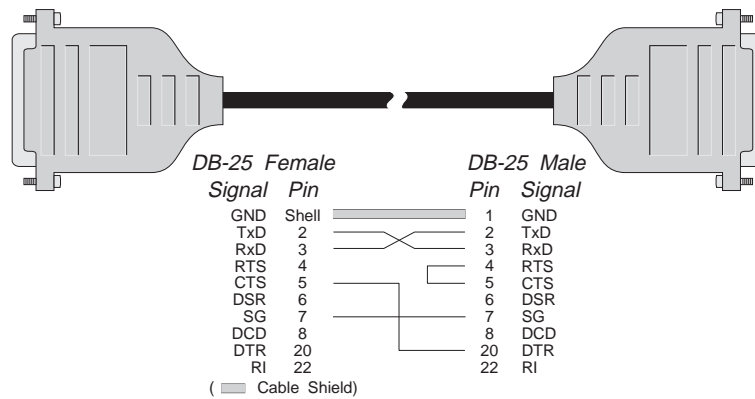
Shielded cable must be used to remain in compliance with Part 15 of FCC rules.

The cable shown in Figure 19 is a three-wire null modem cable—that is, 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 one of the DB-25 connectors on the rear of the concentrator.

Hardware Handshaking (Ready/Busy)

Figure 20 Terminal/Printer Cable with DTR Handshaking (DB-25)



Most terminals and printers use Data Terminal Ready (DTR) for Ready/Busy hardware handshaking. The cable shown in Figure 20 supports this method.

Important!

Shielded cable must be used to remain in compliance with Part 15 of FCC rules.

Note:

Some Okidata printers use a control signal on pin 11, called Supervisory Send Data (SSD) instead of DTR. In this case, simply connect CTS on the female DB-25 side to pin 11 of the male DB-25, instead of pin 20.

Other printer manufacturers may use different methods of flow control. Consult your printer's documentation for specific wiring requirements.

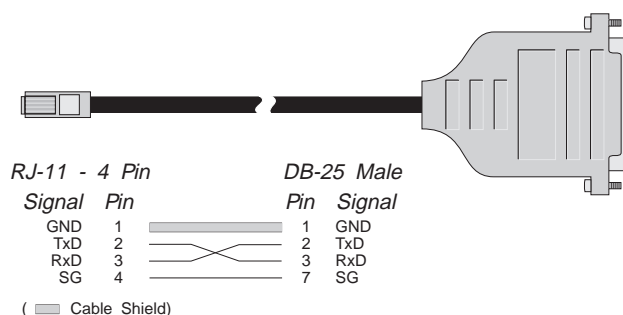
RJ-45 Equipped Concentrators

Software Handshaking (XON/XOFF)

In most cases, serial terminals and printers need only a “three-wire” connection to the concentrator. All Digi device driver software supports XON/XOFF (software) handshaking, so the only signal lines necessary are Transmitted Data (TxD), Received Data (RxD) and Signal Ground (SG). It may be necessary to disable DCD (Data Carrier Detect) sensing through a software command—see your Digi device driver software manual for instructions. Cables must be shielded to remain in compliance with FCC certification requirements, and the shield should be connected to Chassis Ground (GND) at both ends of the cable run.

A simple cable for connecting a terminal or a printer to an RJ-45 equipped concentrator is shown in Figure 21.

Figure 21 **Simple Terminal/Printer Cable (RJ-45)**



The cable shown is a three-wire null modem cable—that is, Transmitted Data on one end of the cable is connected to Received Data at the other end, and vice versa.

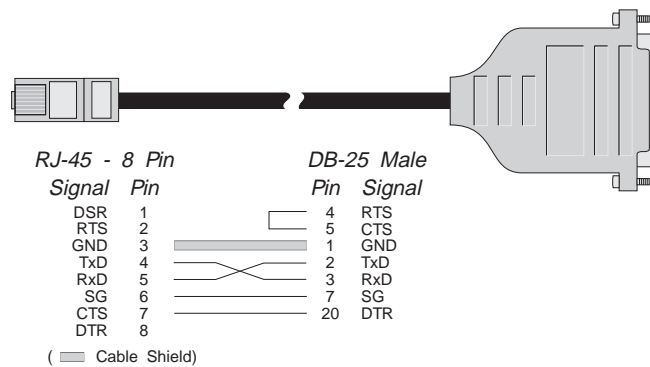
The male DB-25 end can be plugged directly into most serial terminals and printers without any adapters. The RJ-11 plug fits into the center of the RJ-45 jack.

Important!

Shielded cable must be used to remain in compliance with Part 15 of FCC rules.

Hardware Handshaking (Ready/Busy)

Figure 22 Terminal/Printer Cable with DTR Handshaking (RJ-45)



Most terminals and printers use Data Terminal Ready (DTR) for Ready/Busy hardware handshaking. The cable shown in Figure 22 supports this method.

Important!

Shielded cable must be used to remain in compliance with Part 15 of FCC rules.

Note!

Some Okidata printers use a control signal on pin 11, called Supervisory Send Data (SSD) instead of DTR. In this case, simply connect CTS on the RJ-45 side to pin 11 of the DB-25, instead of pin 20.

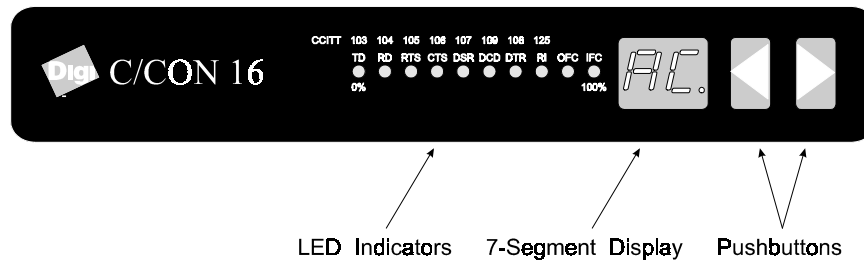
Other printer manufacturers may use different methods of flow control. Consult your printer's documentation for specific wiring requirements.

Operation

Normal operation of the C/CON involves nothing more than turning on the power. If the unit is properly connected and the device driver software is installed and running in the host computer, the seven-segment LED display should show the letters “AC” after the POST (Power On Self Test) sequence is completed.

The C/CON control panel is equipped with ten LED indicators, a two-digit 7-segment LED display and two pushbuttons which can be used to monitor various functions of the concentrator.

Figure 23 **C/CON-16 Front Panel**



Display Modes

The C/CON concentrator front panel has 20 different display modes. Push the right or left arrow pushbuttons to cycle sequentially through the modes.

Table 2 **C/CON Display Modes**

| Mode/Display | Description |
|---------------------------------|--|
| AC | Activity. “AC” appears on the 7-segment display. The ten LEDs turn on sequentially from left to right. The speed of this “chase light” display increases with the overall activity level of the concentrator. |
| 1 - 16 (1 - 8) | <p>Modes 1 through 16 correspond to channels 1 through 16 (1 through 8 for C/CON-8 concentrators). Press the right or left pushbuttons until the desired channel number appears in the 7-segment display. The LEDs now become a “line monitor” for the selected channel. The first eight LED indicators show the activity of each of the eight EIA-232 signals (TD, RD, RTS, CTS, DSR, DCD, DTR and RI). The last two LED indicators show when output flow control (OFC) and input flow control (IFC) are active.</p> <p>Pressing both pushbuttons simultaneously will release software flow control: If OFC is ON, it will be cleared; if IFC is OFF, a start character (e.g. XON) will be transmitted.</p> |
| PC | Packet Count. “PC” appears on the 7-segment display, and the ten LEDs show a binary representation of the total number of packets transmitted or received. Pressing both pushbuttons simultaneously resets the count to 0. |

| Mode/Display | Description |
|-------------------|---|
| EC | Error Count. “EC” appears on the 7-segment display, and the ten LEDs show a binary representation of the total number of errors counted in the data. Pressing both pushbuttons simultaneously resets the count to 0. |
| PU | Processor Utilization. “PU” appears on the 7-segment display, and the ten LEDs become a bar graph indicating the percentage (0-100%) of the time the concentrator’s microprocessor is being used. |
| LU | Line Utilization. “LU” appears on the 7-segment display, and the ten LEDs become a bar graph indicating the percentage (0-100%) of the time the synchronous communications line is being used. |
| 1n, 2n, 3n ... 8n | Node Number. The 7-segment display shows the node number of the concentrator. NOTE—if this concentrator is being run with an older version of the device driver and FEP/OS software, this display mode may not be available. In this case, the node number can still be obtained via the C/CON diagnostics (see page 44). The 10 LEDs behave as in the “AC” display mode. |

Note:

Front panel functions are controlled by the downloaded FEP/OS software. Using device driver software released prior to 9/1/92 will result in minor variations in the display—namely, the node number display will not be present, and the “clear” functions in “EC”, “PC” and the channel monitoring modes will not be present.

EIA-232 Cables and Connector Options

The Digi C/CON concentrator's EIA-232 asynchronous serial interface ports are provided via either DTE-wired male DB-25 connectors (see Figure 24, on page 37), or RJ-45 modular jacks (see Figure 25, on page 39), located on the rear of the unit. The C/CON-16 Rack concentrator is available only with RJ-45 modular jacks.

Cables

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

Grounding

The shield should be grounded at both ends of the cable. Chassis Ground, available on pin 4 of the 10-pin RJ-45 connector, and on pin 1 or the metal shell of the DB-25 connector, is ideal for this purpose.

Environment

While good shielding provides reasonable protection against "noise" (Electro-Magnetic 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.

Capacitance vs. Length of Run

The total capacitance of a cable affects the integrity of transmitted data. As a rule of thumb, the *total* capacitance of a cable (including the connectors) should not exceed 2500 pF. Serial interface cable is usually rated in picofarads per foot. Therefore, if a cable has a capacitance of 50 pF/ft, and the connectors are 100 pF each, the maximum recommended cable length is 46 feet. If the cable is rated at 12.5 pF/ft, the maximum recommended cable length is 184 feet, and 5 pF/ft cable can be run up to 460 feet.

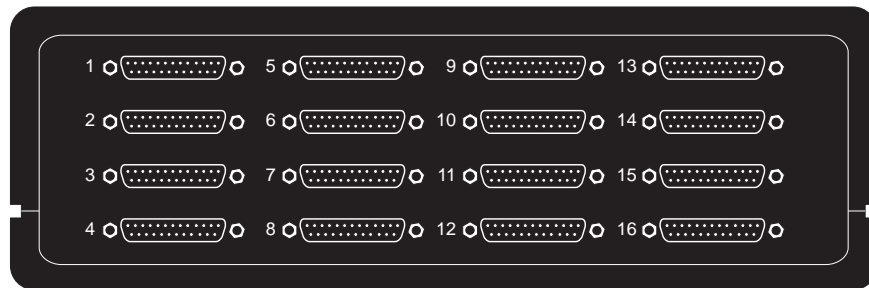
In situations where low-capacitance cable is unavailable, or very long cable runs are required, “short-haul” modems, available from suppliers such as Black Box, can be used to increase the effective range of the EIA-232 interface. Short-haul modems are similar to standard modems, except that they are connected directly to each other via a cable instead of going through a telephone circuit. *NOTE—Externally-powered short-haul modems are recommended.*

Connector Options

The Digi C/CON concentrators are available with either DB-25 connectors or 10-pin RJ-45 “modular” connectors. The C/CON Rack 16 is available only with RJ-45 connectors.

DB-25 Connectors

Figure 24 C/CON-16 Asynchronous Connectors (DB-25 Version)



Note:

The illustration above shows the C/CON-16 concentrator. The C/CON-8 concentrator has eight DB-25 connectors.

The DB-25 version of the C/CON concentrator is equipped with eight or sixteen male DTE-wired DB-25 connectors. The pin assignments for the DB-25 connectors follow the usual conventions for DTE EIA-232 wiring. See Table 3, on the following page, for the pin assignments.

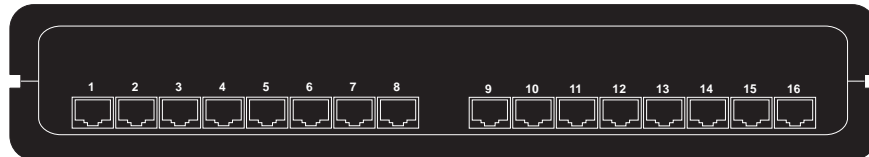
Table 3**DB-25 Connector Pin Assignments**

| Signal | Description | Pin |
|---------------|---------------------|------------|
| GND | Chassis Ground | 1* |
| TxD | Transmitted Data | 2 |
| RxD | Received Data | 3 |
| RTS | Request to Send | 4 |
| CTS | Clear to Send | 5 |
| DSR | Data Set Ready | 6 |
| SG | Signal Ground | 7 |
| DCD | Data Carrier Detect | 8 |
| DTR | Data Terminal Ready | 20 |
| RI | Ring Indicator | 22 |

*Chassis Ground is also available on the connector shell.

RJ-45 Connectors

Figure 25 C/CON-16 Asynchronous Connectors (RJ-45 Version)



Note:

The illustration above shows the C/CON-16 concentrator. The C/CON-8 concentrator has eight RJ-45 connectors.

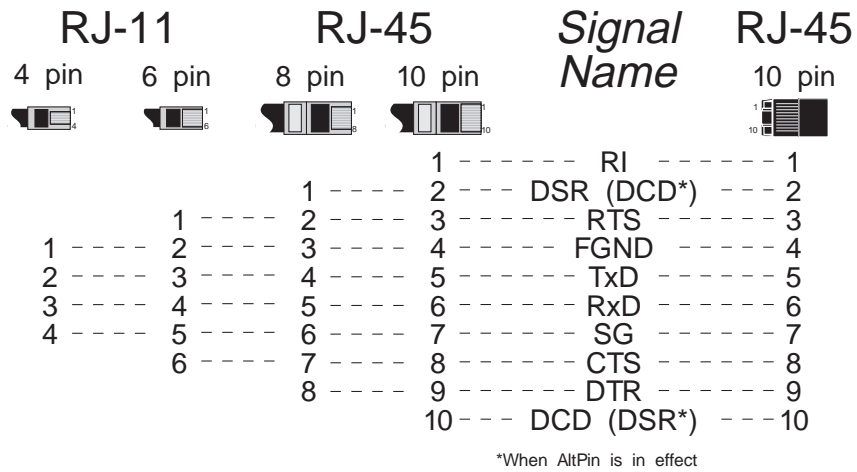
There are four types of modular plugs that can be used with the concentrator's RJ-45 10-pin jack. These are the 4 or 6-pin RJ-11 plugs, and the 8 or 10-pin RJ-45 plugs.

The 8 and 10-pin RJ-45 plugs are the same physical size, but the 10-pin version has one additional wire at each end of the row of contacts. Thus pins 1-8 of an 8-pin RJ-45 directly correspond to pins 2-9 of a 10-pin RJ-45 connector.

Similarly, the two RJ-11 plugs have the same physical dimensions, but the 6-pin version has an extra pin at each end. The RJ-11 plugs are physically smaller than RJ-45 plugs, but are designed so that they fit into the *center* of an RJ-45 jack. In this way, the four pins closest to the center of any size connector will always carry the same signals as the middle four pins of any other connector. The contacts of a 6-pin RJ-11 connector correspond directly to the middle six pins of an 8 or 10-pin RJ-45 connector, and so on.

The diagram below illustrates the relationship of the various modular plug configurations to Digi's standard 10-pin RJ-45 jack, and show which EIA-232 signals are available in each configuration.

Figure 26 Correspondence of Different RJ Plugs to RJ-45 Jack



RJ-45 to DB-25 Conversion

Figure 27

RJ-45 to DB-25 “Cable Leg”

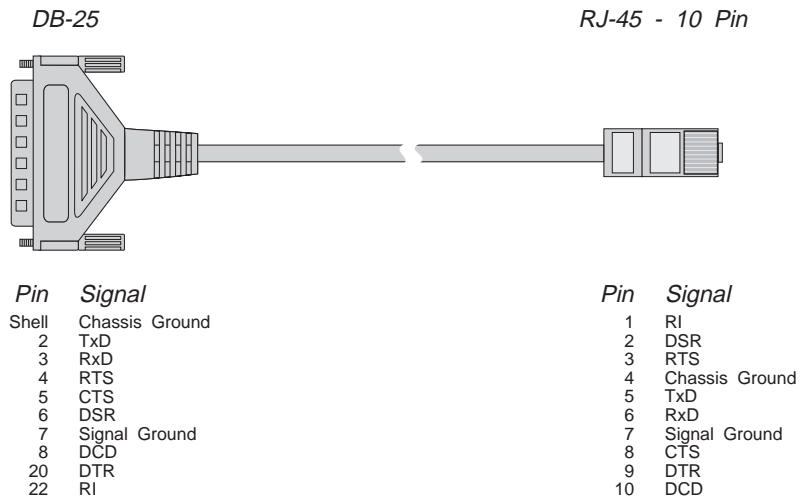


Table 4

Cable Leg Options and Part Numbers

| | DB-25 Male | DB-25 Female | DB-9 Male |
|-----------------------|------------|--------------|-----------|
| 24 Inch Cables | 61020024 | 61030024 | 61070024 |
| 48 Inch Cables | 61020048 | 61030048 | N/A |

Since most EIA-232 devices are equipped with DB-25 connectors, it is necessary to buy or build an adapter to transfer the signals to a DB-25 plug. The most simple and direct approach is to purchase ready-made “Cable Legs” from a Digi dealer or distributor. These are made with a full 10-pin RJ-45 plug (which can be difficult to obtain in the retail market), connected via a two or four foot cable to a DTE-configured DB-25 plug.

The pin configuration of the DB-25 connector on the Cable Leg is identical to that of the DB-25 connectors on the standard Digi DTE octa cable, and provides full modem control.

If you don't need full modem control, you can use one of the many commercially available RJ-45 to DB-25 adapters. These have both an 8-pin RJ-45 jack and a DB-25 plug in a housing no larger than that found on a standard DB-25 plug. The plug and jack are connected within the housing by jumpers which may be installed by the user in any desired configuration.

Diagnostics

Digi C/CON concentrators feature two methods of running their on-board diagnostic programs: Front Panel mode, where the tests are selected and executed by pushing the buttons on the control panel and reading the results on the LED indicators, or Video mode, which permits running the diagnostics from a serial terminal connected to either the first or last port of the concentrator.

Running Diagnostics from the Front Panel



Disconnect the concentrator from the host adapter and other concentrators before running diagnostic tests.

To run the internal diagnostic programs from the concentrator's front panel, turn the concentrator on and wait for the POST (Power On Self Test) to complete. While "P1" is displayed on the front panel, press either button on the control panel.

The first thing you should see is the concentrator's node number. This will be displayed in the form ***xn***, where *x* is the node number (e.g. **1n**, **2n**, etc.).

If you do not wish to change the node number at this time, press the right-hand button again to proceed to Test 1 without rewriting the node number.

Pressing the right-hand button repeatedly will cycle through all of the test numbers without executing the tests. To execute a test, press the left-hand button while the desired test number is displayed. The left-hand decimal point of the 7-segment display will be turned on to indicate that a test is in progress.

To stop running a test in progress, push the left-hand button for approximately 1 second (or until the left-hand decimal point in the 7-segment display goes off). The test will terminate, and the 7-segment display will show the test number preceded by "P" (pass) or "F" (fail).

To exit diagnostic test mode and return to the initialized state ("P1" displayed), run Test 9, the Watchdog Timer test. This test ends by resetting the concentrator and running the POST sequence.

Writing a New Node Number to EEPROM

The concentrator's node number can be changed while the current node number is displayed on the 7-segment display (e.g. **1n**, **2n**, etc.). If you wish to change the node number, press the left-hand button repeatedly until the desired node number appears on the display, then press the right-hand button to save it in EEPROM. If the new node number is successfully written to EEPROM, "**Pn**" will be displayed to indicate a "pass" condition. If the write operation failed, "**Fn**" will be displayed. See *Setting the Node Number* on page 21 for more information about node numbers.

Running Diagnostics from a Serial Terminal

Note!

Disconnect the concentrator from the host adapter and other concentrators before running diagnostic tests.

To run the internal diagnostic programs from a serial terminal, turn off the concentrator and connect the terminal to either port 1 or port 16 (use a cable similar to the one shown in Figure 21, on page 30). Set the terminal's communications parameters to VT-100 emulation, 9600 baud, 8 data bits, no parity and 1 stop bit. Now turn the concentrator back on, and wait for the POST (Power On Self Test) to complete. While "P1" is displayed on the front panel, press the letter "V" (either upper or lower case) on your terminal.

You will see the following screen:

```

          Diagnostics                               EPROM Version: 0226

          Test Name           Passes    ERRORS

A) - ALL TESTS.
1) - Front panel test.
2) - Memory test.
3) - Memory/DMA test.
4) - Async internal test.
5) - Async external test.
6) - Sync EIA-422/DMA test.
7) - Sync EIA-232/DMA test.
8) - EEPROM test.
9) - Watchdog timer test.

*****

Operator Commands:
<Y>/<N> - Stop on 1st error = Y
<B>ell  - Bell rings for each error = ON
<D>ump  - Dumps 256 bytes of the selected memory.
<ESC>ape - Stops the test in progress.
<S>et   - Sets the node number in EEPROM.
<T>oggle - External/Internal mode for EIA-422 & EIA-232 tests = INTERNAL

Enter the test selection or command:
```

Note:

Some terminals (including the Wyse 60) will not transmit data if their CTS (Clear To Send) line is LOW. They will only transmit if CTS is HIGH or floating. When using a fully-configured null modem cable, the terminal's CTS line is connected to the concentrator's RTS (Request To Send) line, which is held LOW by the concentrator until "AC" is displayed. This can prevent the terminal from communicating with the concentrator when attempting to run diagnostics.

The solution to this problem is to use a cable that does not have CTS (pin 5 of a DTE-wired DB-25 connector) connected at the terminal's end. The basic terminal cable shown in Figure 21 on page 30 is suitable for this purpose.

To run individual tests, enter the test number (1-9). To run all tests (except number 9—the Watchdog Timer test), enter "A". The screen will display the number of passes run for each test, and will halt if an error is detected (if "Stop on 1st error" is set to "Y"). To run tests continuously and keep a count of errors detected, press the "N" key prior to running tests.

Test execution may be aborted by pressing <Esc> any time during execution of the test. The current pass of the test will be completed and control will be returned to the terminal.

Pressing "B" toggles the bell option—when set to "ON", the terminal beeps each time an error is encountered.

Pressing "D" allows you to dump 256 bytes of the concentrator's memory to the screen, beginning with a specified address (you will be prompted for the starting segment address).

Pressing "S" allows you to view or change the concentrator's node number. The node number is written in 3 different EEPROM locations to ensure correctness of the number (triple redundancy).

Pressing "T" toggles the loopback mode for EIA-422 and EIA-232 tests (Tests 6 and 7) between INTERNAL and EXTERNAL. When set to INTERNAL, the signals are looped back internally by the relays in the concentrator. When set to EXTERNAL, a standard 8-wire daisy chain cable (such as the one shipped with the concentrator) must be installed between the concentrator's "Host Adapter" port and its "Remote" port.

Diagnostic Test Descriptions

Test 1: Front Panel Test

This test alternately turns all 10 LED indicators and all segments (plus the decimal point) of both 7-segment displays on and off at 1-second intervals to verify proper operation of the front panel indicators. Since the indicators are write only, the operator must visually verify success (or failure) of this test.

Test 2: Memory Test

Each pass of this test performs a pattern test and an address tag test to RAM.

The byte pattern is incremented for each pass and is displayed on LEDs 0-7 (TD-RI). The pattern is written to 32K bytes, beginning at 08000h. The pattern is written again to 32K bytes beginning at 10000h. The two 32K byte blocks are compared to determine pass or fail status of the test.

The address tag test writes 32K bytes beginning at address 08000h. Address 08000h will be written with 0h, address 08001h will be written with 1h, etc. This same tag pattern will be written beginning at address 10000h. The two 32K blocks are compared to determine pass or fail status.

Test 3: Memory/DMA Test

This test uses DMA0 to move data from one memory location to another. The byte pattern is incremented for each pass and is displayed on LEDs 0-7 (TD-RI). The pattern is written to 32K bytes beginning at 08000h. DMA0 is used to move the 32K bytes from 08000h to 10000h. When the move is complete, DMA0 interrupts the CPU and the two 32K blocks are compared to determine pass or fail status. If the DMA transfer is not completed within two seconds, a timeout error causes the test to fail.

Test 4: Async Internal Test

This test checks out the async ports. The test puts the port in local loopback mode. The four output signals (DTR, RTS, OUT1 and OUT2) are looped back (within the UART chip) to the four input signal lines (CTS, DSR, DCD and RI). These signals are checked for high and low conditions. The ports are initialized to 9600 baud, 8 data bits, 1 stop bit and no parity. Data is transmitted and received at the same port. Received data is compared to the transmitted data. An interrupt is generated and checked for each port.

Front Panel Mode

In front panel mode, all 16 async ports are checked in each pass. To begin the test, press the left-hand button while the number “4” is displayed in the 7-segment LED display. The left-hand digit of the 7-segment display shows a pass count. The first five LEDs (TD, RD, RTS, CTS and DSR) give a binary representation of the number of the port under test (TD=LSB; DSR=MSB). The test will be repeated until a failure occurs, or until the left-hand button is pressed. At this point, either “**P4**” (pass) or “**F4**” (fail) will be displayed. Press the left-hand button now to restart the test or the right-hand button to advance to Test 5.

Video Mode

In video mode, 15 async ports (2-16 if the terminal is connected to Port 1, or 1-15 if the terminal is connected to Port 16) are tested in each pass. In addition to the number of passes and errors, the display shows the number of each port under test, and its pass/fail status (a failure will also result in a beep from the terminal).

Test 5: Async External Test

This test is used to check the async ports and their associated driver and receiver circuits. Loopback connectors are required. These connectors enable one async port to transmit and receive data. First, the two control signals, DTR and RTS, are used to test the four input signals (DSR, DCD, CTS and RI) on the same port. DTR is looped back to DCD and DSR, while RTS is looped back to CTS and RI. The port is then tested for transmit and receive data. The port is initialized to 9600 baud, 8 data bits, 1 stop bit and no parity. Data is transmitted out of the port and received by the same port. Received data is compared to the transmitted data. This test functions differently depending upon whether it is run in video mode or front panel mode.

Front Panel Mode

In front panel mode, this test checks one port at a time. Only one loopback cable is needed. Pressing the left-hand button once will display the current port number to be tested. Pressing the left-hand button repeatedly causes the port number to be incremented through all 16 async ports. While the desired port number is displayed, press the right-hand button to begin execution of the test. The loopback cable must be installed on the selected port. The test will be repeated until a failure occurs, or until the left-hand button is pressed again. At this point, either “**P5**” (pass) or “**F5**” (fail) will be displayed. Once the test is halted, pressing the left-hand button again increments the port number, as before. To advance to Test 6, press the right-hand button while “**P5**” or “**F5**” is displayed.

Video Mode

In video mode, 15 async ports (2-16 if the terminal is connected to Port 1, or 1-15 if the terminal is connected to Port 16) are tested in each pass. For repeated testing, 15 loopback cables are necessary. In addition to the number of passes and errors, the display shows the number of each port under test, and its pass/fail status (a failure will also result in a beep from the terminal). To test a single port in video mode, plug the loopback cable into the port to be tested, and set “Stop on first error” to “YES”. If the port passes, 14 errors will be counted (for the 14 ports with no loopback cables). If the port fails, 15 errors will be reported. For repeated testing of a single port, front panel mode is recommended.

The loopback plug for RJ-45 versions (Digi part number 60000401) consists of a single 10-pin RJ-45 plug wired as follows:

- Pin 3 connected to pins 1 and 8 (RTS to RI and CTS);
- Pin 5 connected to pin 6 (TxD to RxD);
- Pin 9 connected to pins 2 and 10 (DTR to DSR and DCD).

For DB-25 versions, the loopback plug (Digi part number 60000442) consists of a female DB-25 connector wired as follows:

- Pin 4 connected to pins 22 and 5 (RTS to RI and CTS);
- Pin 2 connected to pin 3 (TxD to RxD);
- Pin 20 connected to pins 6 and 8 (DTR to DSR and DCD).

Test 6: Sync EIA-422/DMA Test

This test uses DMA0, DMA1 and the SCC 8530 sync port to transmit, receive and verify data via the EIA-422 circuitry. The byte pattern is incremented for each pass and is displayed on LEDs 0-7 (TD-RI). The pattern is written to a block of memory beginning at address 08000h. DMA1 (Tx), DMA0 (Rx) and the sync port are used to move the block of data from 08000h to 10000h. The test checks three modes of synchronous data transmission: 8-wire, 1.2 megabaud (32K byte blocks); 4-wire NRZI, 230K baud, (8K byte blocks); and 4-wire FM0, 460K baud (16K byte blocks). When the move is complete, the sync port generates an interrupt, and the two blocks are compared to determine pass/fail status. If the DMA transfer via the sync port is not completed within 2 seconds, a timeout error causes the test to fail.

Front Panel Mode

While “6” is shown on the 7-segment LED display, press the left-hand button to begin the test. The left-hand digit will now show the number of sync port receive interrupts and the right-hand digit displays the number of transmit interrupts. This test always runs in internal mode (no loopback plug is required), and checks the port in 3 modes of synchronous transmission. The test halts when an error is detected (“F6” will be displayed) or when the left-hand button is pressed again (“P6” will be displayed). At this point, pressing the left-hand button again restarts the test; pressing the right-hand button advances to Test 7.

Video Mode

In video mode, this test can be run with internal or external loopback. To select between internal and external mode, press “T” (Toggle). In internal mode, this test checks the port in 3 modes of synchronous transmission. In external mode, only one transmission method is checked (8-wire, 1.2 megabaud, 32K byte blocks). External mode requires a standard 8-wire daisy chain cable (such as the one shipped with the concentrator) to be installed between the concentrator’s “Host Adapter” port and its “Remote” port.

Test 7: Sync EIA-232/DMA Test

This test uses DMA0, DMA1 and the SCC 8530 sync port to transmit, receive and verify data via the EIA-232 circuitry. The byte pattern is incremented for each pass and is displayed on LEDs 0-7 (TD-RI). The pattern is written to 512 bytes beginning at address 08000h. DMA1 (Tx), DMA0 (Rx) and the sync port are used to move the 512 bytes of data from 08000h to 10000h at an SDLC rate of 19,200 baud. When the move is complete, the sync port generates an interrupt, and the two 512 byte blocks are compared to determine pass/fail status. If the DMA transfer via the sync port is not completed within 2 seconds, a timeout error causes the test to fail. An audible relay click will be heard upon entering and exiting this test. In video mode, this test can be run with either internal or external loopback, by pressing “T” (toggle) on the terminal. External mode requires a standard 8-wire daisy chain cable to be installed between the concentrator’s “Host Adapter” port and it’s “Remote” port.

Test 8: EEPROM Test

This test generates a checksum of the EPROM contents, and compares it with the checksum stored in the EEPROM. If the checksums match, the test passes. This test does not write to the EEPROM (EEPROM write operations only occur when a new node number is set).

Test 9: Watchdog Timer Test

This test checks out the watchdog timer. This is a hardware feature that is used to ensure system reliability. When the watchdog timer is loaded and enabled, the timer begins counting down. It is up to the system to keep reloading the timer to prevent it from expiring. If the timer expires, the hardware forces the CPU into a reset state and the POST sequence is started (exactly as if the concentrator is turned off and then on again). Normal test execution allows the timer to expire and force POST execution. The test fails after 1 second if the timer has not expired.

Specifications

Power Requirements

C/CON-16, C/CON-8 (External Power Supply)

| | |
|--------------------|-------------------------------------|
| +5 volts \pm 5% | 0.88 Amps typical, 1.2 Amps max. |
| +12 volts \pm 5% | 0.180 Amps typical, 0.225 Amps max. |
| -12 volts \pm 5% | 0.050 Amps typical, 0.225 Amps max. |

C/CON-16 Rack (Internal Power Supply)

| | |
|------------|------------------|
| Voltage: | 100-250 Volts AC |
| Frequency: | 60-50 Hertz |
| Current: | 0.5-1.0 Amps |

Environmental

C/CON-16

Ambient temperature 0° C to 55° C
Relative humidity 20% to 80%

C/CON-16 Rack

Ambient temperature 0° C to 50° C
Relative humidity 20% to 80%

Dimensions

C/CON-16

RJ-45 Version

| | |
|--------|-------------|
| Length | 12 inches |
| Width | 7 inches |
| Height | 2.25 inches |
| Weight | 2.7 pounds |

DB-25 Version

| | |
|--------|------------|
| Length | 12 inches |
| Width | 7 inches |
| Height | 4.2 inches |
| Weight | 4.1 pounds |

C/CON-8

RJ-45 Version

| | |
|--------|-------------|
| Length | 12 inches |
| Width | 7 inches |
| Height | 2.25 inches |
| Weight | 2.7 pounds |

DB-25 Version

| | |
|--------|-------------|
| Length | 12 inches |
| Width | 7 inches |
| Height | 2.25 inches |
| Weight | 2.25 pounds |

C/CON-16 Rack

| | |
|--------|-------------|
| Length | 17.5 inches |
| Width | 11.5 inches |
| Height | 1.75 inches |
| Weight | 7 pounds |

Daisy Chain Cables

Twisted pair, overall shield, 28 AWG. Capacitance 15.5 ± 3 pF/ft. Impedance 100 Ω /ft. Belden 8-wire (4 twisted pair) #9806, or Belden 4-wire (2 twisted pair) #9804. HD-15 subminiature connectors, 1 male (AMP #748364-1 or equivalent; contacts: size 22 male AMP #748333-5 or equivalent), and 1 female (AMP #748565-1 or equivalent; contacts: size 22 female AMP #748610-2 or equivalent).

Digi part number 62110120 (10 feet).

Terminator Plug

HD-15 subminiature male plug (AMP #748364-1, or equivalent; contacts: size 22 male AMP #748333-5 or equivalent) with the following pairs of pins wired together:

1-6, 2-7, 3-15, 4-9, 5-10, 8-14.

Digi part number 60000388.

Loop Back Plugs

The loopback plug for RJ-45 versions (Digi part number 60000401) consists of a single 10-pin RJ-45 plug wired as follows:

- Pin 3 connected to pins 1 and 8 (RTS to RI and CTS);
- Pin 5 connected to pin 6 (TxD to RxD);
- Pin 9 connected to pins 2 and 10 (DTR to DSR and DCD).

For DB-25 versions, the loopback plug (Digi part number 60000442) consists of a female DB-25 connector wired as follows:

- Pin 4 connected to pins 22 and 5 (RTS to RI and CTS);
- Pin 2 connected to pin 3 (TxD to RxD);
- Pin 20 connected to pins 6 and 8 (DTR to DSR and DCD).

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