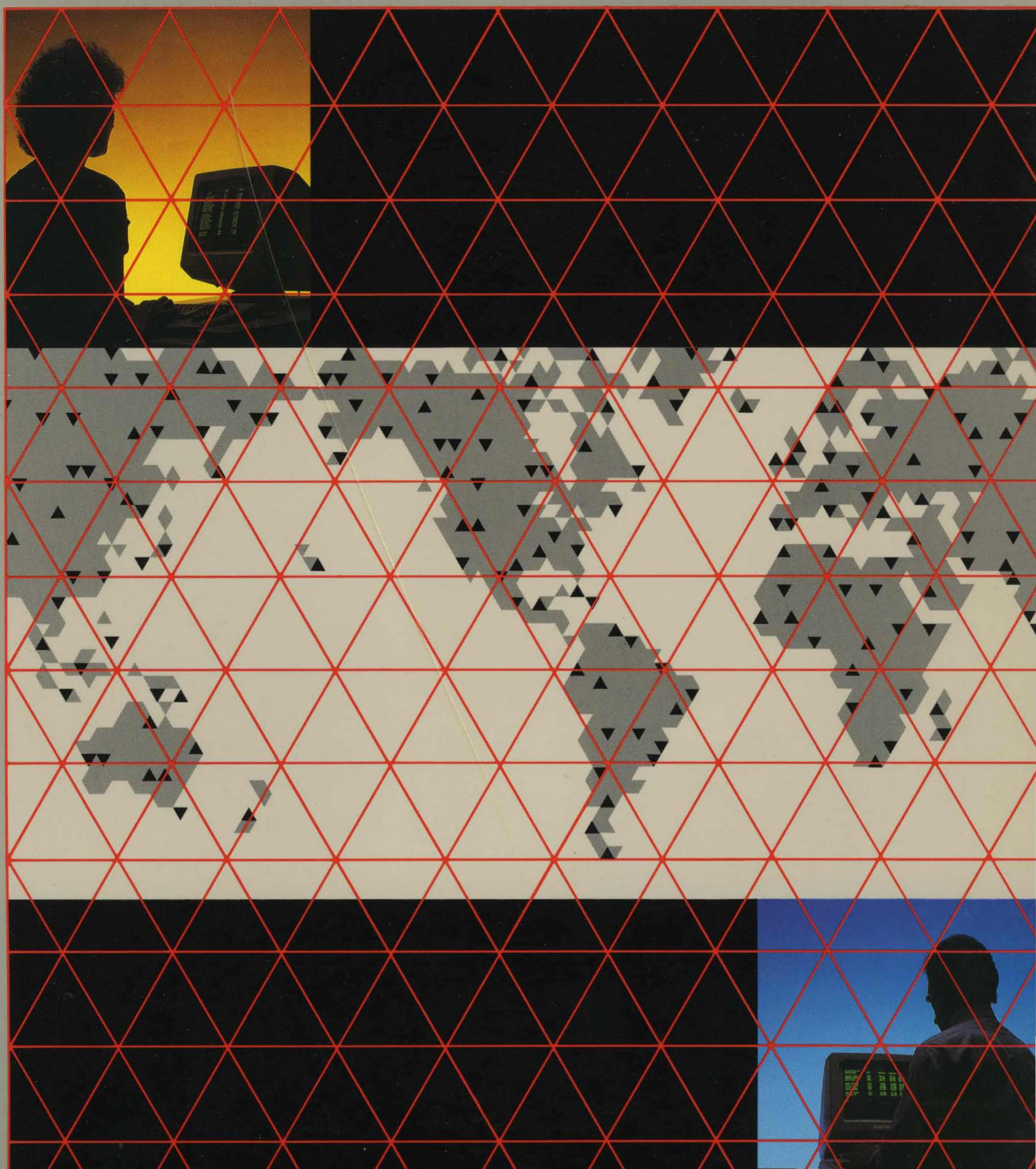
CDCNET Local Area Network

Installation Manual



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CONTROL DATA

CDCNET LAN

Installation Manual

Installation

Publication Number 60462870

Manual History

Revision	System Version/ PSR Level	Date
A	1.0/647	December 1985
B	1.2/678	April 1987
C	1.2.5	August 1987
D	1.3	April 1988

This packet, printed April 1988, updates this manual to revision D. The manual then reflects CDCNET through Version 1.3. The revision D packet includes the equation for calculating lengths of segment cables. The 802.3 transceiver installation procedure has been revised. Appendix B, Vendor Part Numbers, has been revised.

The Propagation Delay information, which formerly appeared in appendix C, has been deleted. Readers are referred instead, to appendix B of the System Guidelines of IEEE Std. 802.3-1985. Appendix I, LAN Product/Equipment Cross-Reference, has been revised and has been moved to become appendix C. Change bars identify new and revised material and pages.

Contents

Figures

Tables

About This Manual

This manual provides site planning, installation, and maintenance information for the local area network (LAN) of the CDC® Control Data Distributed Communication Network (CDCNET).

Audience

This manual is intended for site planners and network hardware installers responsible for the site planning, installation, checkout, and maintenance of the local area network.

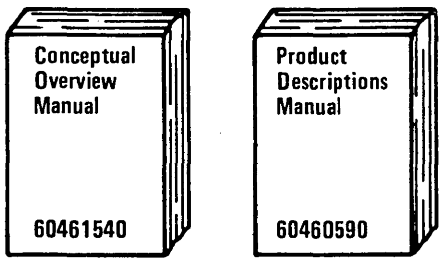
Organization

The information in this manual is organized under the following major sections and appendices:

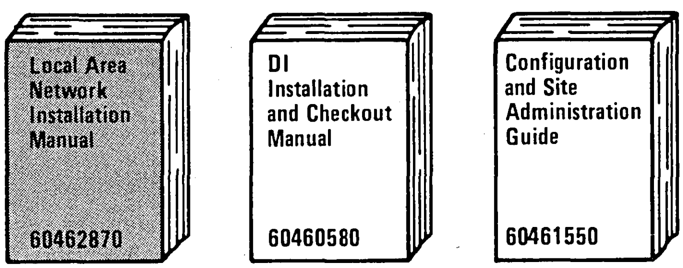
- Chapter 1 - Site Planning
- Chapter 2 - Installation and Checkout
- Chapter 3 - Maintenance
- Appendix A - Glossary
- Appendix B - Vendor Part Numbers
- Appendix C - CDCNET LAN Product/Equipment Cross-Reference
- Appendix D - Segment-Cable Specifications
- Appendix E - Network Configuration Layouts
- Appendix F - Site Requirements Survey Form
- Appendix G - Time Domain Reflectometer
- Appendix H - IEEE 802.3 and Ethernet V1.0, V2.0 Specifications Comparisons

Related CDCNET Manuals

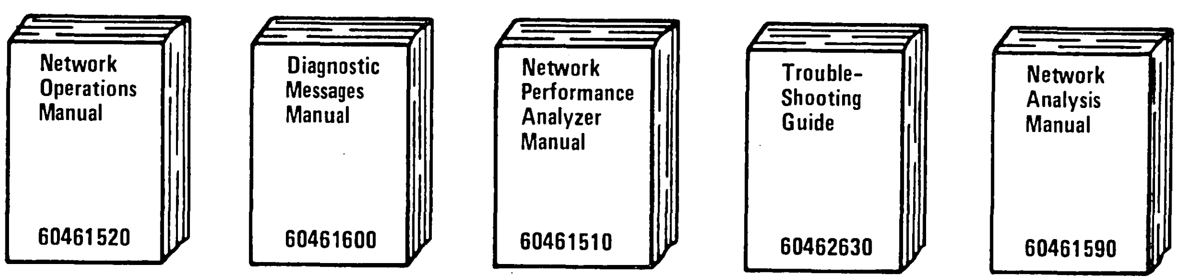
Background (access as needed):



Installation and checkout manuals:



Operating and troubleshooting manuals:



Additional Related Documents

The following documents provide additional information on local area networks:

- ANSI/IEEE Std 802.3 and ISO/DIS Std 8802/3 for Local Area Networks: Carrier Sense Multiple Acess with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.
- Ethernet[1] Specification Version 2.0: A Local Area Network Data Link Layer and Physical Layer Specifications.

Ordering Manuals

Control Data manuals are available through Control Data Sales Offices or Control Data Literature and Distribution Services, 308 North Dale Street, Saint Paul, Minnesota 55103.

Submitting Comments

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You can submit your comments on the comment sheet on the last page of this manual. If the manual has no comment sheet, mail your comments to:

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1. Select `Report a new problem or change in existing PSR` from the main SOLVER menu.
2. Respond to the prompts for site-specified information.
3. Select `Write a comment about a manual` from the new menu.
4. Respond to the prompts.

Please indicate whether you would like a written response.

1. Ethernet is a registered trademark of Xerox Corporation.

Site Planning 1

Site Planning 1

LAN System Overview

The CONTROL DATA® Local Area Network (LAN) implementation of CDCNET (an acronym for Control Data Distributed Communications Network) provides a high-speed communication network for data exchange between computers, data terminals, and other digital devices connected to the network. The area to be serviced by the network is usually within a single building or group of buildings in fairly close proximity. The transmission medium of the network consists of a coaxial cable segment (trunk cable) and related cable connectors, terminators, transceivers, transceiver interface cables, repeaters, and multiplexers (see figure 1-1). These components must be carefully planned and marked on a site configuration layout diagram for use by the installers of the network prior to the actual installation. The planner must also evaluate the restrictions imposed by the building lease, type of structure, facilities requirements, health and safety regulations, and provide for ease of future expansion.

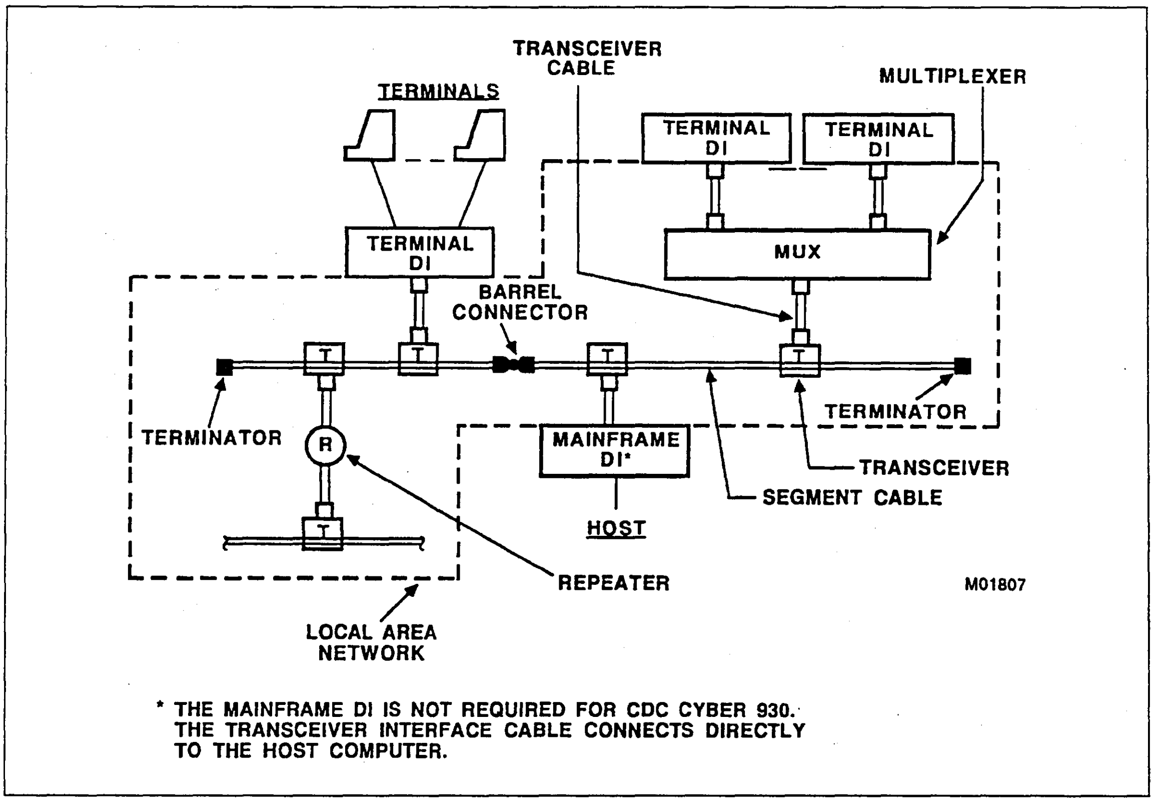


Figure 1-1. Basic LAN Configuration

The major activities involved in the planning and installation of the network are:

- Plan and design the cable route according to the distribution of the CDCNET device interface (DI) cabinets.
- Install the network cables.
- Install the network hardware.
- Commission the network hardware.
- Conduct a system acceptance test demonstration with the customer.

Network Components

The following paragraphs provide brief descriptions of the various network components. The associated Control Data product and/or part numbers as well as vendor product numbers for network components that have been tested by Control Data are also listed where applicable. (Refer to appendix B for additional vendors that provide network components. Refer to appendix C for a LAN product/equipment number cross-reference table.) The site planner must be familiar with these items to ensure that a properly designed network configuration is specified when planning the physical layout of the network. For information pertaining to propagation delay times that occur as a result of the various network components being used, refer to appendix B of the System Guidelines of IEEE Std. 802.3-1985.

Segment Cable

The segment cable (trunk cable) is a constant impedance coaxial transmission line that is used to interconnect the network devices via transceivers. The recommended cable is a Teflon[1]-coated coaxial cable having a characteristic impedance of 50 ±2 ohms. This impedance value and tolerance are critical to the proper operation of the network. The maximum length for the segment cable is 500 m (1640 ft). Note also that terminators must be installed at each end of the cable. Control Data coaxial cables are provided with N-connectors and terminators installed at each end of the cable. Refer to appendix D for detailed specifications on the type of cable recommended for use.

If possible, the total segment cable should be made from one homogeneous cable. Cable segments that must be built from smaller sections should be from the same manufacturer and lot number. If uncontrolled cable sections (mixed manufacturers or lot numbers) must be used to create a longer segment, the length chosen should be such that reflections do not have a high probability of adding in phase. Therefore, cable lengths that are odd integral multiples of half-wave lengths at 5 MHz are recommended.

1. Teflon is a trademark of the Dupont Corporation.

Control Data coaxial cables are available in four standard lengths. Lengths are determined using the following ISO/DIS relationship:

$$\text{Segment length} = \frac{\text{Cable propagation delay}}{\text{Data bit rate}} \text{ N}$$

Where: N = odd integer (1, 3, 5, 7 . . . 21)
Tolerance = ± 0.5m

Example: $$\frac{(0.78)3 \text{ X } 10^8}{(2)5 \text{ X } 10^6} \text{ 3} = 70.2\text{m}$$

The Control Data product numbers for the various lengths of Teflon and PVC coaxial cables (where n = 1, 3, 5, and 21) that meet the required specifications are shown in the following table.

Product No.	Length and Jacket Type
2634-23	23.4 m (76.8 ft) Teflon coaxial cable assembly (recommended).
2634-70	70.2 m (230.3 ft) Teflon coaxial cable assembly (recommended).
2634-117	117.0 m (383.9 ft) Teflon coaxial cable assembly (recommended).
2634-500	500.0 m (1640.4 ft) Teflon coaxial cable assembly (recommended).
2635-23	23.4 m (76.8 ft) PVC coaxial cable assembly (not flame-proof).
2635-70	70.2 m (230.3 ft) PVC coaxial cable assembly (not flame-proof).
2635-117	117.0 m (383.9 ft) PVC coaxial cable assembly (not flame-proof).
2635-500	500.0 m (1640.4 ft) PVC coaxial cable assembly (not flame-proof).

Any mix or match of the above cables can be used as long as the total length does not exceed 500 m (1640 ft).

Transceiver

A transceiver (figure 1-2) is the hardware device that connects directly to the segment cable (via its tap block). It provides both the electronics to send and receive the encoded signals on the cable and the required electrical isolation. When installed on the segment cable, each transceiver must be at least 2.5 ± 0.05 m (8.25 ± 0.165 ft) apart.

Figure 1-2 shows one type of transceiver and tap, Control Data product numbers 2630-1 and 2630-2. Figure 1-3 shows the 802.3 transceiver and tap, product numbers 2630-3 and 2630-4.

The transceiver receives 10 to 15 V dc power from the attached data terminating equipment (DI, ICA, repeater multiplexer and so on) through the transceiver interface cable.

The 802.3 transceiver includes a heartbeat (SQE) test that can be enabled or disabled. The heartbeat (SQE) test must be disabled when the transceiver is connected to an 802.3 repeater.

Five LEDs on the front of the 802.3 transceiver (2630-3) indicate power (PWR), signal quality error test (SQE) or heartbeat, transmit (XMT), receive (RCV), and collision presence (CP). These LEDs help the network troubleshooter to monitor network events.

NOTE

The segment cable is physically marked every 2.5 m (8.25 ft) to assist with transceiver placement.

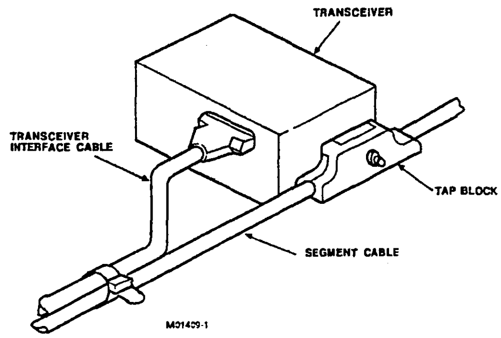


Figure 1-2. Transceiver (2630-1) and Tap Block (2630-2)

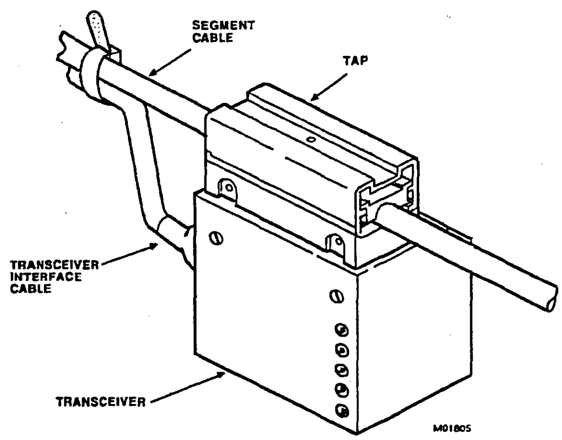


Figure 1-3. 802.3 Transceiver (2630-3) and Tap (2630-4)

Transceiver Interface Cable

The transceiver interface cable connects a transceiver to a device interface (DI), Integrated Communications Adapter (ICA), repeater, or multiplexer to allow access to the network. In normal usage, a single transceiver interface cable (figure 1-4) is used to connect any user device to a transceiver on the LAN segment cable. The maximum total length of interface cable attached to any one transceiver is 50 ± 0.05 m (164 ft). Control Data product and equipment numbers for the four standard lengths of interface cable are as follows. Refer to appendix H for a list of equipment numbers.

Product No.	Length and Jacket Type
2608-116	5 m (16.4 ft) 802.3 Transceiver interface cable, PVC (not flame-proof).
2608-133	10 m (32.8 ft) 802.3 Transceiver interface cable, PVC (not flame-proof).
2608-165	20 m (65.6 ft) 802.3 Transceiver interface cable, PVC (not flame-proof).
2608-100	50 m (164 ft) 802.3 Transceiver interface cable, PVC (not flame-proof).
2608-216	5 m (16.4 ft) 802.3 Transceiver interface cable, Teflon (recommended).
2608-233	10 m (32.8 ft) 802.3 Transceiver interface cable, Teflon (recommended).
2608-265	20 m (65.6 ft) 802.3 Transceiver interface cable, Teflon (recommended).
2608-200	50 m (164 ft) 802.3 Transceiver interface cable, Teflon (recommended).

NOTE

Theoretically, multiple lengths of interface cable could be connected together (chained), like extension cords, but each additional connector degrades reliability and performance. If chaining is deemed necessary to meet an unusual layout requirement, two lengths of cable may be chained, but a single length is preferred. Chaining of more than two lengths is not recommended. Also, the total length of 50 m (165 ft) should be reduced by 8 m (26.4 ft) for each additional transceiver interface cable used.

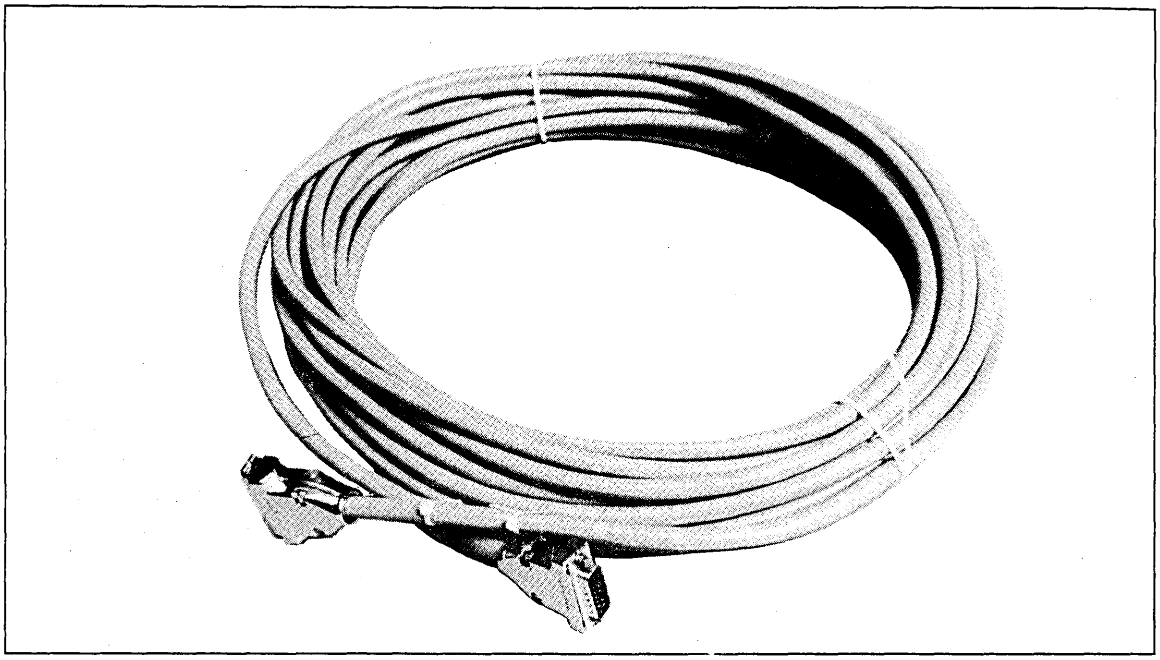


Figure 1-4. Transceiver Interface Cable

Device Interface

The device interface (DI) shown in figure 1-5 is available in several main variants. These variants are a function of both the physical configuration of the DI and the loaded software. Every DI variant consists of:

- Basic DI - Includes power supply and enclosure, a main processor board, and a bus structure for up to eight large and eight small PC boards.
- Memory - Available in increments of 1024K.
- I/O Interface - At least two I/O interfaces per DI.

Control Data offers the following DI variants to perform commonly required network functions.

Product No.	DI Variant
2621-2xx	Mainframe DI (MDI) - The MDI enables data to be transmitted between a 12-bit CYBER host channel and an Ethernet LAN. An MDI is not required by the CYBER 930 computer system, because an Integrated Communications Adapter (ICA), which is resident in the host computer, performs the functions of an MDI.
2622-20x	Terminal DI (TDI) - The TDI enables you to connect terminal devices to an Ethernet LAN.

Product No.	DI Variant
2620-2xx	Mainframe/Terminal Device Interface (MTI) - The MTI is a combination MDI and TDI that enables you to connect terminal devices directly to a CYBER host without using a LAN. Essentially, the MTI is an entry-level unit that may be used when a site has no more than 32 terminal devices and they are all located within approximately 50 m (164 ft) of the CYBER host. As your site adds to and disperses its network hardware, and eventually adds the Ethernet LAN capability, you can reconfigure the MTI into an MDI and TDI by using an MTI conversion kit.
2623-20x	Network DI (NDI) - The NDI provides access from CDCNET to other networks by using two types of connections. In one, it connects a remote CDCNET to a local CDCNET using medium-speed links such as High-Level Data Link Control (HDLC). In this case, the NDI acts as a relay unit in an essentially unified network. Alternatively, the NDI software may contain a special gateway to connect CDCNET to an outside network based on other architectures.
2624-2xx	Remote Terminal DI (RTI) - The RTI functions as a remote line concentrator for up to 31 RS-232 lines. At least one line must be connected to a dedicated HDLC link (4800 bps to 64 Kbps). The HDLC link may be an RS-232, RS-449, or V.35 line.

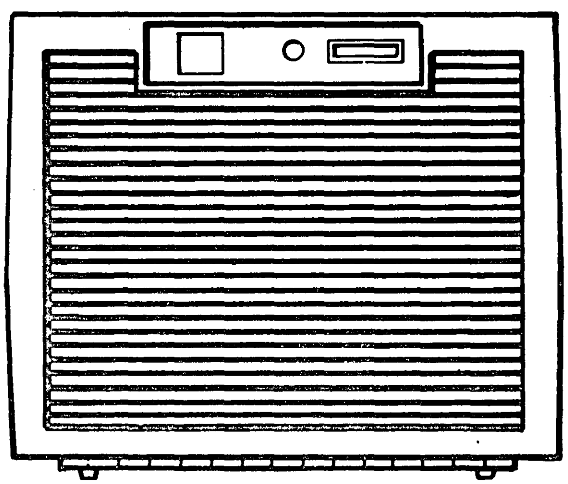


Figure 1-5. Device Interface

Repeater

The 802.3 repeater, Control Data product number 2632-1 (figure 1-6), provides the means of connecting together two segments of a local baseband 10 Mbps CSMA/CD network in compliance with IEEE 802.3 standards. It thereby extends the network beyond one 500-m (1640-ft) length of coaxial cable.

The repeater is connected to each segment of Ethernet coaxial cable via a transceiver interface cable and a transceiver described earlier in this chapter. To comply with IEEE 802.3 standards, transceivers without Heartbeat (SQE) test must be used.

The repeater meets ISO DIS 8802/3 and IEEE 802.3 standards.

The repeater is fully enclosed with sheet metal for wall or 48.2-cm (19-in) shelf mounting or for free-standing use. Front panel lamps indicate internal power, packet activity, and partitioning of port 1 and port 2.

Physical Specifications:

Height: 7.5 cm (2.9 in)

Width: 43.0 cm (16.9 in)

Depth: 26.0 cm (10.2 in)

Environmental Considerations:

Ambient temperature: 0 to 40°C (32 to 104°F)

Humidity: 10 to 95% noncondensing

Power Requirements:

Power inlet: IEC 320

Fuse protection: Double-pole, 1-A antisurge for 110- through 120-V ac; 0.5-A antisurge for 220- through 240-V ac

Mains operation: 98- through 132-V ac or 198- through 264-V ac at 50 through 60 Hz

Power consumption: 50 VA maximum

A transceiver is attached to each of the two coaxial segment cables at any of the transceiver placement marks on the segment cables. The interface cables from each of the two transceivers are then attached to the repeater. The maximum number of repeaters between any two communicating transceivers on the network is two. This restricts the maximum separation of any two DIs to 1800 m (5940 ft) [three 500-m (1650-ft) segment cables plus six 50-m (165-ft) transceiver interface cables]. However, many repeaters can be used to create branches as required. An exception to the 1800-m (5940-ft) limitation is when a fiber optic link is used for an interconnection between two coaxial cable segments. The fiber optic link provides for an additional separation of up to 1000 m (3300 ft), or a maximum separation of 2800 m (9240 ft) between any two DIs in the network. Refer to the typical network configuration diagrams in appendix E for pictorial examples of repeater usage.

ID: RPTR

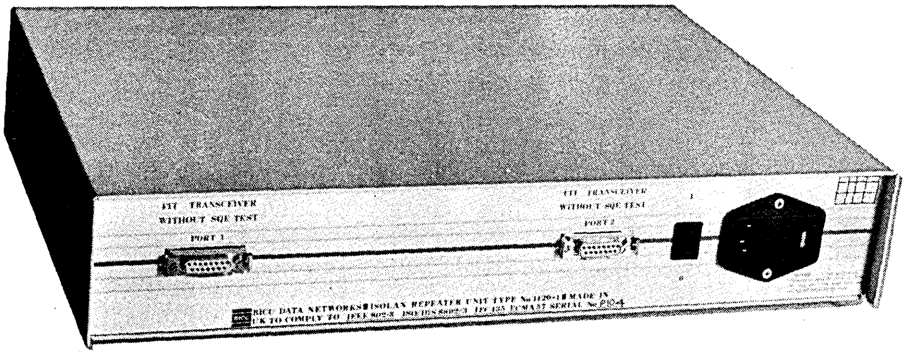


Figure 1-6. 802.3 Repeater

Multiplexer

The 802.3 multiplexer, Control Data product number 2631-2 (figure 1-7), provides a simple and flexible method of grouping up to eight Ethernet services.

ID: MUX

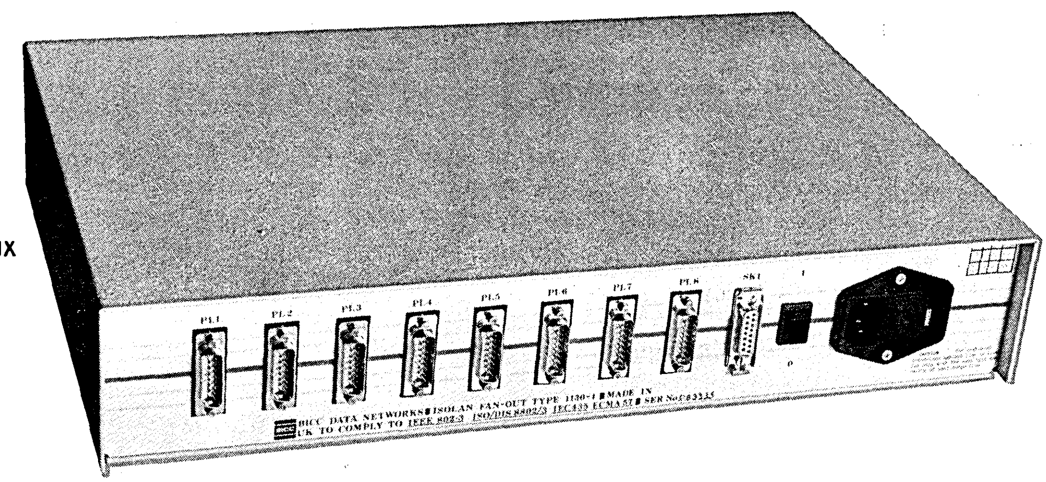


Figure 1-7. 802.3 Multiplexer

The multiplexer provides eight ports for connection of external data processing equipment and one port for connection to a transceiver. Figures 1-8 and 1-9 show how a single multiplexer can be configured into networks with and without an Ethernet coaxial cable. Connections are made using transceiver interface cables described earlier in this chapter.

When the multiplexer connects to an Ethernet coaxial cable (figure 1-8), the connection to the coaxial cable is made through an Ethernet transceiver, which complies with IEEE 802.3 standards. The maximum distance between a DI and the transceiver is 40 m (131.2 ft).

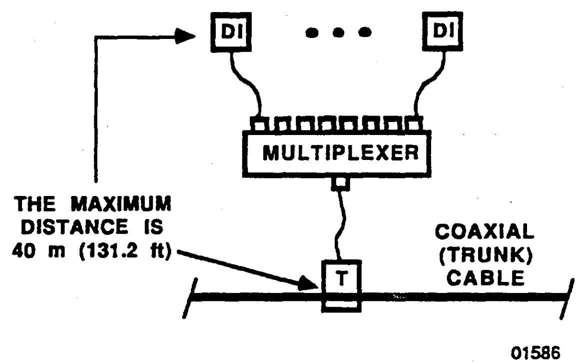


Figure 1-8. Cable Network Using a Single Multiplexer

If the transceiver is not present (figure 1-9), the unit automatically self-configures to operate without the Ethernet cable (standalone or loopback mode). The maximum distance between a DI and the multiplexer is 50 m (164 ft). Using a single multiplexer, cableless networks of up to 100 m (328 ft) in diameter can be configured. When used in this way, the multiplexer simulates the functions of a transceiver except for jabber control and its operation is transparent to the connected equipment. In a cableless or standalone network using a single multiplexer, the maximum length of any transceiver interface cable is 50 m (164 ft).

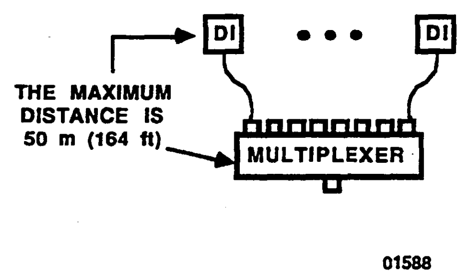


Figure 1-9. Cableless Network Using a Single Multiplexer

Multiplexers may be connected in series (cascaded) if more than eight ports are required. Figures 1-10 and 1-11 show how multiplexers can be cascaded when used in networks with and without an Ethernet coaxial cable. When multiplexers are cascaded in a cable network, the maximum distance (50 m or 164 ft) between a DI and the transceiver is decreased by 10 m (32.8 ft) for each multiplexer used. When multiplexers are cascaded in a cableless network, the maximum distance (1000 m or 3280 ft) is decreased by 10 m (32.8 ft) for each multiplexer used.

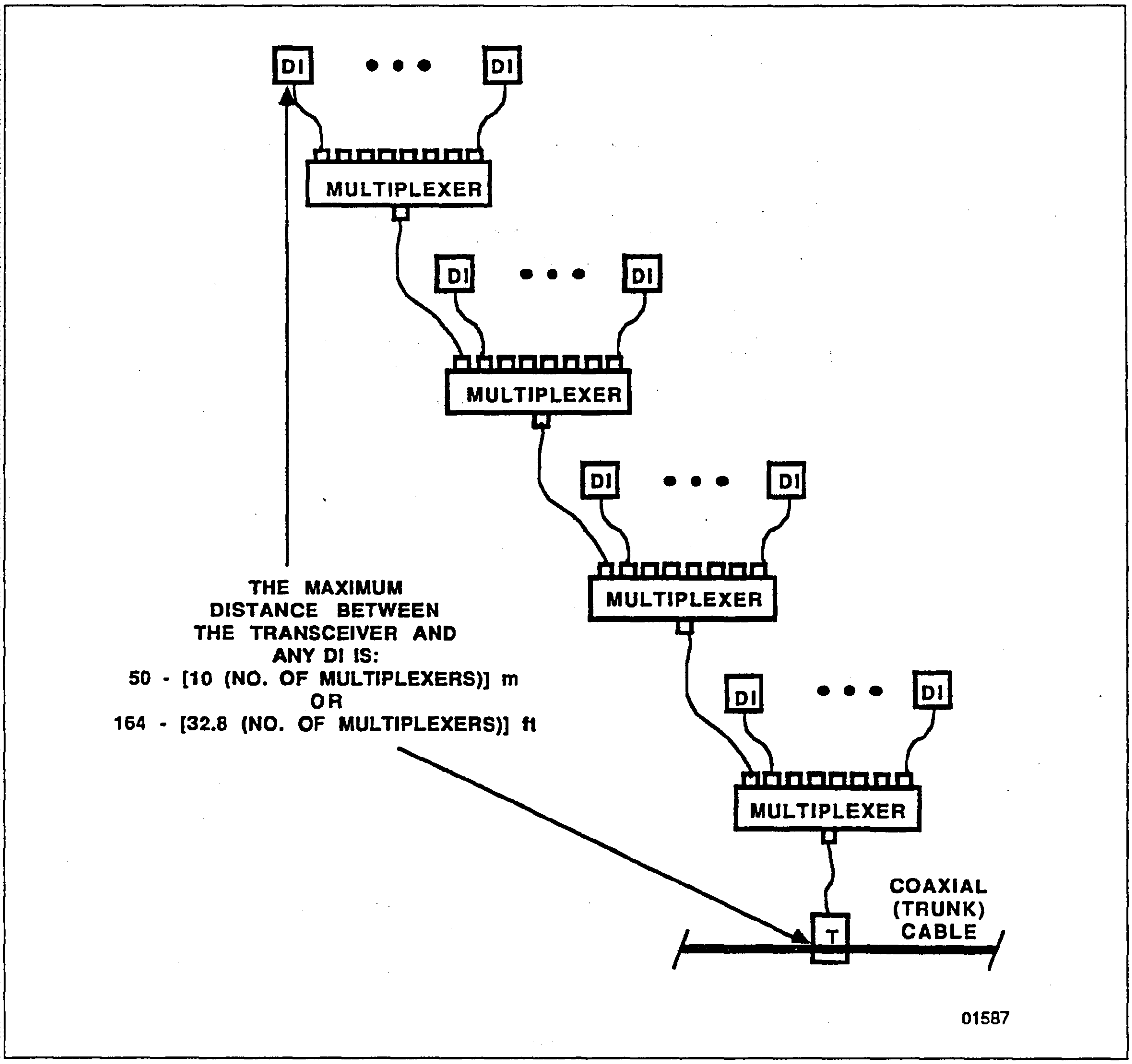


Figure 1-10. Cable Network Using Cascaded Multiplexers

Stated in mathematical terms, the maximum permissible length of cable between a DI and the transceiver in a cable network, or between two DIs in a cableless network is:

Maximum (meters) = 10*(no. of multiplexers) + sum of transceiver cable lengths

Maximum length for a cable network = 50 m
Maximum length for a cableless network = 1000 m

Maximum (feet) = 32.8*(no. of multiplexers) + sum of transceiver cable lengths

Maximum length for a cable network = 164 ft
Maximum length for a cableless network = 3280 ft

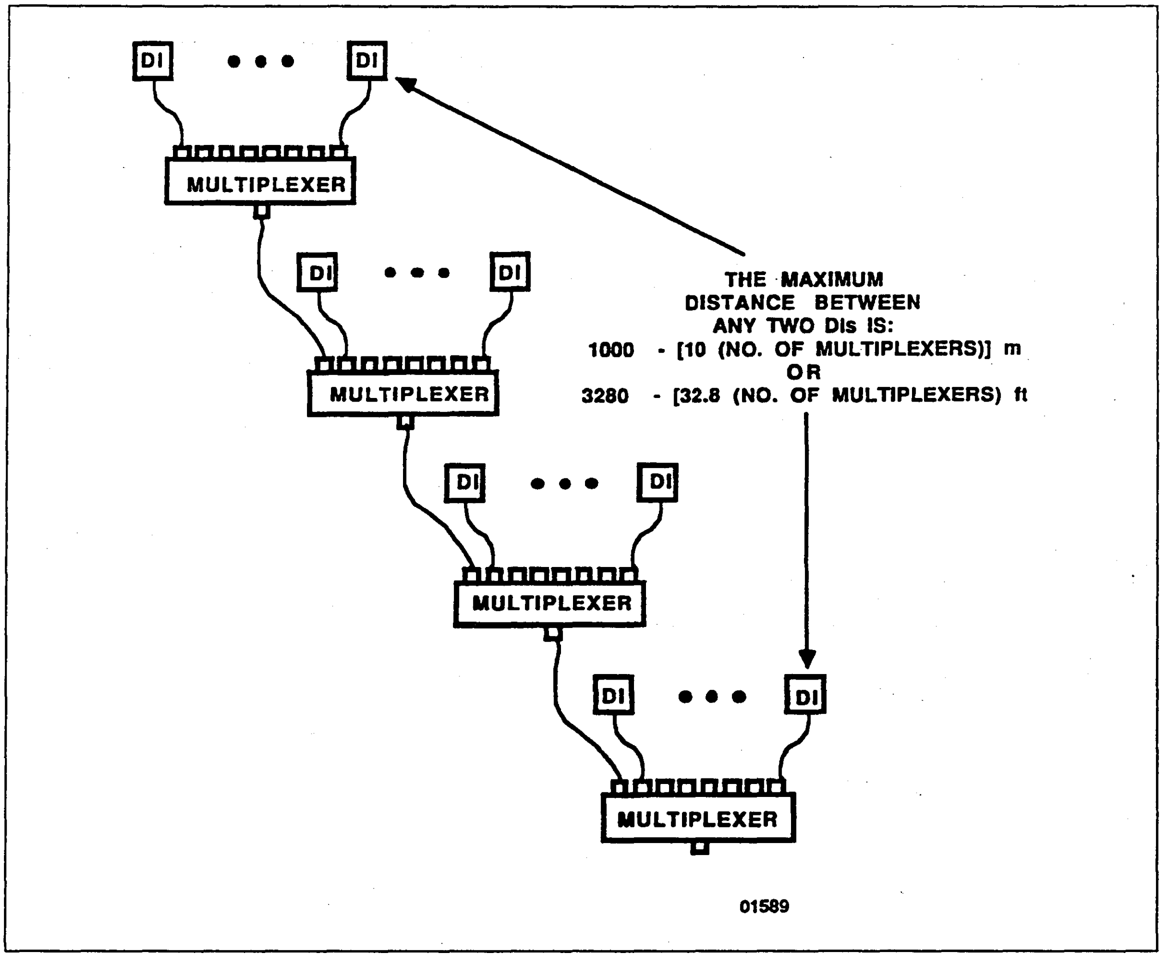


Figure 1-11. Cableless Network Using Cascaded Multiplexers

The multiplexer is fully enclosed with sheet metal for wall-mounting or 19-in shelf mounting, or for free-standing use. Front panel lamps indicate internal and transceiver power, packet activity, and loopback status.

Physical Specifications:

Height: 7.5 cm (2.9 in)

Width: 43.0 cm (16.9 in)

Depth: 26.0 cm (10.2 in)

Environmental Considerations:

Ambient temperature: 0 to 40°C (32 to 104°F)

Humidity: 10 to 95% noncondensing

Power Requirements:

Power inlet: IEC 320

Fuse protection: Double-pole, 1-A antisurge for 110- through 120-V ac; 0.5-A antisurge for 220- through 240-V ac

Mains operation: 98- through 132-V ac or 198- through 264-V ac at 50 through 60 Hz

Power consumption: 50 VA maximum

Cable Connectors

The following cable connectors are typical connectors for use in the network (see figure 1-12).

- Cable connector; type N male plug connector, Control Data part number 15386115
- Cable connector; type N female barrel connector Control Data part number 15386110
- Cable connector; type N 50-ohm terminator Control Data part number 15386105

Note that terminators must be installed at each end of the coaxial segment cable. The LAN will not operate correctly without them.

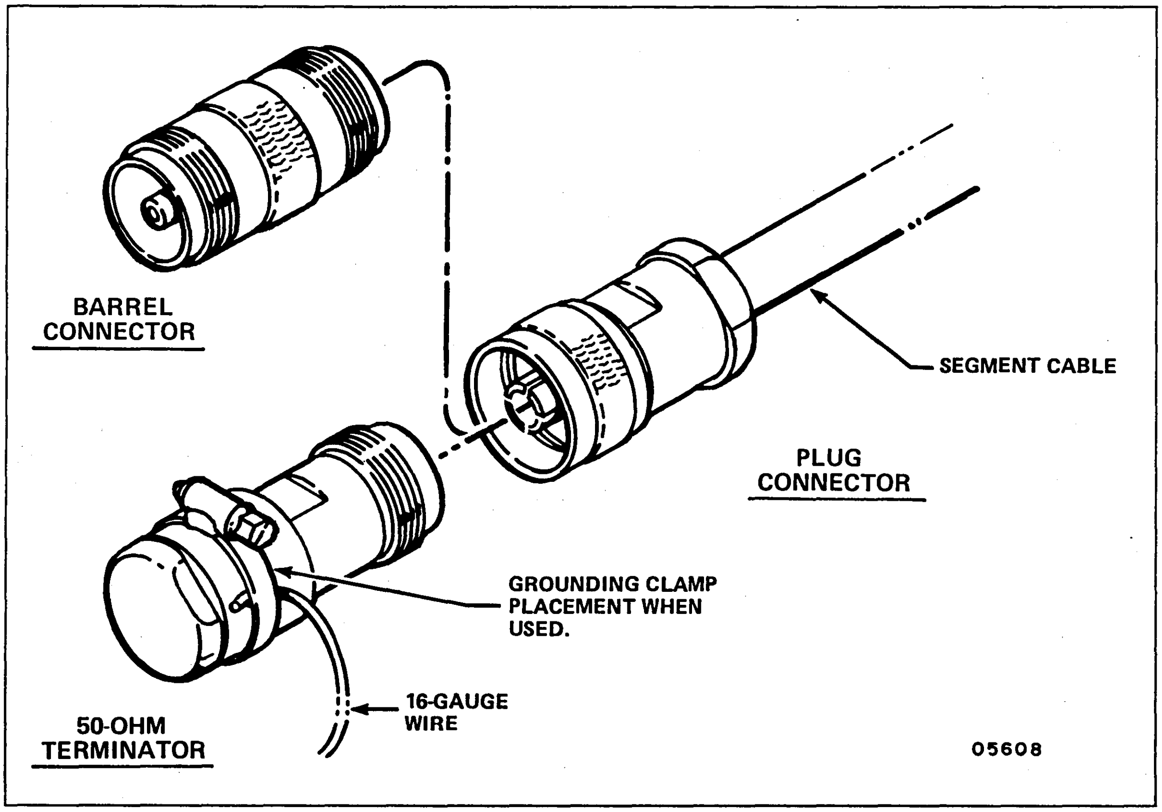


Figure 1-12. Coaxial-Cable Connectors

Grounding Clamp

The braid shield of the segment cable must be grounded only once per segment. The grounding clamp (figure 1-13) should be attached to a barrel connector or a terminator connector, and grounded via a 16-gauge bare copper wire to the nearest incoming mains feeder. Attaching the grounding clamp to a terminator connector is recommended. Refer to figure 1-12 for method of attachment. The Control Data part number for the grounding clamp is 94275202.

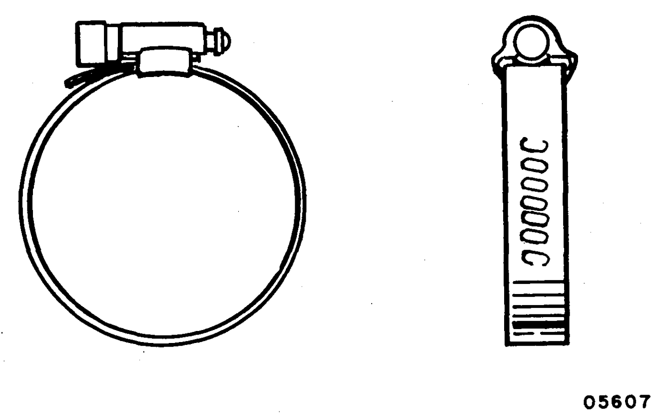


Figure 1-13. Coaxial-Cable Grounding Clamp

Miscellaneous Items

The following kits are available to aid in the installation of the network components. Refer to the installation and checkout section for procedures regarding their use.

Cable-Tap Tool Kits

The cable-tap tool kit (figure 1-14) for installing the 2630-2 tap block includes three separate hand tools that allow the installer to drill holes into the segment cable for the attachment of transceivers. The kit consists of a coring tool, a shield removal tool, and an insulation-piercing tool. The Control Data part number for this kit is 53585366.

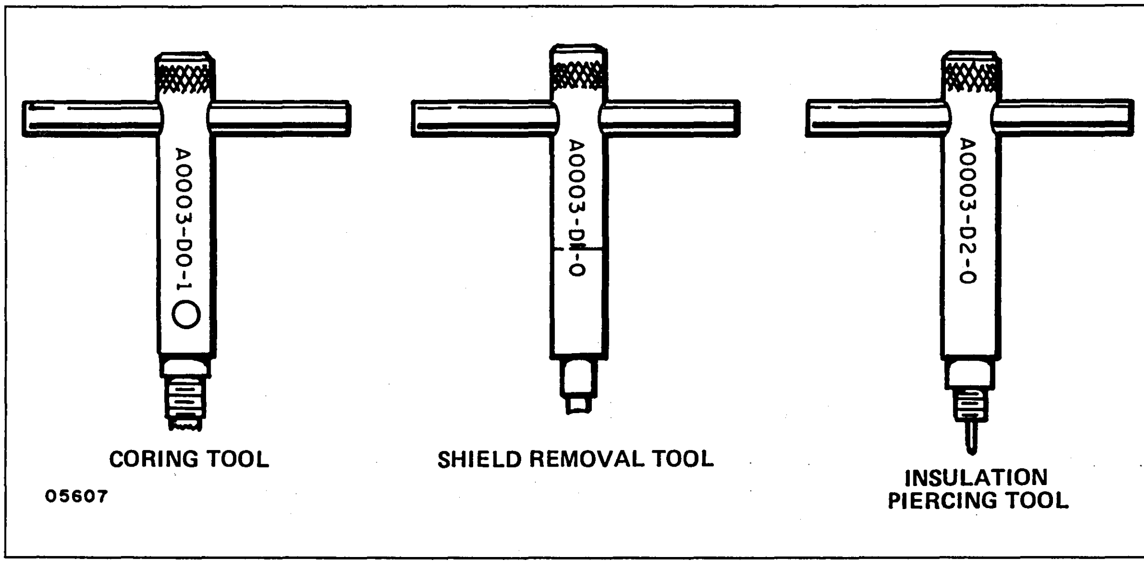


Figure 1-14. Cable-Tap Tool Kit for 2630-2 Tap Block

The cable-tap tool kit (figure 1-15) for installing the 802.3 transceiver and tap block (Control Data products 2630-3 and 2630-4) includes a 1/8-in Allen wrench and a hand tool. The hand tool has a drill bit at one end for drilling holes in the segment cable and a socket wrench at the other end for tightening the center probe of the tap. The Control Data part number of this kit is 22137341.

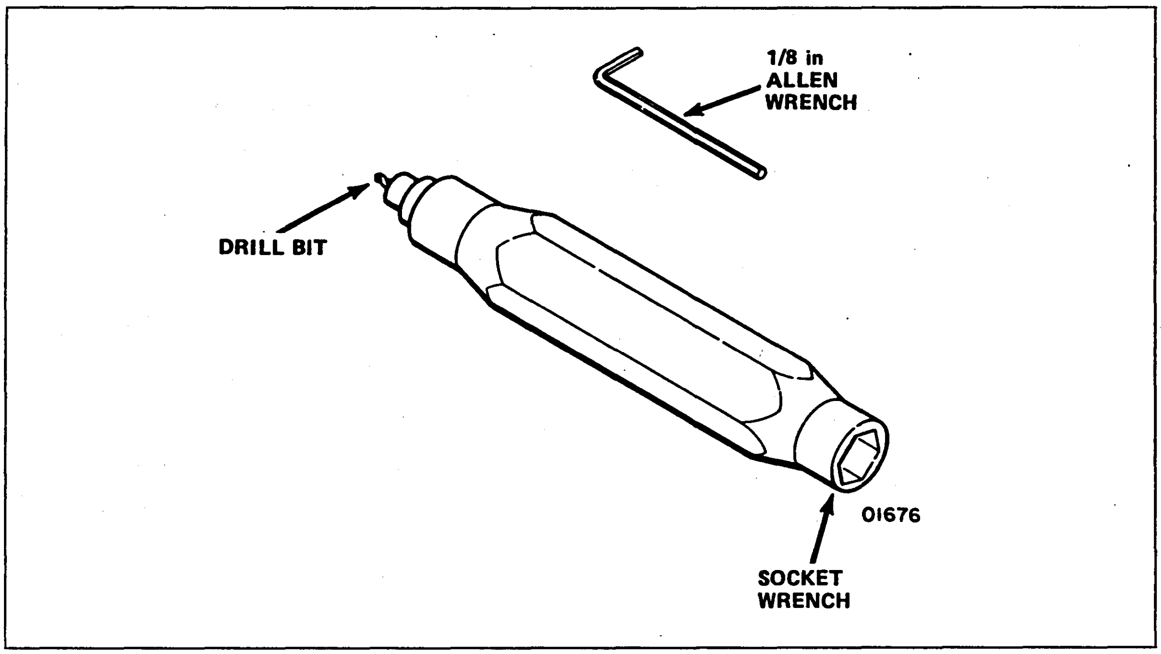


Figure 1-15. Cable-Tap Tool Kit for 2630-4 Tap Block

Splice Kit

The splice kit (Control Data part number 53585364) is used to repair faulty coaxial cables and to add additional lengths of cable. The Control Data product number for the splice kit is 2633-1. The kit consists of:

- Two type N male plug cable connectors
- One type N female barrel connector
- 30.48 cm (12 in) of 1.90-cm (0.75-in) diameter insulation sleeving

Terminator Kit

The terminator kit (Control Data part number 53585365) contains terminators and related hardware needed to terminate each end of the coaxial segment cable with a characteristic impedance load of 50 ohms. It also contains grounding clamps and wire for grounding the segment cable. The Control Data product number for the terminator kit is 2633-2. The kit consists of:

- Two type N 50-ohm terminators
- Two type N male plug cable connectors
- 60.96 cm (24 in) of 1.90-cm (0.75-in) diameter insulation sleeving
- 91.44 cm (36 in) of 16-gauge solid copper wire
- Two grounding clamps

Physical Layout of Network

When planning and designing the physical layout of the network, the type of building structure, the type of occupancy, the local building regulations, and the network configuration specifications must be taken into consideration. These topics are discussed in greater detail in this subsection to provide:

- General guidelines for installing a network within an existing or a new building.
- General information on common building types so that the designer/planner can evaluate the building for installation feasibility.
- A general guide to the cable routing environment.
- A description of the equipment connection methods to aid the designer/planner in selecting the appropriate method and to develop an installation plan based on the connection method.
- A procedure for layout of the network system components and equipment on the customer floor plan.
- A procedure for designing a schematic drawing that shows the network system configuration.

Existing Buildings

When a customer occupies only part of a building, it may be to the customer's advantage to cable the entire building. The building owner and any other occupants should be contacted for their approval. Cooperation between the parties could be of mutual benefit to all. The building owner would be able to regard the facility as a future asset by enhancing its market value. It would also provide the other occupants with networking capabilities at a much reduced installation cost.

New Buildings

New buildings provide a unique opportunity for installing network systems. Provisions can be made by the architect for concealed ducting to accommodate the segment and drop cables, and data ports can be provided as required in each office. One (or more) central points could be allocated to house the shared services (such as data files, communications, and printing), where extra cabling requirements and outlets are required.

Network Site Requirements

Office buildings, warehouses, and manufacturing premises vary considerably in construction. The designer/planner must survey the site thoroughly with assistance from the site service manager or other authorities responsible for the customer's premises. This authority should have detailed knowledge of the services existing in the building.

The network site requirements survey form (appendix F) is designed to help with the site evaluation. It is necessary to analyze the site to determine the following:

- Type of occupancy
- Type of structure
- Cable network environment
- Cable routing method
- Equipment connection method
- Floor plan layout
- Schematic layout

These items are discussed in the following paragraphs:

Type of Occupancy

Is the building owned or leased by the customer? If leased, are there restrictions in the lease that prohibit installation of segment cables or restrictions as to how the segment cable is installed?

The type of occupancy may also have some effect on the installation of the cables. Outright ownership of the facility should present the fewest restrictions. A lease could be very restrictive. Leases may permit only the building owner's personnel to install the cable or cause the tenant to submit plans of the intended installation for approval.

Type of Structure

The following building characteristics need to be investigated.

- Building construction: Building structure is the largest factor affecting the cost of cable installation. Newer facilities usually have T-bar suspended ceilings that are most suitable for routing the segment cable, along with usable risers between floors in multistory buildings. Few structural modifications are required in these types of buildings to incorporate the network. However, concealed spline ceilings are common in modern high-rise buildings and can cause an access problem.
- The number of floors the network equipment will occupy. If the network equipment is to be located on two or more floors, special attention must be given to the method of floor penetration. Existing risers may be available for passing the segment cable through from floor to floor. In a crowded riser, fiber optics may be used. If no risers are available, other methods must be identified. Concrete core drilling, wireways, conduits, air ducts, etc., should be considered. The facilities manager or a local contractor may provide advice on this issue.

CAUTION

The building must have sufficient lightning protection to safeguard its contents. Tall wooden structures are vulnerable to penetration. For protection, contact a local electrical contractor who specializes in lightning conductors.

Cable Network Environment

The coaxial cable must be installed to meet local codes, aesthetic values, security, cost criteria, environmental and maintainability requirements, and the physical limits of the equipments to be attached. Before proceeding with the installation of the cable network and its associated components, the route must be carefully planned, along with the location of the transceivers, repeaters, and other associated devices. Prior to drawing up the plans, a detailed site inspection must take place in order that the best route be chosen. The route must be so planned that it will comply with the following:

- Cables should not be exposed to the possibility of being struck by lightning.
- Avoid areas where electrical noise is present: High-power electrical plants may produce switching transients and radio frequency emissions that may induce interference on the segment cable. However, this will not normally produce data errors in the system that are perceptible to the user, because of the construction of the cable and the error detection capability of the network. It is recommended that a minimum separation of 10 m (33 ft) be maintained between the network cables and any source of high-energy emissions (such as elevator contactors, arc lighting or uncompensated fluorescent lighting, electrical welders, ac substations, generators, and commutators). It is a good practice to avoid running signal lines parallel to and within 7.62 cm (3 in) of power wiring for distances of more than 30 cm (1 ft).
- Avoid areas where mechanical damage is likely: This is an obvious precaution but, nevertheless, must be highlighted, as prolonged downtime on data networks cannot be tolerated. Network systems will not necessarily be confined to an office environment and must be protected accordingly.
- The most accessible route: Easy access to the cables is important in order that the network may be easily extended or rerouted, or damaged sections swiftly replaced.

- The route least likely to be disturbed: The segment cable should be laid in sections to allow break points for system troubleshooting and testing purposes and to enable network enlargement and enhancement. The separate sections are joined using standard N-series coaxial connectors. These connectors once installed should be disturbed as little as possible.

- The shortest route: The shorter the route, the lower will be the probability of physical cable damage and the cost of installation.

- Identification of segment cables: Whenever segment cables co-exist in an area, they must be appropriately labeled to avoid misidentification. Labeling should be implemented to allow easy identification. Recommended usage is for at least one label per each visible cable section and at least one label per every 8 m (26.4 ft) of cable installed in one area.

Cable Routing Method

Several possibilities exist for routing the segment cable. The cable can be routed above a suspended ceiling, under the floor, in floor trunking, in the wall, or on the wall. The preferred installation is to route the cable above the ceiling, out of the way. Investigate each of the following cable routing methods:

NOTE

The segment cable can only be grounded at one point on the cable. Therefore, insulate transceivers and metal connectors to prevent their contact with ground. Avoid bolting transceivers to I-beams or other grounded supports.

- Suspended ceilings: Segment cable can easily be installed in the suspended ceiling in areas where the ceiling tiles can be removed for access. Firewall penetration may be required and should be noted on the installation floor plan (ensure that the local fire regulations are obeyed). The segment cable can be attached by tie wraps to the ceiling hangers every 2 to 3 m (6.6 to 9.9 ft), for support.

- Floor conduits: Many concrete floor structures have wireways running in the floor that can be used to route sections of segment cable that do not have transceiver taps connected. The segment cable must not, however, be bent to less than a 250-mm (10-in) bend radius, and must not be crushed or crimped.

- Raised floors: The segment cable can be laid under the floor in the normal manner. Again, however, care must be taken not to crush, crimp, or bend the segment cable to less than a 250-mm (10-in) bend radius.

- Return air plenums: Many new structures use the suspended ceiling space for return air plenums. Local fire regulations are very restrictive of PVC-type cable, so caution must be used if specifying PVC segment cable. Teflon cable is rated for this type of environment and is recommended for use by Control Data. It is advised that standard PVC cable should not be laid in air plenums.

- Between buildings/hazardous environments: See the following caution.

CAUTION

The segment cable may only pass outside buildings if it is fully protected from being struck by lightning. An optical fiber-based inter-repeater link should be used for connection of the network through hazardous environments (that is, environments not protected from lightning, electrical noise, extreme temperatures, structures requiring the minimum of removed material, or high security paths). The fiber cable also requires use of a special fiber optic transceiver. Control Data, however, does not provide these items. Refer to appendix B for information on suppliers and manufacturers of fiber optic devices.

Equipment Connection Method

Two methods are recommended for running the transceiver interface cable from the transceiver to the DI, multiplexer, repeater, or host computer. These are:

- The transceiver interface cable can be suspended from the ceiling or wall and attached to the equipment.

- The transceiver interface cable can be routed inside a wall, through an outlet (data port), and then attached to the equipment by a separate cable. For this method, ensure that continuity of the cable shield exists.

Floor-Plan Layout

Once the building structure has been evaluated to determine where the cables will be routed (for example, above the ceiling, under the floor, or in the walls), you are ready to lay out the network on a floor plan, as follows:

1. Carry out survey: Complete the network site requirements survey form (appendix F). This form is to be submitted to the Control Data Computer Network Services representative (or other customer network services representative), together with the floor plan. Write in any pertinent information or comments you have concerning the facility.

2. Obtain floor plan: Obtain a floor plan from the facilities manager, architect, or other appropriate source. If no floor plan is available, it is the customer's responsibility to have one made, or a sketch can be drawn and measurements appropriately noted. The floor plan is used to show the layout of the segment cable between devices and to compute its total length. This helps to determine the size and number of cable sections to order, as well as the other network components that are required.

3. Identify network equipment locations on floor plan: Identify all network equipment locations on the floor plan. For cable layout planning purposes, future user devices should be identified as well. Device symbols and abbreviations are shown in figure 1-16. Number each equipment label with its own unique identification number and indicate this number on the floor plan for that device.

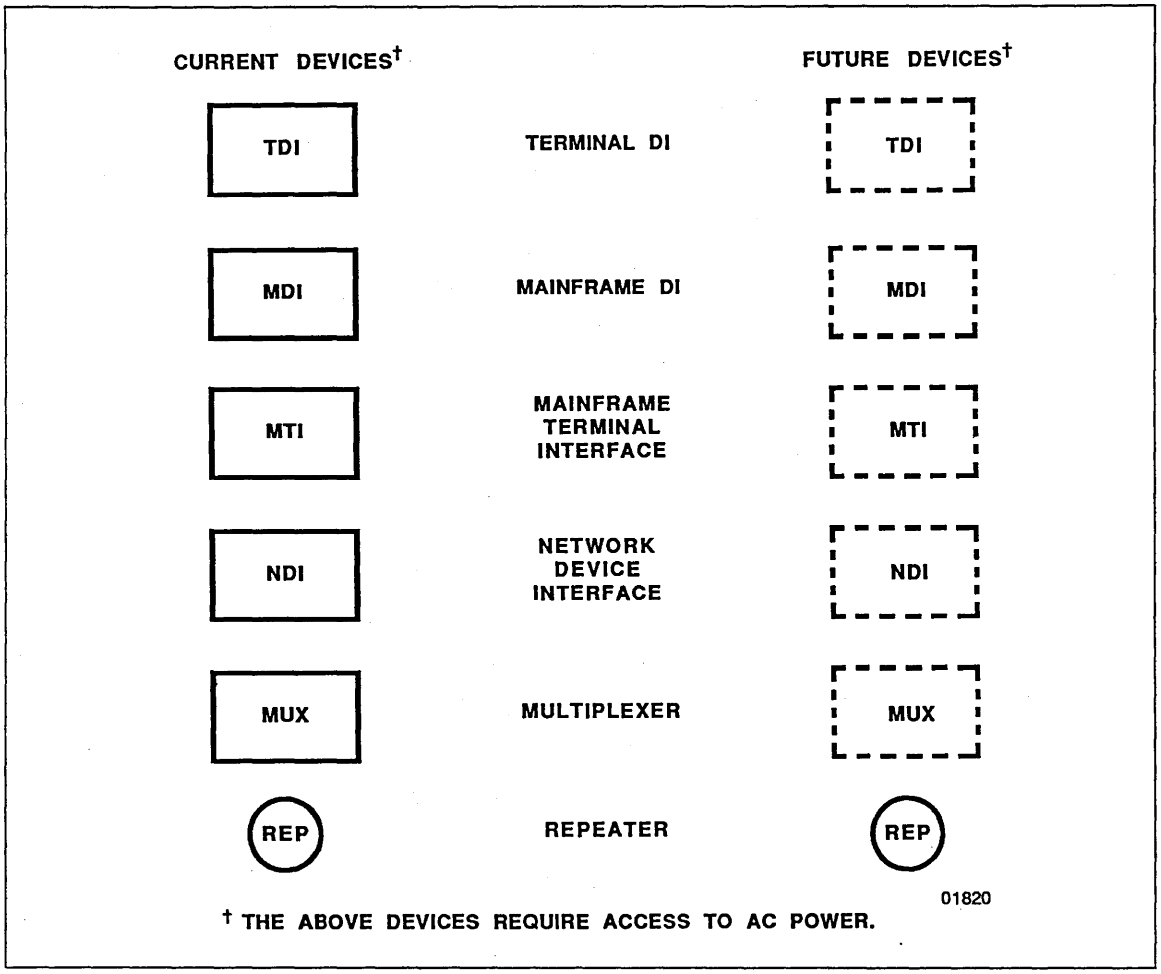


Figure 1-16. Device Symbols/Abbreviations

4. Establish DI locations: Device interface (DI) equipment should be readily accessible to both users and support personnel.

   The transceiver for a DI attaches anywhere along the segment cable, at the 2.5-m (8.25-ft) placement marks. The transceiver cable length determines the distance that the DI may be from the segment cable.

   Remember to include the vertical rise when determining the distance from the equipment to the transceiver.

5. Determine the area to be served by the segment cable: The total area in which network equipment (user devices) can be placed and still attach to the segment cable is determined by the length of transceiver interface cables used, less the vertical rise and horizontal allowance for equipment movement for service or repair.

   The maximum length of transceiver interface cable for each transceiver should not exceed 50 m (165 ft) (achieved in not more than two pieces).

   The early planning phase should allow 4.5 m (14.85 ft) for suspended ceiling installations and 1.5 m (4.95 ft) for under raised floor installations.

6. Identify cable route on floor plan. The factors affecting the segment cable route are:

   Total length of a single network segment cable may not exceed 500 m (1640 ft).

   The longest data path in the network may involve a maximum of three 500-m (1640-ft) segment cables using a repeater between each segment (maximum of two repeaters in series). Note also that one of these repeaters may be replaced by a fiber optic link of up to 1000 m (3300 ft).

   It may be more cost effective when covering larger floor areas to make use of longer transceiver interface cables than to make extra segment cable runs, thus using fewer repeaters. However, the farthest the segment cable can be from the DI, repeater, or multiplexer to be connected is 50 m (165 ft).

   The signal information carried on the segment cable is of low voltage and low electrial current. Best performance can be achieved by ensuring that the cable does not run closer than 10 m (33 ft) to any source of high energy emissions, such as elevator or lift contactors, electric-arc welders, or ac substations.

   The segment cable sections should be routed so that the connectors are conveniently located for service access, maintenance, and ease of installation. Each segment cable should have a unique identifier to allow ease of identification for future expansion or maintenance use.

   A mix of segment cable sections [23, 70, or 117 m (75.9, 231, or 386.1 ft)] may be used in order to conveniently locate connectors.

   Connectors should not be in risers or conduit whenever possible. If they must be enclosed, pull-boxes should be installed in the conduit to house the connectors. When connectors are placed in risers, a strain relief should be used to relieve them from stress due to the weight of the cable. A good practice is to support a vertical cable every 3 or 4 m (9.9 or 13.2 ft), regardless of where it is installed.

   Where the required length of segment cable exceeds 500 m (1650 ft), a repeater is required to ensure reliable performance of the network.

7. Compute the length of the segment cable required to ensure accessibility to the equipment. Allow additional cable length in order to route around obstacles and for other contingencies. Keep in mind the minimum 250-mm (10-in) bend radius when calculating the length of segment cable required.

8. Mark on the floor plan the approximate location of terminators, repeaters, multiplexers, connectors, transceivers, and transceiver interface cables.

9. Attach a written list of all network equipments (such as workstations and repeaters) that are located on the floor plan.

10. Submit the floor plan and the network site requirements survey to the network installation engineer for editing, approval, and cost estimates of components and contractor services.

Schematic Layout

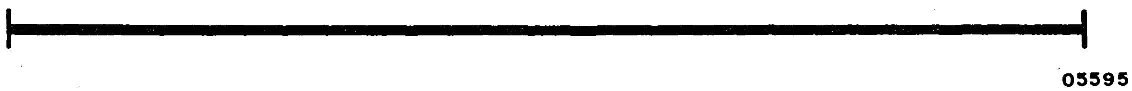
A schematic layout is a simplified diagram of the network configuration. While a schematic layout cannot show detailed placement of the network components (such as workstations, transceivers, and cables) as a floor plan can, it can give a good snapshot of the network design. One can quickly determine how many sections of what lengths make up a given segment of coaxial cable, if multiple segments exist, if repeaters exist, the number of barrel connectors used to connect the cable sections, and the number of different floors that the network services. The schematic layout is also useful in summarizing and cross-checking the network component order.

The schematic layout is created from information obtained from the floor plan. Refer to the Schematic Layout Symbols section that follows for an explanation of the symbols used to depict the various network components and their conventions for use.

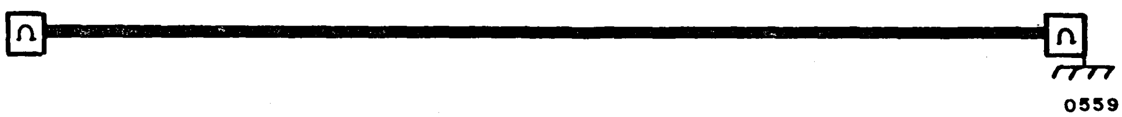
Schematic Layout Symbols

The following symbols are provided for use in depicting a schematic layout of the network. These are presented in a basic tutorial fashion that also provides a summary of the guidelines and conventions previously described in this section.

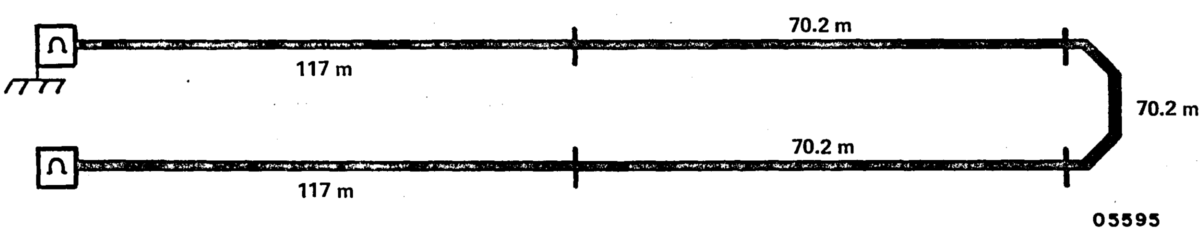
- Each cable segment is shown by drawing a straight line:



- Terminators must be placed at each end of every cable segment [500-m (1650-ft) maximum]. The symbol for a terminator is:

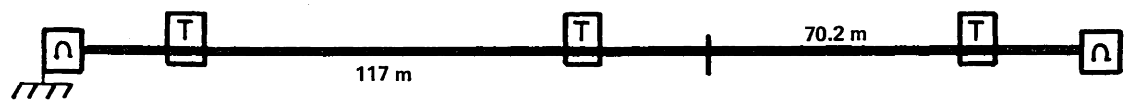


- Barrel connectors should be drawn on the cable segment to show how many sections of cable were used to form the segment. Write in the length of each section. [Multiple sections can be connected using barrel connectors to make a segment of cable – up to 500-m (1650-ft) maximum.] The symbol for a connector is:



- Each coaxial cable segment must be grounded in one place only, either at a terminator, or a barrel connector; grounding at a terminator is recommended. All other exposed conductors or connectors must be isolated from ground. The symbol for grounding is:

- Transceivers are attached to the segment cable near user device locations. Transceivers can be no closer together than 2.5 m (8.20 ft). The maximum is 100 transceivers per segment. The symbol for a transceiver is: T



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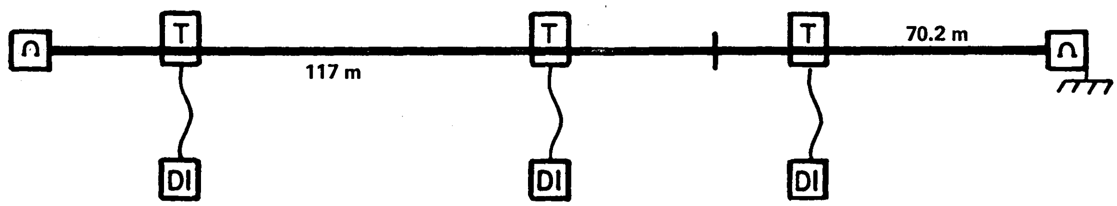
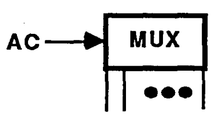
- Device interfaces (DIs) perform network functions according to the DI variant selected for use in the network. DIs require access to an ac power source. The symbol for a DI is:

- Transceiver interface cables are used to attach device interface (DI) cabinets, repeaters, multiplexers, and some host computers to the transceivers to allow access to the network. The symbol for a transceiver interface cable is:

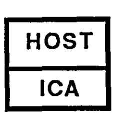


- Multiple segment cables are joined by repeaters. Repeaters require access to an ac power source. The symbol used for a repeater is:

- Multiplexers are used to connect up to eight Ethernet services to one transceiver for access to the network. Multiplexers require access to an ac power source. The symbol for a multiplexer is:

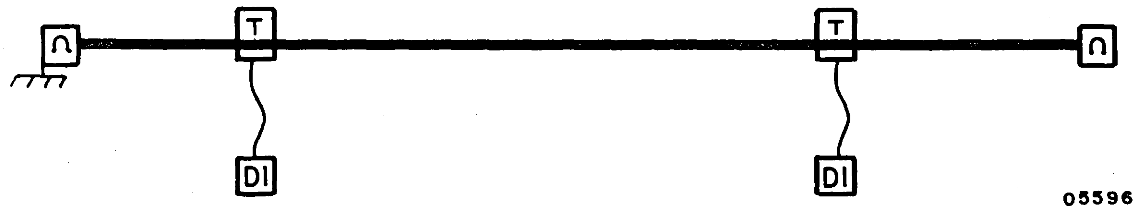


- CDC CYBER 930 host computer systems contain one or more Integrated Communication Adapters (ICA) that allow the host to access the network directly without using an MDI. A transceiver and transceiver interface cable are used for the connection. The symbol for a host computer with ICAs is:

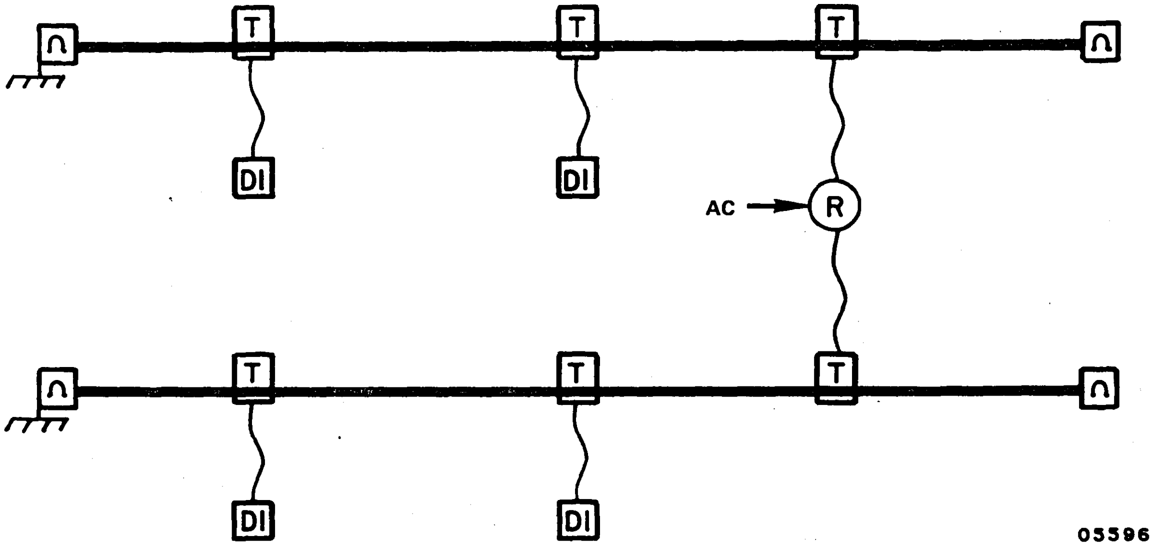


Schematic Layout Examples

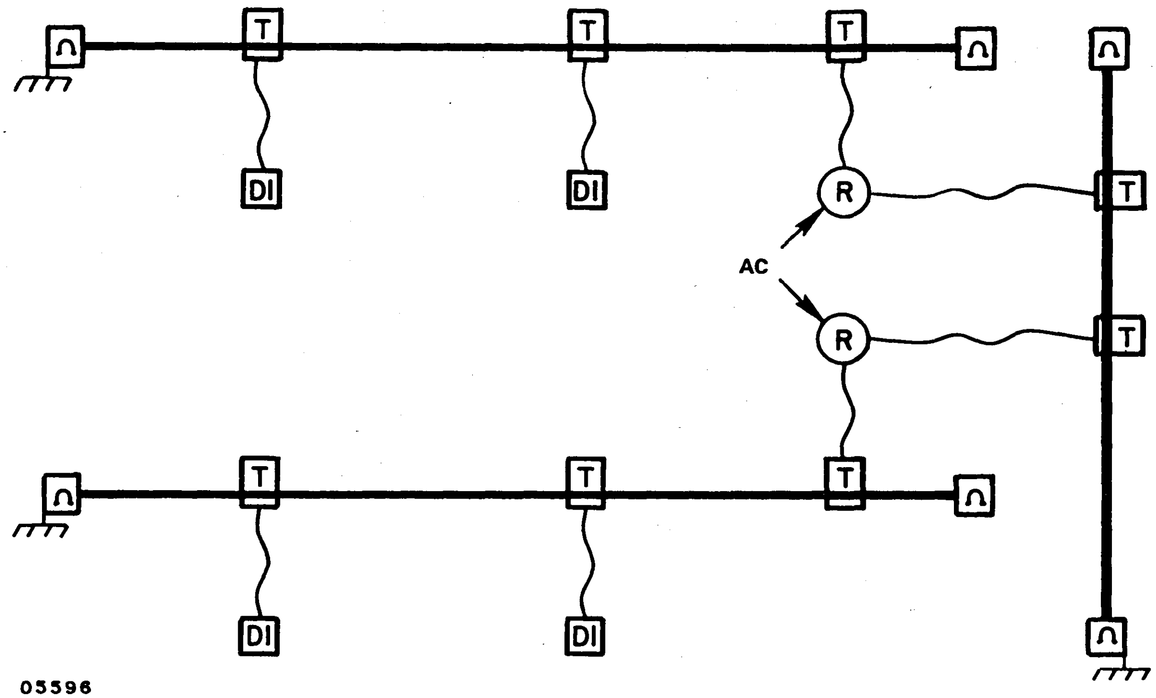
The following examples depict schematic layouts of a few basic network configurations. Refer also to appendix E for additional schematic layouts of typical configurations.



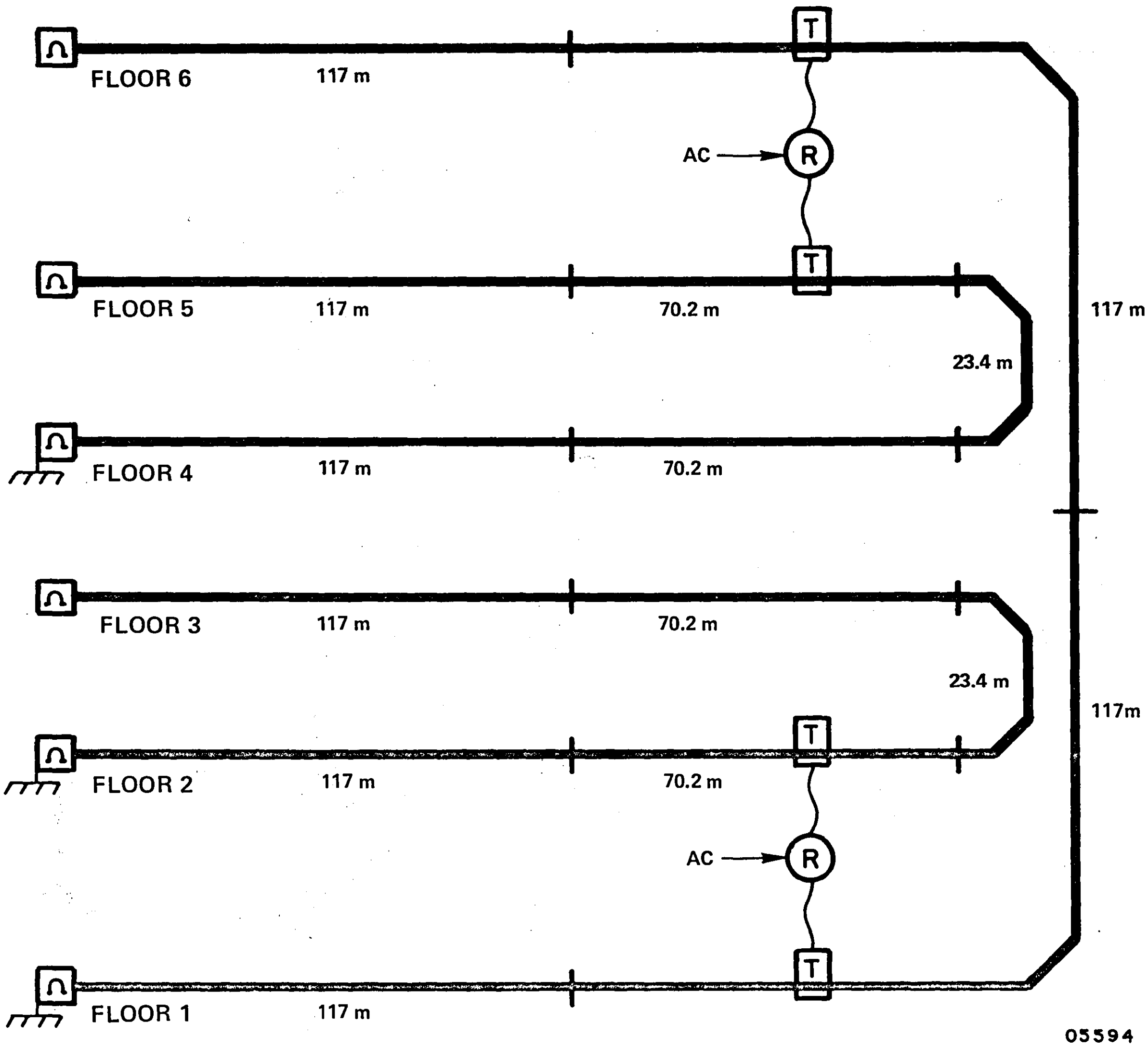
Network of One 500-m (1650-ft) Segment of Coaxial Cable



Network of Two 500-m (1650-ft) Segments of Coaxial Cable



Network of Three 500-m (1650-ft) Segments of Coaxial Cable



Multiple Floor Network Layout Example

Installation and Checkout 2

NOTE

This section of the manual documents or refers to fiber optic links which either are not yet implemented or not fully supported with this release of the product.

Installation and Checkout 2

This chapter provides information necessary to install and check out the LAN system components (segment cable, transceiver interface cables, connectors, terminators, transceivers, multiplexers, and repeaters). Note that the segment cable uses type N connectors and requires unique methods for connecting equipment to it. Because performance specifications are stringent, only experienced technicians should perform the network installation and checkout functions. Control Data's Computer Network Services is available to assist in the installation and testing of the network if desired, and can also supply the various network components. They may be contacted at:

Control Data Corporation
Computer Network Services
800 North Beauregard Street
Alexandria, Virginia 22311
Telephone: 703 998-4666

The installation and checkout information in this section is described under the following major headings:

- Installation Guidelines
- Component Installation
- Installation Acceptance Procedure
- Network Checkout
- Network Expansion

Overview

You should install and check out the LAN system in stages so that you can identify and correct any problems before you install additional equipment, which may make troubleshooting the network more difficult.

Figure 2-1 diagrams the installation and checkout stages and refers you to specific procedures and guidelines in this manual and in other documents.

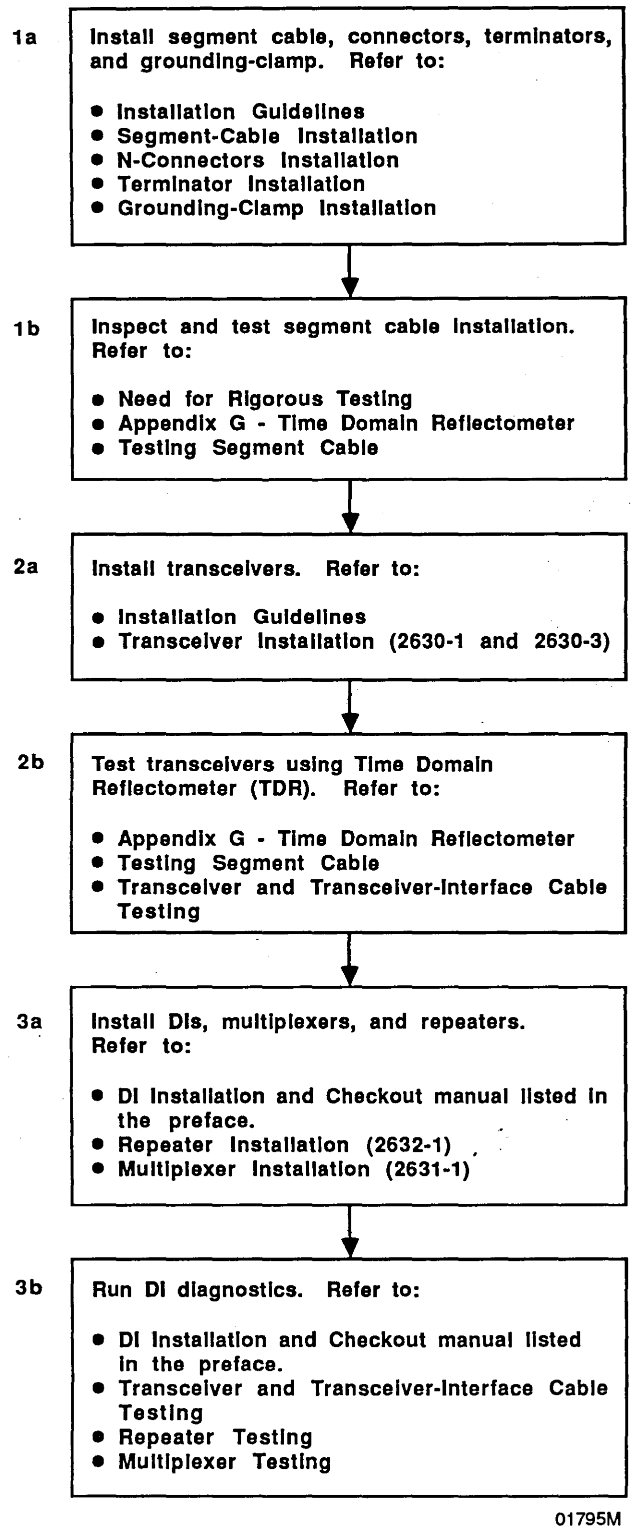


Figure 2-1. Network Installation and Checkout Process

Installation Guidelines

The installation of the network hardware must follow the guidance contained in ECMR 80, IEEE 802.3, or ISO/DIS 8802.3 and the technical report for LAN safety (ECMA TR-SS). These installation guidelines are summarized in the following paragraphs. Note that any deviation from these guidelines may cause performance degradation of the installed network.

- Installation of the network must be in accordance with the marked floor plan.
- All deviations to the network facility, as marked on the floor plan, must be approved by the network installation technician.
- Cable segments must be constructed as specified (see Segment Cable in chapter 1).
- The maximum allowable bend during installation of the segment cable transcribes an arc or circle with a 200-mm (7.87-in) radius. (See figure 2-2 for a full-size template.)
- The maximum allowable bend for installed segment cable transcribes an arc or circle with a 250-mm (9.84-in) radius. (See figure 2-2 for a full-size template.)
- The maximum allowable bend for conduit used to house segment cable transcribes an arc or circle with a 250-mm (9.84-in) radius. (See figure 2-2 for a full-size template.)
- The segment cable must not be compressed, crimped, crushed, or stretched.
- The segment cable jacket must not be cut or damaged in any way which would expose the metal shield.

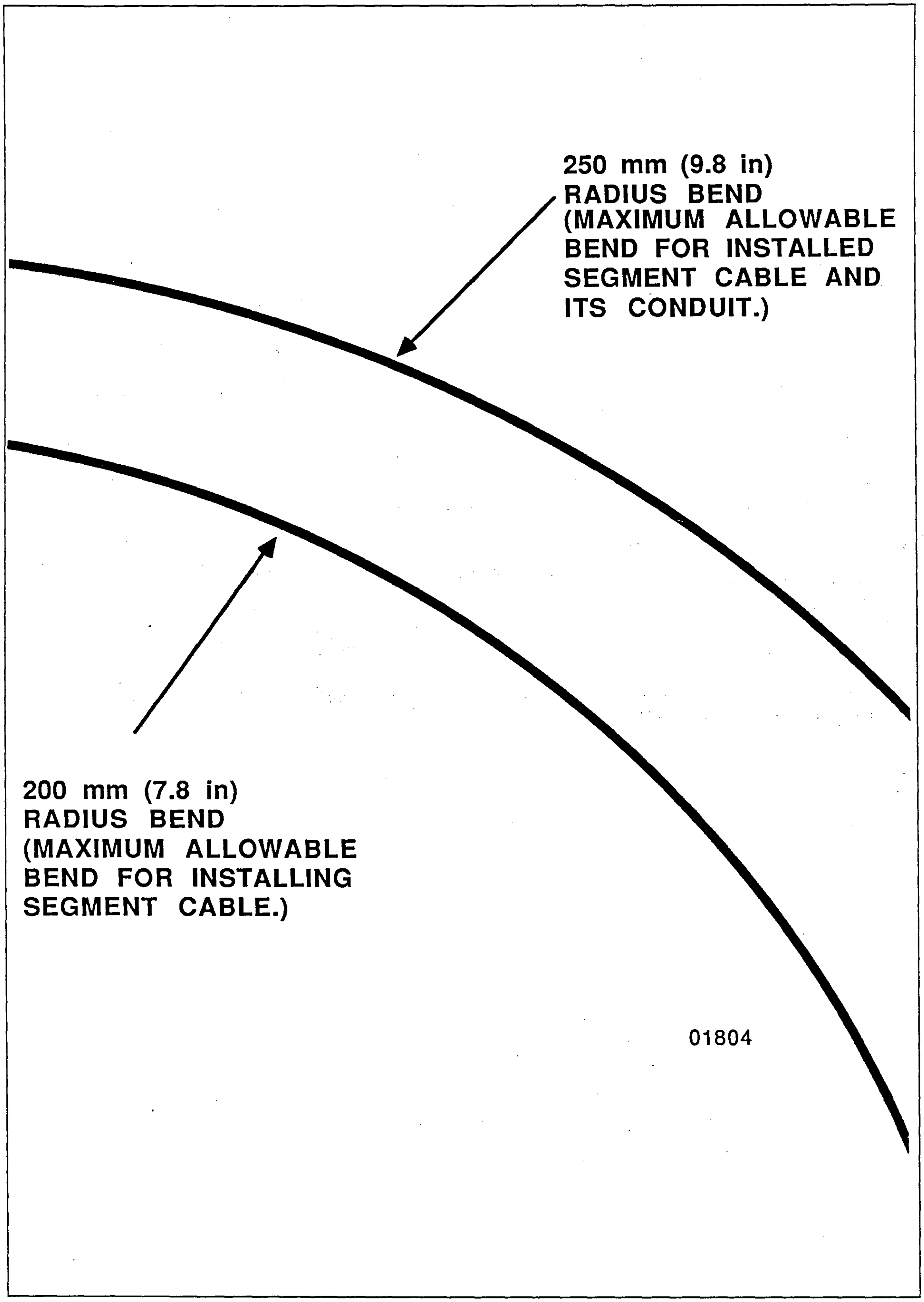


Figure 2-2. Maximum Bend Templates for Segment Cable and Conduit

- Protection must be provided against sharp edges or possible damage caused by work done in the vicinity of the network hardware.
- Segment cable must be protected from radiating energy devices, such as radio frequency, transmissions, and high current switches, by a distance of 10.0 m (32.81 ft) or greater.
- Segment cable, spanning an open area, must be supported every 3.0 m (9.84 ft) or less.
- Any excess segment cable must be coiled in a 250-mm (9.84-in) minimum radius as close to the terminated ends as possible.
- Transceivers must be connected at annular marks indicated on the segment cable sheath every 2.5 m ± 0.05 m (8.20 ft ± 0.2 ft).
- When the installation of segment cable requires conduit, a 35.6-cm (14-in) square by 15.2-cm (6-in) deep pull-box must be installed for each transceiver, segment cable, connector, and terminator.
- Conduit must be installed with pull-boxes in such a way that the segment cable can be routed through the upper portion of the pull-box for installation of transceivers.
- The outer shield must be grounded only once via a 16-gauge bare copper wire to the nearest low voltage main ground. Use a Control Data part number 94275202 grounding strap, or equivalent, attached to either a barrel or terminator connector. Grounding at the terminator is recommended.

  All other segment cable connectors, adapters, terminators, transceivers, and devices must be insulated from any earth ground and from all current-conducting surfaces of the building structure.
- Coaxial cable must not be routed directly over pipes, conduit, other wiring, etc., but must be routed to rest on a supporting surface to minimize the risk of sharp bends or kinks.
- Transceiver interface cables must be tie wrapped to the segment cable to provide a strain relief for the cable tap and to prevent tap movement.
- Where possible, connectors and transceivers should be within 3.0 m (9.84 ft) of the floor and readily accessible from a step ladder.
- For installation above ceilings, access to connections, terminators, and transceivers should not require moving more than a single, easily removable section of the ceiling, or reaching more than 30 mm (1.18 in) from the opening.
- All connections, terminators, transceivers, and transceiver cable locations should be accurately marked on the floor plan during installation.
- All cables should be tagged or marked to provide for ease of identification.
- The terminated ends of the segment should be capable of being brought to 300 mm (11.8 in) above floor level (by leaving slack in the cable) to allow time domain reflectometry (TDR) testing to take place.

Component Installation

The following paragraphs provide procedures for installing the network system components consisting of:

- Segment-Cable Installation
- Installation of N-Connectors
- Terminator Installation
- Grounding-Clamp Installation
- Transceiver Installation
- Repeater Installation
- Multiplexer Installation
- Fiber-Optic-Link Installation

Segment-Cable Installation

The segment cable must meet the required specifications listed in appendix D. The installation of the cable must be performed in accordance with the information presented in this manual. (Refer to the Site Preparation section and the information listed under Installation Guidelines earlier in this chapter.)

N-Connectors Installation

There are typically three types of N-connectors, the solder type, compression type, and the all-crimp type. The installation procedure for the solder-type N-connector (Control Data part number 15386115) is described in the following paragraph. For installation procedures on other types of N-connectors, refer to the specific vendor for information. The tools and materials required to install solder type N-connectors are as follows:

- 100- or 250-W soldering iron with soldering tweezers (alternatively, 30-W soldering iron)
- Solder
- Cable-stripping tool or utility knife
- Side cutters
- Wire brush
- Crescent wrench
- Torque wrench
- Utility saw
- Ruler
- Volt-ohm meter (VOM)
- Tie-wraps

Solder-Type N-Connectors

To install a solder-type N-cable connector, refer to figure 2-3 and perform the steps described thereafter.

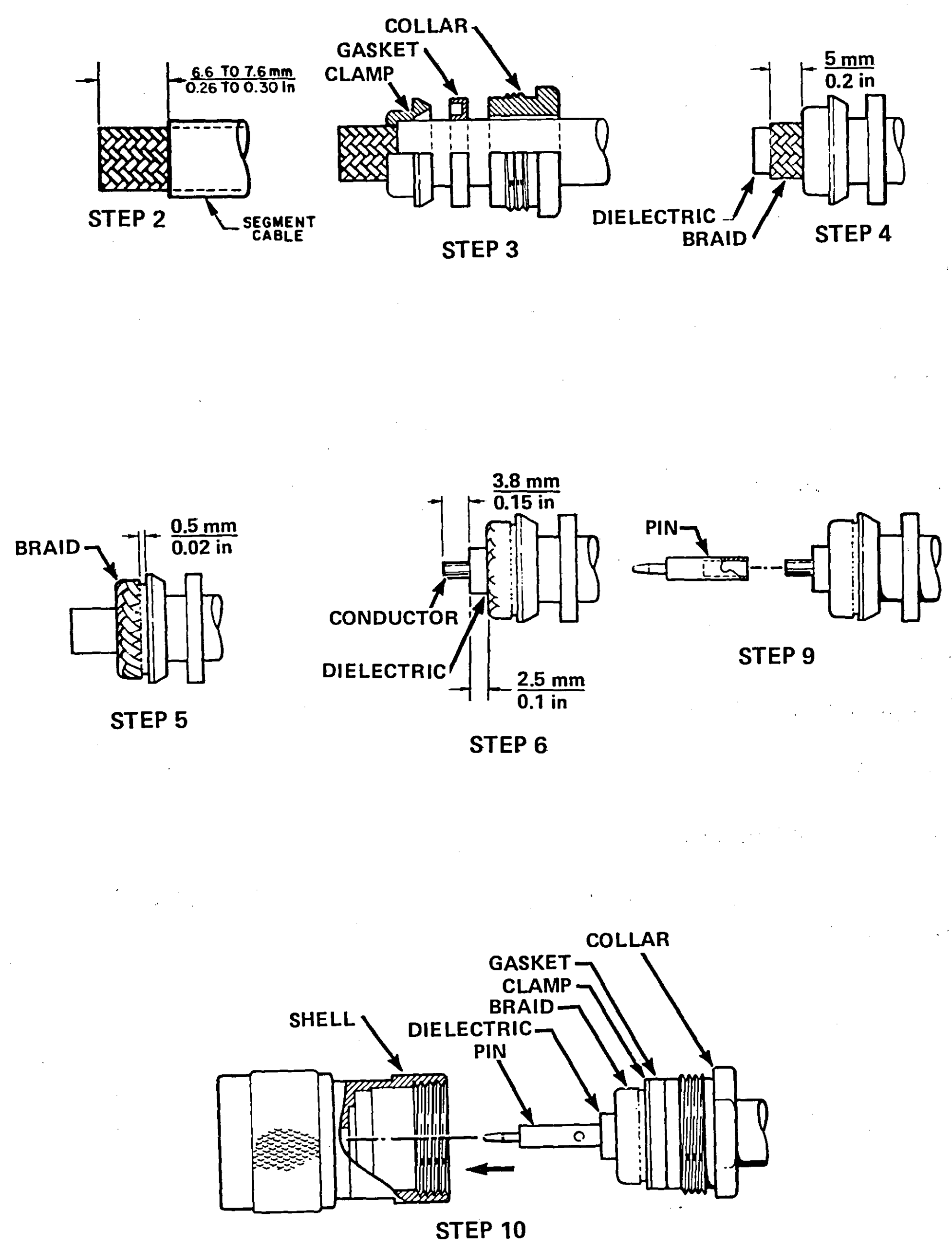


Figure 2-3. Solder-Type N-Connector Assembly

(Continued)

(Continued)

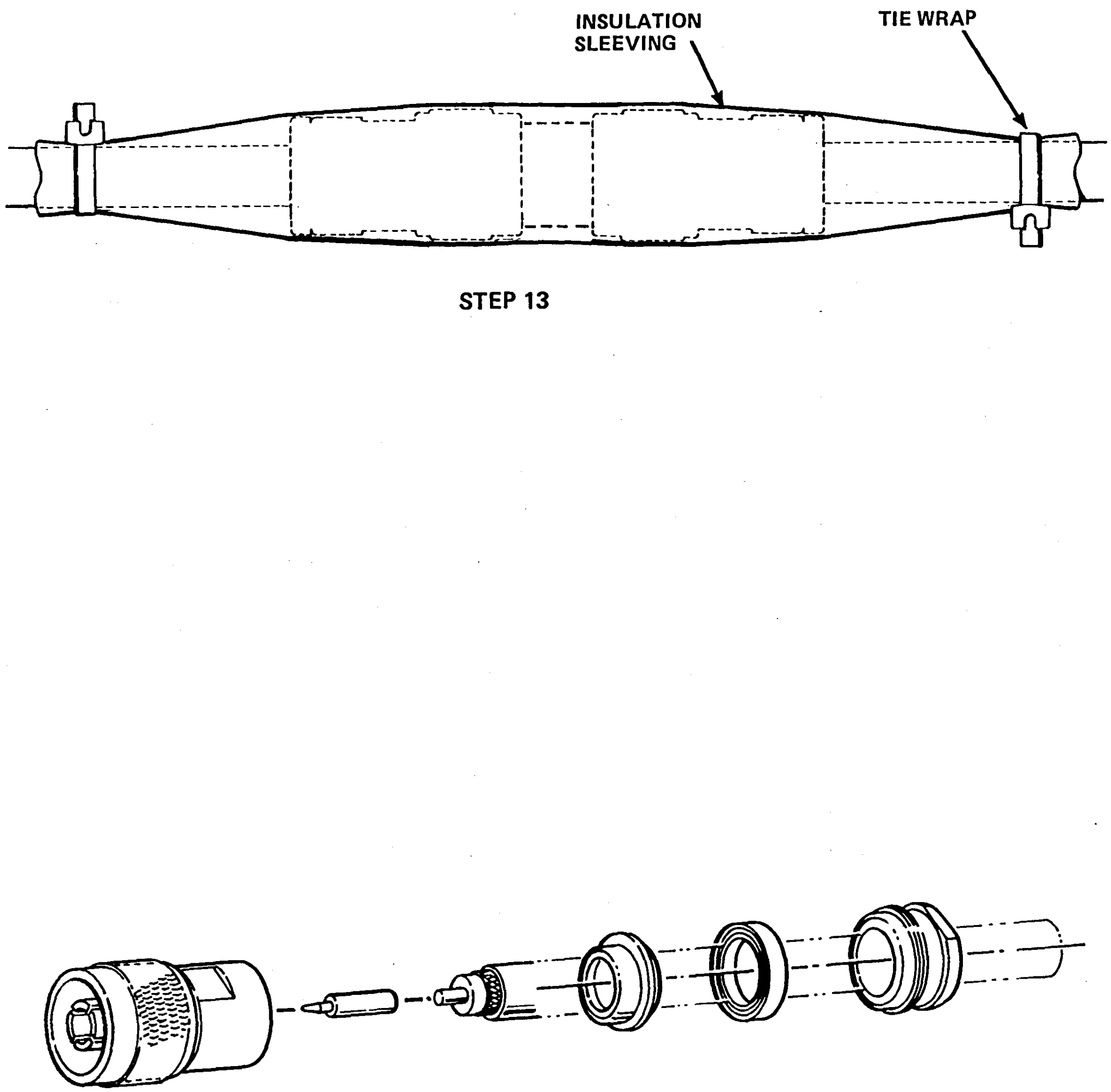


Figure 2-3. Solder-Type N-Connector Assembly

1. Cut end of segment cable using a utility saw to prevent crushing of dielectric.

2. Cut cable jacket 6.6 mm to 7.6 mm (0.26 in to 0.30 in) from end of cable, taking care not to cut shield braid, and remove jacket.

3. Slide threaded collar, rubber gasket, and braid clamp on to cable. Note that V-groove on rubber gasket faces cut end of cable.

4. Cut shield braid(s) and outer foil so that approximately 5 mm (0.2 in) of braid remains on dielectric.

5. Fold shield braid(s) over braid clamp. You may have to unbraid the shield to fold it over the braid clamp. Cut braid so that it is not more than 0.5 mm (0.02 in) from flange of braid clamp yet doesn't overlap flange.

6. Cut dielectric and inner foil back 3.8 mm (0.15 in) to expose center conductor. Approximately 2.5 mm (0.1 in) of dielectric should extend beyond the folded-back shield braid. Check that center conductor is straight; that is, in line with the cable.

7. Check that there are no strands of braid or pieces of foil shorting between center conductor and inner foil.

8. Use soldering iron and solder to tin end of center conductor.

9. Put on center pin. Keep pin in line with cable and feed solder into side hole while heating. Ensure that no solder goes onto the mating part of the pin; that is, the narrow section. Trim off any excess solder from wide part of pin. Check that pin is in line with the cable and is well soldered.

10. Put on connector shell. Hold body flats of shell with wrench [18 mm (0.72 in) across flats] and screw on collar. Use a torque wrench to torque collar to 20 in/lb. The collar is 16 mm (0.64 in) across flats.

11. Using a VOM, check that center pin is not shorted to inner body of connector.

12. Install a terminator or barrel connector into N-connector as applicable.

13. Slide insulation sleeving over connectors for electrical insulation and secure with tie wraps. No metallic part of connectors should be left exposed.

Barrel-Connector Installation

To install a type N barrel connector (Control Data part number 15386110), perform the following steps:

1. Draw back insulation sleeving to expose type N plug connectors at ends of cables to be joined.

2. Install barrel connector between plug connectors. The connectors should only be hand-tightened.

3. Push insulation sleeving back over connectors and secure with tie wraps. The insulation must cover all metallic parts of connectors.

Terminator Installation

To install a type N 50-ohm terminator (Control Data part number 15386105), perform the following steps:

NOTE

Terminators must be installed at both ends of the segment cable.

1. Install terminator at end of segment cable. The terminator and connector should only be hand-tightened.
2. After one terminator is installed, check continuity of segment cable with an ohmmeter. Open end of cable and measure between center pin and outer shell of lug connector. A measurement of approximately 50 ohms should occur. If an open or a short is present, a problem exists.
3. Insulate terminator and connector (unless it is being used to ground the segment cable) using insulation sleeving and secure with tie wraps. All metallic parts of connection must be insulated.

Grounding-Clamp Installation

To install a grounding clamp (Control Data part number 94275202) and grounding wire to the segment cable, perform the following steps:

NOTE

The outer braid screen of the segment cable must be grounded only once via a 16-gauge bare copper wire connected to the nearest low voltage main supply ground.

1. Use a grounding clamp to attach the copper grounding wire to either a barrel connector or a terminator connector of segment cable. Connection to a terminator is recommended. Refer to figure 1-12 in chapter 1 of this manual.
2. Use another grounding clamp to attach other end of grounding wire to nearest low voltage main supply ground.
3. Check that both ends of grounding wire are securely attached.

Transceiver (2630-1) and Tap (2630-2) Installation

The following installation procedure applies to transceivers (Control Data product number 2630-1) with a tap block (Control Data product number 2630-2). See figure 2-4.

Tools Required:

- 9/16-in wrench
- Cable-tap tool kit (Control Data part number 53585366). Kit consists of a cable-coring tool (Control Data part number 12263657), shield-removal tool (Control Data part number 12263663), and an inner insulation-piercing tool (Control Data part number 12263665)
- Tweezers, needle-nose pliers, or solder sucker

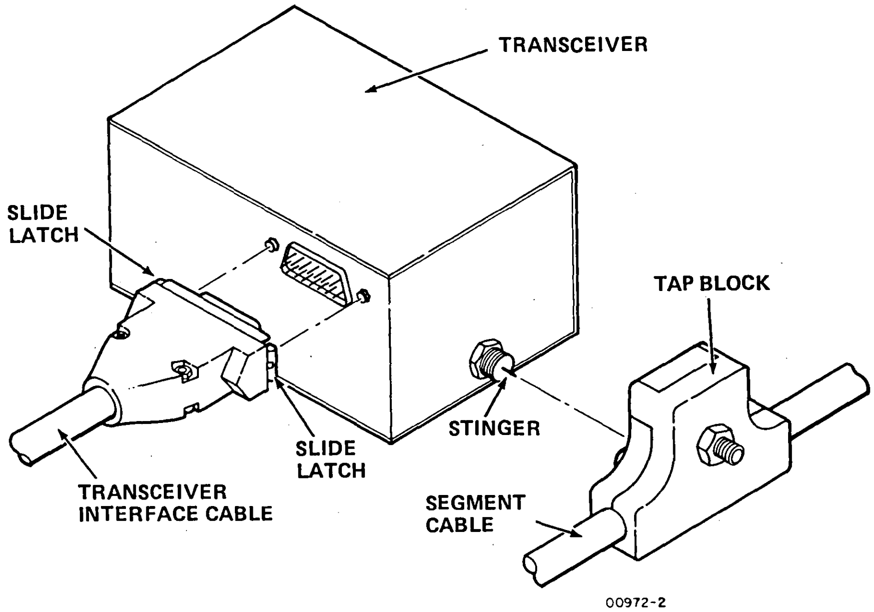


Figure 2-4. Transceiver Assembly Details (2630-1/2)

1. Position transceiver tap block at one of the annular marks on segment cable. These marks are located every 2.5 m (8.25 ft). Using a 9/16-in wrench, clamp tap block to segment cable with threaded hole pointing in direction in which transceiver will be mounted.

   NOTE

   For installation on Teflon cable, place a shim (supplied with transceiver) on cable with split facing tap block nut. Center tap block on shim with threaded hole pointing in direction in which transceiver will be mounted.

2. Screw cable-coring tool (Control Data part number 12263657) into hole in tap block and work tool back and forth a few times until the threads bottom out. Remove coring tool.

3. Insert shield-removal tool (Control Data part number 12263663) into hole and while applying pressure, rotate clockwise to remove any excess braid or foil. Use a pair of tweezers, needle-nose pliers, or a solder sucker to remove any loose insulation and shielding particles.

   NOTE

   The cutting depth of the shield-removal tool can be adjusted if needed. Use a hex-head wrench for adjustment.

CAUTION

If there is any braid left in hole, screwing in transceiver can short the coaxial cable and make the network inoperable.

4. Screw in inner insulation-piercing tool (Control Data part number 12263665) into access hole until you can feel conductor. Remove insulation-piercing tool.

5. Unscrew protective F-connector covering stinger on transceiver.

CAUTION

The stinger is fragile – handle with care. Damage can affect reliability and is not covered under warranty.

6. Install 0-ring onto threads of transceiver. Screw transceiver (at a right angle to tap block) into access hole, finger tight. Do not overtighten transceiver.

7. Connect transceiver interface cable to transceiver using slide latch to lock type D subminiature connector to transceiver.

8. Tie-wrap transceiver interface cable to segment cable to provide a strain relief for transceiver.

9. Insulate transceiver, tap block, and connectors (no metal parts should be left exposed) and secure with tie wraps. Transceiver must be isolated from ground (for example, metal ducts, conduit).

10. Place a tag on segment cable next to transceiver to indicate its position on schematic layout.

11. Connect other end of transceiver interface cable to device interface.

12. Apply power to device interface. Red indicator should light on transceiver. (Also, all LED indicators on ESCI board of DI should be off.) If indicator on transceiver does not light, attached device interface power is off, or is transmitting continuously, or transceiver has detected an internal error. In the latter case, either the transceiver, transceiver interface cable, or device interface is defective and must be checked/replaced. Refer to the CDCNET Troubleshooting Guide for additional information.

Table 2-1 provides the transceiver connector pin assignments of the Control Data product numbers 2630-1 and 2630-3 for reference.

Table 2-1. Transceiver Connector Pin Assignments

Pin	Circuit	Use
3	DO-A	Data Out circuit A
10	DO-B	Data Out circuit B
11	DO-S	Data Out circuit Shield
5	DI-A	Data In circuit A
12	DI-B	Data In circuit B
4	DI-S	Data In circuit Shield
7	CO-A	Control Out circuit A
15	CO-B	Control Out circuit B
8	CO-S	Control Out circuit Shield
2	CI-A	Control In circuit A
9	CI-B	Control In circuit B
1	CI-S	Control In circuit Shield
6	V_C	Voltage Common
13	VP	Voltage Plus
14	VS	Voltage Shield
Shell	PG	Protective Ground (Conductive Shell)

Voltage Plus and Voltage Common use a single twisted pair in the cable.

802.3 Transceiver (2630-3) and Tap (2630-4) Installation

The following installation procedure applies to 802.3 transceivers and taps, Control Data product numbers 2630-3 and 2630-4.

Tools Required:

- Allen wrench and hand tool (Control Data part number 22137341)
- Screwdriver
- Tweezers
- Freon dust chaser (Control Data part number 95047800)

Each tap (figure 2-5) assembly, includes a clamp section and a cable bed section, two braid picks, a center probe assembly, and a protective dust cover (not shown). The tap can be used with either PVC or Teflon cable without adaptation.

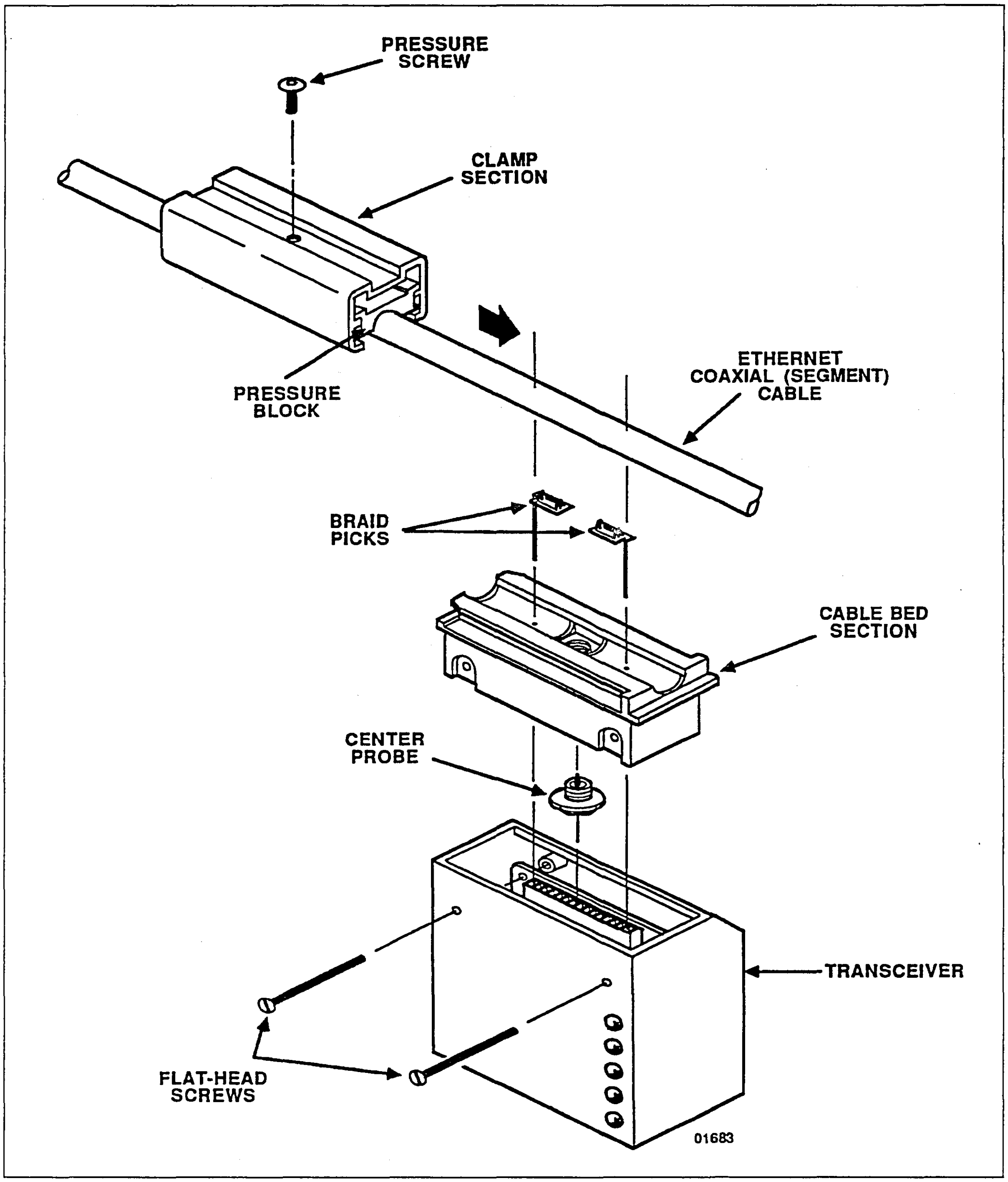


Figure 2-5. 802.3 Transceiver and Tap Assembly Details (2630-3/4)

CAUTION

Wear safety glasses when performing this procedure.

1. Insert braid picks into holes in cable bed section. See figure 2-6. Picks must face inward. Do not turn outward.

2. Determine tapping location at one of the 2.5-m (8.25-ft) placement marks on segment cable.

3. Straighten cable and center it in cable channel of cable bed section.

4. Hold cable bed section in place and slide clamp section onto cable bed section. See figure 2-6. Look in hole to ensure cable is centered.

5. Using an Allen wrench, thread pressure screw into clamp section until pressure block bottoms on track and holds cable securely. See figure 2-6. Ensure pressure block bottoms on all four corners.

6. Using drill bit end of hand tool, drill through cable to center conductor. Hand tool has a stop to prevent overdrilling. Hole should go through outer jacket, braid shield, and into white dielectric. See figure 2-6.

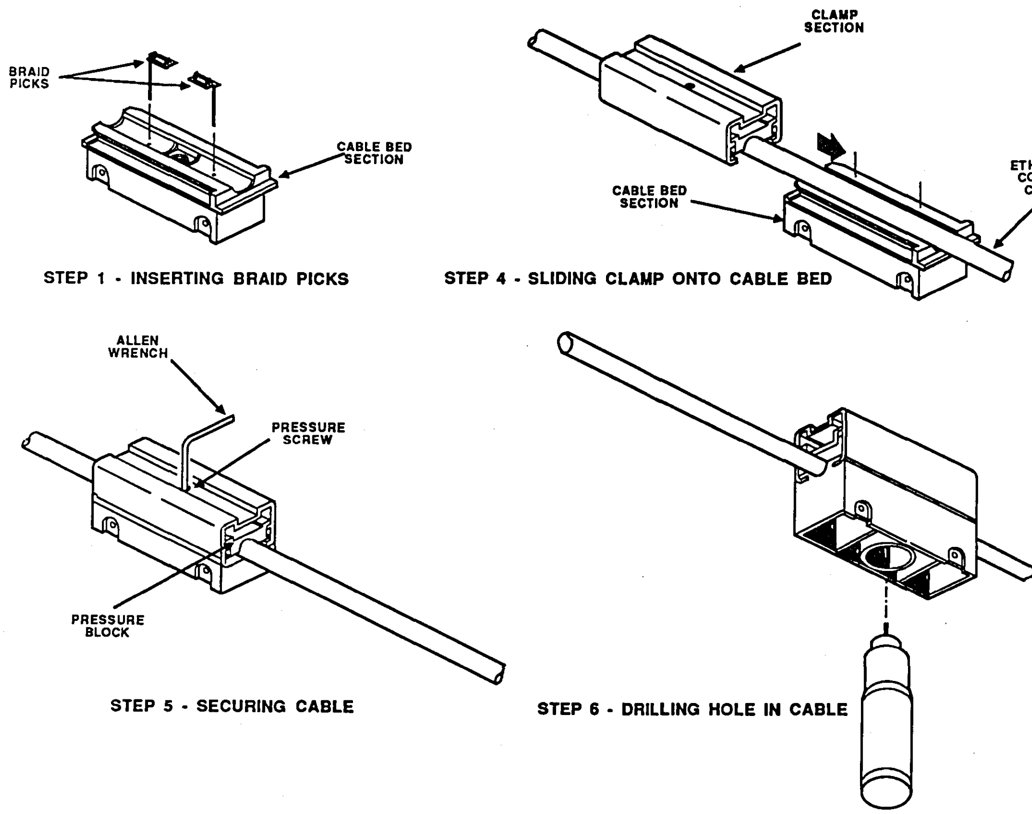


Figure 2-6. 802.3 Transceiver and Tap Installation - Part 1

7. Inspect hole to ensure no particles of shield or other matter remain in hole. Use tweezers to remove any loose insulation or shielding particles. Use dust chaser (Control Data part number 95047800) to blow out finer particles.

8. Using socket wrench end of hand tool, thread center probe assembly into central hole of cable bed and tighten snugly. See figure 2-6.

9. Turn Heartbeat (SQE) test on for DIs, ICAs, and multiplexers. Turn SQE off for repeaters. Refer to figure 2-8 for a top view of open transceiver (without tap attached) showing SQE jumper locations.

   a. To turn Heartbeat (SQE) on, use needle-nose pliers or tweezers to move jumper to third and fourth positions from righthand side.

   b. To turn Heartbeat (SQE) off, use needle-nose pliers or tweezers to move jumper to fourth and fifth positions from righthand side.

   Note SQE setting on outside of transceiver.

10. Remove screws from transceiver.

NOTE

Do not force the tap into the transceiver case. Very little pressure is necessary. Use tweezers to straighten pins before sliding tap into transceiver.

11. Insert tap into open end of transceiver, aligning screw holes. Make sure that center probe and braid pick pins in tap line up with contacts on enclosed circuit board. If tap does not slide into transceiver case easily, pins probably need to be aligned with their contacts. Use tweezers to straighten pins.

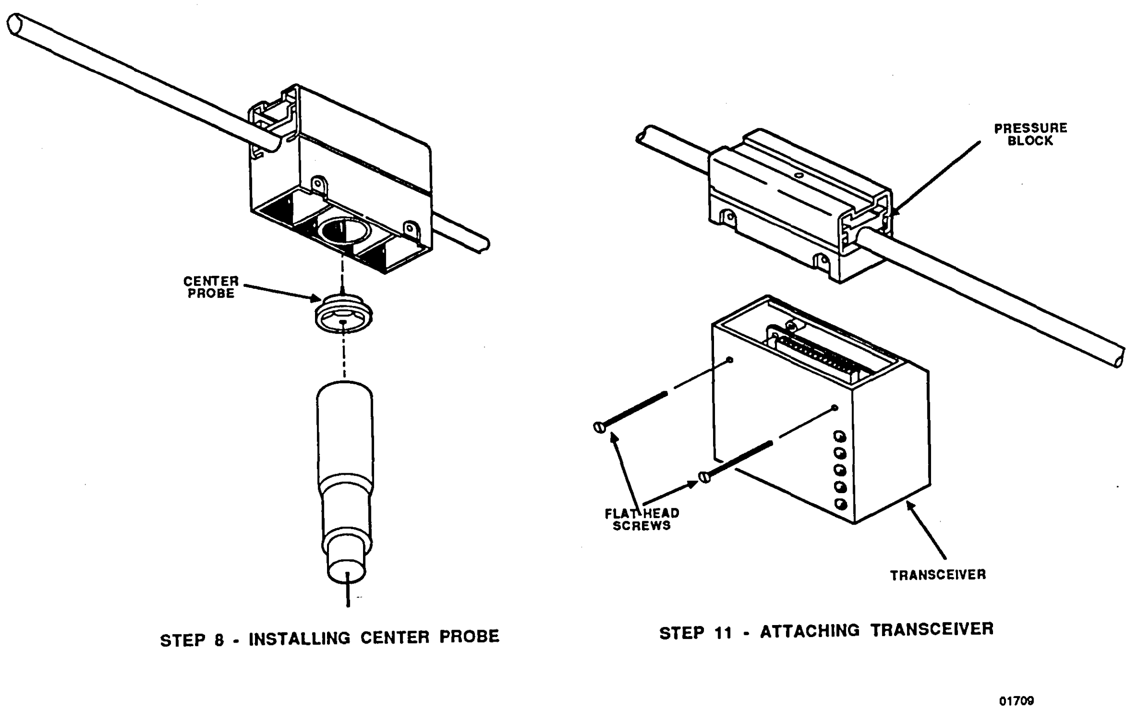


Figure 2-7. 802.3 Transceiver and Tap Installation - Part 2

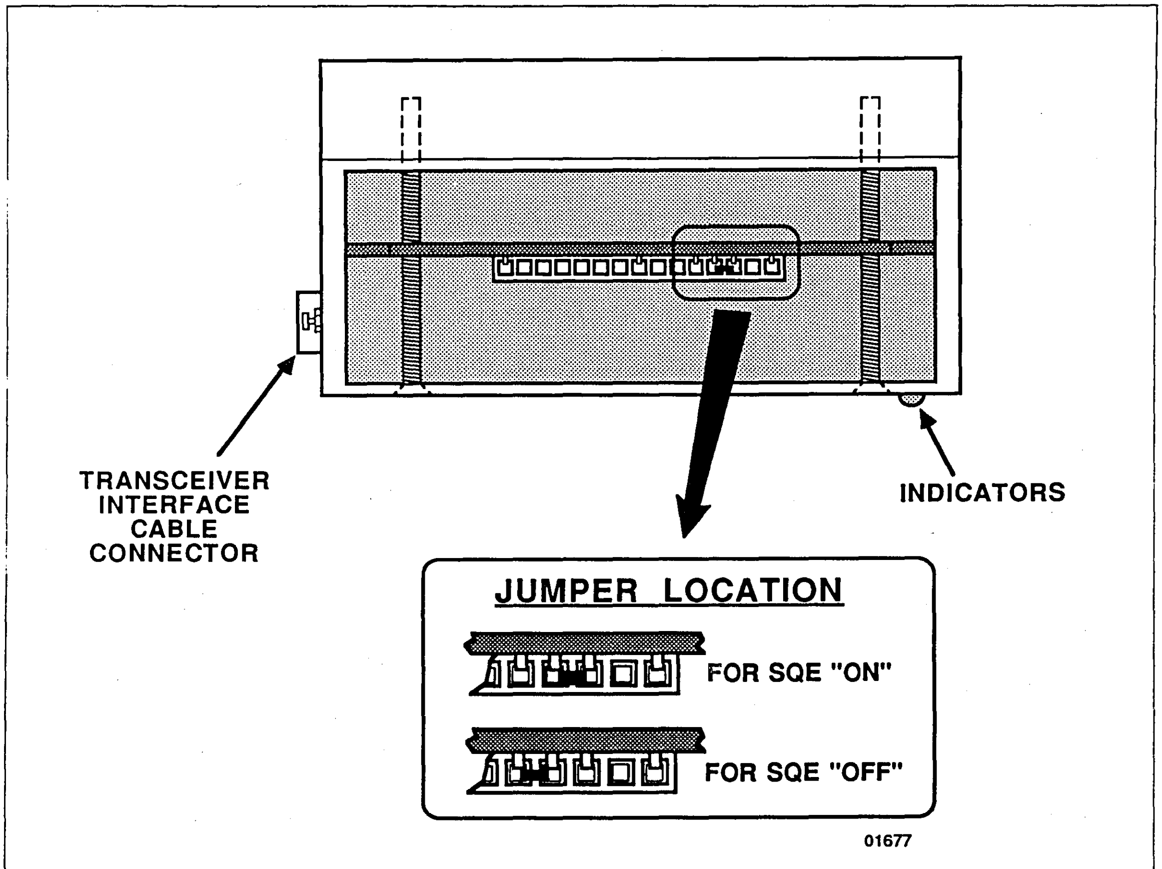


Figure 2-8. SQE Jumper Locations

12. Push screws through holes and tighten screws.

13. Connect transceiver interface cable to transceiver using slide latch to lock type D subminiature connector to transceiver.

14. Tie-wrap transceiver interface cable to segment cable about 15.24 cm (6 in) from transceiver to provide strain relief for transceiver.

15. Insulate transceiver, tap, and connectors with transparent material (no metal parts should be left exposed) and secure with tie wraps. Transceiver must be isolated from ground (for example, metal ducts, conduits).

16. Save protective dust cover. You will need it to cover tap if you remove transceiver.

Refer to table 2-1 for the transceiver connector pin assignments.

Repeater Installation (2632-1)

The following installation procedure applies to the 802.3 repeater (Control Data product number 2632-1). For installation of other types of repeaters, refer to the specific vendor's documentation for information.

1. A window in fuse cover on rear panel shows setting of voltage selector. If this setting does not match your ac power source, change selection and fuses as follows:

   a. Remove ac power cord from power connector, if connected.

   b. Using a small screwdriver, pry open righthand side of fuse cover. Fuse cover is adjacent to power connector. Figure 2-9 shows voltage selector drum and fuse holders that are visible when cover is open.

   c. Remove voltage selector drum and rotate it so desired input voltage is visible through window in cover. Remount drum.

   d. Remove fuse holders by pulling them outwards. Refer to table 2-2 and replace fuses with appropriately rated fuses. Insert fuse holders into their slots, ensuring that white arrows on fuse holders match those inside fuse cover.

Table 2-2. Repeater Voltages

Source Voltage	Fuse Rating	CDC Part Number
100 V ±10%	1 A antisurge	15185575
120 V ±10%	1 A antisurge	15185575
220 V ±10%	500 mA antisurge	95967854
240 V ±10%	500 mA antisurge	95967854

   e. Close fuse cover.

2. The repeater is provided with a 3-prong plug for use with 120 V 10 A circuits. If you require a different plug, remove this plug and install the appropriate national standards mains plug (not provided by Control Data).

   CAUTION

   For safety reasons, you must always connect the equipment's ground wire to a properly earth-grounded system.

   Connect the wires in the cable to the plug as follows:

Color	Circuit Connection
Brown	Live
Blue	Neutral
Green/yellow	Ground

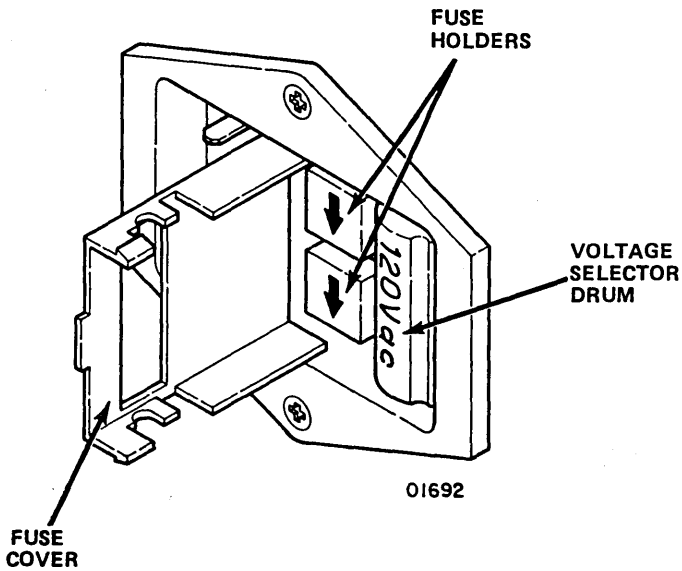


Figure 2-9. Repeater Voltage Selector Drum and Fuse Holders

3. Place repeater at desired location between two segment cables. Make sure that an ac outlet is available. Position unit horizontally. Allow air to flow around unit and through its vents.

4. If transceivers need to be installed on segment cables, refer to transceiver installation procedure described previously. Set transceiver Heartbeat (SQE) to off for repeaters.

5. Connect transceiver interface cables (Control Data part numbers 53590834 through 53590842) between transceivers and repeater. Position connector slide latches to lock type D subminiature connectors in place.

6. Connect ac power cord to repeater. Connect other end to an ac outlet.

7. Apply input power by pressing top of POWER switch on rear panel to position 1. The LED labelled POWER on front panel should light, indicating that both dc power supplies are operating.

   If the POWER LED does not light, replace the fuse as described in step 1. If fuse fails repeatedly, replace the repeater.

Multiplexer Installation (2631-2)

The following installation procedure applies to the 802.3 multiplexer (Control Data product number 2631-2). For installation of other types of multiplexers, refer to the vendor's documentation for information.

1. A window in fuse cover on rear panel shows setting of voltage selector. If this setting does not match your ac power source, change selection and fuses as follows:

   a. Remove ac power cord from power connector, if connected.

   b. Using a small screwdriver, pry open righthand side of fuse cover. Fuse cover is adjacent to power connector. Figure 2-10 shows voltage selector drum and fuse holders that are visible when cover is open.

   c. Remove voltage selector drum and rotate it so desired input voltage is visible through window in cover. Remount drum.

   d. Remove fuse holders by pulling them outwards. Refer to table 2-3 and replace fuses with appropriately rated fuses. Insert fuse holders into their slots, ensuring that white arrows on fuse holders match those inside fuse cover.

Table 2-3. Multiplexer Voltages

Source Voltage	Fuse Rating	CDC Part Number
100 V ±10%	1 A antisurge	15185575
120 V ±10%	1 A antisurge	15185575
220 V ±10%	500 mA antisurge	95967854
240 V ±10%	500 mA antisurge	95967854

   e. Close fuse cover.

2. The multiplexer is provided with a 3-prong plug for use with 120 V 10 A circuits. If you require a different plug, remove this plug and install the appropriate national standards mains plug (not provided by Control Data).

   CAUTION

   For safety reasons, you must always connect the equipment's ground wire to a properly earth-grounded system.

   Connect the wires in the cable to the plug as follows:

Color	Circuit Connection
Brown	Live
Blue	Neutral
Green/yellow	Ground

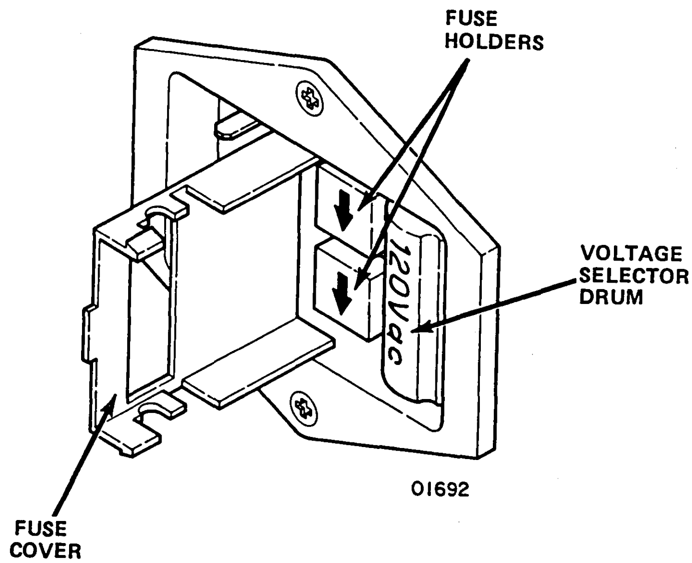


Figure 2-10. Multiplexer Voltage Selector Drum and Fuse Holders

3. Place multiplexer at desired location. Make sure that an ac outlet is available. Position unit horizontally. Allow air to flow around unit and through its vents.

4. If a transceiver needs to be installed on segment cable, refer to transceiver installation procedure described previously.

5. Connect transceiver interface cable (Control Data part numbers 53590834 through 53590842) between transceiver and multiplexer (SK1). Position connector slide latches to lock type D subminiature connectors in place.

6. Connect additional transceiver interface cables (Control Data part numbers 53590834 through 53590842) between multiplexer (PL1 through PL8) and up to eight DIs. Position connector slide latches to lock type D subminiature connectors in place.

7. Connect ac power cord to multiplexer. Connect other end to an ac outlet.

8. Apply input power by pressing top of POWER switch on rear panel to position 1. LEDs labelled -5.2V and TCVR PWR on front panel should light, indicating that both internal -5.2 V dc power supply and transceiver power supply are operating.

   If the LEDs do not light, replace the fuse as described in step 1. If fuse fails repeatedly, replace the multiplexer.

Fiber-Optic-Link Installation

A typical fiber optic link is shown in figure 2-11. This type of link should be used for the interconnection of the network through hazardous environments or between buildings.

Information for installation of the Control Data 2630-3 transceiver and the Control Data 2632-1 repeater is described previously in this chapter. For installation information on the fiber optic transceiver and fiber cables, refer to the vendor's documentation. See appendix B for information on vendors that can supply fiber optic devices.

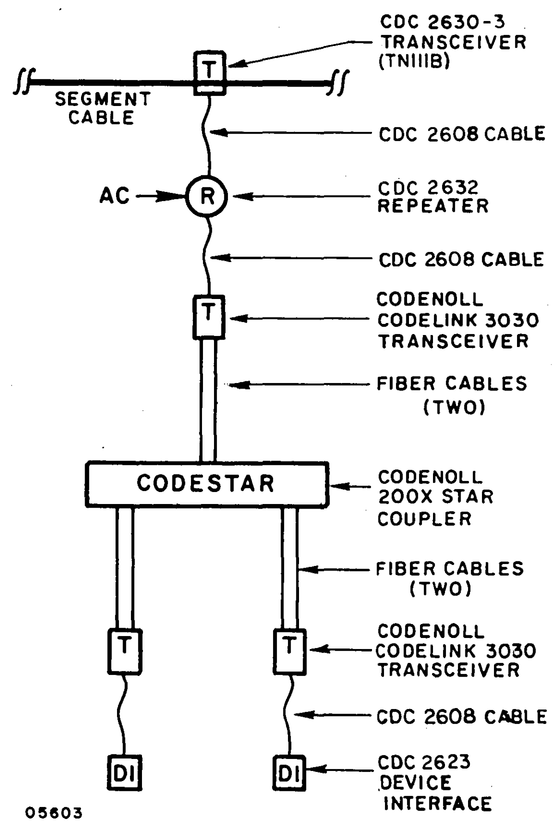


Figure 2-11. Example of Fiber Optic Link

Installation Acceptance Procedure

The following procedures provide methods for testing and accepting the network components at each stage of network installation (see figure 2-1). At each stage you should:

1. Use site plans to make a physical inspection of network installation and check that:
   a. Installation matches approved plan.
   b. Installation meets all site specifications and requirements.
2. Verify integrity of network installation by performing network commissioning tests described under Network Checkout that follows.

Network Checkout

The network hardware (segment cable, transceiver interface cables, connectors, terminators, transceivers, multiplexers, and repeaters) constitutes the communications path of the local area network. It is therefore, of utmost importance that the quality of the installation be ensured and proved by the results of rigorous commissioning tests. This subsection describes the reasons for the need of rigorous and exhaustive testing, and details the tests and procedures that are required to ensure that a network is continuous and homogeneous.

Need for Rigorous Testing

The characteristics of a network comprising a number of jointed lengths of segment cable must be as close as possible to those displayed by an equivalent, unbroken length of segment cable. Badly formed cable connections or terminations can cause points of discontinuity where reflections may take place causing standing waves on the line. Also, sharp bends in the cable or continuous movement due to mechanical disturbances can damage the dielectric material, thereby causing unacceptable losses in the transmission medium.

The sole criteria for accepting the cable network, as regards to electrical characteristics, is the positive results of tests carried out using a time domain reflectometer (TDR). The TDR employs a step generator and an oscilloscope in a system best described as closed-loop radar. A voltage step is propagated down the transmission line being tested, and the incident and reflected waves are monitored by the oscilloscope at a particular point on the line. This echo technique reveals the location and nature of each discontinuity along the line.

For example, the simplest cable network consists of one uninterrupted length of segment cable [e.g., a single length 23.4 m (77.22 ft) long]. This network should, of course, present no difficulty regarding installation and commissioning. When tested with a TDR, there would be no visible step on the TDR's video display terminal (unless of course, the 50-ohm terminator had been left off or the cable itself had been crimped or otherwise damaged). In the case of a missing terminator, there would be a very definite upward step response indicating an open circuit at 23.4 m (77.22 ft). For a crimped or damaged cable, there would be an observable impedance change at the location of the cable fault.

Testing Segment Cable

When testing with a TDR, reflections occur at all connections between cable segments, and where transceivers are connected to the segment cable. Reflections also occur at points on the segment cable that have suffered mechanical damage. However, any reflections of amplitude greater than 4% constitute an automatic rejection of the segment cable. Using the distance readout of the TDR, the location of a fault may be identified and subsequently corrected. If the reflection is the result of mechanical damage to the cable, that section of the cable must be replaced. Refer to appendix H for additional information on the TDR.

Since the TDR is able to identify all points of discontinuity, connectors and transceivers in particular, the TDR's printer can be used to provide a map of the cable network. All connectors and transceivers appear as a point of discontinuity to the TDR, even though the amplitude of the reflection does not exceed network specifications.

Transceiver and Transceiver-Interface-Cable Testing

The proper functioning of transceivers and transceiver interface cables should be verified by confirming successful transfer of data packets using two DIs. The initial test should be carried out on the transceiver interface cables located at both extremities of the segment cable. After verifying the functionality of the overall network, the test can then be carried out on the remaining transceiver installations. An acceptable test criterion is that a successful rate of transfer of data packets has been recorded at all access points to the network (that is, at each transceiver interface cable).

The 802.3 transceiver (2630-3) incorporates LEDs that assist in troubleshooting the network. When power is applied to the 802.3 transceiver through its associated network device, the LEDs should indicate as follows:

LED	Indication	Condition
PWR	On	Power is on.
SQE	On Off	SQE is enabled (DIs, ICA, Multiplexer). SQE is disabled (repeater).
XMT	Off	No packets being transmitted.
RCV	Off	No packets being received.
CP	Off	No collisions occurring.

When packets are being transferred, the XMT and RCV LEDs should flash. The CP LED flashes when XMT flashes and when collisions occur on the network.

Repeater Testing

Two DIs may be used to test a repeater by carrying out the same test procedure described for testing transceivers and transceiver interface cables. This is accomplished by transferring data packets between DIs on each of the two cable segments that are connected by the repeater under test.

The PACKET LED on the front panel of the repeater should flash as packets are being transferred.

The PARTN1 and PARTN2 LEDs should not light. When lighted, these LEDs indicate that the segment attached to port 1 or port 2, respectively, has been partitioned from the network; that is, that a fault exists on the segment attached to that port. Refer to maintenance procedures in chapter 3 of this manual for instructions on identifying and correcting faults in the segment cable.

The SQE LED on the attached transceivers should not light, indicating SQE in the transceiver is disabled. If SQE is lighted, refer to figure 2-7 showing SQE jumper locations, and turn SQE in the transceiver off.

Multiplexer Testing

Multiplexers may be tested in a similar manner by transferring data packets between DIs connected as follows: One DI is connected to a transceiver on the segment cable and the other DI is connected to the desired output connector of the multiplexer port to be tested.

The PACKET LED on the front panel of the multiplexer should flash as packets are being transferred. If the multiplexer is configured in a cableless or standalone network, the LOOPBACK LED should light.

The SQE LED on the attached transceivers should light, indicating SQE in the transceivers is enabled. If SQE is not lighted, refer to figure 2-7 showing SQE jumper locations and turn SQE in the transceiver on.

Network Expansion

The network architecture permits evolutionary growth and expansion. The passive nature of the network allows for removal or relocation of data processing equipment without affecting the operation of the network. This benefits the user in terms of scheduled/unscheduled maintenance and provides the flexibility to relocate equipment to any new area that is within reach of the network cables. This subsection describes general guidelines for expanding the network, provides a discussion of segment cable expansion methods, and describes a procedure that should be used for transceiver relocation or removal.

Guidelines for Expanding the Network

When data processing equipment is to be installed at a new location where the segment cable cannot be reached by a transceiver interface cable, an additional length of segment cable must be added to the network. The planner must go through the same process as described in chapter 1: Evaluate the type of structure, facilities requirements, equipment location and quantity, cable performance specifications, floor plans, and budget. The floor plan and schematic layout will also have to be edited to reflect the expansion.

For any expansion to the network, the installation technician should follow the installation guidelines described at the beginning of this chapter. Because the segment cable can easily be damaged by bending, crushing, crimping, or cutting, problems can be minimized by allowing only trained installation technicians to perform the network expansion.

Segment-Cable Expansion

There are three ways to achieve the needed network cable expansion; these are described in the following paragraphs:

Method 1

Obtain the necessary length of segment cable with connectors on each end. Mark it on the floor plan as a new, separate section. Connect the additional cable to the existing segment cable using barrel connectors. Total segment cable length (including the additional segment cable) cannot exceed 500 m (1650 ft) for a single segment. Use a repeater per method 2 for longer lengths.

Method 2

Attach a repeater and a transceiver to the existing segment cable at a point closest to the area to be added to the network. Attach the other end of the repeater and a transceiver to the additional cable that is routed through the new area. Show it on the floor plan as a new leg, noting the repeater and transceiver, the location of the terminated ends of the cable segment, and the new equipment location.

Method 3

Cut the existing segment cable and install connectors on both cut ends (refer to Segment Cable Repair in chapter 3). Route a new section of segment cable through the new area, and attach it to the existing segment cable using barrel connectors. (Refer to the connector installation procedure described earlier in this chapter for specific information.)

NOTE

The cable should be from the same lot as the existing cable segment. This addition may degrade the cable performance enough to require that a repeater be added.

Transceiver Relocation or Removal

The following procedures describe methods for relocating or removing transceivers from an existing network segment cable. Information is provided for transceivers using tap blocks and also for transceivers with N-connectors attached.

Transceivers (2630-1) with Tap Blocks (2630-2)

To remove or relocate a transceiver (2630-1) that uses a tap block (2630-2) for attachment to the segment cable, perform the following steps:

1. Notify users that network may be interrupted if system is in operation.
2. Cut tie-wrap and disconnect transceiver interface cable from transceiver.
3. Remove insulating material and unscrew transceiver from tap block. Make sure that O-ring remains on transceiver connector threads.
4. Screw tap block plug (Control Data part number 15386796) with its O-ring into tap block remaining on segment cable (this location may be reused at a later date). Insulate tap block to prevent its contact with an electrical ground.
5. Install a new tap block (Control Data part number 15386795) at desired location on segment cable. Use a shim (Control Data part number 15386797) if installing tap block on a Teflon segment cable. Ensure that tap block is placed at one of the annular marks on segment cable. (Refer to Transceiver Installation described previously in this chapter for installation procedure.)
6. Check that O-ring is on connector threads of transceiver, then install transceiver and transceiver interface cable per transceiver installation procedure described previously in this chapter.

802.3 Transceivers (2630-3) with Tap Blocks (2630-4)

To remove or relocate an 802.3 transceiver (2630-3), perform the following steps:

1. Notify users that network may be interrupted if system is in operation.
2. Cut tie-wrap and disconnect transceiver interface cable from transceiver by rotating slide latches (one up and one down).
3. Unscrew (counterclockwise) two flat-head screws from transceiver to release it from tap block.
4. If you are not going to install a new transceiver at this location, cover tap block with cover provided. Tap block remains in place.
5. If you are relocating transceiver, install a new tap block (Control Data product number 2630-4, part number 22137340) at desired location on segment cable. Use 802.3 transceiver and tap installation procedure described previously in this chapter.
6. Reinstall transceiver and transceiver interface cable using 802.3 transceiver and tap installation procedure described previously in this chapter.

Transceivers with N-Connectors

To remove or relocate a transceiver that uses N-connectors for attachment to the segment cable, perform the following steps:

1. Notify users that network is going to be interrupted if currently in use.
2. Without touching metal shells of connectors, cut tie-wraps and slide back insulation sleeving to expose a small section of each connector.
3. Measure ac voltage on each connector shell with respect to local ground potential.

   WARNING

   If more than 30-V ac exists on connectors with respect to local ground potential, a fault has occurred and must be corrected before proceeding.

4. Draw back insulation sleeving to completely expose each connector.
5. Connect a 16-gauge copper wire as a jumper lead to rear of each connector shell.
6. Unscrew each N-connector, and remove transceiver.
7. Attach replacement transceiver, or barrel connector if transceiver is to be removed. Only hand-tighten the N-connectors.
8. Remove the jumper-wire and pull insulation sleeving back over connectors. Secure sleeving with tie-wraps. If a replacement transceiver is installed, it must be insulated to prevent contact with an electrical ground. No part of connectors or transceiver should be left exposed.

Maintenance 3

Installation and Checkout 3

This section provides information necessary to perform repairs on the network cable components and describes specific maintenance procedures to be used. Maintenance should be performed only by qualified technicians with experience in operating a time domain reflectometer (TDR). The TDR is required to locate cable or connector faults that may occur in the network. The various topics of maintenance information discussed are:

- Preventive Maintenance
- Fault Isolation
- Component Repairs and Replacement

Preventive Maintenance

The segment cable can be easily damaged by folding, crushing, crimping, or cutting. Any deformation of the center dielectric can cause degradation of network performance. Therefore, care must be taken to ensure that no damage occurs to the network cable installation. Installation technicians and contractors likely to be working in the area of the segment cable should be cautioned to protect the cable from any inadvertent damage. Problems can be minimized by allowing only trained personnel to make connections or repairs to the network. It is also suggested that a routine check be made to ensure that the network components are not at risk of physical damage.

Fault Isolation

Isolation of coaxial segment cable or connector faults may be achieved by using a time domain reflectometer (TDR) cable tester. Any cable reflection having an amplitude greater than 4% indicates a cable or connector fault. Refer to appendix G for additional information on the TDR. A typical test procedure would start by using the TDR to establish the functionality of the segment cable and performing any repairs or replacement as necessary. When the cable segment and the transceiver taps have been restored to a serviceable condition, and rechecked with the TDR, further diagnosis or verification can be carried out by transferring data packets between DIs connected at appropriate transceiver access points on the cable network.

Component Repairs and Replacement

Segment cables can be repaired by following the segment cable repair procedure that follows. Faulty transceivers, transceiver taps, and connectors should be replaced per the applicable replacement procedure described in this subsection.

Replacements for faulty components such as transceivers, transceiver interface cables, connectors, and complete segment cables if needed, should be obtained from the applicable network component vendor. Refer to appendix B for a listing of various vendors that can supply these network components.

Segment-Cable Repair

Perform the following procedure to repair a faulty portion of a segment cable.

1. Notify users that network is going to be interrupted if system is running.
2. Locate convenient transceiver tap marker on segment cable closest to cable location needing repair [these are annular rings spaced every 2.5 m (8.25 ft)].
3. Locate nearest N-connector on each side of chosen tap marker. It may be quite a distance away depending on whether one long section of cable was used for installation or a mixture of different lengths was used.
4. Perform the following on each of the N-connectors (refer to figure 2-3):
   a. Without touching metal shell of N-connector, cut tie-wraps on insulation sleeving.
   b. Draw back insulation sleeving to expose a small section of N-connector.
   c. Measure ac voltage on N-connector shell with respect to local ground potential.

   WARNING

   If more than 30-V ac exists on connectors with respect to local ground potential, a fault has occurred and must be corrected before proceeding.

   d. Draw back insulation sleeving to expose all of N-connector.
5. Jumper both N-connector shells together using a 16-gauge copper wire and alligator clips as a jumper lead.

   WARNING

   A serious shock hazard exists if ground is not maintained with a jumper between the two sections of cable when the damaged section is cut out in the next step.

6. If coaxial cable is damaged such that you do not have to remove any portion of cable, simply cut cable at that point. If you must remove a portion of damaged cable, you must cut cable at closest annular rings, which you located in step 2.
7. If you did not remove any damaged cable, or you removed cable between annular rings and are still able to reconnect ends, place a piece of insulation sleeving on one of the cut ends. If you must add a length of cable to reconnect ends, place insulation sleeving on both ends of cut cable.
8. Follow N-connector installation procedure in chapter 2 of this manual and install male plug connectors (Control Data part number 15388611) on both ends of cut cable. If both ends of cable can now be connected together, skip to step 10. Otherwise, if you must add a length of cable, perform step 9.
9. If you cannot reconnect the cable ends, you must add a 2.5 m (8.2 ft) length of coaxial cable. Follow the N-connector installation procedure in chapter 2 of this manual and install male plug connectors (Control Data part number 15388611) on both ends of new cable.

10. Install a female barrel connector (Control Data part number 15386110) between installed N-connectors on repaired ends of segment cable. The N-connectors should only be hand-tightened.
11. Slide insulation sleeving over newly installed N-connectors and secure with tie-wraps. No parts of N-connectors should be left exposed.
12. Remove jumper lead between N-connectors. Pull insulation sleeving back over N-connectors (no part of N-connectors should be left exposed) and secure with tie-wraps.
13. Verify integrity of repair.
14. Update site plan to indicate location of repaired segment cable.

N-Connector Replacement

Perform the following procedure to replace a faulty N-connector (terminator, barrel connector, or plug connector) on the segment cable.

1. Notify users that network is going to be interrupted if system is running.
2. Locate convenient transceiver tap marker on segment cable closest to cable connector needing replacement [these are annular rings spaced every 2.5 m (8.25 ft)].
3. Locate nearest good connector on each side of chosen tap marker.
4. Perform the following on each of these connectors:
   a. Without touching metal shell of connector, cut tie-wraps on insulation sleeving.
   b. Draw back insulation sleeving to expose a small section of connector.
   c. Measure ac voltage on connector shell with respect to local ground potential.

   WARNING

   If more than 30-V ac exists on connectors with respect to local ground potential, a fault has occurred and must be corrected before proceeding.

   d. Draw back insulation sleeving to expose all of connector.
5. At faulty connection, cut tie-wraps and slide back insulation sleeving. Then disconnect barrel connector (or terminator) from plug connector(s) attached to segment cable, as applicable.
   - If problem appears to be with barrel connector or terminator, replace appropriate item (hand-tighten only) and skip to step 10 of this procedure.
   - If problem appears to be with plug connector attached to segment cable, continue with this procedure at next step.
6. Cut connector from segment cable as close to connector as possible.
7. Place insulation sleeving onto cut end of segment cable.

8. Follow N-connector installation procedure described in chapter 2 of this manual and install new male plug connector (Control Data part number 15386115) onto cut end of cable.

9. Reinstall barrel connector or terminator (removed in step 5) into plug connector(s) on segment cable. The N-connectors should only be hand-tightened.

10. Pull insulation sleeving over connectors and secure with tie-wraps. No parts of N-connectors should be left exposed.

11. Remove jumper lead between connectors. Pull insulation sleeving back over these connectors and secure with tie-wraps.

12. Verify integrity of repair.

Transceiver and Transceiver Tap-Block Replacement

To replace a faulty transceiver, refer to the Transceiver Relocation or Removal Procedures contained in chapter 2 of this manual. To replace a faulty transceiver tap block, perform the following steps:

1. Notify users that network is going to be interrupted if system is in operation.

2. Locate convenient transceiver tap marker on segment cable closest to tap block location needing repair [these are annular rings spaced every 2.5 m (8.25 ft)].

3. Locate nearest connector on each side of chosen tap marker.

4. Perform the following on each of the connectors:

   a. Without touching metal shell of connector, cut tie-wraps on insulation sleeving.

   b. Draw back insulation sleeving to expose a small section of connector.

   c. Measure ac voltage on connector shell with respect to local ground potential.

   WARNING

   If more than 30-V ac exists on connectors with respect to local ground potential, a fault has occurred and must be corrected before proceeding.

   d. Draw back insulation sleeving to expose all of connector.

5. Jumper both connector shells together using a 16-gauge copper wire as a jumper lead.

6. Cut tie-wrap and disconnect transceiver interface cable from transceiver at location of faulty tap block.

7. Unscrew transceiver from tap block.

8. Remove defective tap block from segment cable.

9. Install a new tap block (Control Data part number 15386795 or 22137340) on segment cable. (Refer to Transceiver Installation described in section 2 for installation procedure.) If segment cable is damaged, cut and splice cable per Segment Cable Repair procedure (steps 6 through 11), then install tap block at a different annular location mark on cable.

10. Check that O-ring is on connector threads of 2630-1 transceiver, then reinstall transceiver and transceiver interface cable. (Refer to transceiver installation procedure described in chapter 2.)

11. Remove jumper lead between connectors. Pull insulation sleeving back over connectors (no part of connectors should be left exposed) and secure with tie-wraps.

12. Verify integrity of repair.

13. Update site plan to indicate any relocation of tap block and/or cable repair.

Appendixes

Glossary A

B

Bus

A hardware arrangement in which processors and storage components are attached to a shared transmission medium.

Bus Structure

Refer to Bus.

C

Catenet

Refer to Concatenated Network.

CDCNET

Refer to Control Data Distributed Communications Network.

Coaxial Cable

A two-conductor (center conductor, shield system), concentric, constant-impedance transmission line used as the trunk medium in the baseband system.

Coaxial Cable Segment

A length of coaxial cable made up from one or more coaxial cable sections and coaxial connectors, and terminated at each end in its characteristic impedance.

Concatenated Network

A communications network composed of more than one type of communications medium (more than one network solution); often established when it is necessary to interconnect a local area network with other resources (for example, another local area network or geographically remote computer-related resources). Also called a catenet.

Control Data Distributed Communications Network (CDCNET)

1. The collection of compatible hardware and software products offered by Control Data to interconnect computer resources into distributed communications networks.
2. A network that is interconnected by Control Data Network Architecture (CDNA)-compatible hardware and software products.

D

Data Terminating Equipment (DTE)

Data communications equipment that allows human interaction with the databases and operations of a network.

Device Interface (DI)

The communications processor that Control Data offers as its CDCNET hardware product. Also called a CDCNET device interface.

DI

Refer to Device Interface.

DTE

Refer to Data Terminating Equipment.

E

Ethernet

A baseband local area network protocol developed by the Xerox Corporation. CDCNET supports an Ethernet-compatible network.

F

Fiber Optic Link

An interconnection method that provides a means for routing the network through hazardous environments or between buildings.

H

Hardware

Electronic circuitry and its housing, including cabinetry, power hookup, and cooling system.

Host Computer

A mainframe computer system, connected to a communications network, that provides primary services such as database access, user application execution, or program compilation. For CDCNET, a host computer provides network support functions, including maintenance of device interface load files. Also called a host.

I

ICA

Refer to Integrated Communication Adapter.

IEEE 802.3

A subset of IEEE 802 that defines line protocol and media access technology for local area networks that use a bus employing CSMA/CD.

Integrated Communication Adapter (ICA)

A hardware device that interconnects a single 16-bit Integrated Controller Interface (ICI) channel of a host computer with CDCNET. The ICA is installed in the CYBER 930 host computer mainframe.

Interface

A mechanism that enables the exchange of data between two dissimilar resources in a communications network.

L

LAN

Refer to Local Area Network.

LED

Light-emitting diode.

Link

1. Any specified relationship between two device interfaces in a network, or a communication path between two device interfaces, or a data link.
2. The communications path between two device interfaces. Also called a line, channel, or circuit.

Local Area Network (LAN)

A privately owned network that interconnects data processing equipment to provide high speed communication. Allows users and services to exchange messages and share resources.

M

Mainframe Device Interface (MDI)

The standard CDCNET device interface variant that interconnects host computers operating under NOS or NOS/VE with an Ethernet local area network.

Mainframe/Terminal Device Interface (MTI)

The standard CDCNET device interface variant that interconnects NOS and NOS/VE host computers with terminals, workstations, and unit record equipment without requiring a local area network.

MDI

Refer to Mainframe Device Interface.

MTI

Refer to Mainframe/Terminal Device Interface.

Multiplexer (MUX)

Equipment that enables a site to concentrate data transmission between multiple slower-speed devices (such as terminals and workstations) and a higher-speed channel. For example, a multiplexer can concentrate data being transmitted between multiple terminals and a host computer by using a local area network.

MUX

Refer to Multiplexer.

N

N-Connector

A type of coaxial cable connector that is used on the segment cable of the local area network (LAN).

NDI

Refer to Network Device Interface.

Network

An interconnected set of host computers, terminals, workstations, and unit record equipment. Refer also to Local Area Network and Concatenated Network.

Network Device Interface (NDI)

The standard CDCNET device interface variant that transfers data between networks (for example, between two local area networks, between a local area network and a communications line, or between a local area network and a public data network).

P

Packet

A group of binary digits, including data and control elements, switched and transmitted as a data unit by communications networks. The packet's data, control signals, and error-control information are arranged in a specific format. Different types of networks use different sizes of packets.

R

Remote Terminal Device Interface (RTI)

The standard CDCNET device interface variant that functions as a remote line concentrator for RS-232-C lines.

Repeater

A network device that extends the network service beyond one 500-meter (1639.3 ft) length of segment cable.

RTI

Refer to Remote Terminal Device Interface.

S

Segment Cable

Refer to Coaxial Cable.

T

TDI

Refer to Terminal Device Interface.

TDR

Refer to Time Domain Reflectometer.

Terminal

An operator input/output device used for communication on the network.

Terminal Device Interface (TDI)

The standard CDCNET device interface variant that interconnects terminals, workstations, and unit record devices with an Ethernet local area network.

Terminator

An electrical/mechanical component that is used to terminate a cable in its characteristic impedance.

Time Domain Reflectometer

A test device used to check out the network cabling by identifying the location and nature of each discontinuity on the cable.

Transceiver

A hardware device that is used to interconnect network devices.

Transceiver Interface Cable

A multiwire cable used to connect a transceiver to a network device.

Trunk

A logical definition of a line and the communications software that allows the line to carry data between communications controllers. These controllers could be device interfaces or devices for other networks. Trunks going to other networks, such as DECNET or SNA, are not recognized as network solutions.

Trunk Cable

Refer to Coaxial Cable.

Vendor Part Numbers — B

This appendix provides part number information for various vendors other than Control Data that also supply network hardware components.

Table B-1. Vendor Part Numbers

Component Supplied	Vendor/Part Number
Major Parts	
Codelink 3030A Fiber Transceiver[1]	CODENOLL 1086 North Broadway, Yonkers, NY 10701
200X Star Coupler[1]	
Fiber Cable[1]	
TRANSLAN III or IV Ethernet Bridge[1]	VITALINK 1350 Charleston Road Mountain View, CA 94043
Active Optical Star Coupler (compatible with IEEE 802.3 and V2.0)[1]	Hirschmann Verwaitung Richard-Hirschmann-Strate 19 D-7300 Esslingen/Neckar West Germany
Ungermann Bass Buffered Repeater, Model 5261A[1]	Ungermann Bass 3990 Freedon Circle Santa Clara, CA 95050
Coaxial Cable Transceiver[1]	3Com Model 3C101
Cabletron ST-500-03 Transceiver for use with Thin Ethernet coaxial cable[1]	Cabletron P.O. Box 6257 Rochester, NH 03867-6257

1. Equipment has been functionally tested on CDCNET but has not been certified as a CDCNET system component.

(Continued)

Table B-1. Vendor Part Numbers *(Continued)*

Crimping Tools	Kings	Amphenol
Crimp Handle	KTH-1000	227-994
Thick Cable Die	KTH-2004	227-1221-25
Thin Cable Die	KTH-2001	227-1221-11

Segment Cables	3Com	Inmac
15 m (49.2 ft)	3C120-15	1062-1H-5
30 m (98 ft)	3C120-30	1062-1H-5
50 m (164 ft)	3C120-50	1062-1H-5
100 m (328 ft)	3C120-100	--
200 m (656 ft)	3C120-200	--
500 m (1640 ft)	3C120-500	--

Transceiver I/F Cables	3Com	Inmac
5 m (16.4 ft)	3C110-005	1063-1H-5
10 m (32.8 ft)	3C110-010	1063-2H-5
15 m (49.2 ft)	3C110-015	1063-3H-5

Bulk Coaxial Cable	3Com	Inmac	Belden
PVC (0.405 in O.D.)	3C121-YYY[2]	1784	9880
FEP (0.375 in O.D.)	--	--	89880
FEP (0.405 in O.D.)	--	1785	--

Coaxial Cable Connectors	3Com	Inmac	Kings	Amp
Male Type N, Clamp (UG1185A/U)	3C150 w/boot	--	KN59-270	51692-2-PVC
Male Type N, Crimp	--	Special Order	KN59-201	--

Connector Adapters	3Com	Inmac	Kings	Amphenol
N male-male Barrel (UG57B)	3C161	--	KN99-44	82-100
N female-female Barrel (UG29B)	3C160	1064-2	KN99-50	82-101
N female-BNC female (M55339/01-00001)	3C540	1064-6	1209-21	82-5550
N male-BNC female (UG201A)	3C541	1064-7	KN99-35	31-216

2. YYY indicates length in meters, available from 3Com in 100-, 200-, and 500-m (330-, 660-, and 1650-ft) lengths only.

CDCNET LAN Product/Equipment Cross-Reference C

Table C-1 lists the Control Data product numbers, internal equipment numbers, part numbers, and description for products currently available for CDCNET configuration.

Table C-1. CDCNET LAN Product/Equipment Cross-Reference

Product Number	Equipment Number	Part Number	Nomenclature
2608-116	YA329-A	22120965	5 m (16.4 ft) 802.3 Transceiver interface cable, PVC (not flame-proof).
2608-133	YA329-B	22120966	10 m (32.8 ft) 802.3 Transceiver interface cable, PVC (not flame-proof).
2608-165	YA329-C	22120967	20 m (65.6 ft) 802.3 Transceiver interface cable, PVC (not flame-proof).
2608-100	YA329-D	22120968	50 m (164 ft) 802.3 Transceiver interface cable, PVC (not flame-proof).
2608-216	YA328-A	22120970	5 m (16.4 ft) 802.3 Transceiver interface cable, Teflon (recommended).
2608-233	YA328-B	22120971	10 m (32.8 ft) 802.3 Transceiver interface cable, Teflon (recommended).
2608-265	YA328-C	22120972	20 m (65.6 ft) 802.3 Transceiver interface cable, Teflon (recommended).
2608-200	YA328-D	22120973	50 m (164 ft) 802.3 Transceiver interface cable, Teflon (recommended).
2630-1	TN111-A	53368889	Ethernet transceiver.
2630-2	YA300-A		Ethernet tap block and plug kit for 2630-1.
		15386795	Transceiver tap block.
		15386796	Tap block plug.
		15386797	Shim.
2630-3	TN111-B	22120964	Ethernet 802.3 transceiver.
2630-4	YA331-A	22137340	802.3 tap block for 2630-3 transceiver.
2631-2	TN112-C	22120962	802.3 multiplexer.
2632-1	TN114-B	22120963	802.3 repeater.
2633-1	YA302-A	53585364	Ethernet splice kit.
2633-2	YA301-A	22183230	Ethernet terminator kit.
2634-23	YA304-A	22179670	23.4 m (76.8 ft) Teflon coaxial cable assembly with terminators (recommended).
2634-70	YA304-B	22179671	70.2 m (230.3 ft) Teflon coaxial cable assembly with terminators (recommended).
2634-117	YA304-C	22179672	117.0 m (383.9 ft) Teflon coaxial cable assembly with terminators (recommended).
2634-500	YA304-D	22179673	500.0 m (1640.4 ft) Teflon coaxial cable assembly with terminators (recommended).

(Continued)

Table C-1. CDCNET LAN Product/Equipment Cross-Reference *(Continued)*

Product Number	Equipment Number	Part Number	Nomenclature
2635-23	YA303-A	22179666	23.4 m (76.8 ft) PVC coaxial cable assembly with terminators (not flame-proof).
2635-70	YA303-B	22179667	70.2 m (230.3 ft) PVC coaxial cable assembly with terminators (not flame-proof).
2635-117	YA303-C	22179668	117.0 m (383.9 ft) PVC coaxial cable assembly with terminators (not flame-proof).
2635-500	YA303-D	22179669	500.0 m (1640.4 ft) PVC coaxial cable assembly with terminators (not flame-proof).
2653-1	TN499-1	24679501	CDCNET maintenance kit.
2653-2	YA332-A	22137345	CDCNET 802.3 maintenance kit.

Segment-Cable Specifications D

The segment cable specified for LAN use is a special coaxial cable that has an average characteristic impedance of 50 ±2 ohms when measured in accordance with MIL-STD C17E and IEEE Standard 802.3.

The segment cable must conform, at a minimum, to the following requirements:

- The coaxial cable shall consist of a center conductor, dielectric, shield system, and overall insulating jacket.
- Solid-copper center conductor, 2.17 ± 0.013 mm (0.0855 ±0.0005 in) diameter.
- Foamed-core dielectric material.
- Inside diameter of innermost shield, 6.15 mm (0.242 in) minimum.
- The shielding system may contain both braid and foil elements.
- Outer shield of 90% or greater tinned copper braid with an outside diameter of 8.28 ±0.178 mm (0.325 ±0.007 in).
- Outside diameter of jacket must be 9.27 mm (0.365 in) minimum to 10.465 mm (0.412 in) maximum.
- Concentricity such that the center conductor is within 0.5 mm (0.020 in) of its ideal concentric position with respect to the jacket.
- Jacket must be marked with annular rings spaced 2.5 m ±5 cm (8.20 ft) apart in a color contrasting with the jacket background color.
- The coaxial cable jacket, shield system, and dielectric material shall be pierceable either by a connector type that meets IEEE 802.3 specifications (see transceiver and tap descriptions in chapter 1) or by an external core tool. Overall cable system pierceability (the ability of a tap probe to pierce the jacket, shields, and dielectric cable system without substantial dielectric deformation and without causing a short circuit between center conductor and shield system) is a vital parameter affecting tap connection reliability.
- Maximum cable length of 500 m (1640.4 ft).
- Attenuation:

  6.0 dB/500 m (1640.4 ft) at 5 MHz,
  8.5 dB/500 m (1640.4 ft) at 10 MHz
- Propagation Velocity:

  0.77 c
- Cable must meet applicable flammability criteria and local codes for the installed environment.
- The dc loop resistance of any coaxial cable segment, including any connectors, shall not exceed 5 ohms. Transceivers, which require severing the cable as the connecting means, must be included in the loop resistance measurement. Each in-line connector pair shall be no more than 10 m ohms.

- All cable connectors shall be N-series 50-ohm constant impedance types. An isolation method must be provided to ensure that the connector shells do not make contact with any building metal, or other unintended conductor.

Network Configuration Layouts E

This appendix shows typical configurations of various network cable layouts. Examples are shown for networks with and without repeaters (figures E-1, E-2, and E-3) and two layouts (figures E-4 and E-5) are shown in three dimensions to depict alternative methods of connection between floors. Also shown are fiber optic link (figure E-6) and remote repeater (figure E-7) connection examples. An example of a CDC CYBER 930 host connection (figure E-8) is provided, as well as an example of a Network DI used as a relay unit (figure E-9).

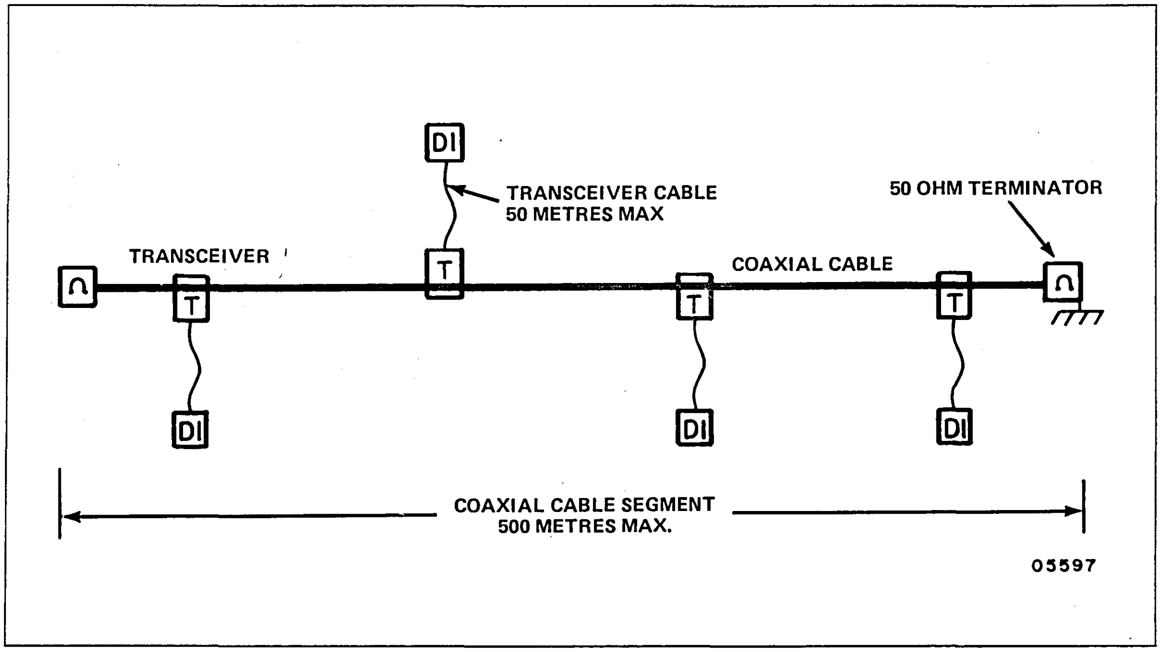


Figure E-1. Single-Segment Network Example

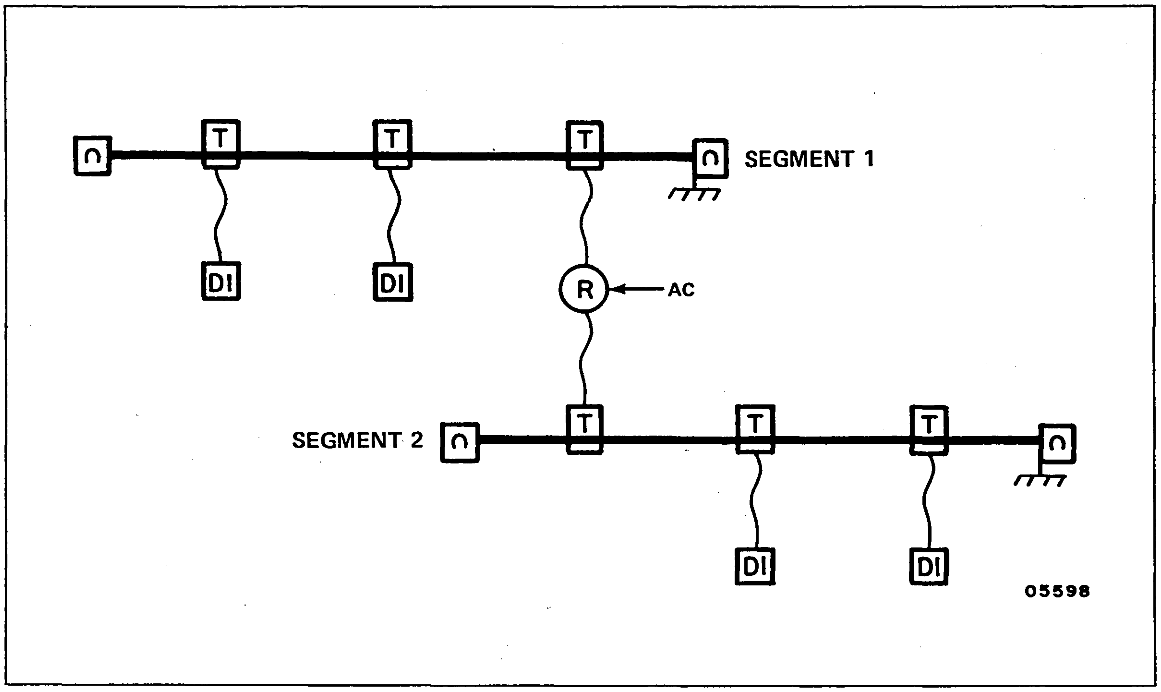


Figure E-2. Two-Segment Network Example

Figure E-3 depicts a more complex network layout employing six repeaters. This layout, however, does not violate the rule requiring that there not be more than two repeaters between any station-to-station signal path.

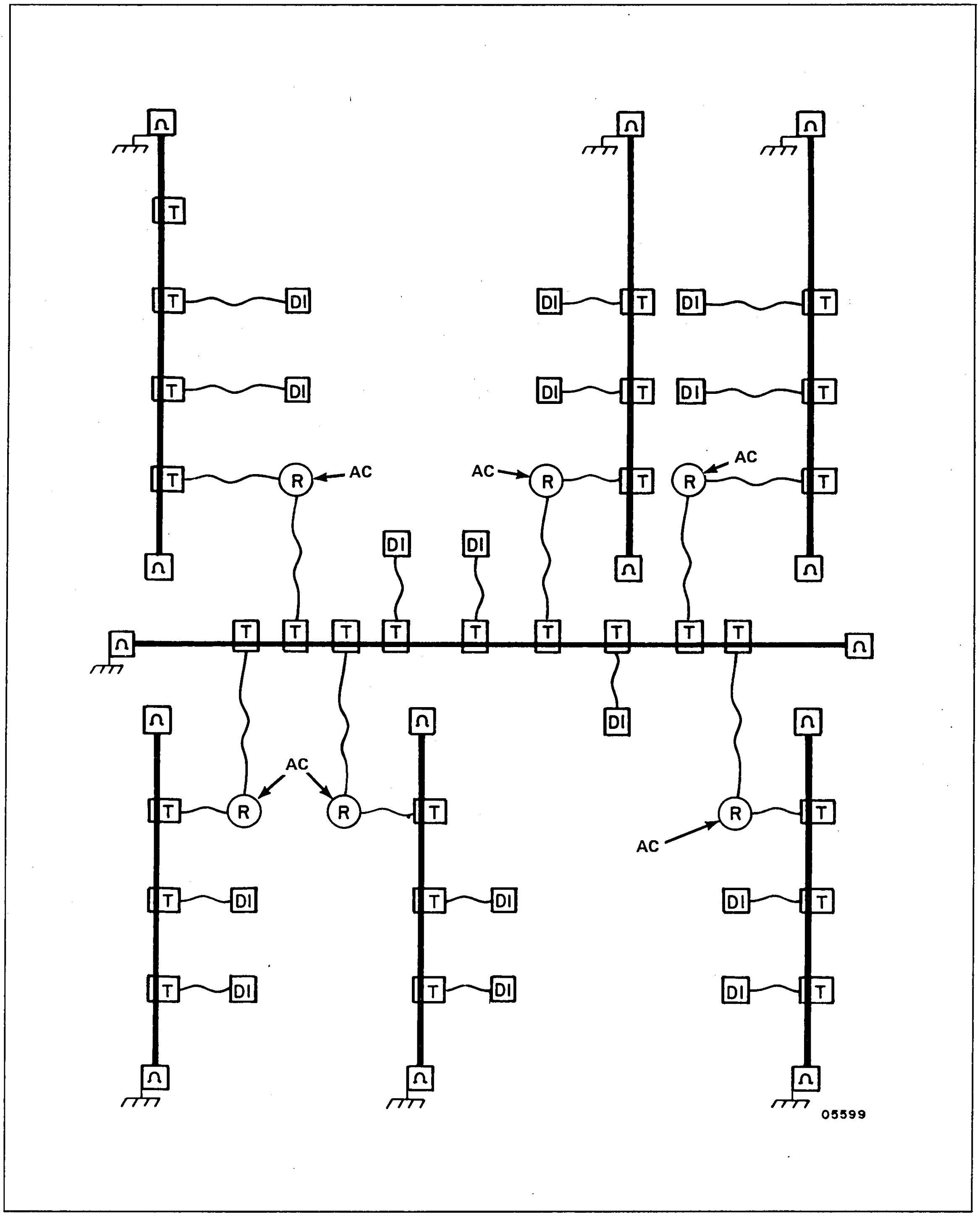


Figure E-3. Complex Network Example Using Six Repeaters

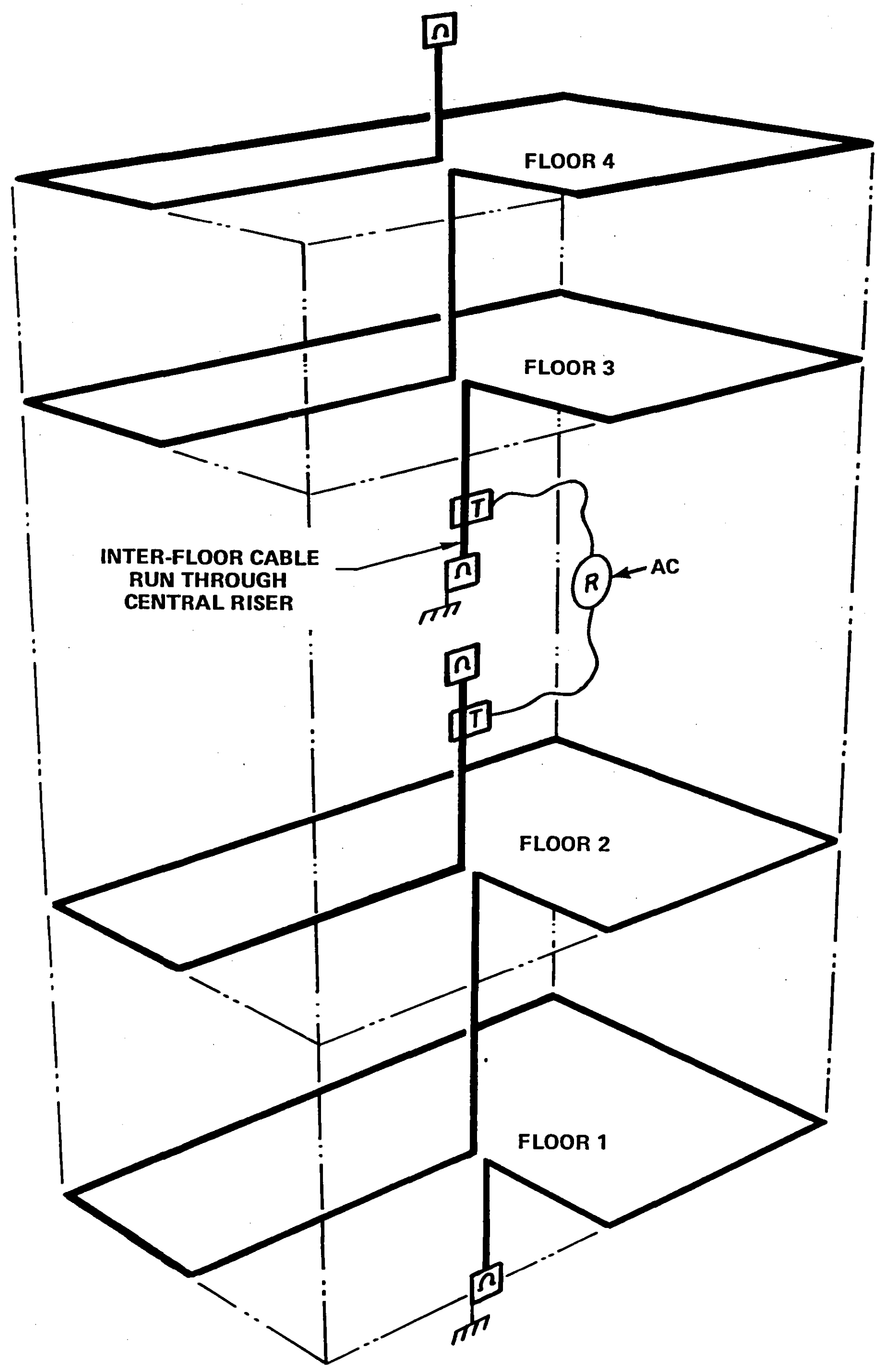


Figure E-4. Four-Floor, Two-Cable Network Example

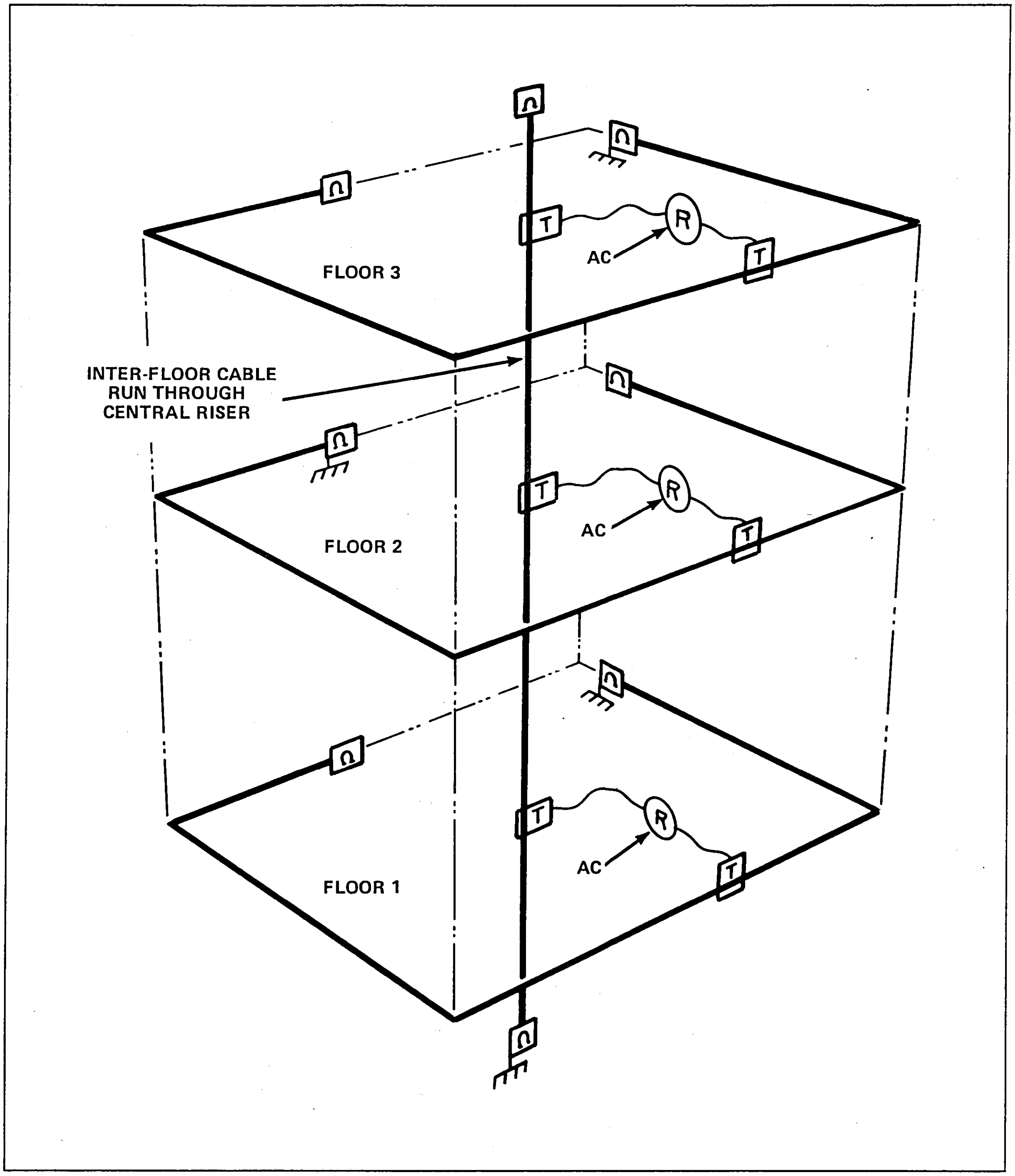


Figure E-5. Three-Floor, Four-Cable Network Example

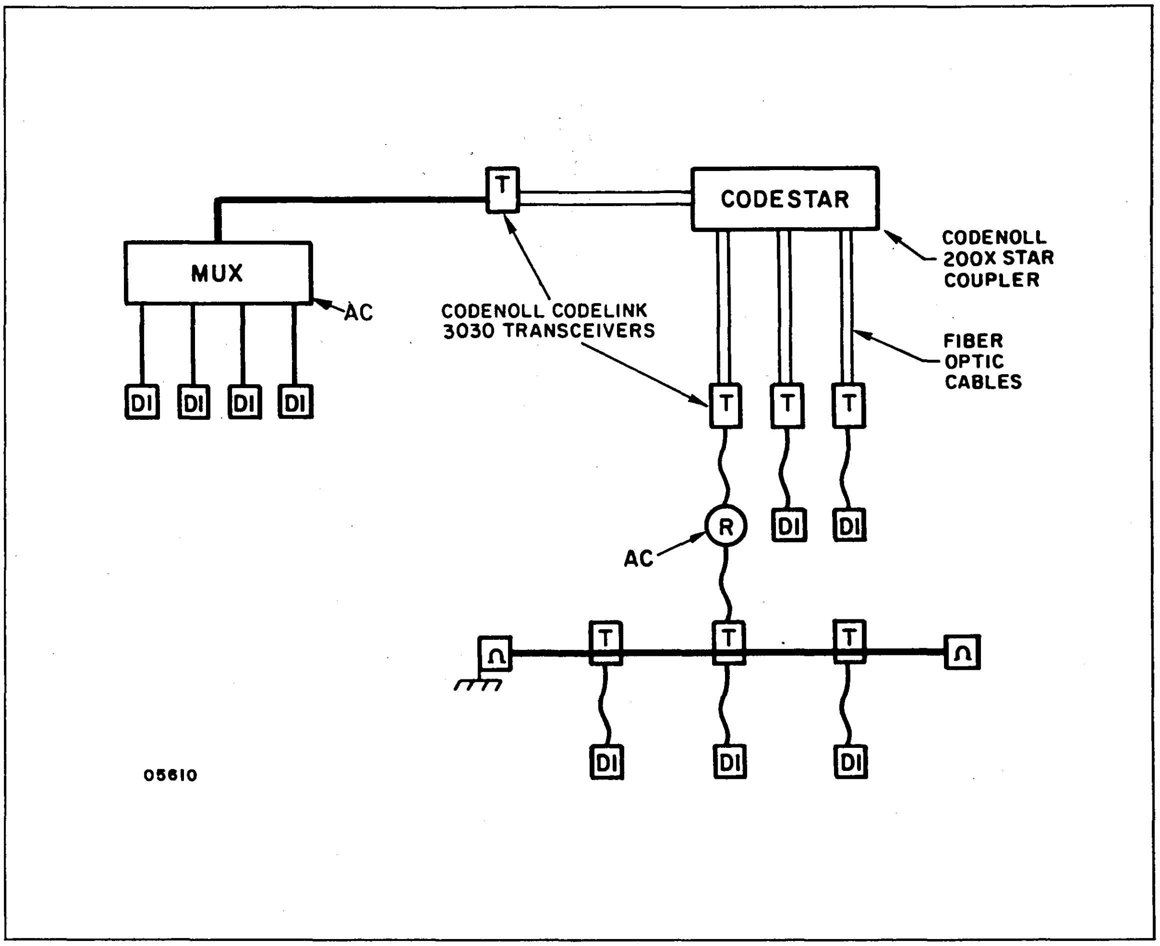


Figure E-6. Example of Fiber-Optic-Link Connection with Multiplexer

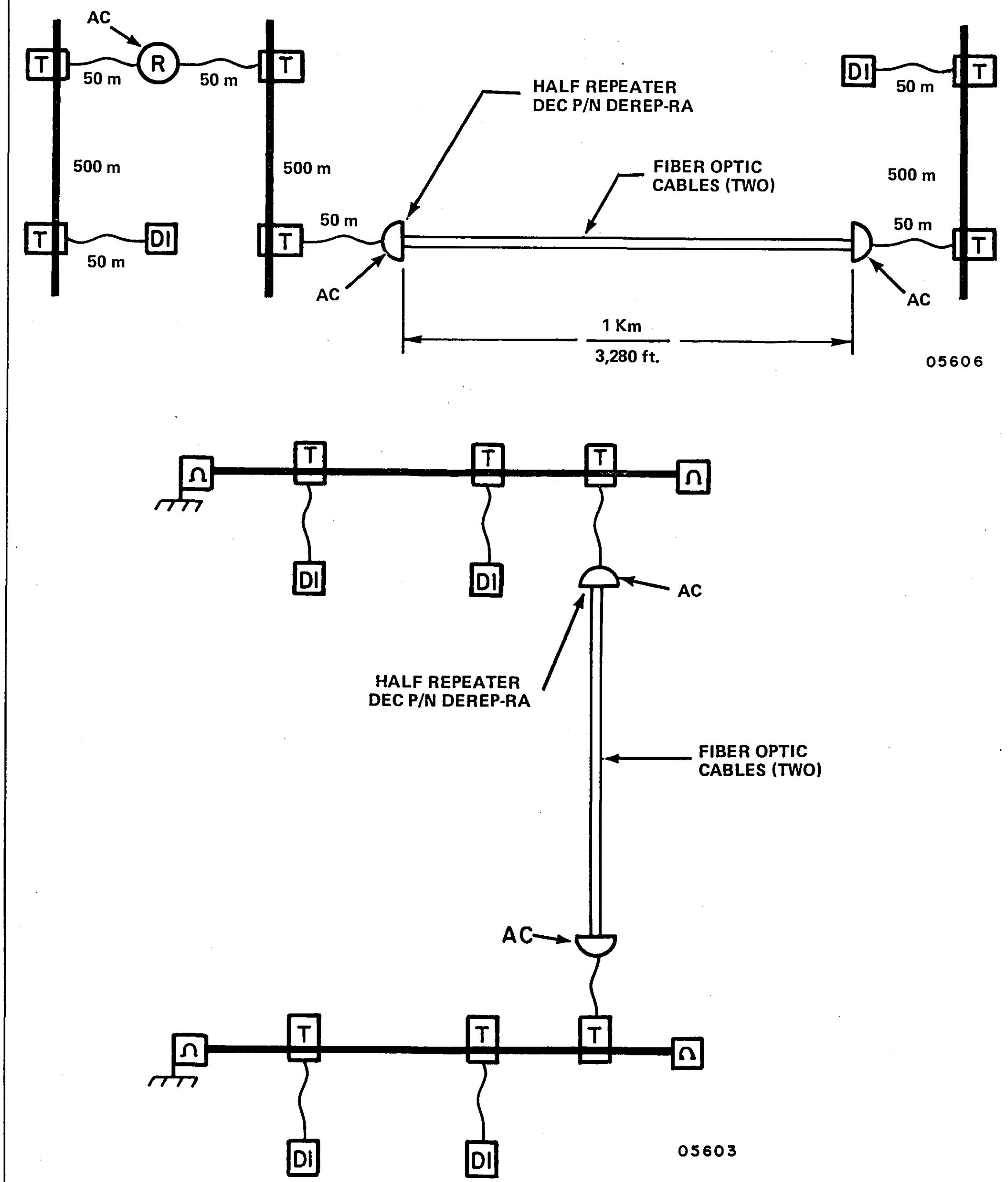


Figure E-7. Examples of Remote Fiber-Optic-Repeater Connection

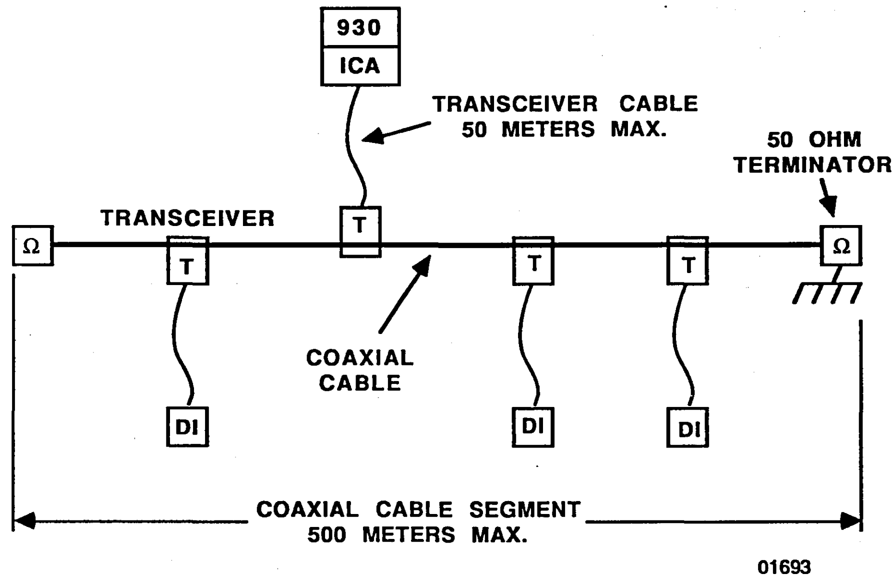


Figure E-8. Example of Network Accessed by CDC CYBER 930 with ICA

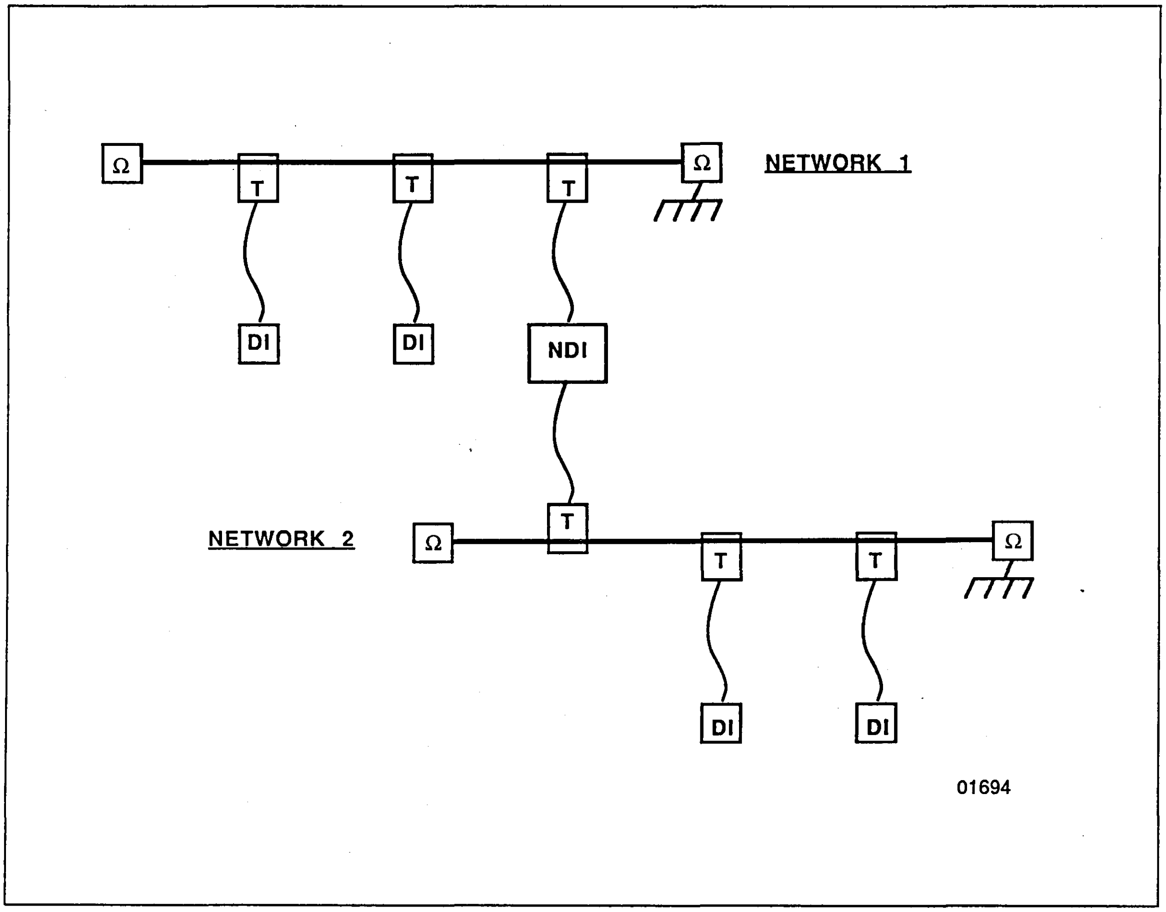


Figure E-9. Example of Two Networks Connected by NDI Used as a Relay Unit

Site Requirements Survey Form F

This appendix contains the site requirements survey form designed to help the designer/planner in performing the network site evaluation. The form should be completed by the designer/planner with assistance from the site service manager or other authorities responsible for the customer's premises.

1. Is building owned or leased? ____________________

2. Name and telephone number of lease holder ________________________

3. Do any ceilings have removable panels or access doors? ________________

4. Are any of the false ceilings used as an air (plenum) return? ____________

5. Will any of the cabling be run in the walls? _________________

6. Are the walls:

   a. Cement block? __________
   b. Plaster? _______________
   c. Standard wall board easily penetrable? _________________
   d. Tile? _______________
   e. Other? ______________

7. If cable is to be run in a false ceiling:

   a. Is there sufficient room for a 250-mm radius bend where needed? _______
   b. Is there room for mounting a tap block and transceiver? _____________
   c. Will there be firewalls to penetrate? ____________

8. If cable is to be routed between floors:

   a. Is there access from the false ceiling into (or out of) the telephone closet? __
   b. Is there access from one telephone closet to the one above (or below)? ____
   c. Is there an air shaft or pipe chase that can be used between floors? _____

9. If cable is to be routed under a false floor:

   a. Is the area deep enough to accommodate the cable? ____________
   b. Is there a path that can be used to avoid pipes, congested areas, electrical wires, and conduit? ______________
   c. Is the floor itself earth-grounded? ______________

10. If cable is to be routed between buildings:

    a. Is connective conduit available? ____________
    b. Is the conduit large enough to accommodate the cable and 250-mm (10-in) radius bends? ____________
    c. How many access manholes are there? ____________
    d. How far apart are the manholes? ____________
    e. Will it be necessary to route cable on telephone poles? ____________
    f. Will a fiber optic link be used? ____________

11. Your remarks: (Name and telephone number of building maintenance engineer that can be contacted for difficult routing areas, etc.)

Time Domain Reflectometer G

This appendix contains general information on the time domain reflectometer (TDR) recommended for use in detecting network cable or connector faults.

TDR Description

The time domain reflectometer (TDR) sends a positive-going step-voltage pulse down the cable under test. Each and every cable fault is shown as a point of discontinuity that causes energy to be reflected back down the cable to the source where it is detected by the TDR. The reflected voltage is superimposed on the advancing initial step and is displayed on the display screen of the TDR as a step-up or a step-down transition. Inductive faults or faults of higher resistance than the resistive component of the characteristic impedance of the cable cause a rise or step-up transition. Capacitive faults, or faults of lower resistance than the normal resistive component of the segment cable characteristic impedance cause a step-down transition. The time delay between incident and reflected pulses gives the distance of the fault(s) from the source (TDR). The TDR automatically converts this time interval to a distance (in meters).

Recommended Model

The TDR recommended for coaxial cable network commissioning tests is the TEKTRONIX 1503 Cable Tester with Option 01 (distance calculator), Option 04 (chart recorder) and Option 05 (metric readout). This device has a maximum range of 1500 metres with a ±2% accuracy.

NOTE

Transceivers must not transmit during TDR testing. If transmission occurs, the input to the TDR may become invalid.

TDR Resolution and Accuracy

It is important to distinguish between resolution and accuracy in a TDR; they are two entirely different things. Resolution measures how closely together two separate, independent cable faults may be located before the TDR detects them as only one fault, and is determined primarily by the rise time of the pulses received by the TDR. Since the rise time of any pulse is degraded by transmission through a long cable, resolution depends on both the TDR and the cable under test.

It is also important to note that the TDR provides the electrical length rather than than the actual physical length. Therefore, it is necessary to take into account the following factors:

- Cable snaking, twists, and loops.
- Propagation velocity variation in a given type of cable.
- Sections composed of different cables with different propagation velocities (i.e., cables from different manufacturers).
- Accuracy of physical cable length measurement.

Propagation Velocity

Propagation velocity is the speed at which a signal travels down the cable, and depends on both the dielectric material used for the cable insulation and the geometry of the cable cross-section. The accuracy to which the propagation velocity is known and controlled determines the relationship between the electrical and physical length. Although most cable manufacturers can control propagation velocity to within 0.5%, cable from different manufacturers may have variations of 2% to 3%. It is thus desirable not to mix cable from different manufacturers in the same cable segments.

Improving Distance Accuracy

Cable length reduces the TDR waveform and, subsequently, the accuracy of the TDR to determine feature characteristics of the cable. The shorter the length of segment cable between the TDR and the point of interest, the better the picture.

For example, the longest passive cable run is 500 m (1650 ft) and, if the cable cannot be broken for test purposes, the worst-case situation would be a point of discontinuity at a distance of 250 m (825 ft) from one end (i.e., the midpoint of the cable run). This point could be identified to within a length of 10 m (33 ft).

Two basic ways to improve distance measurement accuracy are:

- Take Multiple Readings - Since all TDR distance errors are percentage errors of the 'scan length', a good technique is to move closer to the fault resulting in progressively more accurate distance readings.

- Use all available information - By using known points on the cable to calibrate TDR timing, improved accuracy is possible if the segment cable dielectric is the same for the entire length of the cable. For example, if it is known that a change of cable propagation velocity exists at 300 m (900 ft), then calibrate the TDR for the dielectric of the first section using a scan length of 300 m (900 ft) only.

Common Mechanical Faults

During installation, the segment cable may suffer mechanical damage that results in either an open circuit or a short circuit. Intermittent faults may occur due to severe abrasion resulting in part of the sheath, screen, and dielectric being worn away; and if the cable is crimped by accident, the dielectric may be ruptured. Figure G-1 shows examples of various cable reflections as viewed on a TDR.

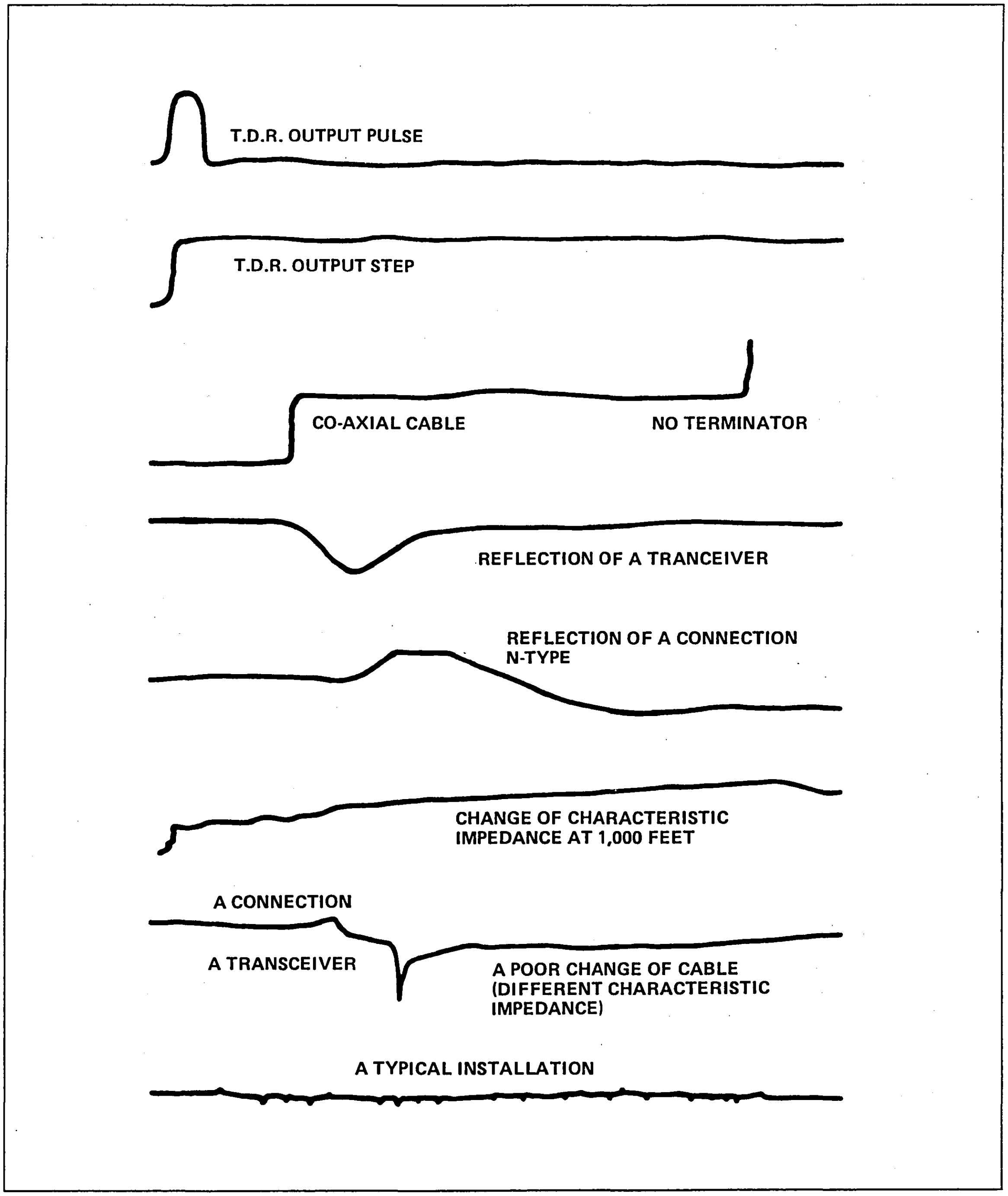


Figure G-1. Reflections as Viewed on a TDR

IEEE 802.3 and Ethernet V 1.0, V 2.0 Specifications Comparisons — H

Table H-1 notes some of the differences between the IEEE 802.3 and the Ethernet V 1.0, V 2.0 specifications that may present implementation problems. The material in the table is listed in the order in which it appears within the IEEE 802.3 specification. For the most part, times are given in bit times. Real times are specified relative to a 10-Mbit-per-second data rate. A dash (–) indicates that a value was not specified or could not be found in the specification.

Table H-1. 802.3 and V 2.0, V 1.0 Specifications Comparison Chart

Subject	802.3	V 2.0	V 1.0
Preamble	56 bit times	64 bit times	64 bit times
Preamble bits consumed by DTE	18 max	16 max	16 max
Carrier Sense Inhibit function:			
• Minimum time to clear the Carrier Sense signal after loss of carrier presence (receive and collisions).	–	1.6 bit times	–
• Carrier Sense inhibited period	4 to 8 μs	4 to 9.6 μs	–
Data Rates Supported	1 to 10 M bps	10 M bps	10 M bps
Transceiver Cable Driver:			
• AC Signal Levels	450 mV min – 1315 mV max	550 mV min 700 mV nom 1200 mV max	– – –
• Idle (IDL) Levels	0 mV ± 40 mV	0 mV	700 mV
• Time for returning to IDL state following last positive-going transition of the frame.	200 ns to 8 μs	300 ns to 2 ms	–
• Voltage presented to the transceiver cable by the driver during return to IDL time.	100 mV differential	100 mV differential	–

(Continued)

Table H-1. 802.3 and V 2.0, V 1.0 Specifications Comparison Chart *(Continued)*

Subject	802.3	V 2.0	V 1.0
• Collision Presence test.			
– Time following the last positive-going transition on the transmit pair by which the signal shall begin.	4 ns	360 ns	–
– Time following the last positive-going transition on the transmit pair by which the signal shall end.	8 ns	500 ns	–
– Duration of signal.	10 ± 5 bit times	300 ns min (3 bit times)	–
• Transceiver cable squelch (receiver threshold level)	160 mV min	175 mV min	–
• DC Common Mode output (driver) voltage (V_C)	0 - 5.5 V	0 - 5 V	0 - 5 V
Timing distortion jitter	1.5 ns max	± 2 ns with ± 200 mV peak sinusoidal signal	± 2 ns with ± 200 mV peak sinusoidal signal
Maximum jitter received by DTE	± 18 ns	± 7 ns	± 7 ns
Circuit shield terminators:			
• Pins 1, 4, 8, 11, and 14	Grounded in DTE; capacitively coupled to V_C in transceiver	Reserved	Reserved
• Connector ground pin	Ground shield connected to connector shell	Pin 1 connected to connector shell and ground shield	Pin 1 connected to connector shell and ground shield

(Continued)

Table H-1. 802.3 and V 2.0, V 1.0 Specifications Comparison Chart *(Continued)*

Subject	802.3	V 2.0	V 1.0
Jabber control	Auto reset by absence of transmit signal for 0.5 sec ± 50 %	No auto reset. Must be ready to transmit within 100 ms of fault determination	No auto reset. Must be ready to transmit within 100 ms of fault determination
Input bias current	+2 μA to -25 μA	–	50 mA
Collision (SQE) to Jam Delay of Repeater	6.5 bit times	–	–
Propagation Delay through Repeaters	7.5 bit times	6 bit times	8 bit times
Worst Case Round Trip Signal Propagation Delay	499 bit times	464 bit times	465 bit times

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