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Cluster and Network

Hardware Installation Guide

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About This Guide

Introduction

The purpose of this guide is to provide assistance in the planning and installation of a CTOS cluster, and to provide assistance in connecting a cluster to other networks.

Scope

This guide includes general guidelines for designing the physical layout of clusters, as well as Ethernet and token ring networks. It provides information about required hardware for these networks and for networks accessed through the RS-232, X.21, and ISDN interfaces. It is not intended to provide detailed information about operating system or network software.

Audience

This guide is written for the following technical personnel:

- System administrators
- Customer MIS personnel
- Unisys Customer Service personnel (CSEs)
- PBX technicians

Organization

The manual is divided into three parts, each of which is divided into several sections.

- In Part I, Sections 1 through 5 provide equipment requirements, planning information, and installation instructions for two cluster types: daisy-chain cluster and TeleCluster.

- In Part II, Sections 6 through 11 provide equipment requirements, planning information, and installation instructions for two types of standard local area networks (LANs) commonly used with clusters: Ethernet and token ring.
- In Part III, Sections 12 through 18 provide equipment requirements, planning information, and installation instructions for three interfaces used to connect clusters to wide area networks (WANs): X.21, RS-232, and ISDN.

Terminology

In this guide, the term *cluster* refers only to a CTOS cluster, unless specified otherwise in the text.

In addition the term *server* refers to the cluster server. *Server* replaces the term *master* used in some older documentation.

Finally, the term *TeleCluster* refers to Advanced TeleCluster. The older voice over data TeleCluster product is referred to as *voice/data TeleCluster*.

Related Documentation

For more information see the following hardware and software documentation:

- ***CTOS Workstations Installation Guide***
- ***XE-530 Shared Resource Processor Hardware Installation Guide***
- ***CTOS Workstations Compatibility Matrix***
- ***Unisys Building Wiring Guide***
- ***USERNET Token Ring Network Planning Guide***
- ***Unisys LAN Planning and Installation Guide***
- ***10BaseT Local Area Network (LAN) PLanning and Installation Guide***

- *International Standard ISO 8802-3: 1989 (ANSI/IEEE Std 802.3: 1988)*
- *ANSI/IEEE Std 802.3 Supplements B, C, D, E, and I to ISO 8802-3: 1989)*
- *IEEE Standard 802.5-1989*
- *Unisys Cable Buyer's Guide*
- *CTOS System Administration Guide*
- *CTOS BNet II Installation, Configuration, and Administration Guide*
- *Modem Service Operations and Programming Guide*
- *CTOS Generic Print System Administration Guide*
- *BTOS X.21 Circuit Switching Service Operations Guide*
- *BTOS ClusterShare SNA 3270 Emulator Installation and Operations Guide*
- *BTOS Multiple Gateway Server Operations and Programming Guide*
- *BTOS SNA BNet Transport Service Operations Guide*
- *BTOS SNA BNet Transport Relay Operations Guide*
- *BTOS SNA Transport Operations and Programming Guide*
- *BTOS TCP/IP Operation and Programming Guide*
- *BTOS Virtual Terminal Emulator (VTE) Operations Guide*
- *BTOS Burroughs Multipoint Communications Service (BMULTI) Operations and Programming Guide*
- *BTOS DCA Transport Administration Guide*
- *BTOS Enhanced SNA Emulator Operations and Programming Guide*
- *BTOS X.25 Gateway Operations and Programming Guide, Release 9.0*

Part I

Section 1
Introduction to CTOS Clusters

Introduction to Section 1

This section describes the CTOS cluster: it tells what a cluster is and what the different types of cluster are.

What is a Cluster?

A cluster is a computer network made up of workstations and a server connected by cable through their RS-422 or RS-485 ports. In a cluster, the workstations can communicate with the server to use server resources, such as disk storage, printers, modems, and connections to networks outside the cluster. (Workstations in a cluster generally do not communicate directly, but instead communicate via the server.)

What separates a CTOS cluster from other computer networks is that support for the cluster is built directly into each workstation and into the CTOS operating system itself. Every workstation and server provides the RS-422 or RS-485 port required for a cluster, and the CTOS operating system provides the required software support. As a result, since no extra network hardware or software is required, a cluster is cost effective, easy to install, and easy to use.

Workstations

The workstation is the "building block" of the cluster. Workstations are intended to function in a cluster rather than as standalone systems, although they can function as standalones.

The workstations used in a cluster are usually proprietary CTOS systems. However, IBM-compatible PCs can be used in a cluster if the appropriate adapter board and software are installed (see Section 2).

Servers

Any workstation with a hard disk can be used as a cluster server. However, a common practice is to use the more powerful models as servers, and less powerful models as cluster workstations.

In addition to workstations, another type of system can be used as a cluster server: the shared resource processor. This is a dedicated cluster server that provides enhanced processing and storage facilities.

Types of Cluster

In all clusters, workstations are connected together through their RS-422 or RS-485 ports. However, the cabling method used to connect these ports can vary from cluster to cluster. A cluster can be cabled by using

- A daisy-chain cable between workstations (daisy-chain cluster)
- Telephone cable routed to a central hub (TeleCluster)

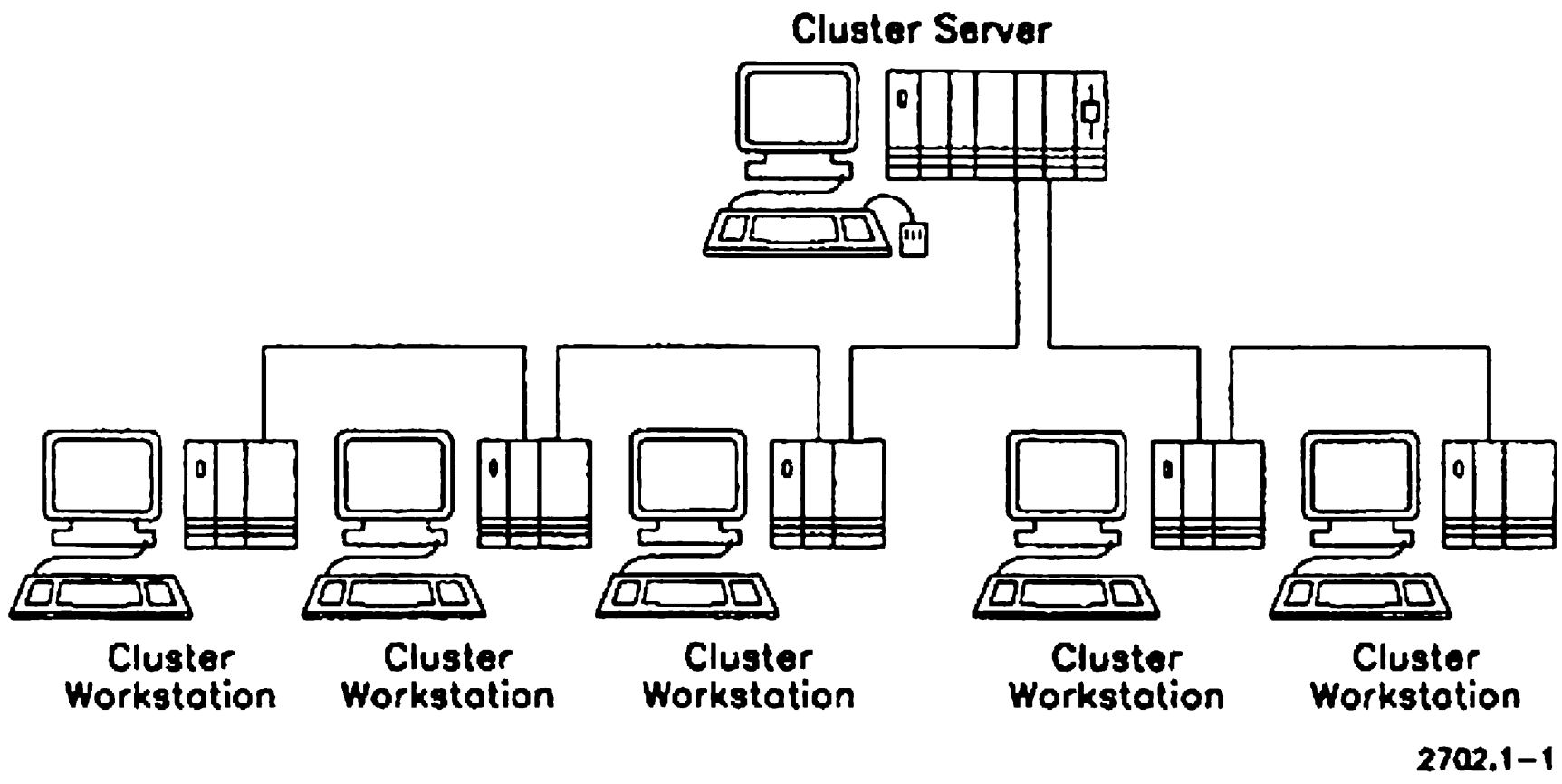
Both of these types of cluster are described below.

Daisy-Chain Cluster

In a daisy-chain cluster, cluster cable is daisy-chained from workstation-to-workstation (see Figure 1–1). Data flows through the daisy-chain bus and through the RS-422 or RS-485 port of every workstation in the cluster.

Note: *Spur cluster, an older type of daisy-chain cluster, is described in Appendix D.*

Figure 1–1. Daisy-Chain Cluster



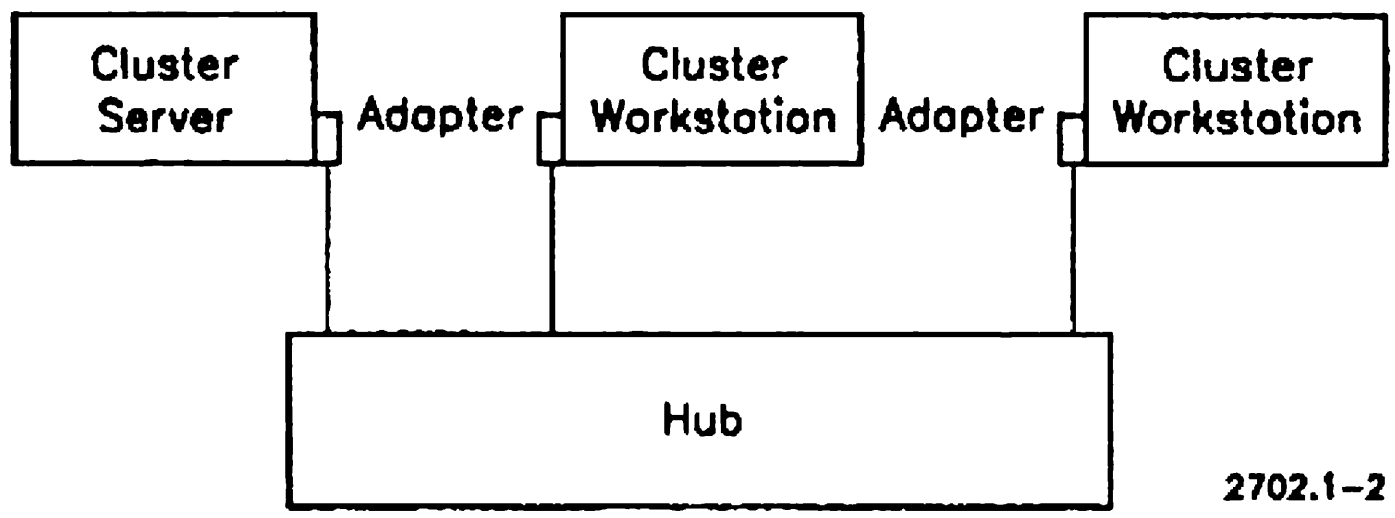
The daisy-chain cabling method is a simple and inexpensive way to connect workstations that are close together. If a cluster has just a few workstations, and workstations are not likely to be added or moved, daisy-chaining might be the best cabling method.

The drawback of daisy-chaining a cluster is that a daisy-chained cluster must be shut down whenever a workstation is added to or removed from the cluster. Furthermore, moving a workstation requires the moving or installing of cluster cable. As a result, this cabling method may be less desirable for installations in which workstations are moved frequently.

TeleCluster

TeleCluster connects each of the workstations in a cluster to a central hub, which broadcasts data through the cluster (see Figure 1–2). A key feature of TeleCluster is its ability to use existing telephone cable (a spare wire pair is required) to link workstations to the hub.

Figure 1–2. TeleCluster



TeleCluster uses a building's existing telephone cable. There are two benefits to this: (1) you don't have to buy and install cable; (2), you can install a cluster workstation wherever you have a phone line with a spare wire pair. This makes TeleCluster well suited for applications that require flexibility.

With TeleCluster, workstations can be added to or removed from the cluster without affecting cluster operation. Moreover, a failure at one cluster workstation will not affect cluster operation. This makes TeleCluster suitable for applications requiring continuous network operation.

However, if you use TeleCluster, you may have to resolve cable ownership issues before using TeleCluster with existing telephone wiring.

Section 2
Requirements for Daisy-Chain Cluster

Introduction to Section 2

This section lists the requirements for installing a daisy-chain cluster. Hardware requirements include one server, workstations, cable, and two cable terminators. You'll also need a ClusterCard for each IBM compatible PC in the cluster.

Software requirements include the CTOS operating system and the ClusterShare software required for ClusterCard.

Cluster Servers

Any CTOS workstation or shared resource processor with a hard disk can be used as a server. However, the more powerful workstations or shared resource processors are commonly used as cluster servers.

Workstations and shared resource processors have varying capabilities regarding cluster speed and the number of supported workstations. These capabilities are listed in Appendix B "Workstations and Servers".

Cluster Workstations

Any CTOS workstation can be used as a cluster workstation.

IBM Compatible PCs

PCs with an AT-bus can be used in a cluster if they have an AT-bus ClusterCard. These ClusterCards can be obtained from your Unisys representative.

Note: *The XT-bus ClusterCard is no longer available. However, if you already have one of these, you can use an XT-bus PC in a cluster.*

Cable

The server and workstations are connected together by cluster cable. Two different types of cable can be used:

- Standard cable (100 ohm)
- Extended length cable (140 ohm)

See Appendix A, "Cables," for cable specifications.

Note: *You must use only one type of cluster cable in a cluster network.*

Adapter Cables

Two DB9-RJ45 adapter cables are required for each PC with an AT-bus ClusterCard installed. (See Appendix A, "Cables", for specifications.) Two DB9-RJ45 adapter cables are also required for each SuperGen Series 5000 workstation in the cluster.

Terminators

Each daisy-chain cluster requires two terminators, one at each end of the daisy chain. The impedance of the terminator must match the impedance of the cable. For example, if you use 100 ohm cable, you must use 100 ohm terminators.

Note: *RJ45 terminators, which are designed for use with some ClusterCards and with Series 2000 or Series 5000 workstations, are typically 100 ohm terminators. They can be used only if 100 ohm cable is used in the cluster.*

Software Requirements

The following software is required:

- Server operating system and workstation operating system
- ClusterShare software (if PCs are connected to the cluster)

Section 3
Installing a Daisy-Chain Cluster

Introduction to Section 3

This section provides information about planning and installing a new cluster, as well as adding to an existing cluster.

This section contains information on the following topics:

- Site preparation
- Planning the cluster
- Configuring the cluster
- Connecting the cluster

Note: *Even if you are familiar with clusters, you should review the cabling information, since some of the rules have been revised.*

Basic Site Preparation

To prepare your site for a cluster installation, you must

- Make sure the planned installation meets all applicable safety and electrical codes
- Resolve building ownership issues
- Employ a qualified installer

Safety and Electrical Code Requirements

When you install cluster cable, you must make sure that the installation complies with national and local safety and electrical codes. Contact your local building code authority for complete code requirements.

Building Ground Requirements

The building must have AC safety grounds with continous low impedance. Ground potential difference between cluster cabling and workstations must be measured prior to connecting a workstation to the cabling. (The potential difference must not exceed 1V ac.)

Building Ownership Issues

Building ownership issues should be resolved before installing a cluster. For example, if the building is leased rather than owned, you should be aware that some lease arrangements impose restrictions on cable installations

Who Should Install the Cluster

The cluster installer should be familiar with cluster installation, and should be able to measure voltages between the cluster cable and a workstation. A knowledge of applicable building and wiring codes is required for installing cable.

Planning the Cluster

To plan a cluster, follow these steps:

1. Conduct a site survey.
2. Obtain floor plans or building plans.
3. Determine the type of the workstations to be installed.
4. Select a cluster speed.
5. Select a cluster cable type.
6. Determine the maximum cluster cable length.
7. Determine the maximum number of workstations.
8. Identify workstation locations.
9. Select a server location.
10. Identify cluster cable routes.

11. Calculate the total cable length.
12. Complete and maintain cluster documentation.

Each of these steps are described below in more detail.

Conducting a Site Survey

In a site survey, an installation planner assesses the building to determine where to install cable, taking into consideration the location of power sources, risers, conduits, cable trays, fire walls, etc., as well as the existence of special hazards or restrictions. Normally, a site survey requires the assistance of the building site manager, or some other building authority who has a thorough knowledge of the building.

Obtaining Floor Plans

Obtain a current set of floor plans from the building facilities manager or other appropriate source. Floor plans are useful for diagramming the layout of cluster cable and workstations.

Determining the Type of Workstations

If the cluster server and workstations have been selected and purchased, or if you must use existing equipment, you must determine the maximum cluster speed of each workstation, as well as the cluster port type: RS-422 or RS-485. (See Appendix B, "Workstations and Servers.") You'll need this information when you select a cluster speed and cluster size.

If the cluster equipment has not been decided upon, consider the cluster port and cluster speed supported by each workstation before making a decision. Using workstations with RS-422 ports will limit cluster size and speed.

Selecting a Cluster Speed

Three cluster speeds are available:

- 307 Kbps
- 1.8 Mbps
- 3.7 Mbps

When you select a cluster speed, make sure that each workstation in the cluster is able to support that speed. In addition, make sure the operating system version installed in the cluster server supports the desired cluster speed.

Note: *The 3.7 Mbps speed decreases the maximum cable length by 50%.*

Selecting the Cable Type

Two types of cluster cable are available:

- Standard (100 ohm)
- Extended length (140 ohm)

If you are using existing cluster cable, determine whether the cable is standard cluster cable or extended length cable (see Appendix A, "Cables" for specifications). Older installations might have a third cable type, low-speed cable, which supports a maximum speed of 307 Kbps.

Note: *If you add more cable to an existing cable run, make sure that the cable you add is the same type of cable.*

If you are not adding to an existing cable, you should determine the cable length requirements for your cluster before deciding on the cable type. (Allow for future expansion.) Refer to Table 3–1 for the distances supported by each cable type.

Table 3–1. Peak Maximum Cable Lengths*

Cable Type**	Cluster Speed (Mbps)	End to End	Server to End Workstation
Standard	1.8	1200 ft	800 ft
Standard	3.7	600 ft	400 ft
Extended Length	1.8	3000 ft	2400 ft
Extended Length	3.7	1600 ft	1200 ft

* These peak maximums assume a cluster with one server connected to one workstation. In most clusters, the peak maximum must be further reduced. (See "Configuring the Cluster" later in this section for reduction rules.)

** Maximums for low-speed cable (307 Kpbs) are the same as those for standard cable at 1.8 Mbps.

Determining the Maximum Cable Length

The actual maximum cable length allowed for a cluster varies from cluster to cluster, because it depends on cluster speed, the number of workstations, and the type of workstations. (See "Configuring the Cluster" later in this section for instructions on determining the maximum cable length.)

Determining the Maximum Number of Workstations

The maximum number of workstations allowed in a particular cluster depends on the server, and on whether the workstations in the cluster have RS-422 ports or RS-485 ports. See Appendix B, "Workstations and Servers," for a list of workstations and their cluster ports.

Table 3–2. Maximum Number of Workstations

Server Type	All Cluster Workstations Have RS-485	Max Number of Workstations*
Workstation	Yes	32
Workstation	No	16
XE-530	Yes	128
XE-530	No	112
XE-520	NA	64

* This number includes the server.

Note: *These are hardware limits only. The operating system version or application program may further reduce these maximums.*

Identifying Workstation Locations

On the floor plans, mark the locations where workstations are to be installed. Indicate the workstation type on the floor plans.

Note: *There must be at least 25 feet of cable between workstations.*

Selecting a Server Location

Using the marked up floor plans, choose a location for the server. There are two basic configurations: you can locate the server at one end of the cluster, or you can locate it somewhere in the middle.

The key factors in selecting a server location are user convenience and cable length restrictions. (Locating the server near the middle of the cluster allows you a greater overall cable length.) See "Configuring the Cluster" later in this section for more details.

Identifying Cable Routes

From the marked up floor plans, identify the cable routes, and mark the cable lengths. (Be sure to account for any vertical cable runs.) When you plan the cable layout,

- Make sure you don't exceed the maximum length allowed for the cluster (see "Configuring the Cluster" later in this section)
- Make sure that the cluster cable is routed separately from ac power cable to minimize electromagnetic interference. TeleCluster cable should be kept the following distances from power cables:
  - 3 inches (75 mm) from ac cables with 2 kVA or less
  - 12 inches (300 mm) from ac cables with 2 kVA to 5 kVAO
  - 40 inches (1 meter) from ac cables with 5 kVA or greater
  - 5 inches (130 mm) from fluorescent fixtures
- Make sure there is at least 25 feet of cable between workstations

Calculating the Total Cable Length

From the marked-up floor plans, calculate the total length of cable required to connect the workstations in the cluster. Compare this total with the maximum length allowed for the cluster (see "Configuring the Cluster" later in this section).

Completing and Maintaining Cluster Documentation

Date the final version of the marked-up floor plans and keep them as an "as-built" record of the cluster. Copies of this version may be made and used as working copies when network expansion or modification is undertaken. Be sure to update the network floor plans after modifying or expanding the network.

The marked-up floor plans and other network documentation should be maintained by the network administrator.

Configuring the Cluster

There are two basic daisy-chain cluster configurations (see Figures 3–1 and 3–2):

- Server-in-the-middle (of the cluster)
- Server-at-the-end (of the cluster)

The key factors to consider when choosing a configuration is the physical layout of your work area, and the maximum cable length. If the cluster extends over a large area, for example, you may want to locate the server somewhere in the middle of the daisy-chain, because this configuration provides the greatest maximum cable length.

Note: *You can install the server anywhere in the middle, provided that you don't exceed the cable length maximums between the server and an end workstation.*

Figure 3–1. Server at the End

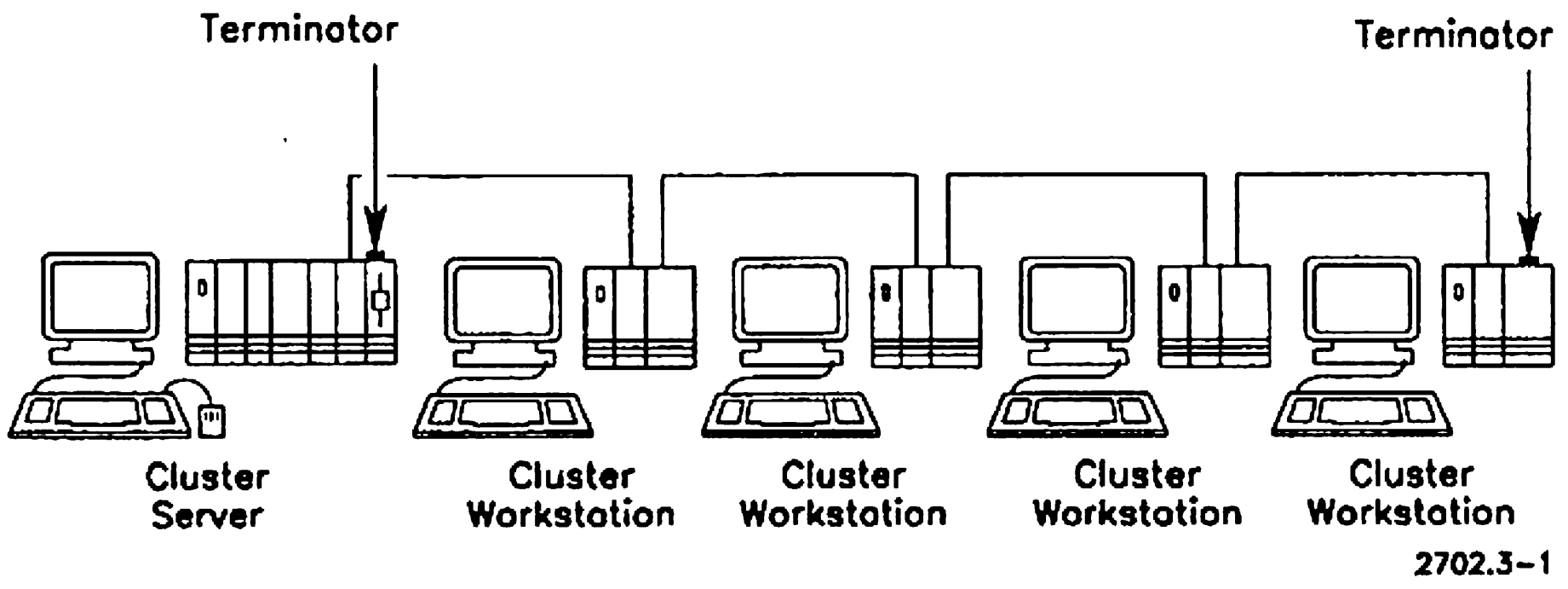
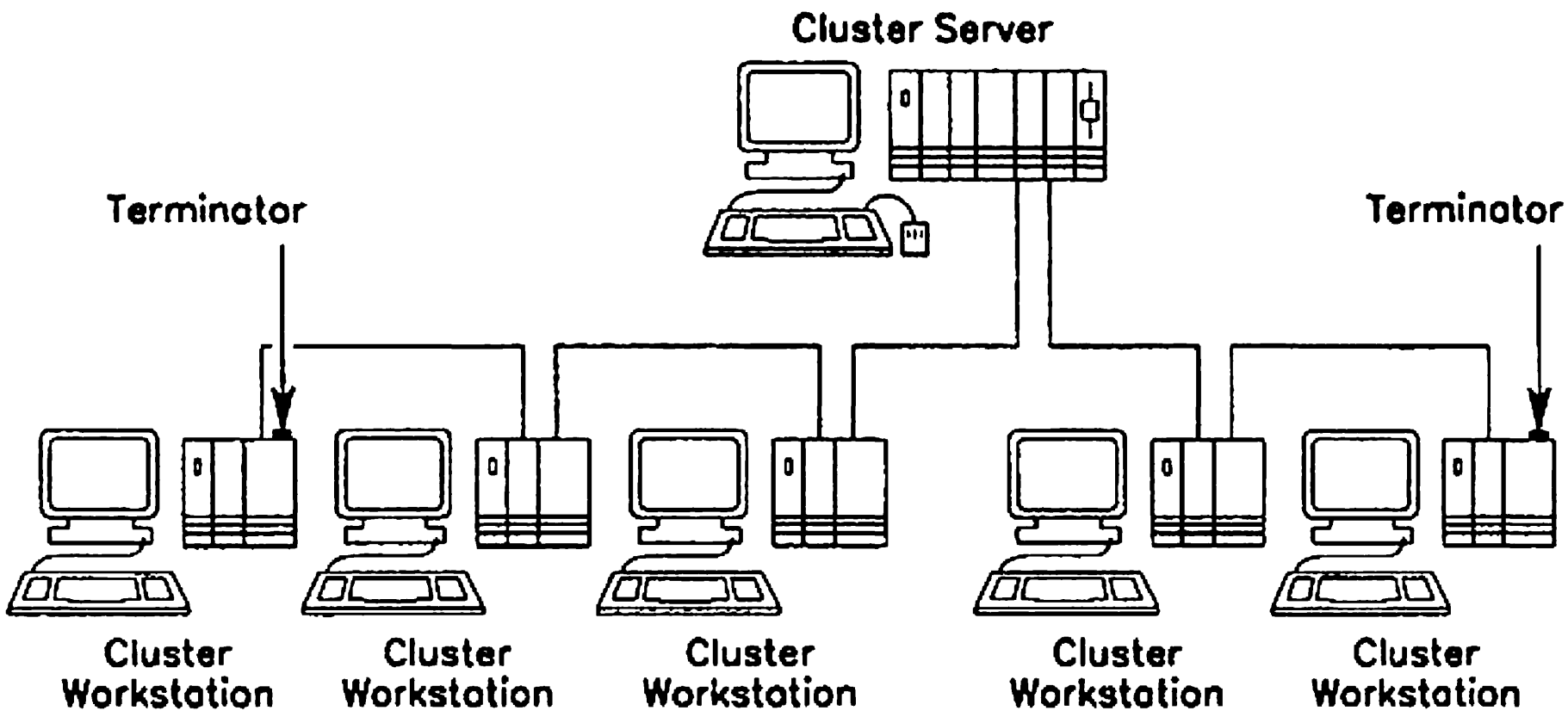


Figure 3–2. Server in the Middle



Calculating the Actual Maximum Cluster Cable Length

The actual maximum length for a cluster is the peak maximum listed in Table 3–1 minus a reduction. (The peak maximum must be reduced to compensate for the signal degradation that occurs when signals pass through RS-422/RS-485 ports and over cable sections that differ in impedance.)

The method of calculating the actual maximum length differs slightly, depending on the configuration used. The calculations required for each configuration are described below.

Server-at-the-End Configuration

To calculate the actual maximum cable length allowed for your cluster, use the formulas provided in Table 3–3 to determine the reduction required by the cluster. Subtract the reduction from the peak maximum for the cluster (see Table 3–1): the result is the actual maximum cable length.

Table 3–3. Actual Maximum Length Formula

Formula
Reduction = peak maximum x (R* x 1% + S** x 0.5% + T*** x 2%)
Actual maximum length = Peak maximum - Reduction

* R = the number of workstations with RS-422 ports (include the server).

** S = the number of workstations with RS-485 ports (include the server).

*** T = the number of locations where cable of different manufacture is connected. (If the cable is from the same manufacturer, this number = 0. See the following note.

Note: *If different manufactures of cable are used, you must find out the number of locations where different cable is connected. The connection can be direct (cable to cable), or indirect (different cables connected to a single workstation.)*

Example

Suppose a cluster is configured in the following way:

- 10 workstations with RS-422 ports
- 4 workstations with RS-485 ports
- A cluster speed of 1.8 Mbps
- Standard 100 ohm cable from the same manufacturer is used

Using Table 3–1, the peak maximum length for this cluster is 800 feet.

Calculate the actual maximum using the formulas in Table 3–3:

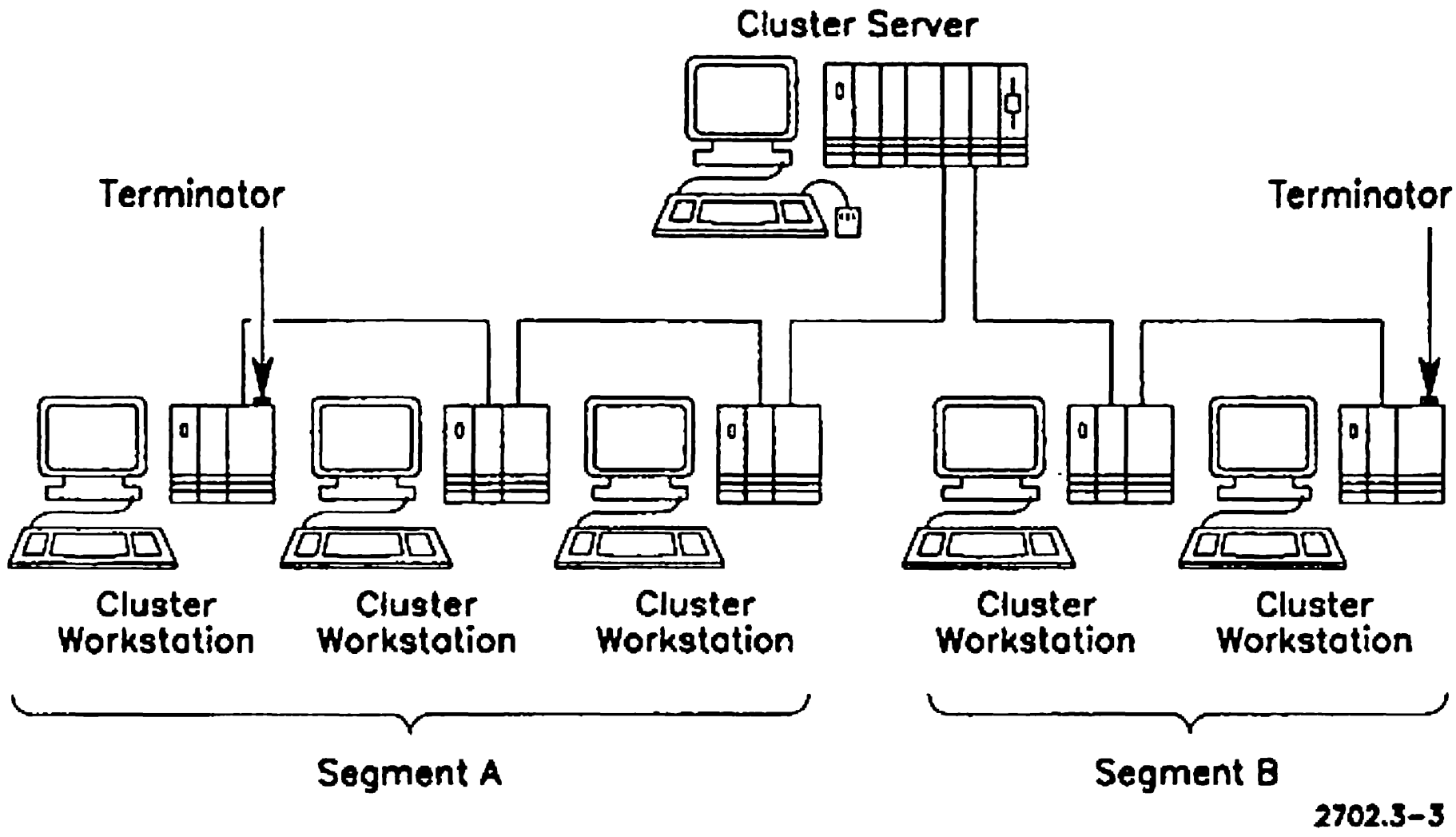
Reduction = 800 feet x [(10 x 1%) + (4 x 0.5%)]
= 800 feet x (12%)
= 96 feet

Actual maximum length = 800 feet - 96 feet
= 704 feet

Server-In-the-Middle Configuration

If the server is located somewhere in the middle of the cluster, you must calculate the actual cable length maximum separately for the cable segments on either side of the server (see Figure 3–3).

Figure 3–3. Calculating Maximum Lengths



To calculate the actual maximum length of Segment A, which is the longer cable segment (see Figure 3–3),

1. Find the peak maximum listed in Table 3–1. Use the "Server to End Workstation" column.
2. Calculate the actual maximum cable length for Segment A using the formulas in Table 3–4 below.

Table 3–4. Actual Maximum Cable Length (Segment)

Formula
Reduction = Segment peak maximum x (R* x 1% + S** x 0.5% + T*** x 2%)
Actual maximum length = Segment peak maximum - Reduction

* R = the number of workstations with RS-422 ports in Segment A (include the server).

** S = the number of workstations with RS-485 ports in Segment A (include the server).

*** T = the number of locations where cable of different manufacture is connected in Segment A. (If the cable is from the same manufacturer, this number = 0. See the note under Table 3–3.

To calculate the actual maximum length of Segment B (see Figure 3–3),

1. Find the peak maximum in Table 3–1 for the entire cluster. Use the "End Workstation to End Workstation" column.
2. Determine the peak maximum for Segment B. (The Segment B peak maximum is the cluster's end-to-end peak maximum minus Segment A's peak maximum.)
3. Calculate the actual maximum cable length for Segment B using the formulas in Table 3–4.

Example

Suppose a cluster is configured in the following way:

- 10 workstations with RS-422 ports in segment A
- 10 workstations with RS-485 ports in segment B
- A cluster speed of 1.8 Mbps
- Standard 100 ohm cable from the same manufacturer is used

Segment A

Using Table 3–1, the peak maximum length for segment A is 800 feet. Calculate the actual maximum using the formulas in Table 3–4:

Reduction = 800 feet x (10 x 1%)
= 800 feet x (10%)
= 80 feet

Actual maximum length = 800 feet - 80 feet
= 720 feet

Segment B

Using Table 3–1, the peak maximum length for segment B is 400 feet (1200 feet - 800 feet).. Calculate the actual maximum using the formulas in Table 3–4:

Reduction = 400 feet x (10 x 0.5%)
= 400 feet x (5%)
= 20 feet

Actual maximum length = 400 feet - 20 feet
= 380 feet

Connecting the Cluster

After the cable layout is finished, you can connect the cluster. In general, you should connect cable to the server first, then connect cable between the server and the first workstation, then connect cable between the first worstation and the second workstation, and so on.

Connecting the cluster cable in this sequence allows you to check the ground potential difference before connecting a workstation to the cable.

The following procedures are described in detail below:

- Connecting the server
- Daisy-chaining workstations to the server
- Daisy-chaining PCs (optional)

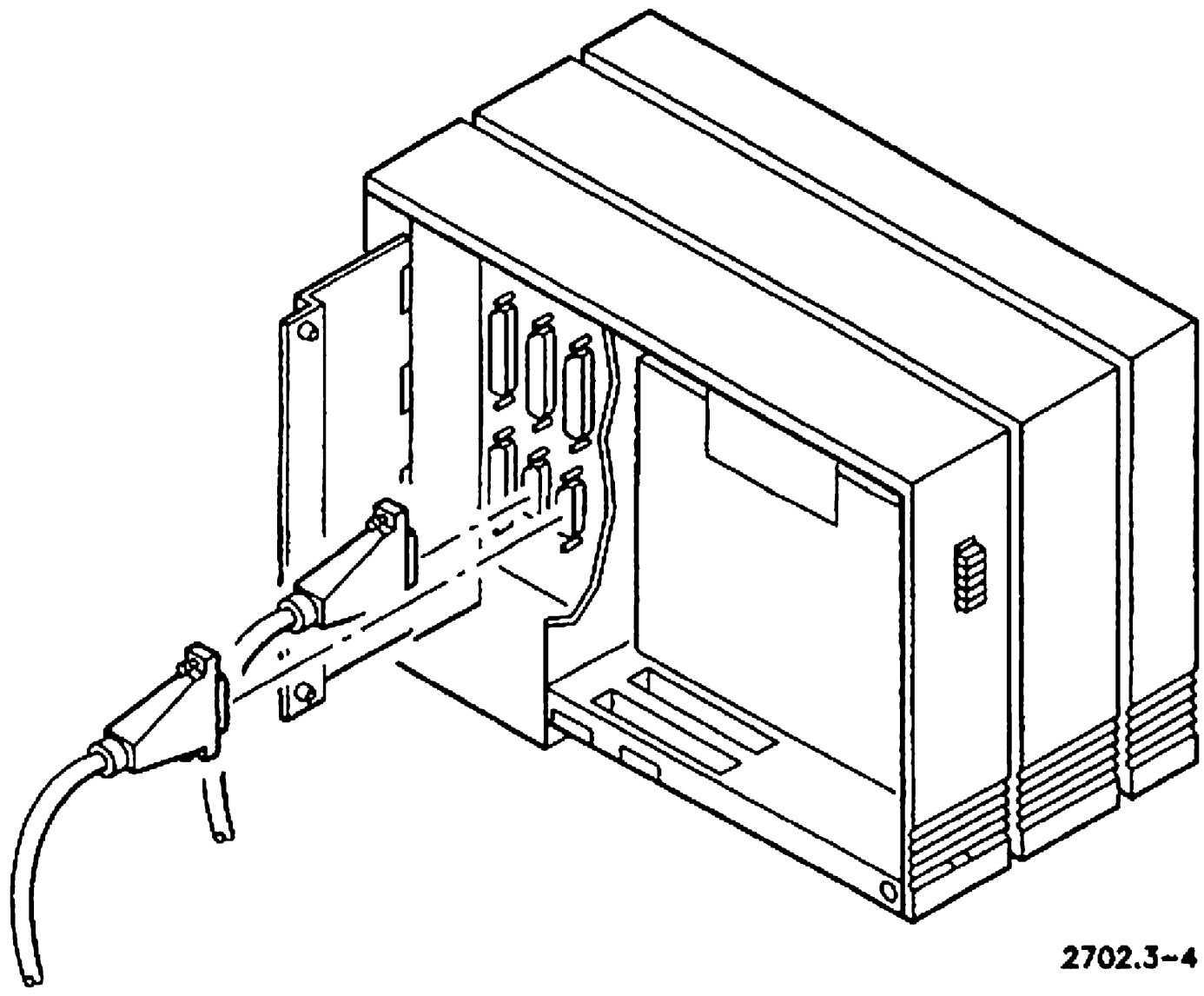
Connecting the Server

To connect a server,

1. Install the server as directed by the appropriate hardware installation guide. Make sure you connect the power cord to an ac outlet, but do not power on the system.
2. Install the operating system and set the server for the appropriate cluster speed: 307 Kbps, 1.8 Mbps, or 3.7 Mbps. See the *CTOS System Administration Guide* for instructions on how to do this. Make sure that the server and all the workstations in the cluster can support the selected speed.
3. Locate the server cluster ports that you want to connect to workstations. Connect a cluster cable to each of these ports (see Figure 3–4).

Note: *You can daisy-chain workstations to each of the two cluster ports on CTOS server/workstations. However, a CTOS shared resource processor (SRP), has four cluster ports per GP board or CP board: port 1A, 1B, 2A, 2B. Ports 1A and 1B must be used for one daisy-chain, and 2A and 2B for a separate daisy-chain.*

Figure 3–4. Connecting Cluster Cables



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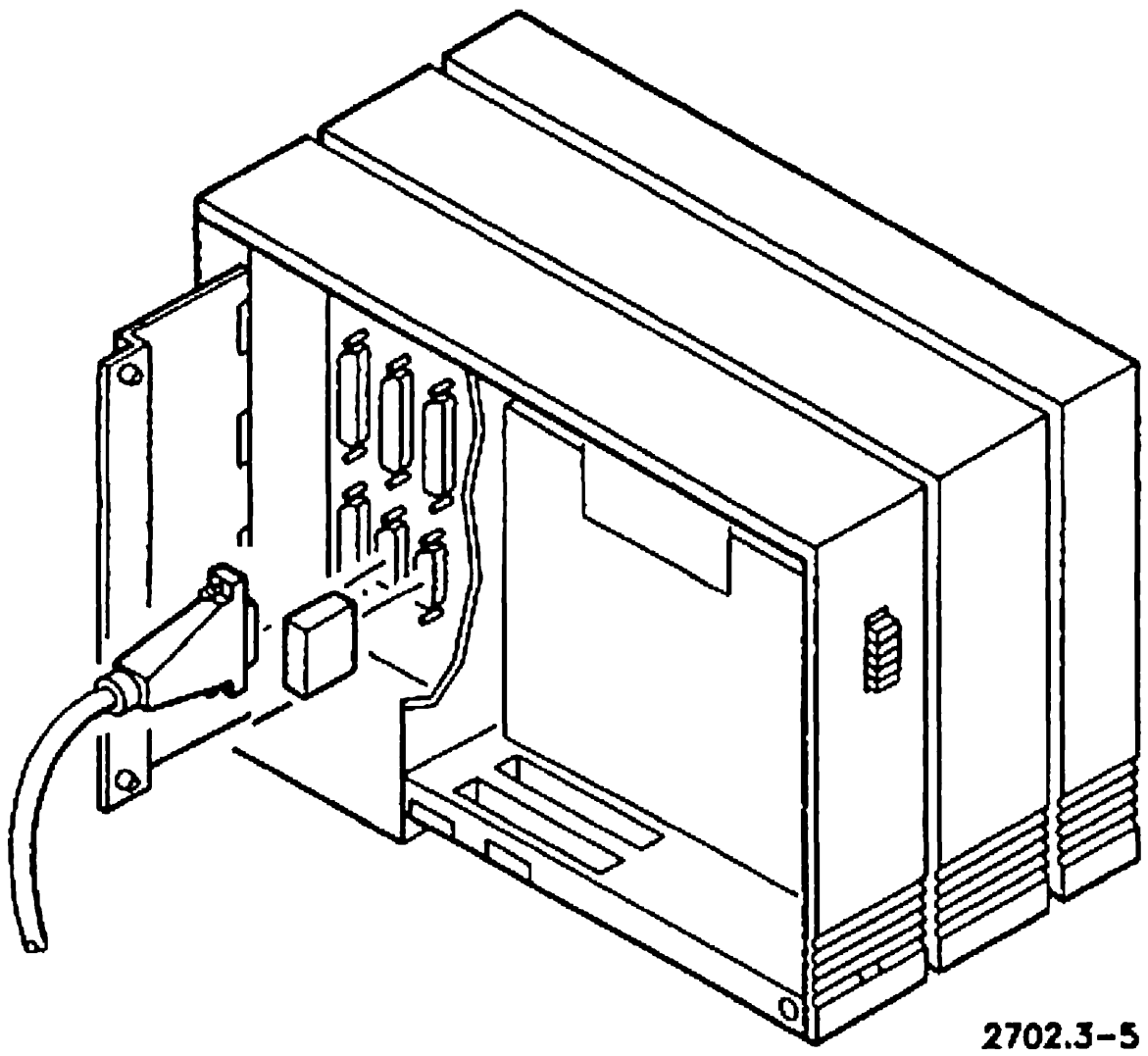
4. Install a terminator on the unused cluster port, making sure that the terminator impedance matches the cable impedance (See Figure 3–5.). It makes no difference which port is used for the cable and which is used for the terminator, unless the server is a shared resource processor.

Note: *On shared resource processors, if workstations are daisy-chained to port 1A, but not 1B, you must install a terminator on 1B. Likewise, if workstations are connected to port 2A, but not 2B, a terminator must be installed on 2B.*

Figure 3–5. Connecting Cluster Cable and Terminator



Daisy-Chaining Workstations to the Server

When you daisy-chain, you should connect cluster cables to the server first and then to the workstations.

Note: *The procedures described in steps 1 through 6 tell how to daisy-chain workstations to one of the cluster ports on the server. To daisy-chain workstations to other cluster ports on the server, simply repeat steps 1 through 6 for the other cluster port.*

To daisy-chain workstations to the server,

1. Install the workstations and software as directed by the appropriate installation guides, but do not install cluster cables yet. Make sure the power cords are connected to the ac outlets, but do not power on the workstations.

2. At the first workstation (i.e., the workstation that is connected directly to the server), measure the ground potential difference between the cluster cable connected to the server and the ground terminal of the ac outlet used by the workstation.

   To do this, measure the voltage between the cable shield and the ground terminal of the ac outlet used by the workstation. There must not be more than 1.0V ac difference. The resistance between cable shield and ground terminal must not exceed 1 ohm.

CAUTION

Ground potential differences exceeding the above specifications can damage electronic components and may result in erratic cluster performance.

3. Connect the cluster cable from the server to a cluster port on the workstation (see Figure 3–4).
4. Next:
   - If the workstation *is not* the last workstation in the daisy-chain, connect a cluster cable to the remaining cluster port on the workstation.
   - If the workstation *is* the last workstation in the daisy-chain, install a terminator on the remaining cluster port (see Figure 3–5).
5. Proceed to the second workstation and repeat the procedures described in steps 3 through 5. (Make sure you measure the voltage between the cable shield on the cable that is connected to the first workstation and the ground terminal of the ac outlet used by the second workstation.)

6. Repeat the above procedures for the remaining workstations that you are daisy-chaining to the cluster. Make sure you measure the voltage between cable shield and ac ground terminal before connecting a workstation to another workstation that is already daisy-chained.

Note: *The general procedures described in steps 1 through 6 apply to any workstation that is daisy-chained in a cluster, whether the workstation is a CTOS workstation, a PC with a ClusterCard, or a Series 2000/Series 5000 workstation.*

Daisy-Chaining PCs

To daisy-chain a PC,

1. Install a ClusterCard adapter in the PC as directed by the ClusterCard installation guide.

Note: *The 3.7 Mbps cluster speed requires an 80386-based (or 80486-based) PC running at 20 MHz or faster, along with the AT-bus ClusterCard.*

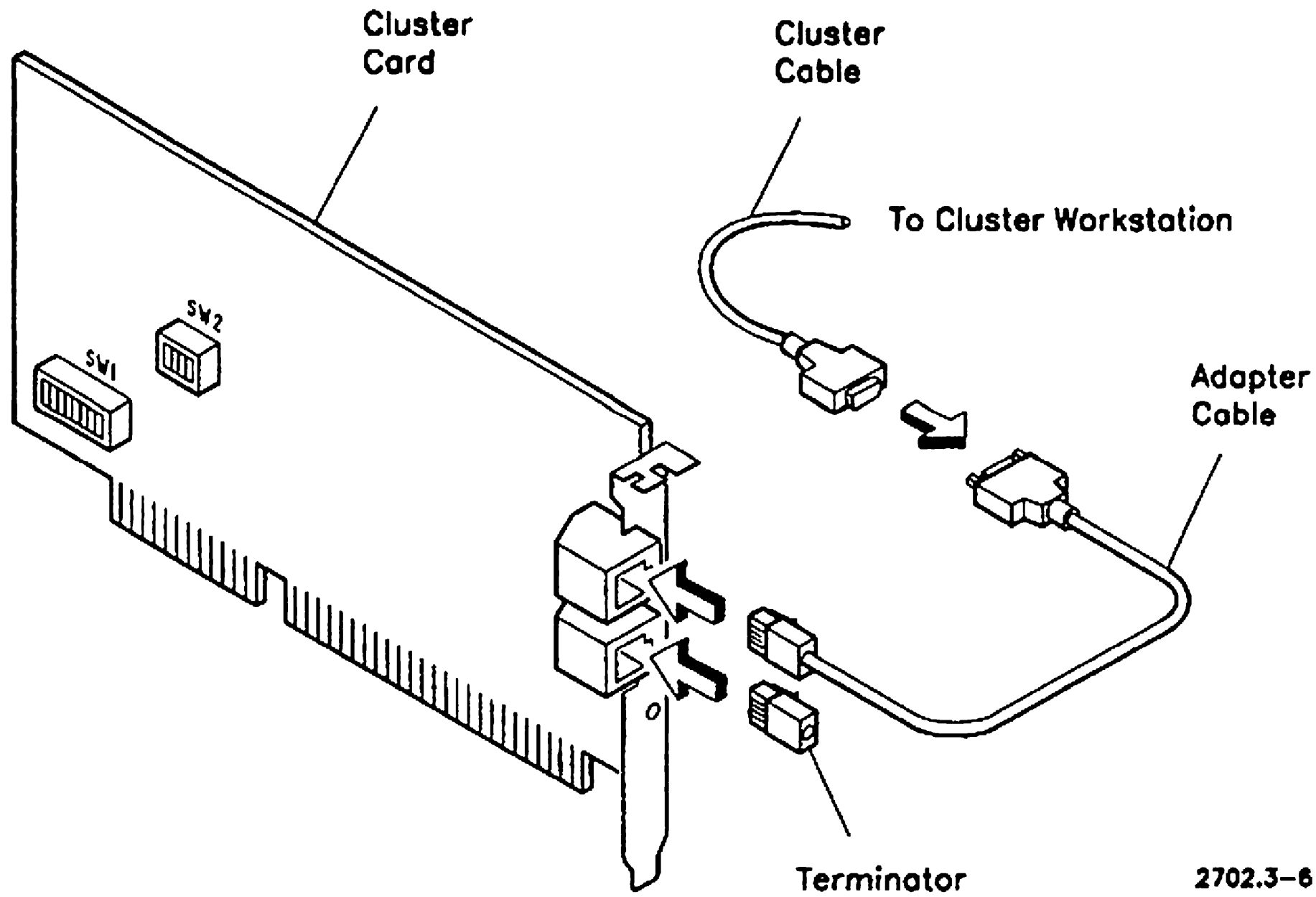
2. Install the ClusterShare software in the PC and in the cluster server (see the *ClusterShare Administrator's Guide*).

3. Before daisy-chaining the PC to the cluster, measure the ground potential difference between the cluster cable and the PC, following the procedures described above in *Daisy-Chaining Workstations to the Server*.

4. If the PC has an AT-bus ClusterCard, and the PC is at the end of a cluster, connect one DB9-RJ45 adapter cable to the either of the two ClusterCard ports (see Figure 3–6). Connect a terminator to the remaining port.

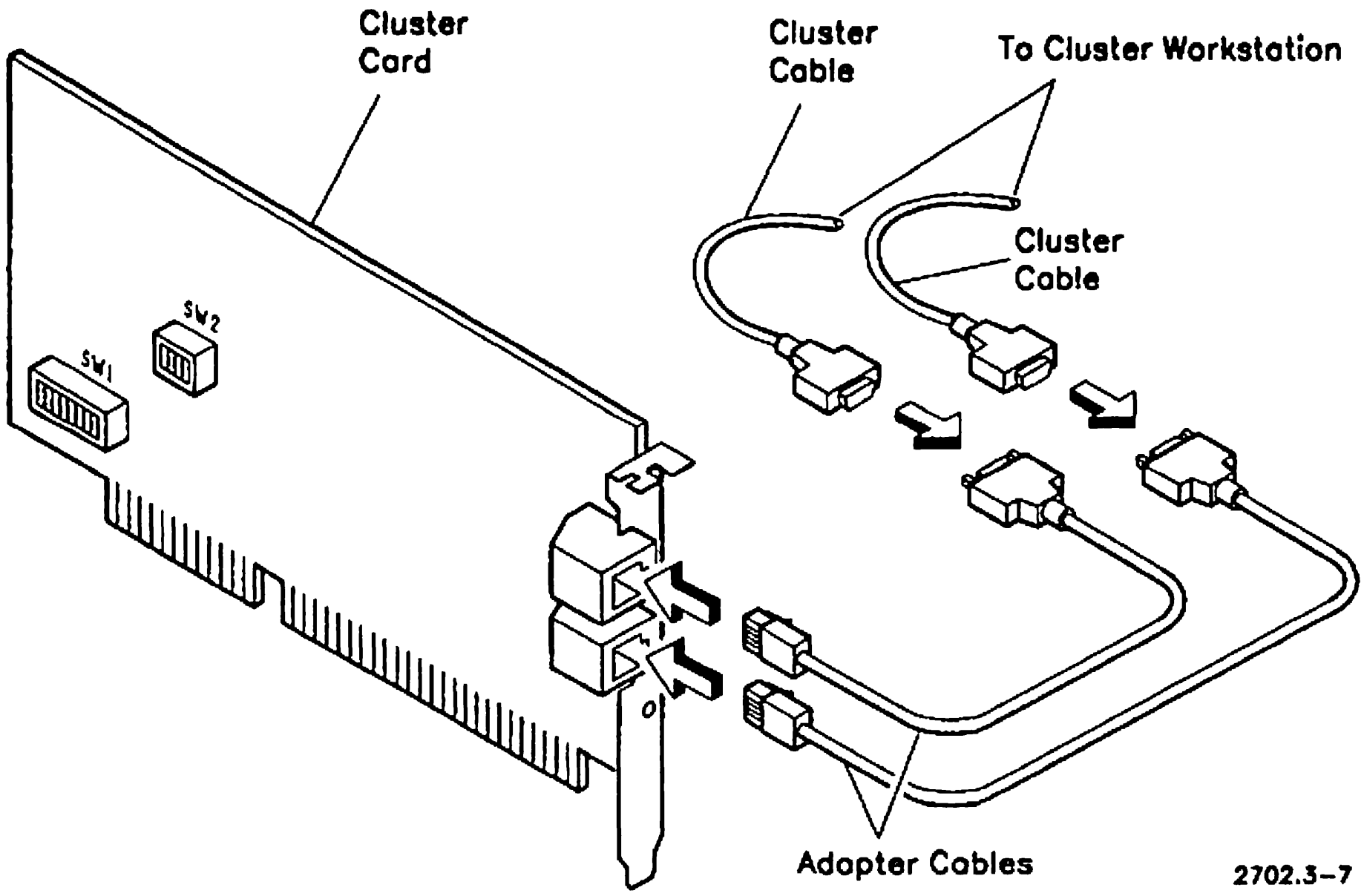
Note: *An RJ45 terminator is available for 100 ohm cables. If the cluster has 140 ohm cable, you must install a second DB9-RJ45 adapter in the ClusterCard and plug a 140 ohm terminator into the adapter.*

Figure 3–6. Installing DB9-RJ45 and Terminator



5. If the PC has an AT-bus ClusterCard, and is in the middle of a cluster, connect two DB9-RJ45 adapter cables to the ClusterCard. Then connect the cluster cables to the adapter cables. (See Figure 3–7.)

Figure 3–7. Installing Two DB9-RJ45 Cables



6. If the PC has an XT-bus ClusterCard, and is at the end of a cluster, connect the cluster cable to either of the cluster ports on the ClusterCard, and install a terminator on the remaining port. Make sure the terminator impedance matches the cable impedance.

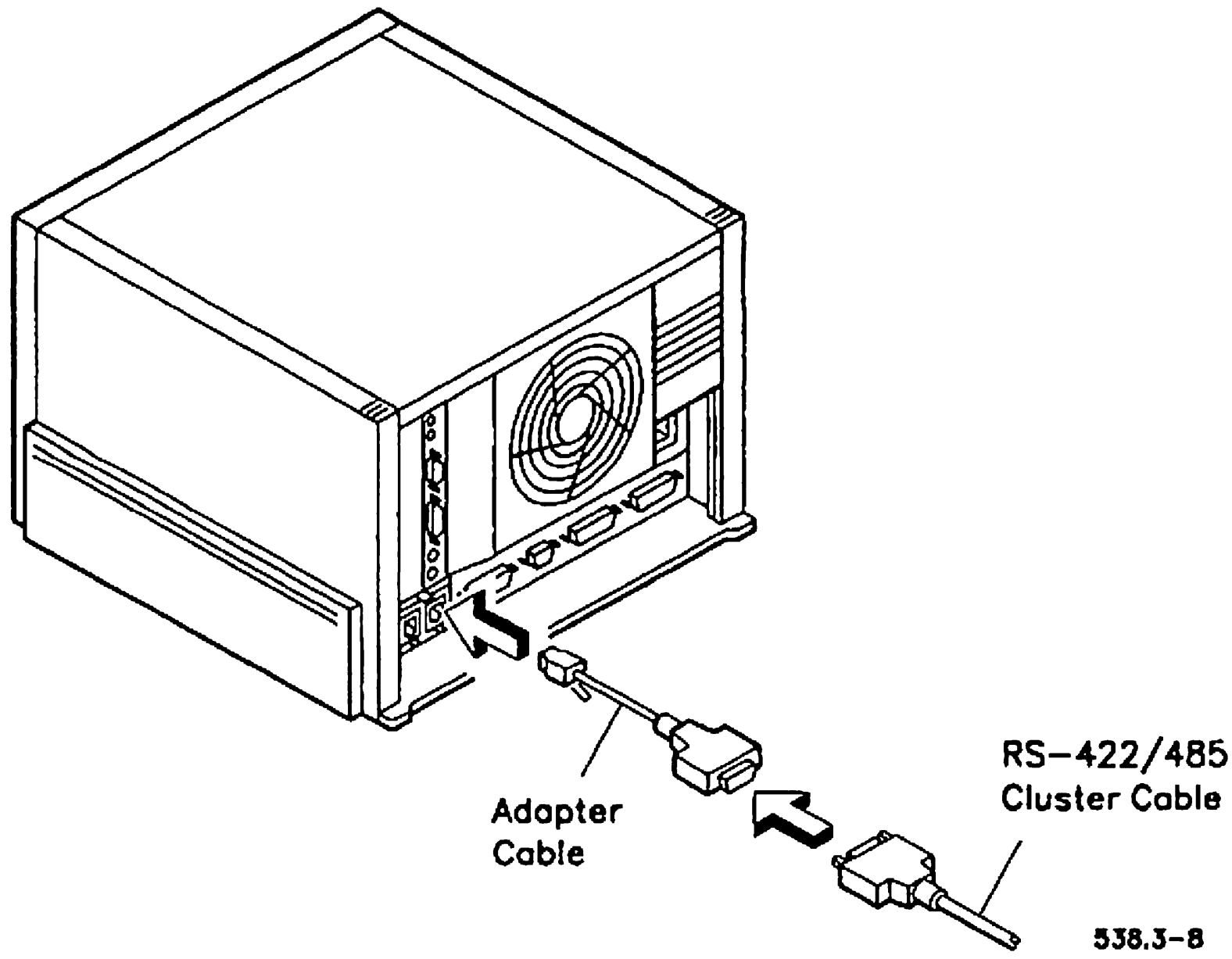
   If the PC is in the middle of the cluster, connect a cluster cable to each of the ports on the ClusterCard.

Daisy-Chaining a Series 5000 Workstation

To daisy-chain a Series 5000 workstation,

1. Install the Series 5000 as directed by the appropriate hardware installation guide. Make sure you connect the power cord to an ac outlet, but do not power on the system.
2. Connect two DB9-RJ45 adapter cables to the workstation (see Figure 3–8).

Figure 3–8. DB9-RJ45 Installation (Series 5000)



3. If the Series 5000 is not the server, follow the procedures described above in *Daisy-Chaining Workstations to the Server.*

Note: *If you need to use a terminator, connect the terminator to the DB9-RJ45 adapter cable. Or, if you are using 100 ohm cluster cable, you can remove the DB9-RJ45 adapter cable and plug an RJ45 terminator directly into the workstation.*

4. If the Series 5000 is the server for a cluster that has already been cabled together, connect it to the cluster following the procedures described above in *Daisy-Chaining Workstations to the Server.*

5. If the Series 5000 is the server for a cluster that has not yet been cabled together, follow the procedures described above in *Connecting the Server.*

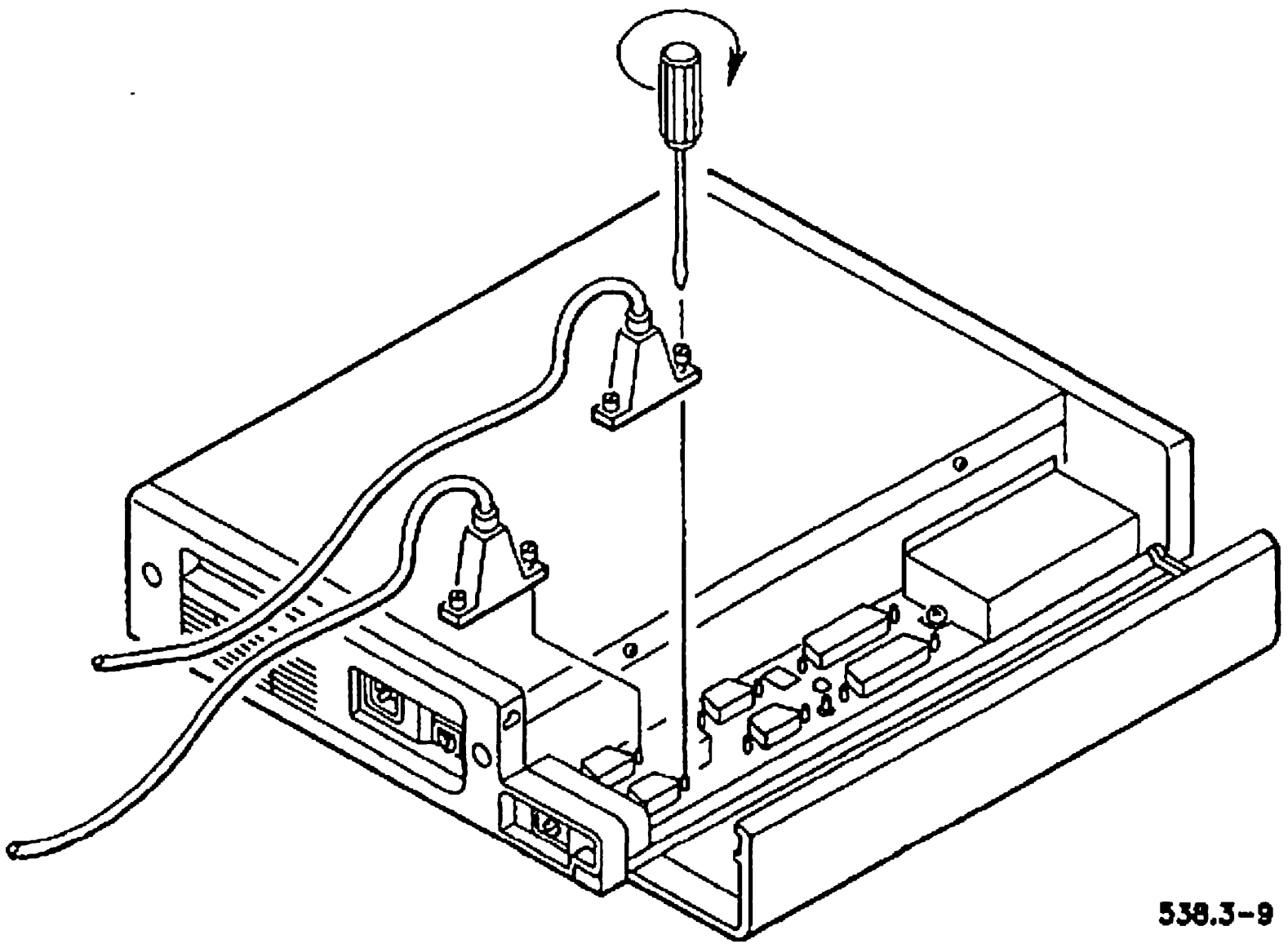
Daisy-Chaining a Series 2000 Workstation

To daisy-chain a Series 2000 workstation,

1. Install the Series 2000 as directed by the appropriate hardware installation guide. Make sure you connect the power cord to an ac outlet, but do not power on the system.
2. Measure the ground potential difference with the Series 2000 workstation and the cluster cables, following the procedures described above in *Daisy-Chaining Workstations to the Server.*
3. Open the cable cover on the workstation (see Figure 3–9), and connect cluster cables to the cluster ports.

Note: *If the Series 2000 workstation is at the end of a cluster, connect a terminator to the remaining cluster port. (Make sure the terminator impedance matches the impedance of the cluster cable.)*

Figure 3–9. Cluster Installation (Series 2000)



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Section 4
Requirements for TeleCluster

Introduction to Section 4

This section describes the hardware and software required for installing a TeleCluster network.

Typical hardware requirements include a cluster server, one or more cluster workstations, at least one TeleCluster hub, and two ore more TeleCluster adapters.

If you want to use IBM compatible PCs, you'll need an AT-bus ClusterCard for each PC. Advanced TeleCluster can use the existing telephone wiring in the building (a spare wire pair is required).

Typical software requirements include the CTOS operating system and the ClusterShare software required for ClusterCard.

Note: *In this section and throughout this manual, the term "TeleCluster" refers to Advanced TeleCluster. The older voice over data TeleCluster product is referred to as "voice/data TeleCluster".*

Cluster Servers

Each cluster must have one and only one cluster server. Any CTOS workstation or shared resource processor that has a hard disk can be used as a server. However, it is a common practice to use the more powerful workstations or shared resource processors as cluster servers.

You should be aware that workstations and shared resource processors have varying capabilities regarding cluster speed and the number of cluster workstations they can support. These capabilities are listed in Appendix B, "Workstations and Servers".

Cluster Workstations

Any CTOS workstation can be used as a cluster workstation. (Shared resource processors are used as servers, rather than as workstations.)

IBM Compatible PCs

You can use PCs with an AT-bus in a TeleCluster network, if each PC has an AT-bus ClusterCard installed. However, if you want to run the TeleCluster network at the 3.7 Mbps speed, you must use a 80386-based or 486-based PC running at 20 MHz or faster.

The AT-bus ClusterCard has a built-in TeleCluster adapter, and therefore does not require an external adapter.

Note: *The XT-bus ClusterCard is no longer available. However, if you have PCs with the XT-bus ClusterCard installed, you can use these in a TeleCluster network (they do require a TeleCluster adapter, however) as long as the cluster speed does not exceed 1.8 Mbps.*

Cable

- A TeleCluster installation always uses
- Unshielded twisted pair (for main TeleCluster wiring)
- Hub cable (provided with the TeleCluster hub)

A TeleCluster installation can optionally use

- IBM type 1, 2, 6, or 9 cable (for main TeleCluster wiring, as a replacement for unshielded twisted pair)
- Standard cluster cable, 100 ohm (for daisy chaining workstations)
- DB9-to-RJ45 adapter cable (for daisy chaining PCs or Series 5000 workstations)
- RJ11 to RJ45 TeleCluster adapter cable (required for Series 2000/5000 workstations, and for AT-bus ClusterCards)

See Appendix A, "Cables" for specifications.

Terminators

If you daisy-chain workstations or PCs to a workstation with a TeleCluster adapter, you must install the following terminators at the end of the daisy chain:

- 100 ohm cable terminator (installed in workstations or PCs with XT-bus ClusterCards)
- 100 ohm RJ45 terminator, (installed in PCs with AT-bus ClusterCards or in Series 5000 workstations)

Note: *Terminators are not installed in workstations connected directly to the TeleCluster hub.*

TeleCluster Wall Outlets

You need one RJ11 or RJ45 wall jack for each workstation with a TeleCluster adapter.

TeleCluster Hub

You need at least one TeleCluster hub for each TeleCluster installation. You can daisy chain a maximum of five modular TeleCluster hubs in one installation.

Note: *The 5-hub daisy-chain maximum applies only to the new modular hub. For daisy-chain maximums for the voice/data hub and the intelligent hub (IHU), see Appendix F.*

Network Interface Unit

Some countries require the network interface unit to isolate signals. You must install one of these devices for each hub. (Consult your local telephone company to determine whether you need this unit.)

TeleCluster Adapter

PCs with the AT-bus ClusterCard, Series 2000 workstations, and Series 5000 workstations have built-in TeleCluster adapters. However, all other CTOS workstations or servers, and PCs that use the XT-bus ClusterCard, require an external TeleCluster adapter.

Note: *See Appendix F "Voice/Data TeleCluster" for compatibilities between the Advanced TeleCluster and the older voice/data TeleCluster products.*

TeleCluster Adapter Power Supply

A power supply is required for the TeleCluster adapter if

- The workstation the adapter is attached to does not supply +5V for TeleCluster
- Other workstations are daisy-chained to the TeleCluster adapter and the workstation with the adapter may be turned off occasionally

Some workstations provide +5V for the TeleCluster adapter, and some do not. See Appendix B, *Workstations and Servers*, for a list of workstations that provide +5V for the adapter. (Shared resource processors do not supply +5V.)

Note: *Older voice/data TeleCluster adapters plug directly into an ac outlet.*

Punchdown Blocks

You need at least one type 66 or one type 110 (or an equivalent) punchdown block for each hub.

Software Requirements

The following software is required:

- Server OS and workstation OS.
- ClusterShare software (if PCs are connected to the cluster)

Section 5
Installing TeleCluster

Introduction to Section 5

This section provides information about site preparation, planning, and installation. You should read this section if you are installing or modifying a TeleCluster network.

Note: *The information in this section applies only to the new modular hub and data-only adapters (TA3/TA4). For information on older TeleCluster products such as voice/data TeleCluster, see Appendix F.*

This section provides information about the following topics:

- Basic site preparation
- Planning the installation
- Installing and daisy-chaining hubs
- Installing modular wall jacks
- Installing TeleCluster adapters
- Daisy-chaining workstations
- Starting TeleCluster
- Troubleshooting TeleCluster

Note: *We recommend that the building wiring (including punchdown blocks, wall jack outlets, and cabling) conform to standard wiring practice. Refer to the "Unisys Building Wiring Guide" for more information.*

Basic Site Preparation

To prepare your site for a cluster installation, you must

- Make sure that the planned installation meets all applicable safety and electrical codes
- Prepare the wiring closet for the hub or hubs
- Resolve cable ownership issues
- Resolve building ownership issues
- Employ a qualified installer

Safety and Electrical Code Requirements

If you install cable, you must make sure that the installation complies with local safety and electrical codes. Contact your local building code authority for complete code requirements.

Preparing the Wiring Closet for the Hub

To prepare the wiring closet for the hub,

1. Make sure that the wiring closet conforms to the standards described in the *Unisys Building Wiring Guide.*
2. Make sure that there is a 115V or 220V ac outlet withing 6 feet of the place where you plan to install the hub.
3. Make sure that there is at least 3 inches clearance at the back and on the sides of the hub. There must be enough clearance in front of the hub to connect the hub cable and read the LEDs.
4. Make sure that there are no flammable materials located near the hub.
5. Make sure that the wiring closet has a standard 19-inch equipment rack for the hub. (If you use a 25-inch rack, you must supply your own rear support for the hub.)

Telephone Cable Ownership Issues

If you intend to use the building's existing telephone cabling, you must first determine who owns the telephone cable, what restrictions apply to the use of that cable, and whether the cable is suitable for TeleCluster. (You may have to consult with the building owner to resolve these issues.)

Building Ownership Issues

If the building is leased rather than owned, you should be aware that some lease arrangements may restrict cable installation.

Who Should Install TeleCluster

Only qualified technical personnel should install TeleCluster. In particular, the installer must be familiar with telephone equipment and wiring closets.

Planning a TeleCluster Installation

To plan an installation, you should

1. Conduct a site survey.
2. Obtain floor plans or building plans.
3. Determine the cable type and size.
4. Select a cluster speed.
5. Determine the maximum cable length.
6. Determine how many hubs are required.
7. Determine the maximum number of workstations.
8. Select workstation, server, and hub locations.
9. Identify cluster cable routes.
10. Complete and maintain cluster documentation.

Each of these steps are described below in more detail.

Conducting a Site Survey

In a site survey, an installation planner assesses the building to determine where to install cable, taking under consideration the location of power sources, risers, conduits, cable trays, fire walls, etc., as well as the existence of special hazards or restrictions.

Note: *A site survey may not be required if you use existing cabling.*

Obtaining Floor Plans

A current set of floor plans should be obtained from the building facilities manager or other appropriate source. The floor plans are useful for showing cable routes and workstation location.

Determining the Cable Type and Size

Normally, a TeleCluster installation uses unshielded twisted pair wiring. However, you can use IBM type 1, 2, 6, or 9 cable that are commonly used in token ring applications. (You can't share the cable between a TeleCluster and a token ring network, however.)

Unshielded Twisted Pair Cable

If you intend to use the existing unshielded twisted pair cabling in the building, you must determine the gauge of the cable. Acceptable cable gauges are: 22 AWG (0.6mm), 24 AWG (0.5mm), and 26 AWG (0.4mm). Other gauges are not supported.

If you are installing unshielded twisted pair, 24 AWG (0.5mm) cable is recommended. See Appendix A, "Cables" for specifications.

Note: *A single installation can have a mixture of gauges (e.g., some of the cabling can be 24 AWG and some can be 26 AWG). However, if there are different gauges of cable between a hub and a TeleCluster adapter, you must use only the smallest gauge cable when you calculate maximum cable lengths.*

IBM Type 1, 2, 6, or 9 Cable

You can use a wiring pair in type 1, 2, 6, or 9 cable to connect the hub to an adapter. You must use only one of these cable types between the hub and an adapter.

Selecting a Cluster Speed

The new modular TeleCluster hub supports two cluster speeds:

- 1.8 Mbps
- 3.7 Mbps

These speeds are supported whether you use a single hub or daisy-chained hubs.

Note: *For information about the speeds supported by the older hubs, such as the voice/data hubs and intelligent (IHU) hubs, see Appendix F.*

When you select a cluster speed, make sure each workstation in the TeleCluster network can support that speed.

Note: *Some versions of the server operating system do not support the 3.7 Mbps cluster speed. Check the server operating system documentation to determine whether it supports 3.7 Mbps.*

Maximum Cable Lengths

The maximum length of cable between a hub and a workstation depends on the cable type, cluster speed and cable size. Table 5–1 shows the maximums for unshielded twisted pair; Table 5–2 shows the maximums for IBM type 1, 2, 6, and 9 cable.

Note: *Since the hub acts as a signal repeater, maximum length restrictions apply only to the distance between the hub and a TeleCluster adapter connected to that hub, not to the total length of cable used throughout the installation.*

Table 5–1. Maximum Lengths (Unshielded Twisted Pair)

Cable Size	Cluster Speed (Mbps)	Max Length (Hub to Adapter)
22 AWG (0.6 mm)	1.8	1300 ft
22 AWG (0.6mm)	3.7	900 ft
24 AWG (0.5mm)	1.8	1200 ft
24 AWG (0.5mm)	3.7	800 ft
26 AWG (0.4mm)	1.8	1000 ft
26 AWG (0.4mm)	3.7	700 ft

Note: *The maximum length between any two directly connected daisy-chained hubs is 800 feet.*

Table 5–2. Maximum Lengths (Type 1, 2, 6, or 9 Cable)

Cable Type	Cluster Speed (Mbps)	Max Length (Hub to Adapter)
1	1.8	2000 ft
1	3.7	1300 ft
2 (data)	1.8	2000 ft
2 (data)	3.7	1300 ft
2 (voice)	1.8	1600 ft
2 (voice)	3.7	1000 ft
6	1.8	1200 ft
6	3.7	800 ft
9	1.8	1200 ft
9	3.7	800 ft

Note: *The maximum length between any two directly connected daisy-chained hubs is 800 feet.*

Determining the Number of Hubs

You must have at least one hub in a TeleCluster network (see Figure 5–1). If you want to connect more workstations to the TeleCluster network, or if you want to extend the distance that will be spanned by the network, you can add more hubs (daisy-chain). A maximum of five hubs can be daisy-chained (see Figure 5–2.)

Figure 5–1. TeleCluster Network (One Hub)

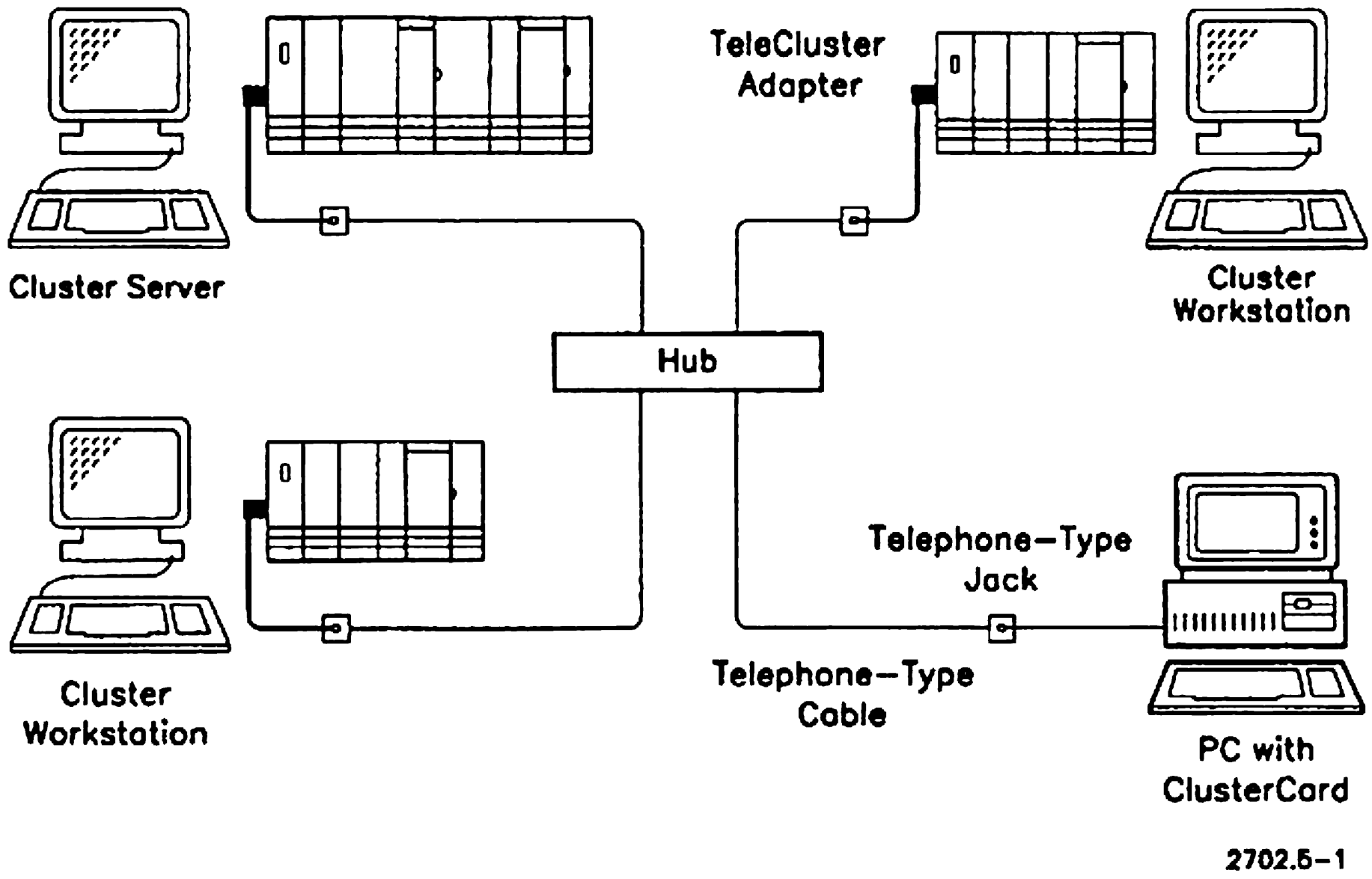
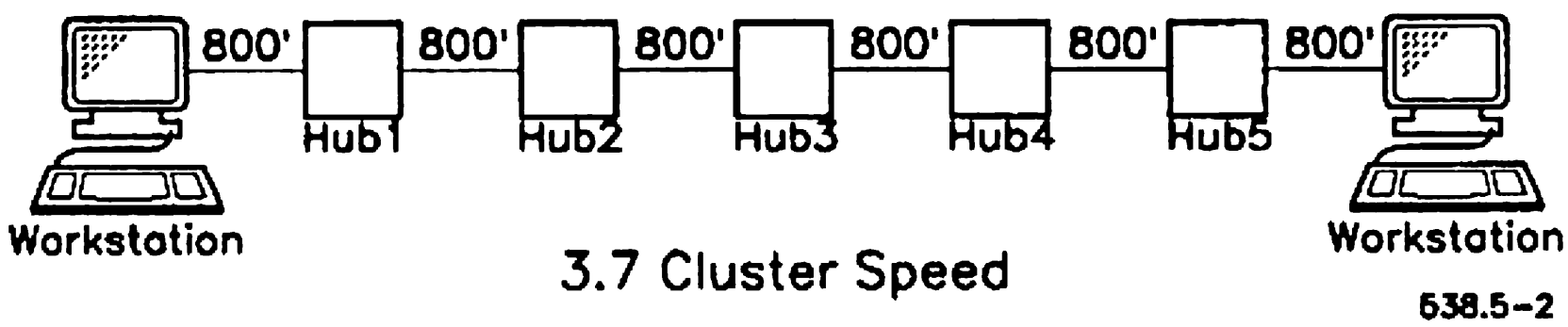


Figure 5–2. Daisy-Chained Hubs (5 Maximum)

S



Determining the Number of Workstations

The maximum number of workstations allowed in a particular TeleCluster network depends partly on software considerations and partly on hardware considerations, such as the number of TeleCluster adapters supported by each hub.

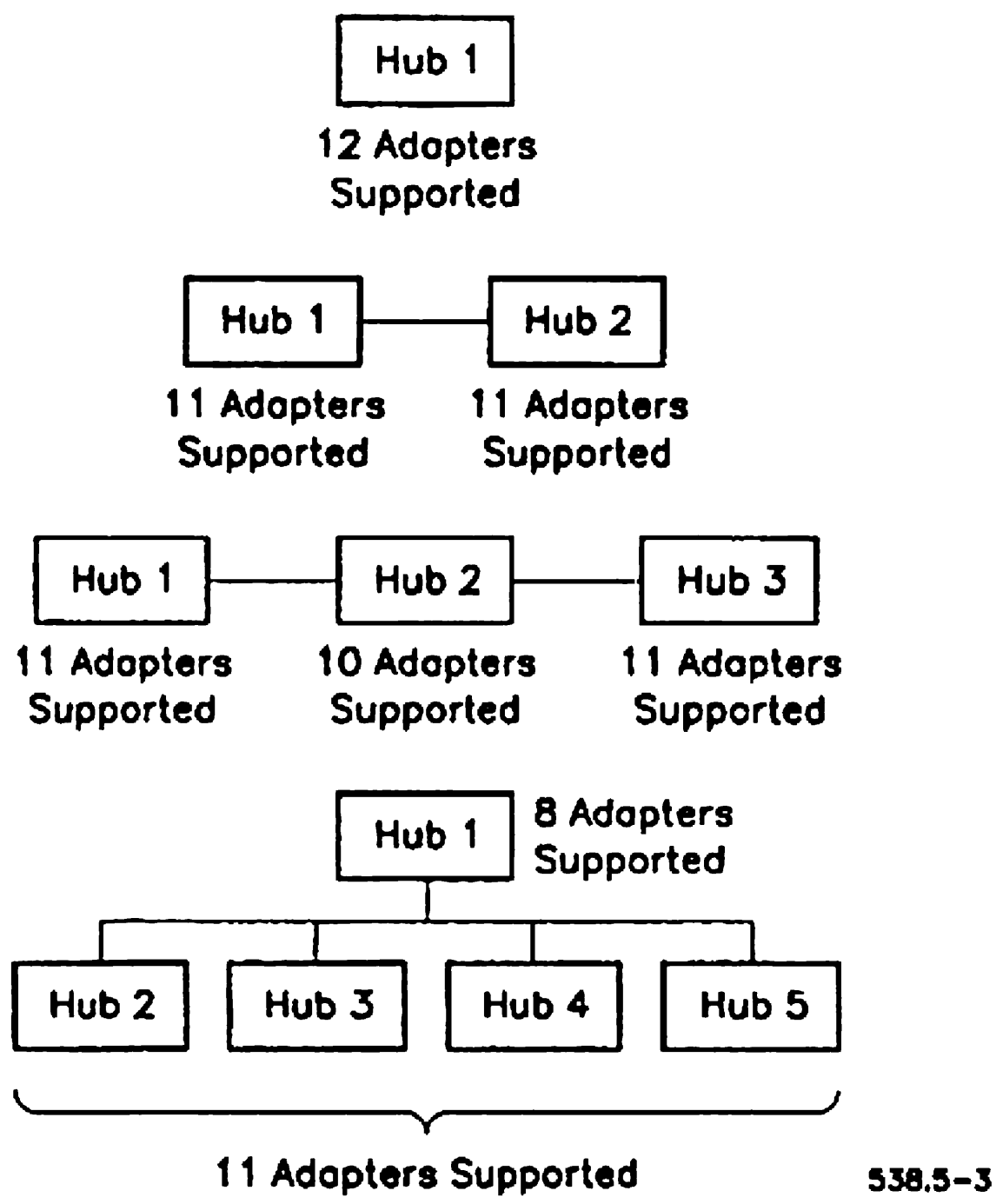
Note: *Only hardware limitations are described here. Read the appropriate software release announcement (SRA) documentation for information about software limitations.*

A single hub supports 12 TeleCluster adapters. Each TeleCluster adapter provides direct support for one workstation and up to three other workstations that are daisy-chained to that workstation by cluster cable.

Note: *The server must have a TeleCluster adapter (installed or built-in).*

However, if hubs are daisy-chained, each hub supports fewer than 12 adapters because one or more of a hub's 12 channels will be used for daisy-chaining. (Each daisy-chain connection removes one adapter.) The exact number of adapters supported will depend on the configuration of the hubs. See Figure 5–3 for some examples.

Figure 5–3. Hub Configuration and Adapter Support



Selecting Workstation, Server, and Hub Locations

On the floor plans, mark the locations where workstations, server, and hubs are to be installed. Indicate the workstation type on the floor plans.

Workstations and Servers

Make sure that there is at least 25 feet of cable between the hub and any TeleCluster adapter.

Hubs

Locate the hub in the wiring closet that is nearest to the majority of the cables used for TeleCluster. If you are daisy-chaining hubs, make sure that there are no more than 800 feet of cable between any two directly connected hubs in the daisy-chain (see Figure 5–2).

Note: *There should be no more than three punchdown blocks between a hub and and a TeleCluster adapter, or between any two directly connected hubs in the daisy-chain. If more than three punchdown blocks are used, each additional punchdown block reduces the maximum cable length by 50 feet.*

Identifying Cable Routes

From the marked floor plans, identify the cable routes and mark the cable lengths. (Be sure to account for vertical cable runs.) Make sure that

- The maximum cable length limits between a hub and a TeleCluster adapter are not exceeded
- The TeleCluster cable is routed separately from ac power cable to minimize electromagnetic interference. TeleCluster cable should be kept the following distances from power cables:
  - 3 inches (75 mm) from ac cables with 2 kVA or less
  - 12 inches (300 mm) from ac cables with 2 kVA to 5 kVA
  - 40 inches (1 meter) from ac cables with 5 kVA or greater
  - 5 inches (130 mm) from fluorescent fixtures

Completing and Maintaining Network Documentation

Date and keep the final version of the marked floor plans as an "as-built" record of the cluster. Copies of this version may be made and used as working copies when network expansion or modification is undertaken. Be sure to update the network floor plans after modifying or expanding the network.

The marked floor plans and other network documentation should be maintained by the network administrator.

Installation Overview

To install a TeleCluster network, you need to do the following:

- Install the hub
- Daisy-chain hubs (optional)
- Install the Network Interface Unit (optional)
- Install modular wall jacks
- Install TeleCluster adapters
- Daisy-chain workstations (optional)

Installing Hubs

Note: *For information on using the new modular hub with older hub products, see Appendix F.*

To install a hub,

1. Make sure that the wiring closet selected for the hub contains all of the cables leading out to the TeleCluster adapters. If it doesn't, install more cable so that a wire pair links each TeleCluster adapter to the hub.

2. Mount a punchdown block within 20 feet of the hub. (Each hub should have its own block.) The block should be within 20 feet of the hub because the hub-to-punchdown block cable supplied with the hub is only 20 feet long. If you need a longer cable, consult your Unisys representative.

   Note: *There should be no more than three punchdown blocks between a hub and and a TeleCluster adapter. If more than three punchdown blocks are used, each additional punchdown block reduces the maximum cable length by 50 feet.*

3. Label each of the wire pairs leading to the TeleCluster adapters, so that you can identify which wire pair goes to which adapter. This will make maintenance easier later.

4. Connect each of the wire pairs to the punchdown block (see Figure 5–4). Table 5–3 lists the tip/ring polarity for each punchdown block position, as well as the hub channel corresponding to each pair of positions on the punchdown block.

Figure 5–4. Punchdown Block and Wire Pairs

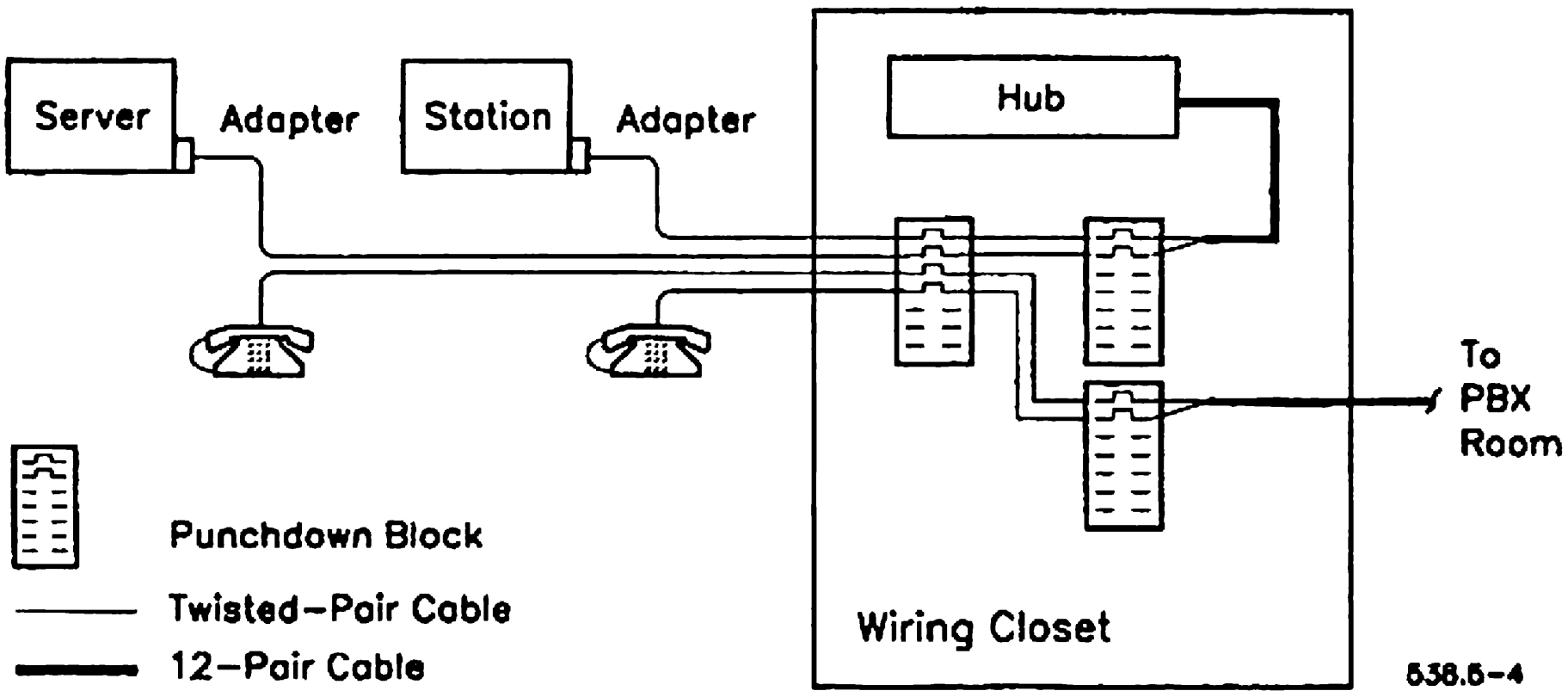


Table 5–3. Hub Channel Positions on the Punchdown Block*

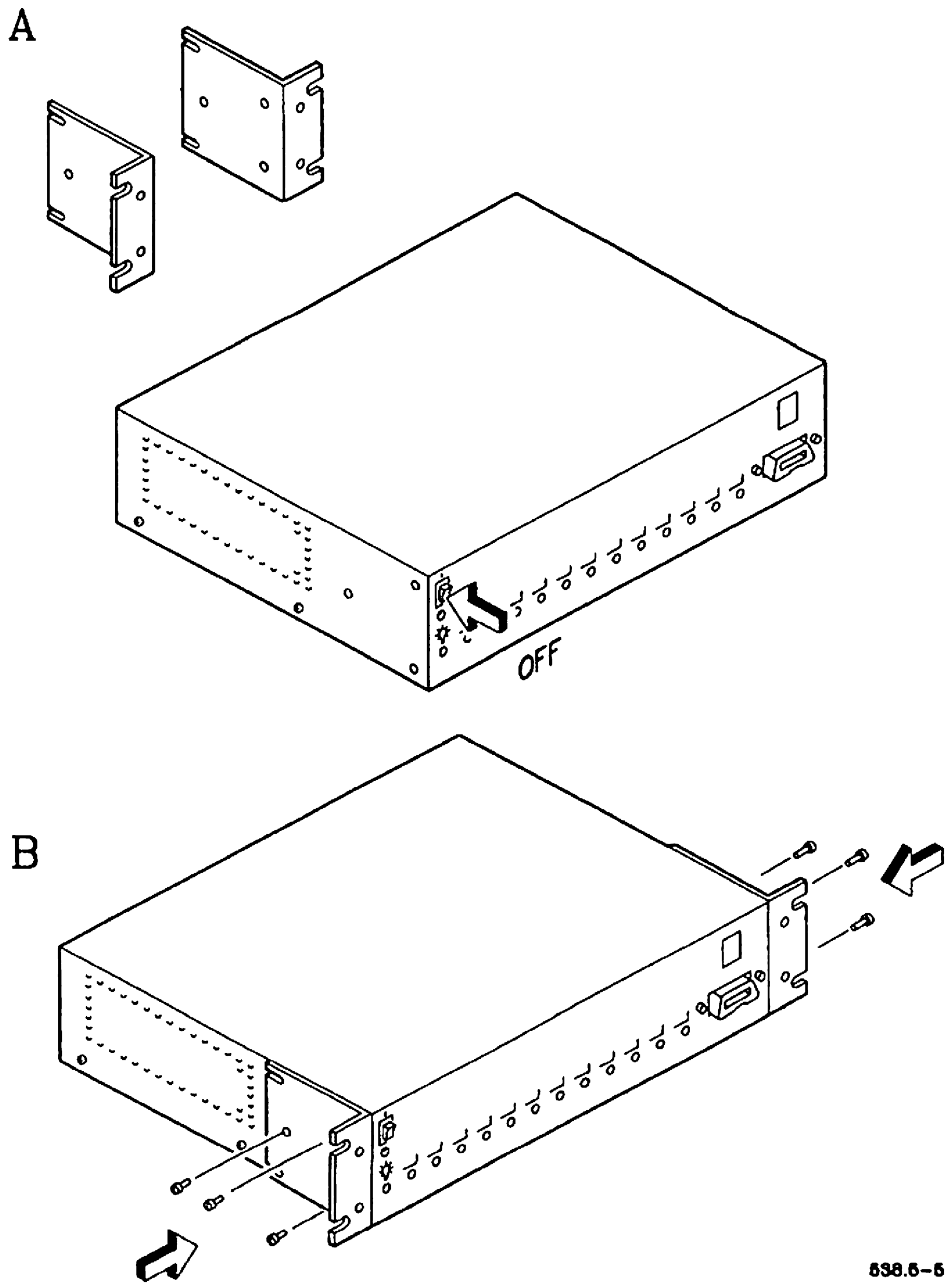
Channel Number	Tip	Ring
1	Position 1 (White-blue)	Position 2 (Blue-white)
2	Position 3 (White-orange)	Position 4 (Orange-white)
3	Position 5 (White-green)	Position 6 (Green-white)
4	Position 7 (White-brown)	Position 8 (Brown-white)
5	Position 9 (White-gray)	Position 10 (Gray-white)
6	Position 11 (Red-blue)	Position 12 (Blue-red)
7	Position 13 (Red-orange)	Position 14 (Orange-red)
8	Position 15 (Red-green)	Position 16 (Green-red)
9	Position 17 (Red-brown)	Position 18 (Brown-red)
10	Position 19 (Red-gray)	Position 20 (Gray-red)
11	Position 21 (Black-blue)	Position 22 (Blue-black)
12	Position 23 (Black-orange)	Position 24 (Orange-black)

* The color codes reflect the color codes for the wire pairs in the 12-pair cable provided with the hub; the color coding in your building's wire pairs may vary. (Color codes are provided here mainly to illustrate tip/ring polarities.)

5. Check the clearance at the rear of the equipment rack that will be used for the hub. If there is insufficient clearance, plug the power cord into the hub back panel before you mount the hub, but do **not** plug the other end of the power cord into an ac outlet.

6. Attach the two front mounting brackets to the side of the hub (see Figure 5–5)

Figure 5–5. Mounting Hub Brackets



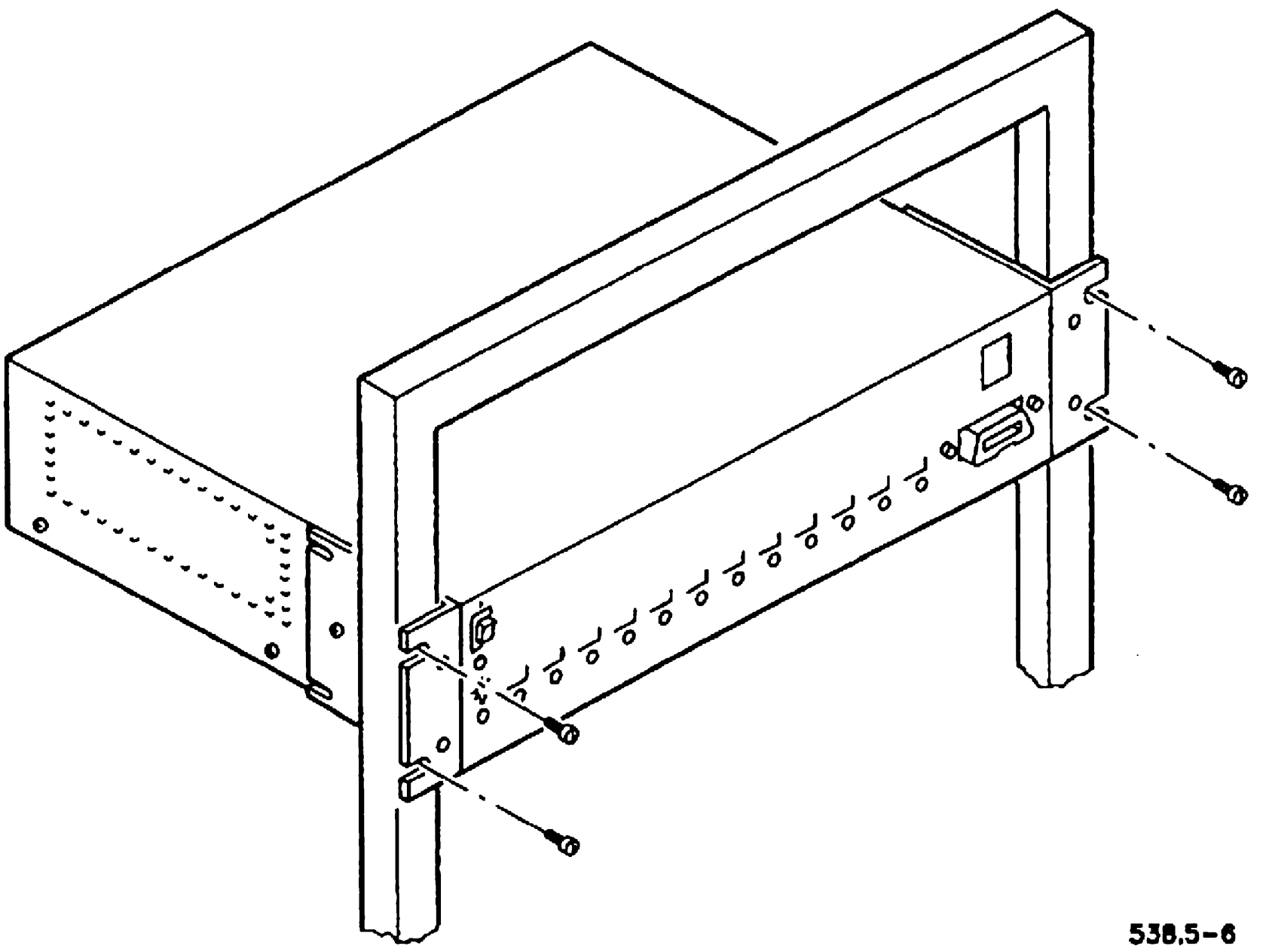
538.6–5

7. Place the hub in the rack, and fasten the hub to the rack by tightening screws or bolts into the lower and upper sets of rack-mount cutouts on the hub's front panel. (See Figure 5-6).

CAUTION

If you use 25-inch equipment racks, you must provide a rear support for the hub.

Figure 5–6. Mounting a Hub

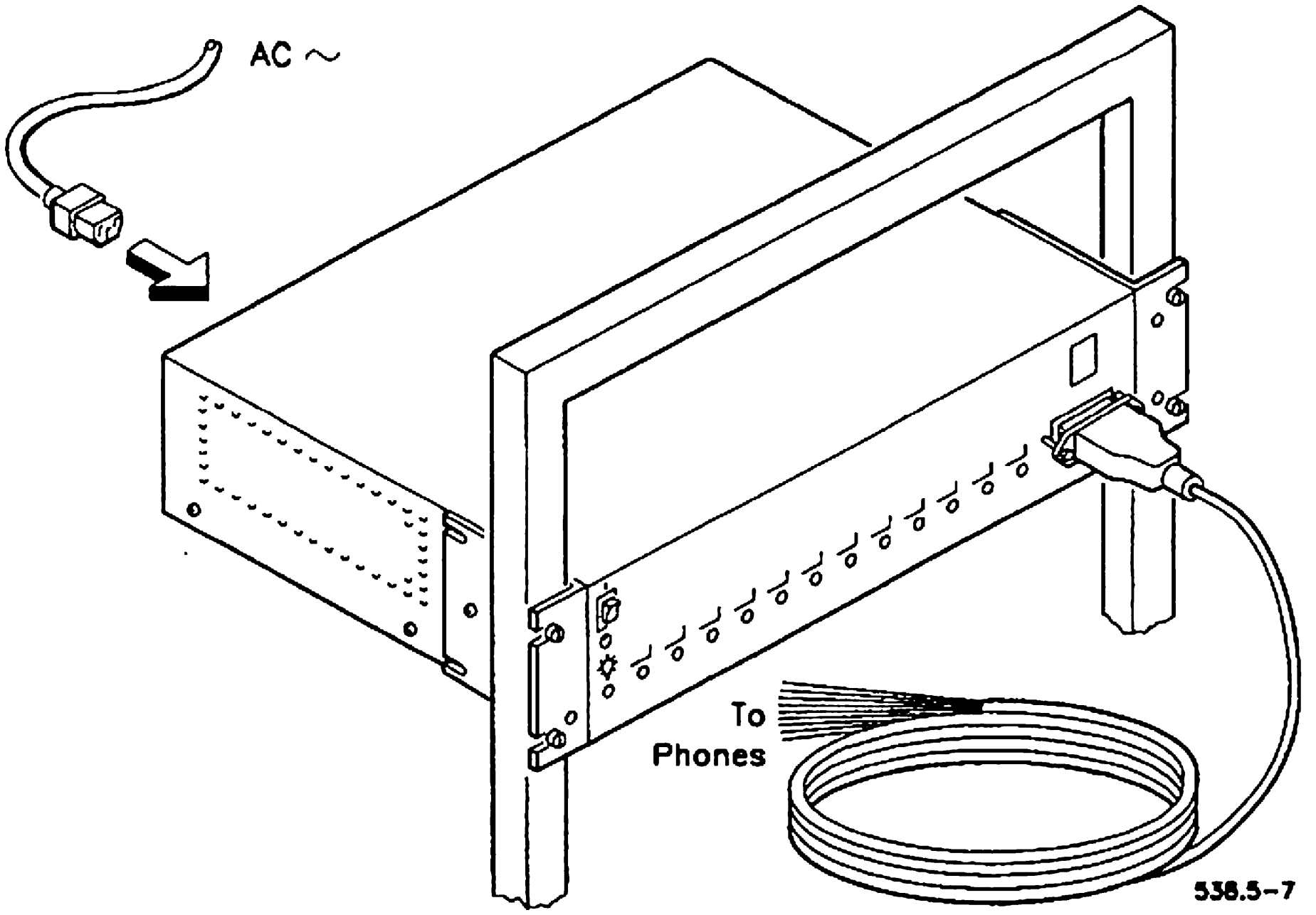


538.5-6

8. If you haven't already done so, plug the power cord into the hub's back panel, but do **not** plug the other end of the power cord into an ac outlet.

9. Locate the 12-pair cable supplied with the hub, and connect the cable's 24-pin connector to the 24-pin connector on the front of the hub. (See Figure 5–7.)

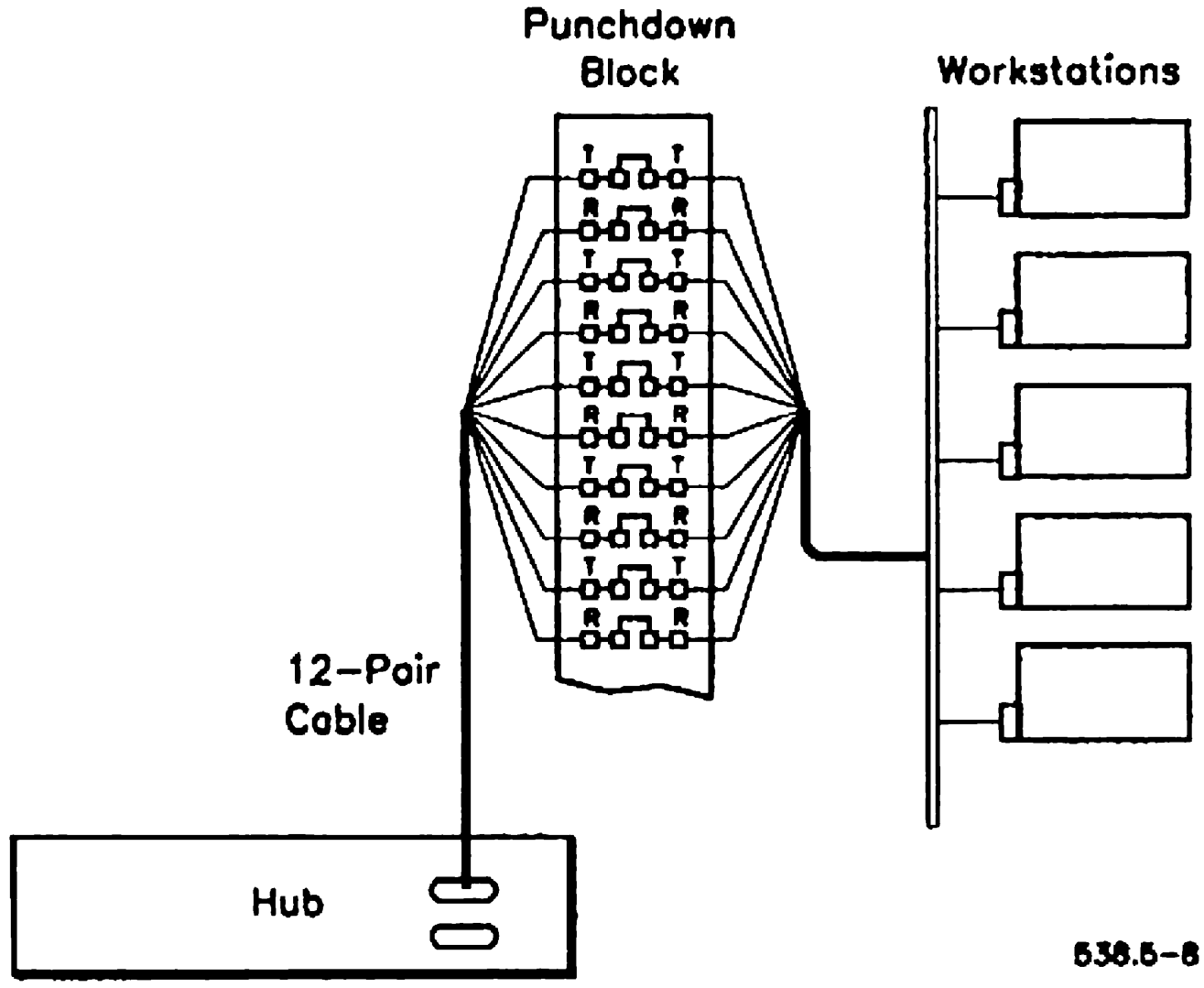
Figure 5–7. Connecting a 12-Pair Cable



10. The remaining end of the 12-pair cable has no connector. Instead, the individual wire pairs in the cable are exposed so that they can be connected to the punchdown block. Using the hub channel assignments listed in Table 5–4, connect each wire pair to the punchdown block. (See Figure 5–8.).

Note: *Use cross-connect wires in a punchdown block rather than bridge clips. The use of bridge clips can result in unreliable connections.*

Figure 5–8. Wiring the Punchdown Block



11. Locate the blank channel location labels on the front of the hub. (There's one blank label above each hub channel LED.) Mark the location of each TeleCluster adapter on this label so that you can easily determine which adapter is connected to which hub channel.

12. Plug the hub's power cord into an ac outlet.

Daisy-Chaining Hubs

You can daisy chain a maximum of five TeleCluster hubs together. The cable connecting any two hubs cannot be longer than 800 feet.

To daisy chain hubs,

1. Install the hubs as described above in "Installing Hubs."
2. Make sure that there are available wire pairs linking the wiring closets where the hubs are installed.
3. Using the hub punchdown blocks, connect one end of an available wire pair to one hub, and the other end to the other hub. Make sure that the tip/ring polarity is as described in Table 5–4 above. (You can use any of the 12 hub channels for the daisy-chain connection.)

Note: *There must be no more than 3 punchdown blocks between any two directly connected hubs. If there are more than 3 blocks between the hubs, each additional block reduces the 800 foot maximum cable length by 50 feet.*

Installing a Network Interface Unit

The Network Interface Unit (NIU) insulates the TeleCluster hub from direct connection to the telephone lines. Some countries require an NIU to be installed to ensure that no unexpected signals pass between the hub and the telephone lines. (Consult your local telephone authority for details.) If an NIU is required, you must install one NIU for each hub.

CAUTION

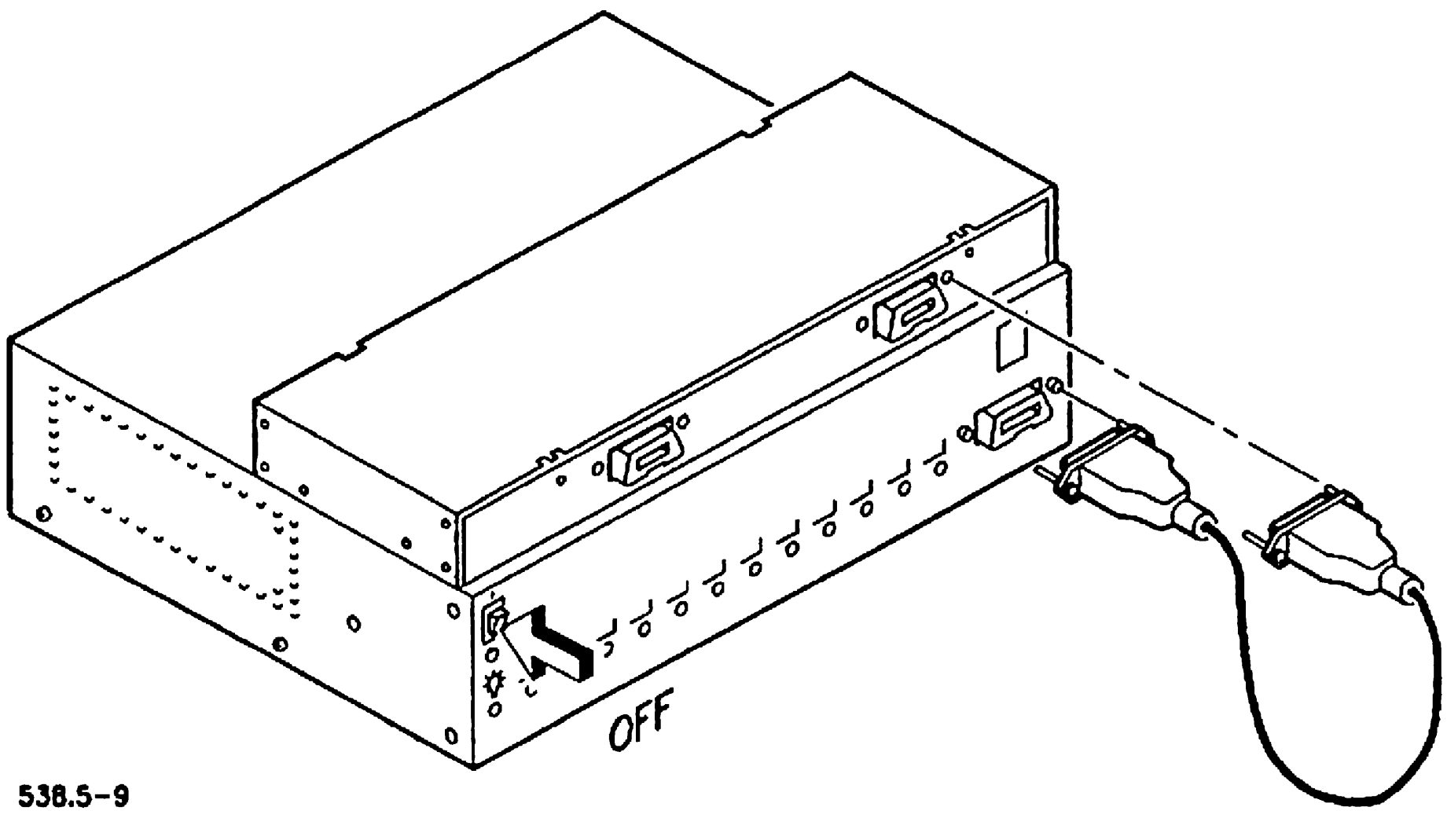
If you use an NIU in a TeleCluster network, the maximum allowed cluster speed is 1.8 Mbps.

Note: *The Network Interface Unit cannot be used with the older voice/data TeleCluster hub.*

To install the Network Interface Unit,

1. Mount the NIU in the same equipment rack used by the hub. The NIU must be installed directly above the hub.
2. Locate the short 24-pair telephone cable shipped with the NIU. Plug one end of this cable into the connector labelled "Out-Hub" on the NIU. Plug the other end of the cable into the 24-pair connector on the hub. (See Figure 5–9.)
3. Connect the cables leading to the TeleCluster adapters to the connector labelled "In-adapters" on the NIU.

Figure 5–9. Connecting the NIU



Installing Modular Wall Jacks

Each twisted pair cable leading from the hub to a TeleCluster adapter must be connected to an RJ11 or RJ45 modular wall jack. You can use a dedicated wall jack, or you can share the jack used by the telephone line. (If you share the wall jack with the telephone line, you need a special Y adapter.)

A general procedure for installing a modular jack and connecting TeleCluster to the jack is described below.

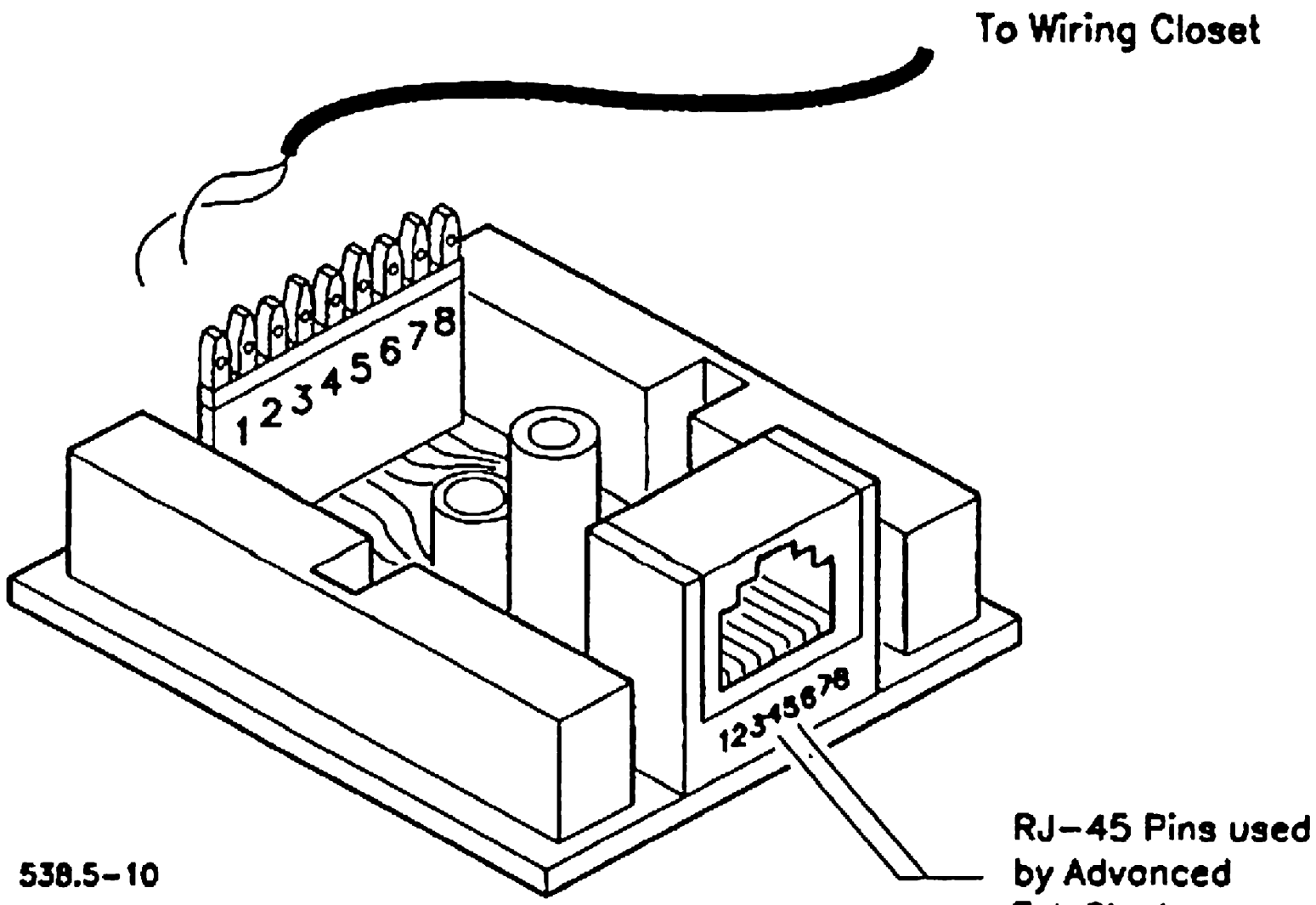
To install a wall jack,

1. Locate the wire pair used for TeleCluster.
2. Remove existing cover plates from the jack housing.
3. Connect the tip and ring leads of the wire pair to wall jack posts so that tip and ring are connected to the middle two pins of the RJ11 or RJ45 connector. That is, on an RJ11 jack, tip is connected to pin 3 and ring to pin 4; on an RJ45 jack, tip is connected to pin 4 and ring to pin 5 (see Figure 5–10).

Note: *Different makes of wall jacks may vary as to which jack posts are connected to the middle pins of the RJ11 or RJ45 connector. You'll have to determine this before you wire the jack.*

4. Reassemble the wall jack housing.
5. Label the wall jack to indicate that it has been wired for TeleCluster.

Figure 5–10. Wiring a Wall Jack



Installing TeleCluster Adapters

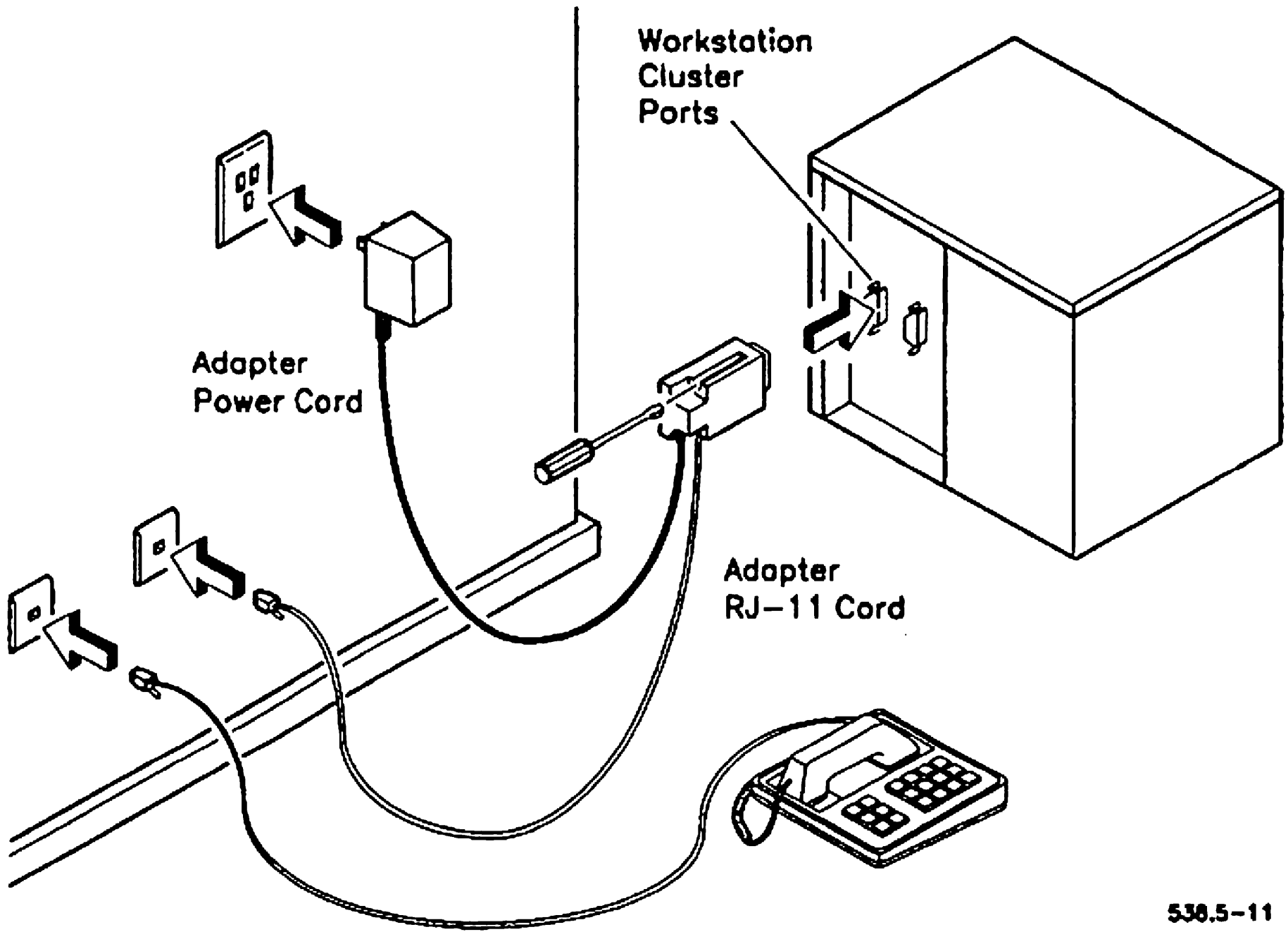
To connect to a TeleCluster network, a workstation must have a TeleCluster adapter, or be daisy chained to a workstation that has one.

Note: *PCs with an AT-bus ClusterCard, Series 2000 workstations, and Series 5000 workstations do not require a TeleCluster adapter to be installed because they have built-in adapters.*

To install a TeleCluster adapter,

1. Connect the adapter to an RS-422 or RS-485 port on the workstation or server (see Figure 5–11). You can use any of the RS-422 or RS-485 ports on a workstation or server.

Figure 5–11. Installing a TeleCluster Adapter



2. Determine whether the workstation or server provides +5V for the TeleCluster adapter. (See Appendix B, "Workstations and Servers".) If the workstation or server does not provides +5V, you must install an adapter power supply as shown in Figure 5–8. (The power supply plugs into an ac outlet.)

   If the workstation or server does provide +5V, an adapter power supply is not required.

   Note: *Turning off a workstation turns off the +5V power that it provides for the TeleCluster adapter, cutting off any other workstations daisy-chained to the adapter. Therefore, when other workstations are daisy-chained to the adapter, you should install an adapter power supply even if the workstation provides +5V, if you plan on turning off the workstation.*

3. Connect the workstation to the hub by plugging the cable from the TeleCluster adapter into the wall jack.

Connecting Series 2000/5000 Workstations

To connect Series 2000 or Series 5000 workstations to a TeleCluster network,

1. Locate the RJ11-RJ45 TeleCluster adapter cable.
2. Connect the smaller cable connector (RJ11) to the TeleCluster wall jack, and the larger cable connector (RJ45) to the workstation (see Figures 5–12 and 5–13).

CAUTION

Do not connect the RJ11 end of the cable to the workstation!!! Doing so may damage the pins on the workstation's RJ45 TeleCluster jack.

Figure 5–12. Series 2000 Installation

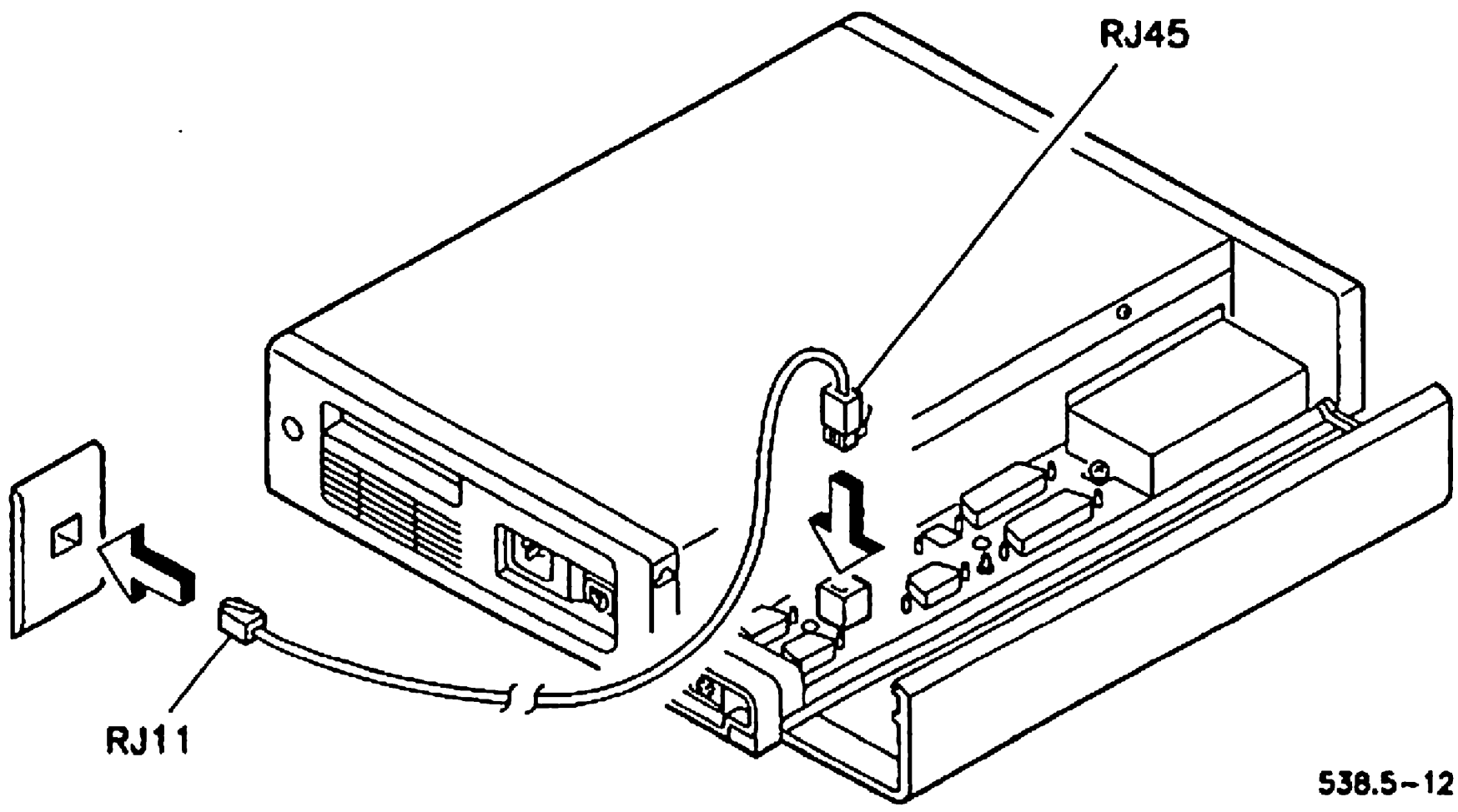
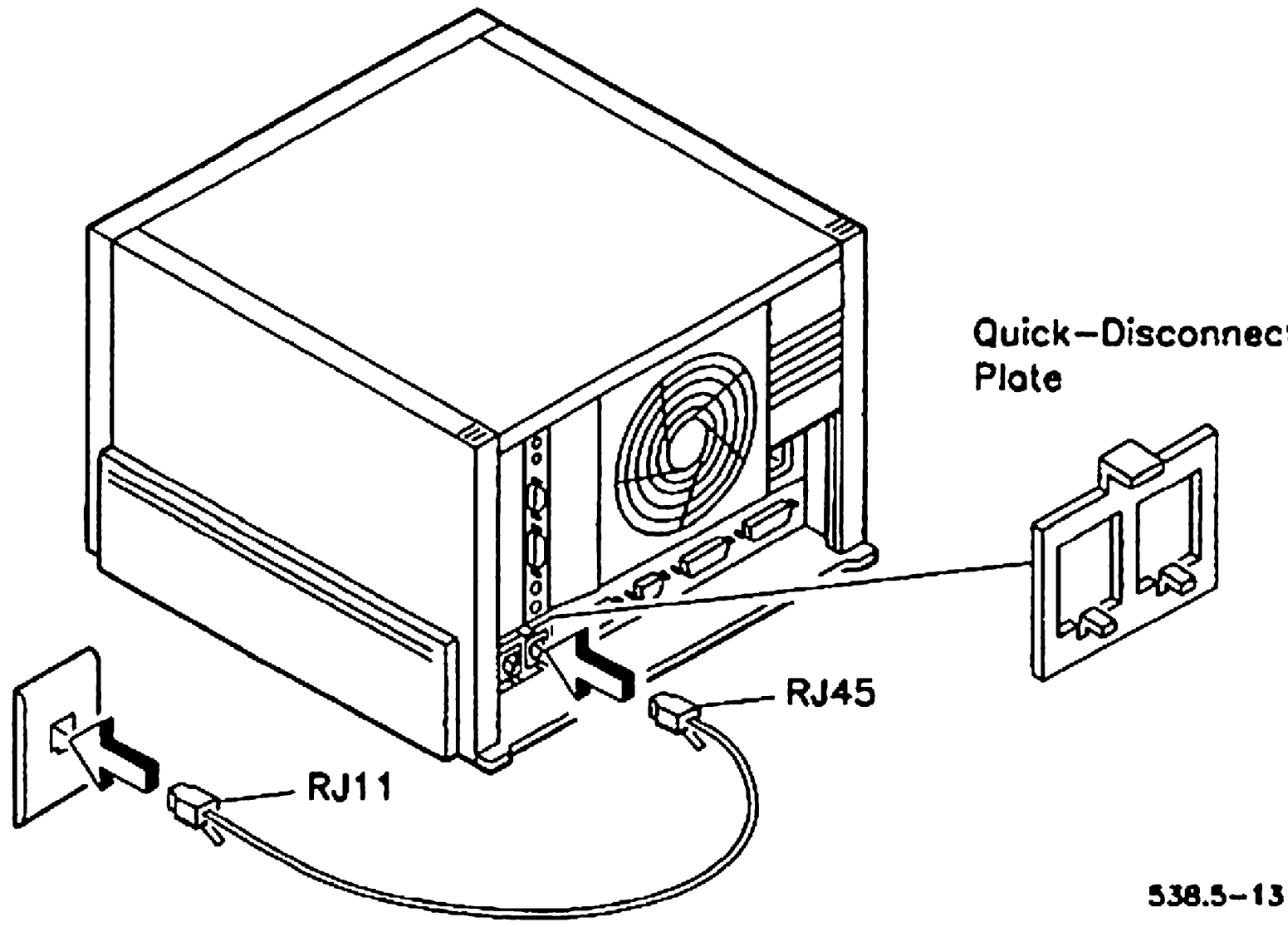


Figure 5–13. Series 5000 Installation



Connecting PCs

To connect a PC that has an AT-bus ClusterCard, to a TeleCluster network,

1. Locate the RJ11-RJ45 TeleCluster adapter cable.
2. Connect the smaller cable connector (RJ11) to the TeleCluster wall jack, and the larger cable connector (RJ45) to the ClusterCard.

CAUTION

Do not connect the RJ11 end of the cable to the workstation!!! Doing so may damage the pins on the workstation's RJ45 TeleCluster jack.

Daisy-Chaining Workstations

A TeleCluster adapter supports a maximum of 4 workstations: one workstation that has the adapter, and three others that are daisy-chained to that workstation. A maximum of 4 workstations can be daisy-chained to the server.

Note: *The server must have a TeleCluster adapter and be directly connected to the hub.*

If you daisy-chain workstations or PCs,

- Make sure that the workstation with the TeleCluster adapter either provides +5V for the adapter or has an adapter power supply. If this workstation must be turned off occasionally, an adapter power supply is required even for workstations that provide +5V.
- Make sure that the planned installation does not exceed the maximum length limits for cluster cable (see Table 5–4 below)
- Make sure there will be at least 25 feet of cable between any two workstations or PCs.
- Make sure you use 100 Ohm cluster cable and terminators.

Table 5–4. Daisy Chain Maximums (Workstations)*

Cluster Speed (Mbps)	Maximum Length
1.8	600 ft
3.7	300 ft

* The cluster cable must be standard 100 Ohm cluster cable.

To daisy-chain workstations or PCs,

1. Install DB9-RJ45 adapters in each PC that has an AT-bus ClusterCard, or in each Series 5000 workstation. (See Figures 5–14 and 5–15.)
2. Check the ground potential difference between the workstation and the cluster cables, following the procedures described in *Daisy-Chaining Workstations to the Server* in Section 3 of this manual.

CAUTION

Ground potential differences exceeding the above specifications can damage electronic components and may result in erratic cluster performance.

3. If the ground potential difference is within the acceptable limits, connect the cluster cable.

Figure 5–14. DB9-RJ45 Adapter Installation (PC)

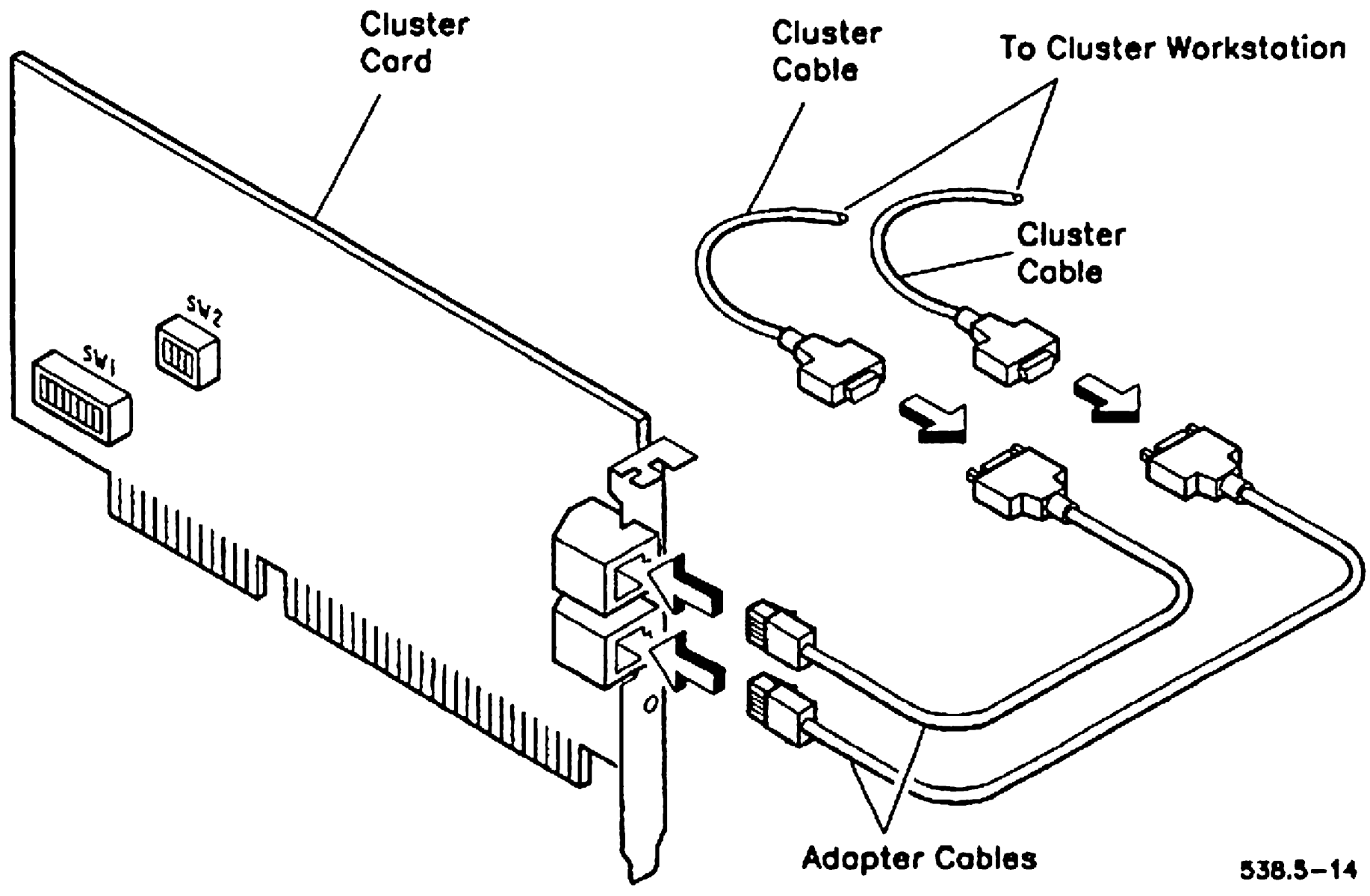
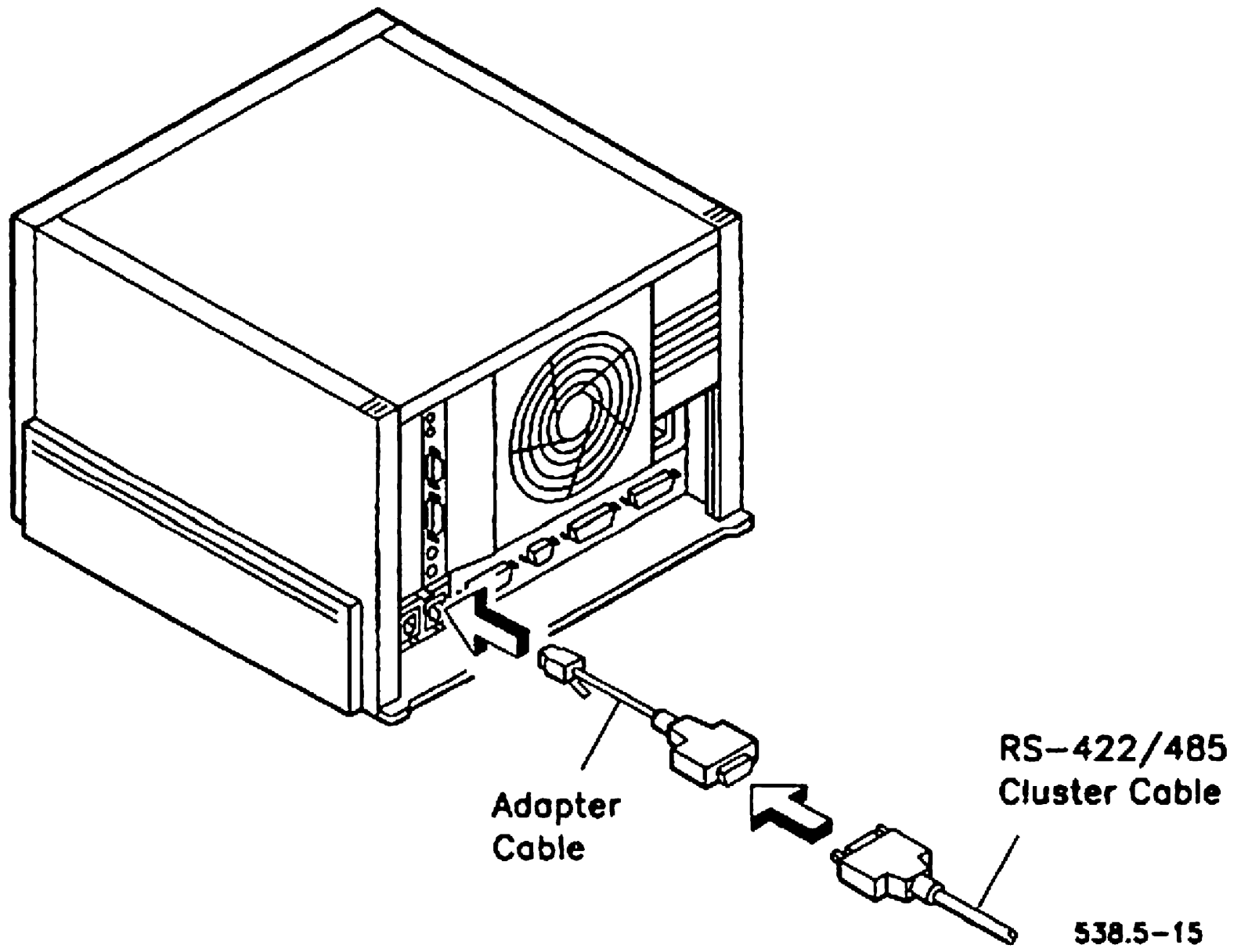


Figure 5–15. DB9-RJ45 Adapter Installation (Series 5000)



Starting the Cluster

After the TeleCluster network is connected, start up the cluster. To do this,

1. Turn on all of the hubs in the TeleCluster network. (The power switch is in the front of the hub.)
2. Boot the server.
3. Boot all of the workstations and PCs in the TeleCluster network.
4. Run the Cluster Status (in the Executive program) command on the server to verify that all workstations are operational on the cluster.

Troubleshooting

There are three common symptoms of TeleCluster failure:

1. Some of the workstations cannot access the server.
2. No workstation can access the server.
3. The TeleCluster has intermittent errrors.

If your TeleCluster network has one of these symptoms, you can usually isolate the cause of the problem using the procedures described below.

Some Workstations Cannot Access the Server

If some of the workstations in the TeleCluster are unable to access the server, but other workstations can access the server, you should suspect the individual workstations and their cable connections to the hub, or the connections between daisy-chained hubs. (In this case, the hubs themselves and the server are probably not the cause of the problem.)

No Workstation Can Access the Server

If none of the workstations in the TeleCluster (or none of the workstations connected to a particular hub), can access the server, you should suspect a hub or the server. (In this case, the individual worstations and cable connections are probably not the cause of the problem.)

The TeleCluster has Intermittent Errors

Intermittent errors are usually caused by incorrectly daisy-chaining workstations to the workstation that has the TeleCluster adapter. See the *CTOS System Administration Guide* for information about troubleshooting daisy-chained workstations.

Troubleshooting Workstations

If you have determined that the problem is caused by the workstation or by faulty cable connections between hub and workstation, you can use the LED on the TeleCluster adapter to further isolate the problem. The adapter LED helps you identify and solve communication problems at a workstation.

The adapter LED can be in one of three states: off, flickering, or on. Examine the adapter LED, and perform the procedures listed below.

Note: *Series 5000 workstations do not have TeleCluster adapter LEDs.*

The Adapter LED Is Off

The adapter LED is on whenever the adapter has power. Therefore, if the LED is off, the adapter has no power. Use the following chart to identify the cause and fix the problem.

Possible Cause	Action
The workstation has no power or is not operational.	Make sure the workstation has power and works correctly. Make sure the workstation is powered on.
The adapter is not receiving power from the workstation.	If the adapter is being used without an external power supply, make sure the workstation provides +5V for the adapter. The workstations that provide +5V are listed in Appendix B, "Workstations and Servers". If the workstation provides +5V for the adapter, reconnect the adapter to the cluster port. If the adapter still does not receive power from the workstation, connect an adapter power supply to the adapter.
The adapter is not receiving power from the adapter power supply.	If the adapter is being used with the adapter power supply, make sure that the power supply is plugged into a live ac outlet. Then make sure its cord is correctly connected to the adapter.
The adapter power supply is faulty.	Replace the adapter power supply.
The adapter is faulty.	Replace the adapter.

The Adapter LED Flickers

The adapter LED flickers when the adapter receives data from the server via the TeleCluster cable. Therefore, if the adapter LED flickers, the workstation should be able to access the server.

If workstation cannot access the server, even though the adapter LED flickers, use the following chart to identify the cause and fix the problem.

Possible Cause	Action
The adapter is not connected to the workstation correctly.	Remove the adapter and reconnect it. Make sure it is connected to a cluster port.
The cluster line is not terminated.	If you have daisy-chained other workstations to the workstation that has the TeleCluster adapter, disconnect them. If this fixes the problem, you have not daisy-chained correctly. Make sure that the length of the daisy chain does not exceed 600 feet if the cluster speed is 1.8 Mbps, or 300 feet if the cluster speed is 3.7 Mbps. Also, make sure that the cluster cable is terminated at the last workstation in the daisy chain.
The adapter is faulty.	Replace the adapter.
The workstation is faulty.	Connect a known-good workstation to the adapter. If that workstation can access the server, replace or repair the original workstation.

The Adapter LED Is On

The adapter LED is on whenever the adapter has power, and flickers whenever the adapter receives data from the server via the TeleCluster cable.

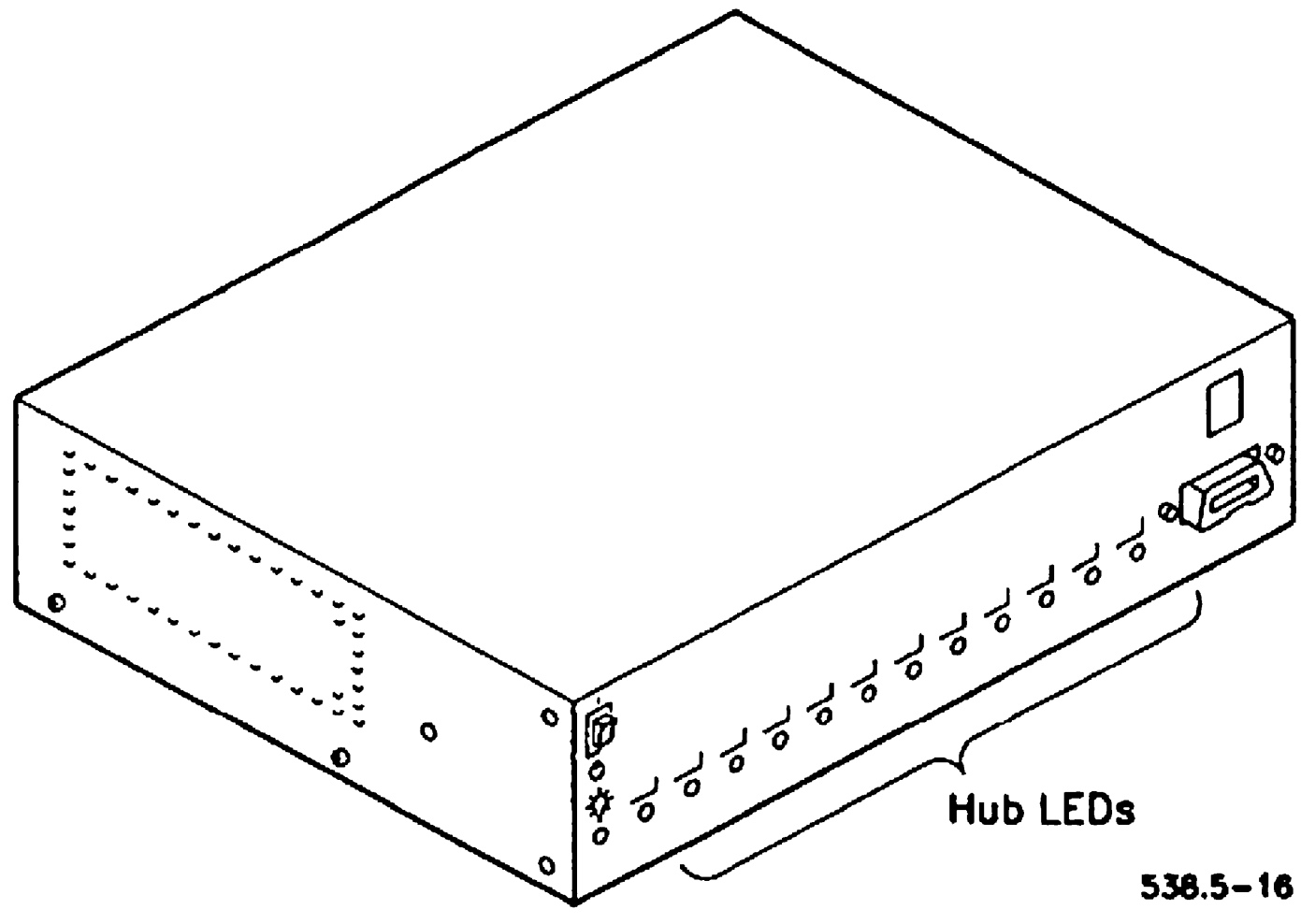
If the adapter LED is on, but does not flicker, even though data is sent to or from the server, use the following chart to identify the cause and fix the problem.

Possible Cause	Action
The telephone cord from the adapter is connected to the wrong wall jack.	Make sure that the cord from the adapter is plugged into the wall jack that has been wired for TeleCluster.
The wall jack is wired incorrectly.	See "Installing Modular Wall Jacks" earlier in this section for instructions on wiring the wall jack. If you are using the older voice/data adapters (B25-TA1/TA2) in a TeleCluster network that also uses Advanced TeleCluster adapters (B25-TA3/TA4), you may have to reverse tip and ring at the malfunctioning voice/data adapters.
The adapter is faulty.	Replace the adapter.
The problem lies with the Hub, the cross-connections on the punchdown block, or the TeleCluster cabling.	Make sure all connections are correct..

Hub LEDs

The hub has 12 LEDs, one for each TeleCluster channel (see Figure 5–16). An LED flickers whenever there is activity over the channel.

Figure 5–16. Hub LEDs



Part II

Section 6
Introduction to Local Area Networks

Introduction to Section 6

This section introduces two standard local area networks (LANs) that are supported in the CTOS environment:

- Ethernet
- Token ring

A cluster can use either of these two LANs to connect to other cluster networks or to non-CTOS networks.

Note: *This section does not cover the hardware required to connect CTOS clusters to Ethernet and Token Ring LANs. That information is provided in Section 7 (Ethernet) and Section 10 (Token Ring).*

What is a LAN?

A local area network (LAN) is a data communications system that allows independent computers to transfer data. The "local area" is normally restricted to about 2.5 kilometers because of the limitations on the part of the transmission media.

There are several types of LAN, usually distinguished by the network access method employed or by the transmission medium used. This section describes two common LANs, Ethernet and token ring.

Note: *A CTOS cluster is technically a LAN; however, in this guide, the term "LAN" is used only for Ethernet or token ring networks.*

What is Ethernet?

Ethernet is a local area network first developed in the early 1970s and standardized in 1985 as IEEE 802.3. The standardization allows computers of varying manufacture and type to be interconnected by an Ethernet network.

Ethernet Access Protocol

Ethernet is distinguished by its network access control method; that is, by the way it allows a given computer to gain control of the network in order to transmit data. Ethernet uses a contention method in which each computer contends with the others for access to the network. This contention method is called Carrier Sense Multiple Access with Collision Detect (CSMA/CD).

An account of how CSMA/CD works is best seen from a concrete example. A computer's Ethernet controller constantly monitors the network data channel in "listening mode", waiting for incoming data. Consequently, the Ethernet controller detects when data is being transmitted by some other computer on the network and it detects when no data is being transmitted. This is called "Carrier Sense": the Ethernet controller at each computer will not transmit data if it detects activity (carrier) in the channel.

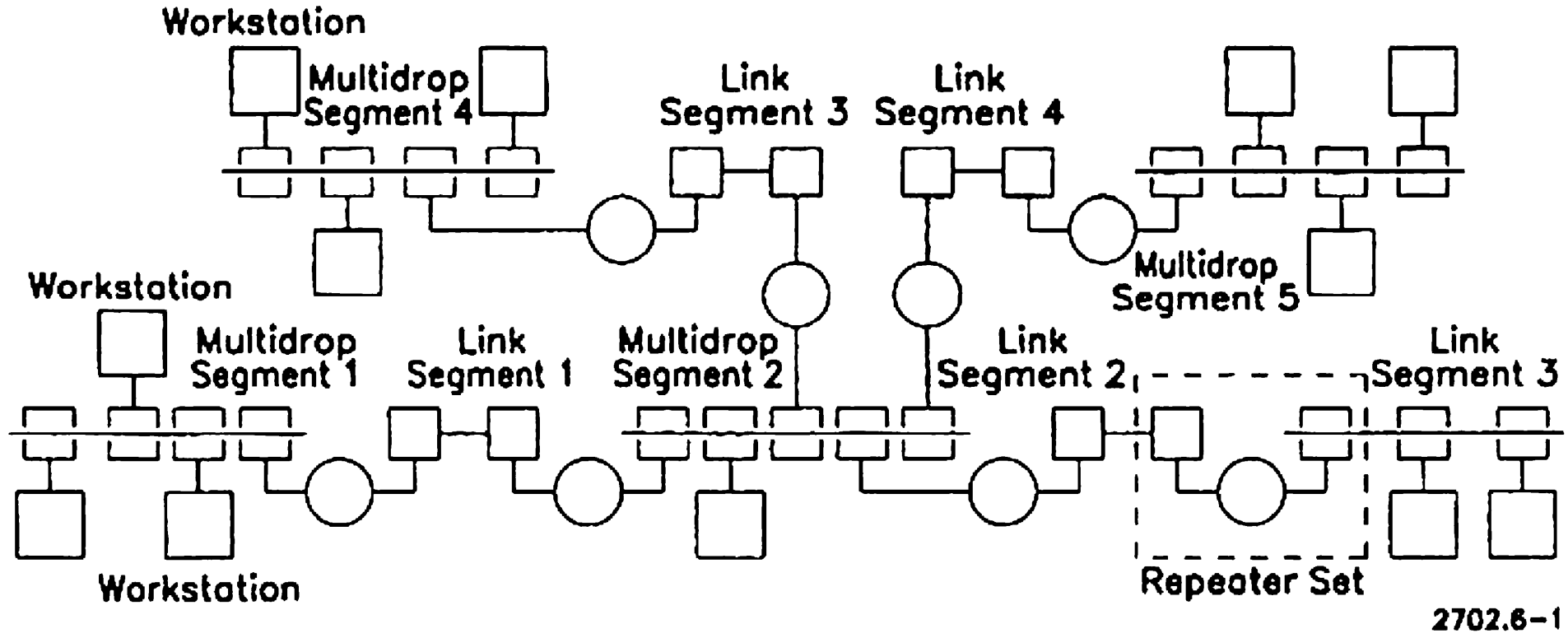
If there is no activity in the Ethernet, the Ethernet controller can transmit data; or, more precisely, any Ethernet controller can transmit data. This gives rise to the possibility of simultaneous transmissions, where two or more controllers try to transmit at the same time or at nearly the same time. If this happens, there is a collision, which is detected (Collision Detect). A jam signal is issued to alert all other controllers to the collision. The transmitting controllers then stop transmitting and wait for a period of time before attempting to retransmit the data. (The period of time is quasi-randomized at each controller, to make a second collision unlikely.)

The data rates for an Ethernet network are typically around 10 megabits per second.

Ethernet Cable Segments

The fundamental building block of an Ethernet network is the cable segment (see Figure 6–1). Cable segments are used to connect workstations to an Ethernet network or to connect other cable segments.

Figure 6–1. Ethernet Example Network



There are two basic types of segment: multidrop segments and link segments.

A multidrop segment is a section of cable that allows individual network workstations to connect to the cable at any point along the cable.

A link segment, on the other hand, is a section of cable that allows only one connection at each end of the cable; it does not allow workstations to connect to the cable at other points. Link segments are used mainly to connect two multidrop segments or to connect 10BaseT hubs to other hubs or to workstations.

Note: *Link segments that connect two multidrop segments are also called "inter-repeater link segments" because this type of link segment requires repeaters.*

Types of Multidrop Segment Cable

The CTOS environment supports two types of multidrop cable:

- 10Base5 coaxial cable, also called "thicknet" or "standard Ethernet"
- 10Base2 coaxial cable, also called "thinnet" or "Cheapernet"

An Ethernet installation will use one or both of these cable types to take advantage of the cable type's particular strengths. For example, 10Base2 cable is cheaper and more flexible than 10Base5 cable, while 10Base5 cable supports more workstations and can extend over greater distances.

Types of Link Segment Cable

The CTOS environment supports four types of link segment cable:

- 10Base5 coaxial cable, used as a link segment
- 10Base2 coaxial cable, used as a link segment
- 10BaseT cable (unshielded twisted pair)

Note: *10Base2 link segments are normally used only to link 10Base2 multidrop segments.*

Connecting Workstations to Ethernet Cable

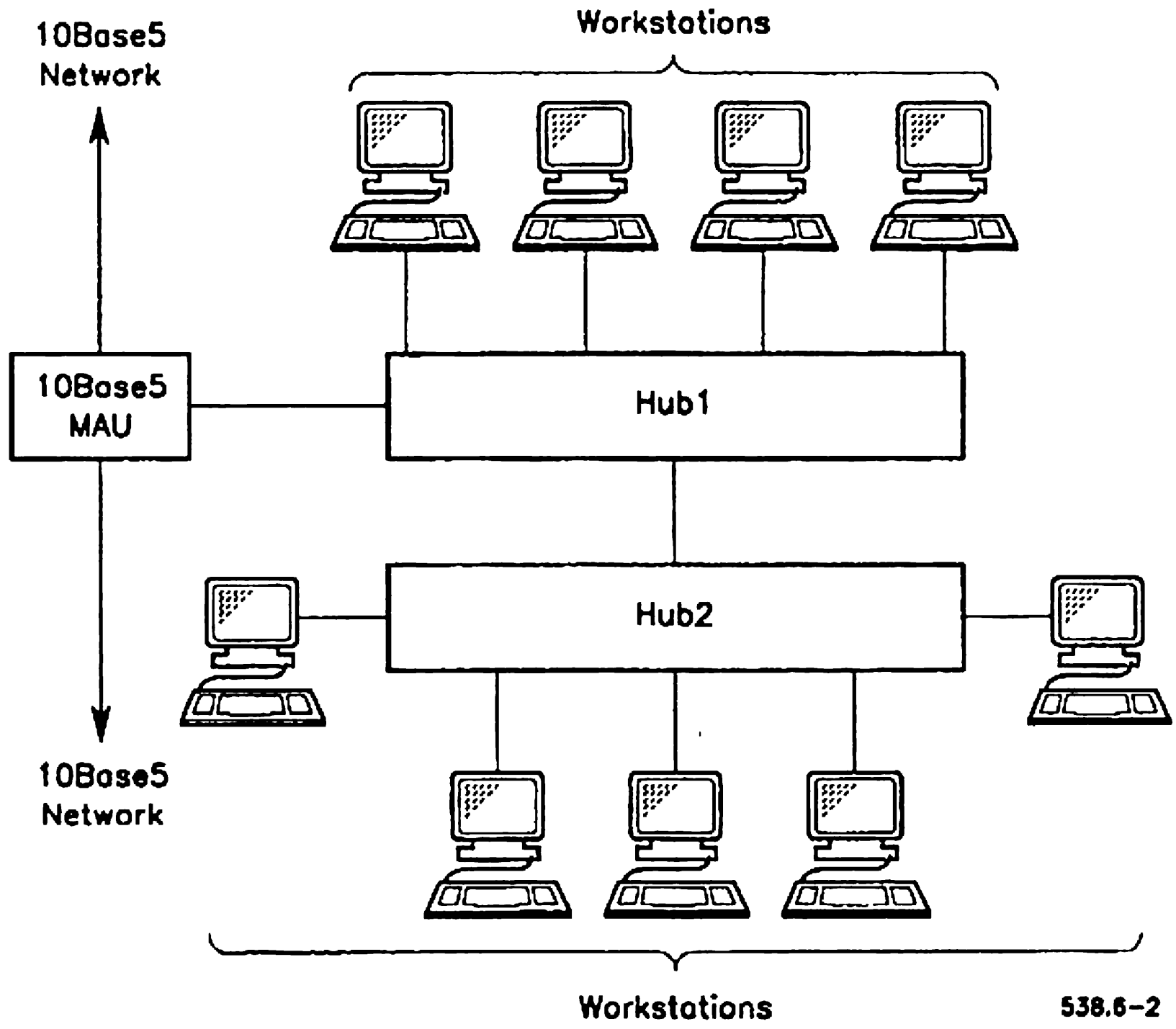
Workstations are connected to a multidrop cable segment by a medium attachment unit (MAU), which attaches directly to the Ethernet cable. The workstation is connected to the MAU by a special drop cable called an attachment unit interface (AUI) cable.

10BaseT Networks

A version of Ethernet called 10BaseT allows unshielded twisted pair cable to be used as the link segment between a 10baseT hub and a workstation or between 10baseT hubs. This cable is much cheaper than the coaxial or fiber optic cable required by other types of Ethernet, and is much easier to install. In addition, many newer buildings are already pre-wired for 10BaseT, which makes this type of Ethernet especially attractive.

In a 10BaseT network, each workstation is connected to a hub by the twisted pair wiring (2 pair are required). A hub can also be connected to other hubs to expand the size and distance of the network (see Figure 6–2).

Figure 6–2. 10BaseT Example Network



What Are Ethernet Networks Used For?

An Ethernet network only provides the underlying physical connection between workstations; it does **not** provide the software layers required for communication between workstations. These software layers are provided in the various types of proprietary and standardized network software designed for use over Ethernet.

In the CTOS environment, a proprietary network software package called BNet allows different clusters to communicate (under the CTOS operating system) over an Ethernet network.

Other types of network software allow clusters to communicate with non-CTOS equipment and networks over the underlying Ethernet links. This is made possible by a network software standard called Open Systems Interconnection (OSI). For example, after the appropriate OSI compliant network software is installed in a cluster, the cluster can communicate with other systems that use OSI compliant software.

What is Token Ring?

A token ring network is a standardized (IEEE 802.5) local network that uses token passing to control access to the network. The standard is based on an IBM protocol which allowed workstations in a ring to access a central host mainframe.

Token Ring Access Protocol

In a token ring network, a token (a specified sequence of bits) is circulated around the ring network until it is claimed by a workstation that wants to transmit data. The token is then converted into data frames and the frames are sent out around the ring. Each workstation on the ring inspects the destination address of the frames to determine whether the frames are addressed to it. When the frames reach their destination, the recipient(s) copies the frames.

After the recipient copies the frames, the frames continue around the ring to the sender, which checks the frame status field to determine whether the recipient copied the frames properly. If there are errors, the frames are retransmitted; if there are no errors, the sender regenerates the token out onto the ring, where it is circulated until claimed.

The data rates for a token ring network are typically around 4 megabits per second.

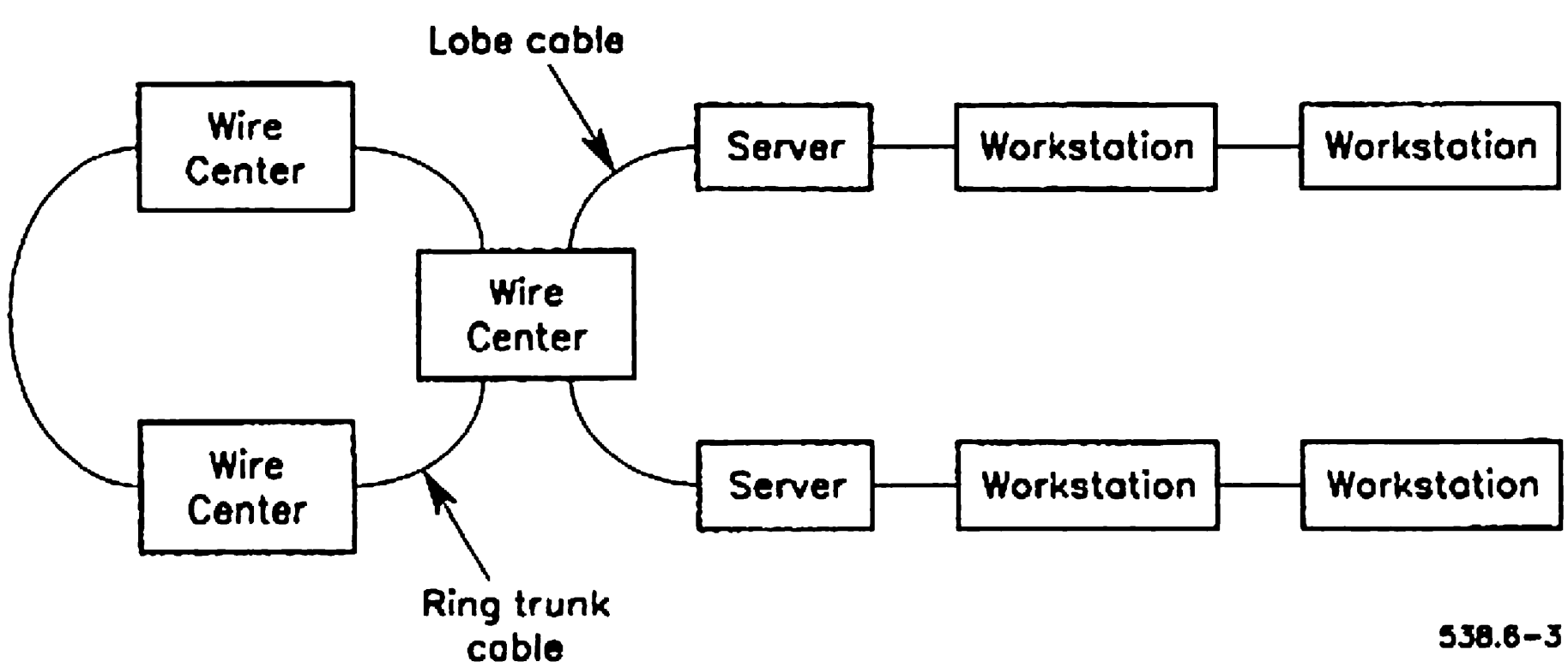
The Unisys Implementation of Token Ring

The Unisys implementation of token ring uses a device called a wire center, a rack-mounted box with connectors for eight workstations. One or more wire centers can be installed in one central wiring closet or in several wiring closets. The wire centers and the wiring closets are connected by shielded twisted pair cable called "ring trunk cable".

Individual workstations are connected to the wire centers by shielded twisted pair cable called "lobe cable" (see Figure 6-3). Normally, the lobe cable connects the wire center to a wall outlet near the workstation, and an adapter cable connects the workstation to the wall outlet.

Note: *Ring trunk cable, lobe cable, and adapter cable can consist of the same cable, namely shielded twisted pair. The different names are assigned only to indicate the function of a particular cable.*

Figure 6-3. Token Ring Example Network



What is Token Ring Used For?

Token ring was originally designed to connect terminals to a host mainframe computer. Many token ring networks are still used for this purpose. In the CTOS environment, this usage is supported: clusters can communicate with a host mainframe in a token ring network if the proper terminal emulation or SNA software is installed.

However, a token ring network can also be used for peer-to-peer communication. For example, using BNet and the appropriate OSI software (see Appendix C, "Network Software"), clusters can communicate in a token ring network under the CTOS operating system.

Section 7
Requirements for an Ethernet Network

Introduction to Section 7

This section describes the hardware and software required for connecting a CTOS cluster to an Ethernet network. Typically, only the cluster server has an Ethernet adapter; the other workstations in the cluster access the Ethernet network via the the server's adapter.

Cluster Servers

Any shared resource processor or workstation with a hard disk *except B21 and B22* workstations can be used as a server in a cluster that is connected to an Ethernet network. However, B27 workstations support only 10Base2 (Cheapernet) if used as a cluster server.

Note: *Ethernet adapters cannot be installed in shared resource processors. Therefore, if a shared resource processor is used as a cluster server, the Ethernet module must be installed in a cluster workstation, and XE-LAN Relay (or a new version of BNet II) software must be installed in the server.*

Cluster Workstations

Any workstation can be used in a cluster that is connected to an Ethernet network, including PCs that have the AT-bus ClusterCard.

Note: *The XT-bus ClusterCard is no longer available. However, if you already XT-bus ClusterCards, you can use them in a cluster that is connected to an Ethernet network.*

ClusterCard

Each PC in the cluster requires a ClusterCard. ClusterCards are available for PCs with an XT-bus or AT-bus.

Ethernet Adapters

In order to be connected to an Ethernet network, the server must have an Ethernet adapter installed. The Ethernet adapter for B25 workstations is included in the B25 Ethernet module. The Ethernet adapter for SuperGen Series 5000 workstations is included in the Ethernet cartridge designed for the Series 5000.

If the server is a shared resource processor, an Ethernet adapter must be installed in one of the cluster workstations, and XE-LAN Relay (or a new version of BNet II) software must be installed in the server.

MAU

One medium attachment unit (MAU) is required for each server or workstation that is directly connected to the Ethernet network. (One MAU is also required for each repeater.)

The type of MAU that is required depends on the cable medium used. For example, 10Base5 coaxial cable requires a 10Base5 MAU. Likewise, 10Base2 cable requires a 10Base2 MAU, and 10BaseT cable requires a 10BaseT MAU.

Note: *The Ethernet cartridge for the Series 5000 workstation does not require an MAU when connected to a 10BaseT hub: it has a built-in 10BaseT MAU.*

AUI Cable

One attachment unit interface (AUI) cable is required for each B25 Ethernet module, regardless of the type of MAU used. The Series 5000 Ethernet cartridge does not use AUI cable if it is connected to a 10BaseT hub; however it does requires an AUI cable (and a 10Base5 MAU) if it is connected to 10Base5 cable.

Ethernet Cable

If you are installing the Ethernet cabling, you need the following cable:

- 10Base2 or 10Base5 coaxial cable (for multidrop or link segments)
- Unshielded twisted pair (2-pair, for 10BaseT link segment)

See Appendix A, "Cables," for cable specifications

Terminators

One terminator is required at each end of a 10Base2 or 10Base5 segment. (Terminators are not used with 10BaseT cabling.)

Repeaters

One repeater is required at each end of a link segment.

Note: 10BaseT hubs function as repeaters for a 10BaseT segment.

Hubs

At least one 10Base T hub is required for a 10BaseT network. The number of workstations that are supported by the hub will vary, depending on the make and model of the hub.

Tables 7–1 through 7–3 list recommended 10BaseT hub products:

Note: *In Table 7–1, AUI refers to a 15-pin slide latch D connector, RJ45 refers to an 8-pin modular connector, and Telco refers to a 50-pin telco connector. SNMP refers to SNMP management.*

Table 7–1. Synoptics 10BaseT Hub Products

Part Description	Synoptics Number (Unisys Number)
Transceiver, 10 BaseT	508A* (85-9036-907)
Chassis, 12 card	3000-01 (85-9000-903)
Chassis, 4 card	30303-01 (85-9002-909)
Retiming module, AUI	3333** (85-9175-903)
Retiming, SNMP, AUI	3313-02** (85-9041-907)
Retiming, Advanced SNMP, AUI	3313-02A** (85-9170-904)
802.3 to 802.3 Bridge, AUI	3323-008** (85-9171-902)
12-port module, Telco	3307 (85-9008-906)
12-port module, RJ45	3308 (85-9009-904)
36-port concentrator, SNMP, RJ45, AUI	2310-02 (85-9030-900)

continued

Table 7–1. Synoptics 10BaseT Hub Products (cont.)

Part Description	Synoptics Number (Unisys Number)
36-port concentrator, advanced SNMP, RJ45, AUI	2310-02A (85-9210-916)
12-port concentrator, RJ45, AUI	2800-00*** (85-9031-908)
12-port concentrator, SNMP, RJ45, AUI,	2810-02*** (85-9166-902)
12-port concentrator, advanced SNMP, RJ45, AUI	2810-02A*** (85-9212-912)

* This transceiver requires an AUI cable; it cannot attach directly to a workstation or other DTE AUI interface..

** Along with a 10BaseT module or combination of modules (12-port and 36-port), each chassis requires one retiming module, or one retiming module with SNMP, or one bridge module for operation.

*** These concentrators are fixed-capacity hubs: they cannot be expanded with modules.

Note: *In Table 7–2, AUI refers to a 15-pin slide latch D connector, RJ45 refers to an 8-pin modular connector, and Telco refers to a 50-pin telco connector. SNMP refers to SNMP management.*

Table 7–2. Cabletron 10BaseT Hub Products

Part Description	Cabletron Number (Unisys Number)
Transceiver, 10 BaseT	TPT-T (85-7089-908)
Chassis, 8 card, flexible network bus	MMAC-8FNB* (85-7018-907)
Power supply for MMAC-8FNB	PSMR (85-7021-901)
Chassis, 5 card, flexible network bus	MMAC-5FNB* (85-7016-901)
Power supply for MMAC-5FNB	MMAC-5PSM-5 (85-7022-909)
Chassis, 3 card	MMAC-3* (85-7013-908)
Repeater module, management, AUI	IRM (85-7025-902)
Repeater module, SNMP, AUI	IRM-2 (85-7026-900)
802.3 to 802.3 Bridge, SNMP, AUI	IRBM (85-7042-907)
12-port module, RJ45	TPMIM-12 (85-7031-900)
12-port module, Telco	TPMIM-22 (85-7030-902)
24-port module, RJ45	TPMIM-14 (85-7034-904)
24-port module, Telco	TPMIM-24 (85-7035-901)

continued

Table 7–2. Cabletron 10BaseT Hub Products (cont.)

Part Description	Cabletron Number (Unisys Number)
12-port hub, RJ45, AUI	MRX-2 (85-7148-902)
12-port hub, RJ45, AUI	MRX (85-7023-907)
12-port hub, SNMP, RJ45, AUI	MRXI-2 (85-7149-900)
12-port hub, SNMP, Telco, AUI	MRXI (85-7024-905)

* Along with a 10BaseT module or combination of modules (12-port and 24-port), each chassis requires one repeater module, or one SNMP repeater module, or one bridge module for operation.

Note: *In Table 7–3, AUI refers to a 15-pin slide latch D connector, and RJ45 refers to an 8-pin modular connector.*

Table 7–3. AT&T Starlan-10 Hub Products

Part Description	AT&T Number (Unisys Number)
Transceiver, 10BaseT	2611-010* (Unisys Direct SOS)
11-port hub, RJ45, AUI	2610-010* (Unisys Direct SOS)

* Available from Unisys Direct as Special Order Sales (SOS).

Software Requirements

The following software is required to connect a cluster to an Ethernet network:

- Server and/or workstation operating system
- Intelligent Data Module System Service (IDMSS)
- XE-LAN Relay (allows use of shared resource processor servers)
- BNet II (allows use of shared resource processor servers)
- ClusterShare software (required for PCs in the cluster)
- Network software (see Appendix C, "Network Software")

Section 8
Installing a Coaxial Ethernet Network

Introduction to Section 8

This section provides general information about Ethernet site preparation, installation planning, configuration, and installation. It contains information about the following topics:

- Basic site preparation
- Installation planning
- Network configuration
- General installation procedures
- Modifying an existing network
- Connecting a cluster to an Ethernet network

Note: *This section does not provide detailed installation instructions. For more detailed information, see the related documentation listed at the front of this manual in "About This Guide."*

Basic Site Preparation

To prepare your site for an installation, you must make sure that

- The planned installation meets all applicable safety and electrical codes
- The coaxial cabling that is used meets the Ethernet 10Base2 and 10Base5 standards
- Building ownership issues are resolved

Who Should Install the Network

Only technical personnel familiar with installing coaxial cable should install or modify an Ethernet coaxial network. (Electricians and licensed contractors may be required.)

Safety and Electrical Code Requirements

Make sure that the installation complies with local safety and electrical codes. Contact your local building code authority for requirements.

Building Ownership Issues

Building ownership issues must be resolved before installing a network. Some of the issues involved are listed below:

- Do you own the building or lease the building? Some lease arrangements may impose restrictions on cable installations
- Will some type of operator's license be required?
- If more than one company in a building uses the network, who will be the network administrator? Who will maintain the network?

Planning the Installation

Proper planning is critical to the success of an Ethernet installation. Planning an Ethernet network generally requires nine steps:

1. Conduct a site survey.
2. Obtain floor plans or building plans.
3. Identify workstation locations
4. Identify cable routes.
5. Calculate total trunk cable length.
6. Identify network component locations.
7. Create a network schematic diagram.

8. Determine the type and number of network components required.
9. Complete and maintain network documentation.

Each of these steps is described below in more detail.

Note: *The network planning information presented here is not intended to serve as a comprehensive checklist, but rather provides an overview of procedures commonly followed by network planners.*

Conducting a Site Survey

In a site survey, an installation planner assesses the building to determine the type of cable to be installed and where to install it. Therefore, the location of power sources, risers, conduits, cable trays, fire walls, etc., as well as the existence of hazards or special restrictions are of primary importance. Normally, a site survey requires the assistance of the building site manager, or some other building authority who has a thorough knowledge of the building.

Note: *A site survey is especially critical in older buildings since these can be very difficult to cable: for example, old buildings frequently have solid floors, spline ceilings, or insufficient riser space or cable trays.*

Obtaining Floor Plans

Obtain a current set of floor plans from the building facilities manager or other appropriate source. The floor plans are useful for showing the cable layout and for calculating the cable lengths required for the installation.

Identifying Workstation Locations

On the floor plans, mark the locations where workstations are to be installed. Key factors to consider in planning a workstation location are the device's accessibility to users and the distance from the network cable to the workstation. (The AUI drop cable between the trunk cable and the workstation cannot exceed 50 meters.)

Note: *Be sure to include vertical runs as well as horizontal runs when determining the cable length between the workstation and the trunk cable.*

Identifying Cable Routes

On the floor plans, mark the layout of the network trunk cable. In planning the cable layout, follow these guidelines:

- Do not exceed Ethernet cable segment limits (see "Configuring the Network")
- Make sure that the cable (fiber optic cable excepted) is routed separately from ac power cable to minimize electromagnetic interference. The cable should be kept the following distances from power cables:
  - 3 inches (75 mm) from ac cables with 2 kVA or less
  - 12 inches (300 mm) from ac cables with 2 kVA to 5 kVA
  - 40 inches (1 meter) from ac cables with 5 kVA or greater
  - 5 inches (130 mm) from fluorescent fixtures
- Locate network components (including cable connectors and terminators) where they can be easily serviced

Note: *If the network covers a large floor area, it may be more cost-effective to use longer drop cables or transceiver multiplexers instead of extra trunk cable and repeaters.*

Calculating Total Trunk Cable Length

From the marked floor plans, calculate the length of trunk cable required. Make sure that you include all vertical cable runs as well as horizontal runs. In addition, make allowances for routing cable around obstacles.

Note: *Do not exceed cable segment limits. (See "Configuring the Network.")*

Identifying Network Component Locations

On the floor plans, mark the location of network components, such as terminators, repeaters, connectors, MAUs, drop cables, etc. Mark each of the component types with its own symbolic code.

Creating a Network Schematic Diagram

From the marked floor plans, create a schematic network diagram; indicate cable types, lengths, and components. The schematic diagram is an essential map for future expansion or modification of the network.

Calculating the Number and Type of Network Components

Using the network schematic diagrams, count and list the number of network components (e.g., connectors, terminators, MAUs, drop cables, repeaters, etc.) that are required for the network. Use this list to order the parts required for the network.

Maintaining Records of the Network

Date and keep the final version of the marked floor plans as an "as-built" record of the network. Copies of this version may be made and used as working copies when network expansion or modification is undertaken. Be sure to keep a dated copy of the floor plans used in modifying or expanding the network.

The marked floor plans, network schematics, and other network documentation should be maintained by the network administrator.

Configuring the Network

The main factors that you must consider when configuring an Ethernet network are :

- Network structural requirements
- Cable characteristics
- Maximum number and length of cable segments
- Maximum number of workstations
- Network configuration rules

Network Structural Requirements

Only a single cable path is allowed between any two workstations in an Ethernet network: loops or parallel cable installations are not allowed.

Cable Characteristics

Different types of cable have different segment length and workstation maximums. In addition, some types of cable can be used for both multidrop and link segments, while other types of cable can be used only for link segments. Table 8–1 lists the cable characteristics:

Note: *Only one type of cable can be used in a cable segment.*

Table 8–1. Cable Characteristics

Cable Type	Max Segment Size	Max Workstations Supported	Segment Type
10Base5 (Thicknet)	500 m	100	Multidrop and Link
10Base2 (Thinnet)	185 m	30	Multidrop and Link
Fiber Optic	1.0 km	0	Link Only

Maximum Number of Cable Segments.

Table 8–2 shows the maximum number of cable segments allowed between any two workstations in an Ethernet network.

Note: *No more than 4 repeaters are allowed between any two workstations.*

Table 8–2. Maximum Segments Between Two Workstations

Segment Type	Maximum Segments Allowed
Multidrop	3
Link	2
Repeaters	4

Maximum Number of Workstations

A maximum of 1024 workstations are allowed in a single Ethernet network.

Maximum Configuration Examples

Figures 8–1 and 8–2 provides examples of maximum Ethernet network configurations.

Figure 8–1. Maximum Data Path Between Two Workstations

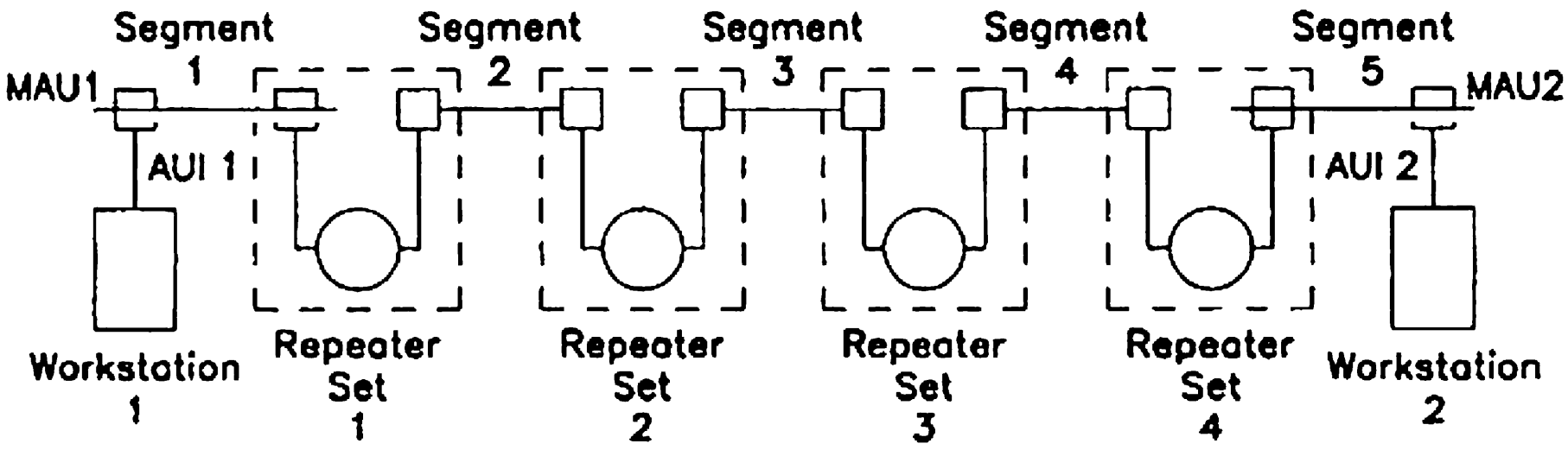
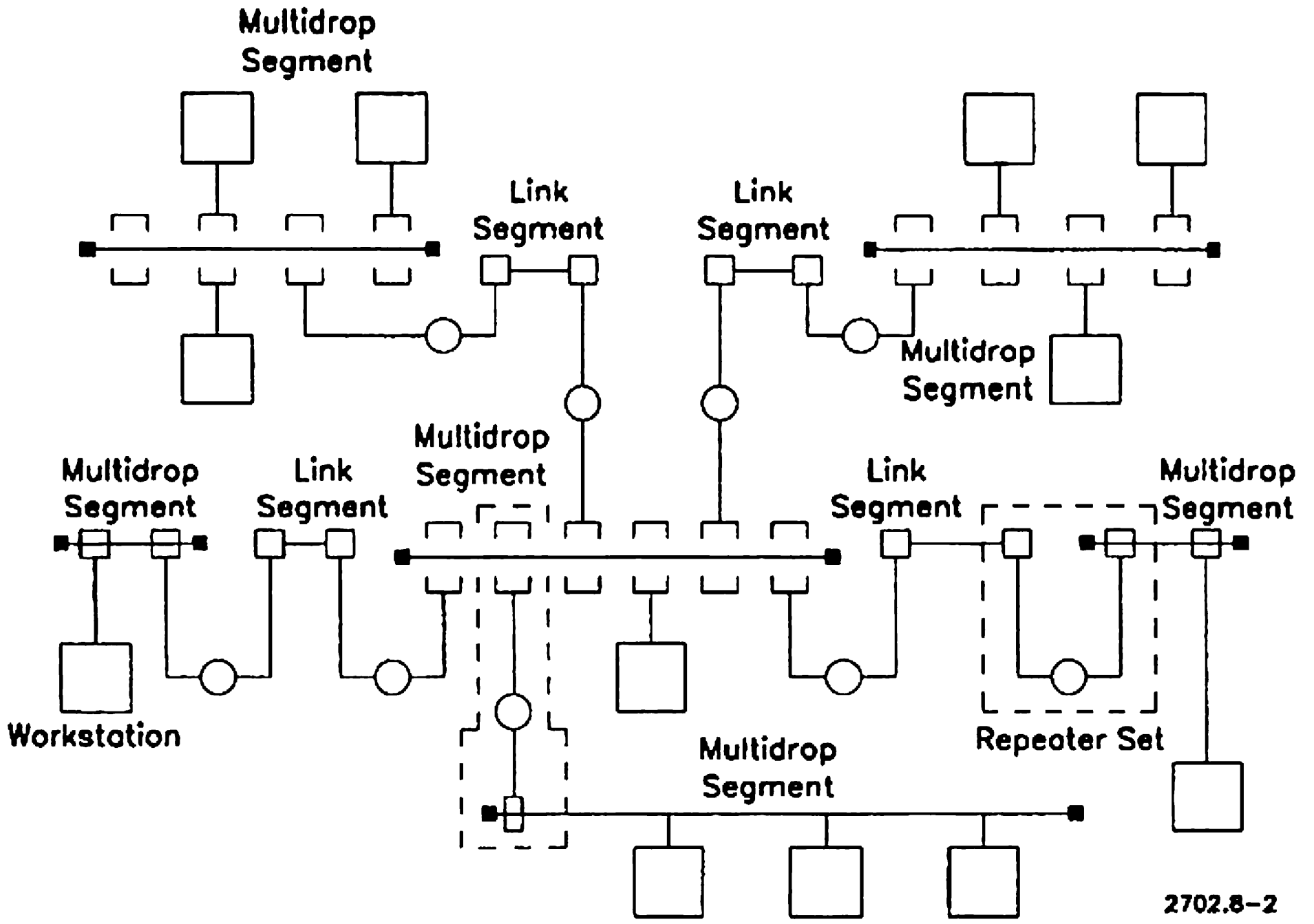


Figure 8–2. Maximum Network Example



Network Configuration Rules

When you plan the network configuration, you must follow these rules:

1. A repeater must be used to connect two segments.
2. No more than five cable segments (of which only three can be multidrop) and four repeaters can be between any two workstations in the network.
3. On a coaxial segment, a repeater can be located at any MAU position; on a link segment, repeaters must be located at the ends of the cable.
4. Workstations are connected to multidrop segments only, not to link segments.
5. A network can use different types of cable, provided that each segment is made up of a single cable type.

Installation Overview

Installing an Ethernet network requires consideration of the following topics:

- Safety procedures
- Preinstallation tests
- Network grounding
- Rules for segmenting cable
- Installing cable
- Installing cable connectors and terminators
- Installing MAUs and AUI drop cables

Note: *The procedures described here are intended to provide an installation overview; they do not provide detailed installation instructions.*

Safety Procedures

WARNING

Cable installers are exposed to potential shock hazards. Therefore, only qualified electrical personnel should install cable. Sound installation and safety practices must be followed at all times.

All cabling systems, including Ethernet, are subject to electrical shock hazards from the following sources:

- Direct contact between network components and other electrical circuits
- Static charge build-up
- High-energy transients released into the network
- Potential differences between safety grounds linked by network cabling

To minimize electrical shock hazards,

1. Make sure that the cable shield (coaxial cable) is grounded at only one point along the length of the cable.
2. Network components that come into contact with the cable and cable shield (that is, cable connectors and terminators) must be insulated by insulation boots or sleeves.
3. Ethernet cable must be electrically isolated from the AUI drop cable. Normally, this isolation is implemented in the MAU.
4. Do not allow the exposed cable shield to come into contact with any unintended conductors or grounds.
5. The cable shield should not be broken or exposed (for servicing or installation) if there is a likelihood of a high-energy transient in the cabling system.
6. Personnel should not contact both the cable shield and a grounded conductor at any time.
7. If it is necessary to sever coaxial cable, continuity between the cable segments must be maintained at all times.

Note: *The precautions listed above are not exhaustive: installation or service personnel should consult and be familiar with local, national, and international safety regulations governing cable installation and servicing.*

Network Grounding

WARNING

Improper grounding of the network cable or the equipment connected to it can cause hazardous voltages that can damage your equipment and injure persons coming into contact with the equipment.

To determine proper grounding, you should consult with a qualified electrician, as well as local building and electrical codes. However, you should consider the following:

1. Locate the safety grounds in your building and determine how and where they are connected, and what kind of equipment is connected to them. It is best if heavy machinery is on a separate ground bus.
2. Make sure that the building or safety ground has a sufficiently low impedance to prevent voltage drops from developing on the network.
3. Make sure that the network coaxial cabling is grounded at only one point.
4. Ground-bonding jumpers may need to be installed in buildings with more than one power distribution system or power source.

Preinstallation Tests

The continuity of the trunk cable should be tested before the cable is installed. The most efficient way to do this is to test the cable while it is still in the drum, spool, or reel.

Cable Segmentation Rules

When installing Ethernet coaxial cable, try to use a single cable (no breaks), if possible, in a single segment.

If you cannot use a single unbroken cable in a segment, observe the following rules:

1. If a segment is made up of smaller sections of cable, use cable from the same manufacturer and lot.
2. If a segment is made up of smaller sections of cable, some of which come from different manufacturers and/or lots, use only the following standard lengths: 23.4 meters, 70.2 meters, or 117 meters.

If none of the above cable segmentation rules can be followed, you can use any arbitrary arrangement so long as the worst-case signal reflection due to impedance discontinuity does not exceed the 802.3 specifications. (See IEEE 802.3 Section 8.6.2.1.)

Installing Ethernet Coaxial Cable

When installing trunk cable,

1. Make sure that the bend radius limits of the cable are not exceeded.
2. Make sure that the cable is not crushed, kinked, or stretched.
3. Make sure that the metal cable shielding is not exposed in any way. Be especially watchful for sharp edges along the cable route.
4. Provide sufficient support for the cable and MAUs.
5. After cable has been installed, but before connectors and terminators are installed, check the cable for continuity.
6. Install connectors and terminators as needed, conducting the appropriate post-installation tests as each component is installed.
7. Make sure all connectors, terminators, and MAUs are easily accessible for servicing.
8. Mark both ends of a cable segment with the identification code marked on the network schematic diagram.

Installing Connectors and Terminators

Follow these guidelines when installing connectors and terminators:

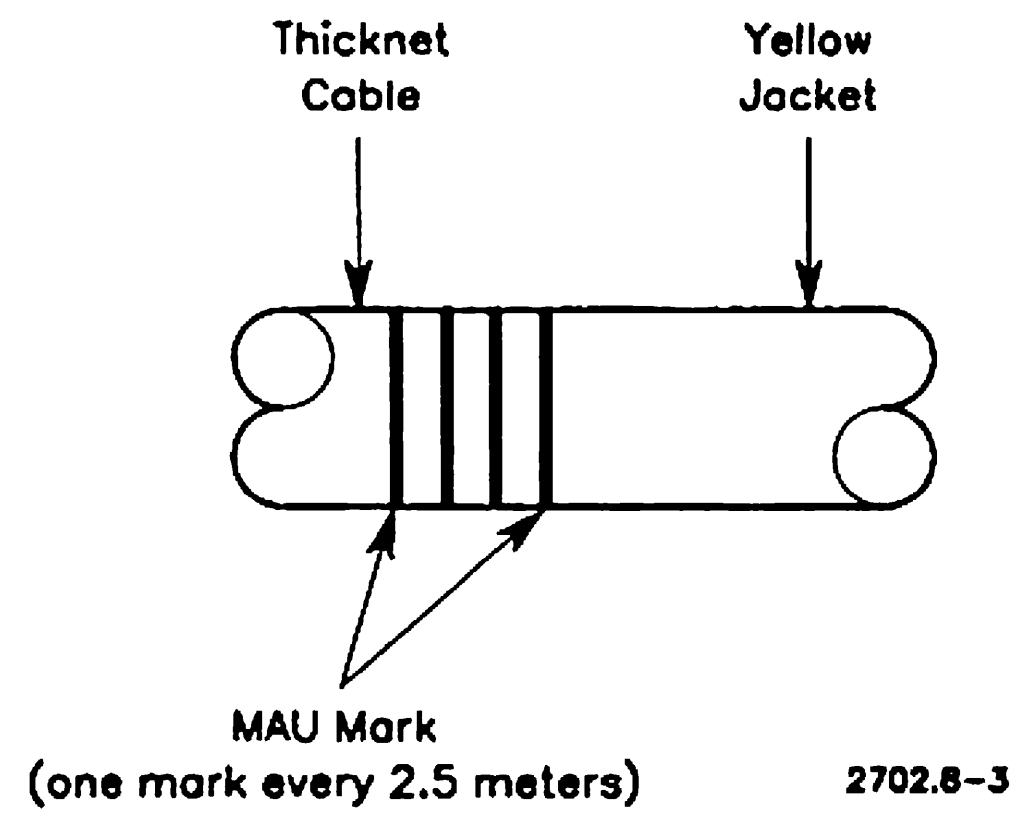
1. Thicknet (10Base5) cable segments must be terminated at both ends by an N-type plug connector (crimped type) attached to an N-type barrel connector installed at the end of the cable.
2. Thicknet cable sections are connected by an N-type barrel connector. An insulating boot must be placed over the connector.
3. Thinnet (10Base2) cable segments must be terminated at both ends by a BNC plug connector (crimped type). This connector plugs into a BNC T connector installed at the end of the cable.
4. Sections of a thinnet cable segment are connected by a BNC barrel connector. An insulating boot must be placed over the connector. (BNC T connectors can be used at planned MAU locations. However, it is best not to leave unused BNC T connectors in the network.)

Installing MAUs and AUI Cables

Observe the following rules when installing MAUs and AUI cables:

- An MAU tap connector for a thicknet cable can only be installed at one of the 2.5 meter marks on the cable (see Figure 8–3)
- Tap connectors and MAUs are ground-isolated and therefore do not require further insulation
- Make sure you label all MAUs according to the identification codes on the network schematic diagram
- Some thicknet MAUs can be used in thinnet cabling, others cannot; check the specifications of an MAU before using it

Figure 8–3. MAU Marks In Thicknet Cable



- Although the maximum length for an AUI drop cables is normally 50 meters, some AUI cables have a shorter maximum length; check with the manufacturer of the cable to determine the maximums
- Normally, a single AUI drop cable is used to connect a workstation to an MAU; however, if an installation requires it, a maximum of 2 AUI drop cables can be connected together

Modifying an Existing Network

Networks can be modified in four ways:

- By relocating or removing workstations from the network
- By extending the end of a cable segment
- By inserting a section of Ethernet cable
- By adding a new cable segment

Note: *Obtain the permission of the network administrator before modifying a network. Network floor plans and network schematics should be updated to reflect any changes.*

Relocating or Removing Workstations

Network operation is not affected when workstations are removed or relocated on a thicknet cable segment; however, a workstation cannot be installed at a new location on a thinnet cable segment without shutting down the network.

Note: *Although a workstation can be removed from a thinnet cable segment without requiring a network shutdown, it is recommended that the network be shut down, and the BNC T connector replaced by an appropriate barrel connector.*

Extending a Cable Segment

Extending a cable segment requires a network shutdown. To extend the end of a segment, remove the terminator from the end, install the additional cable as required, and install a terminator at the end of the added cable.

Note: *The total cable length (previous length + extension) cannot exceed the cable segment maximum.*

Inserting Cable in an Existing Segment

More cable can be inserted in the middle of an existing cable run, provided that the resulting cable length does not exceed the maximum allowed for the cable segment. Inserting a section of cable will require network shutdown.

Inserting cable requires the severing of the existing cable segment and the installation of four connectors (one at each cable end).

Note: *If thicknet cable is inserted, it must be from the same manufacturer and lot as the existing cable segment.*

Adding a New Cable Segment

To add a new cable segment, you'll need a minimum of two additional MAUs, two AUI drop cables, one repeater, and coaxial cable for the new segment.

Note: *If two coaxial segments are to be connected by a link segment, you'll also need the link cable, one repeater for each end of the link cable, two MAUs and two drop cables for each repeater (for a total of two repeaters, four MAUs, and four drop cables).*

In selecting a location for a repeater, consider the following:

- The repeater requires mains power
- The repeater must be within drop cable range (50 meters) of both cable segments
- The repeater should be installed at the point where the two cable segments are closest

Connecting a Cluster to an Ethernet Network

To connect a cluster to an Ethernet network, install an Ethernet adapter in the cluster server, and connect the adapter to an MAU that has been installed in the Ethernet multidrop segment (see Figures 8–4 and 8–5).

Figure 8–4. Connecting an Ethernet Module

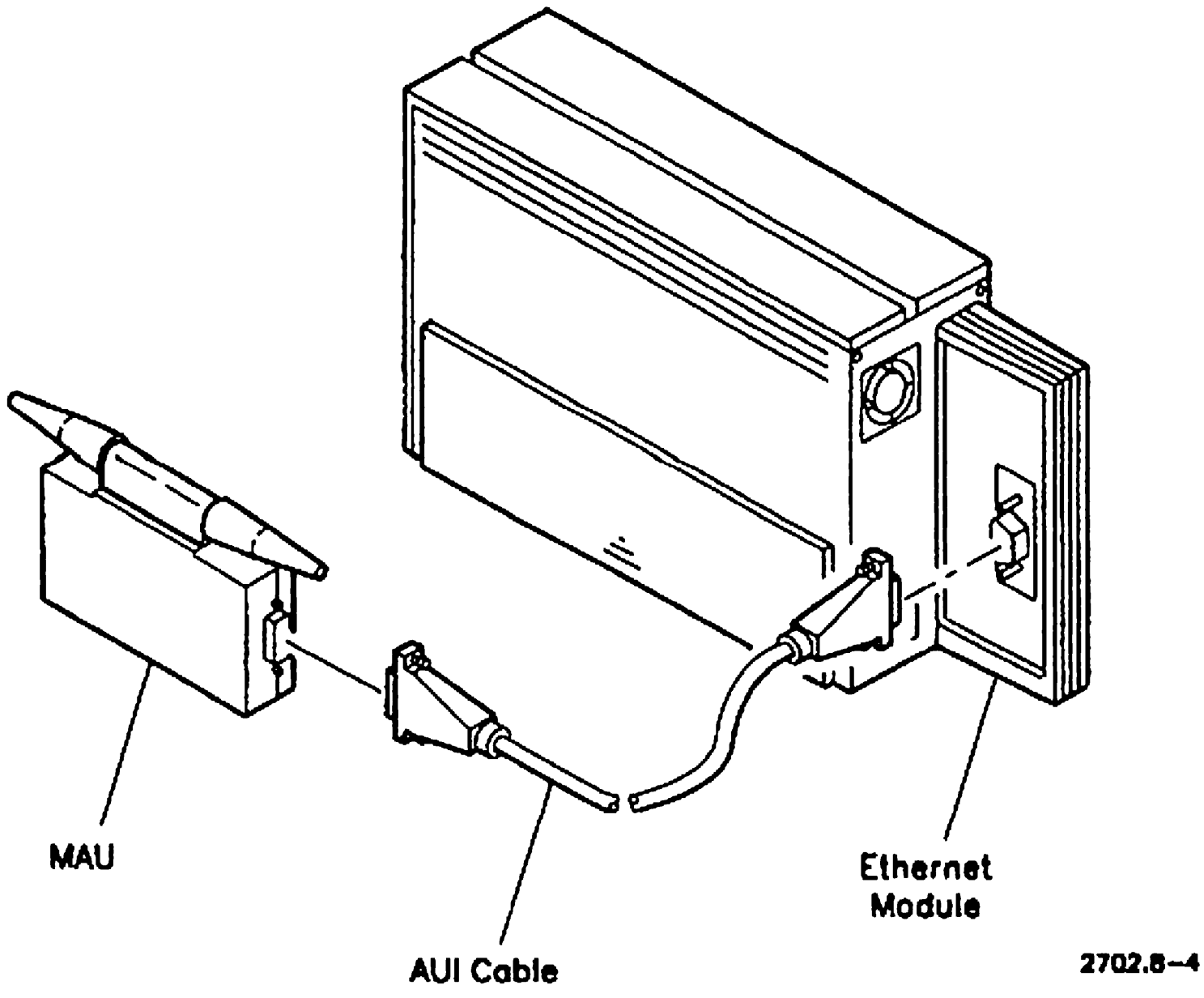
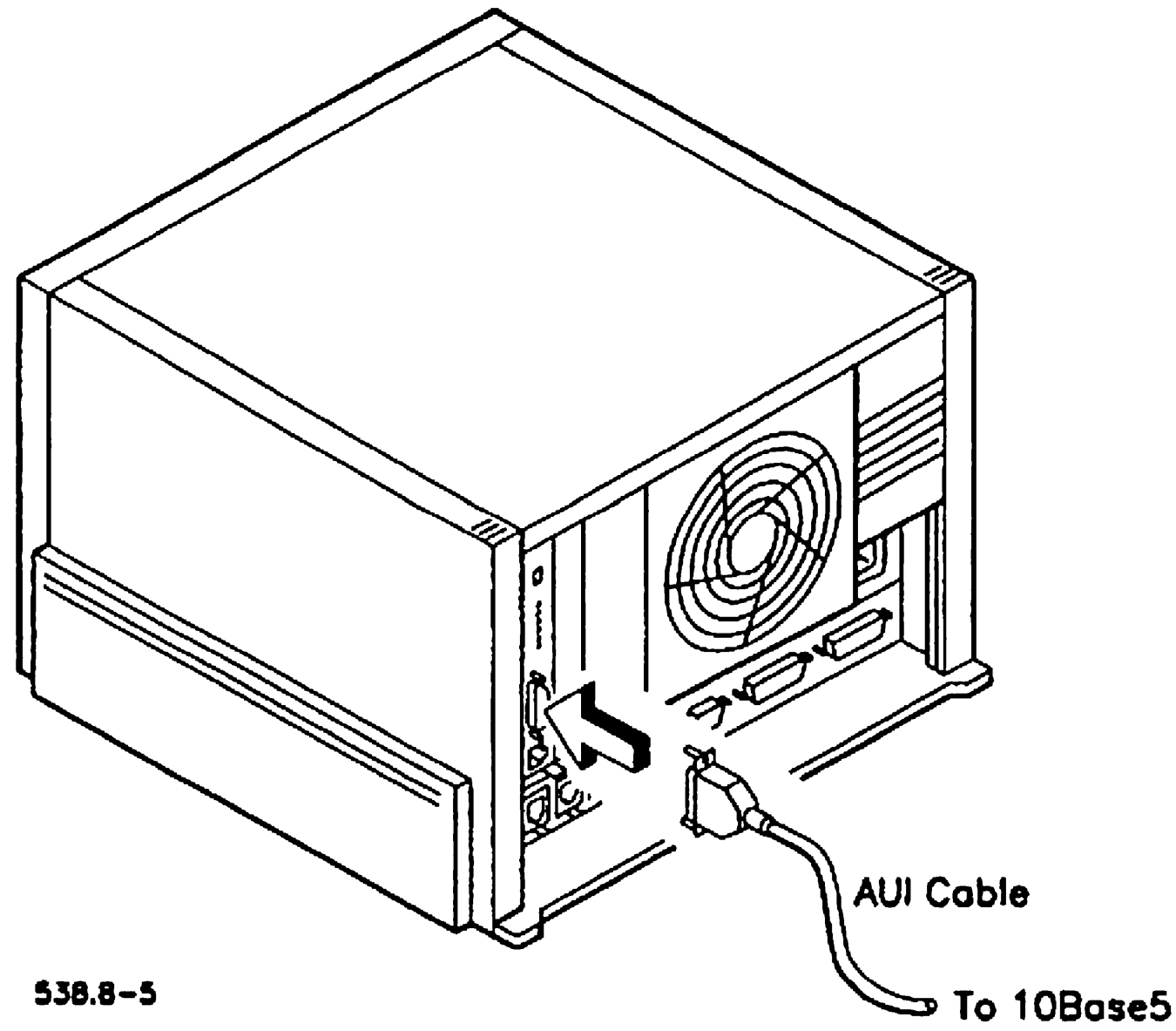


Figure 8–5. Connecting a Series 5000 Ethernet Cartridge



Install IDMSS software in the server, along with any additional network software that is required (see Appendix C, "Network Software," for more information).

Note: *If cluster uses a shared resource processor as a server, the Ethernet module must be installed on a cluster workstation, and XE-LAN Relay (or a new version of BNet II) software must be installed in the server.*

Section 9
Installing a 10BaseT Ethernet Network

Introduction to Section 9

This section provides the following information:

- Network configuration
- Installing 10BaseT hubs
- Connecting a cluster to 10BaseT
- Connecting 10BaseT to non-10BaseT Ethernet (Hybrid Networks)

Note: *This section does not cover cable installation or the installation of specific makes and models of hubs.*

Site Preparation and Planning

The site preparation and planning issues for installing 10BaseT Ethernet are similar to those listed for a coaxial Ethernet installation in Section 8 of this guide. However, in addition, you must make sure that

- The twisted pair cabling meets 10BaseT standards
- The installers are familiar with telephone type wiring, wiring closets, and punchdown blocks
- Cable ownership issues are resolved
- The planned locations for hubs and workstations take into account the 100 meter maximum distance between hubs or between a hub and a workstation
- There are enough hub ports (you need one port for each workstation and for each hub that is directly connected)

Configuring the Network

When you configure a 10BaseT network, you must consider

- Maximum cable lengths
- Maximum number of hubs
- Maximum number of workstations
- 10BaseT wiring rules

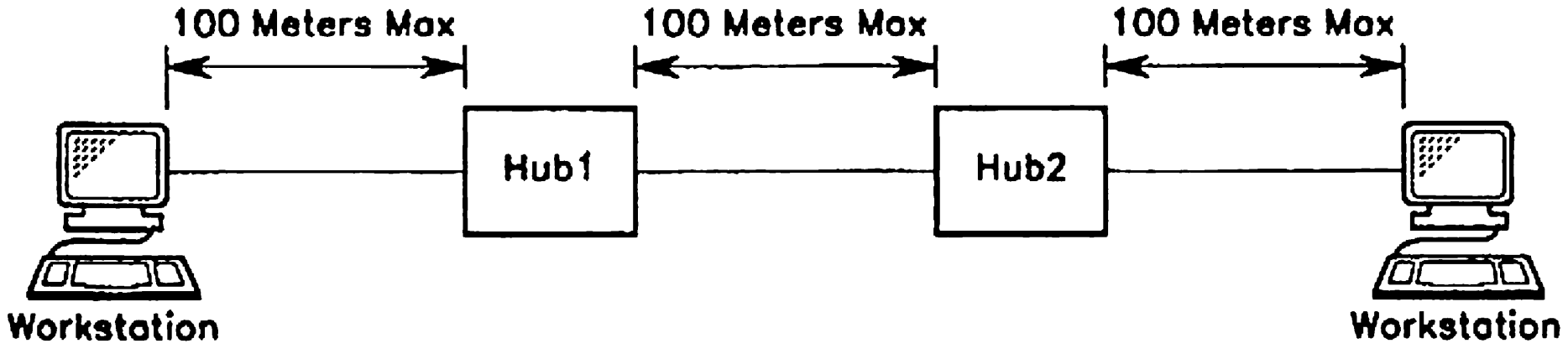
Each of these topics is described in more detail below.

Maximum Cable Lengths

A maximum of 100 meters of cable is allowed between

- Two directly connected hubs (see Figure 9–1)
- A hub and a workstation connected to that hub

Figure 9–1. 10BaseT Cable Lengths



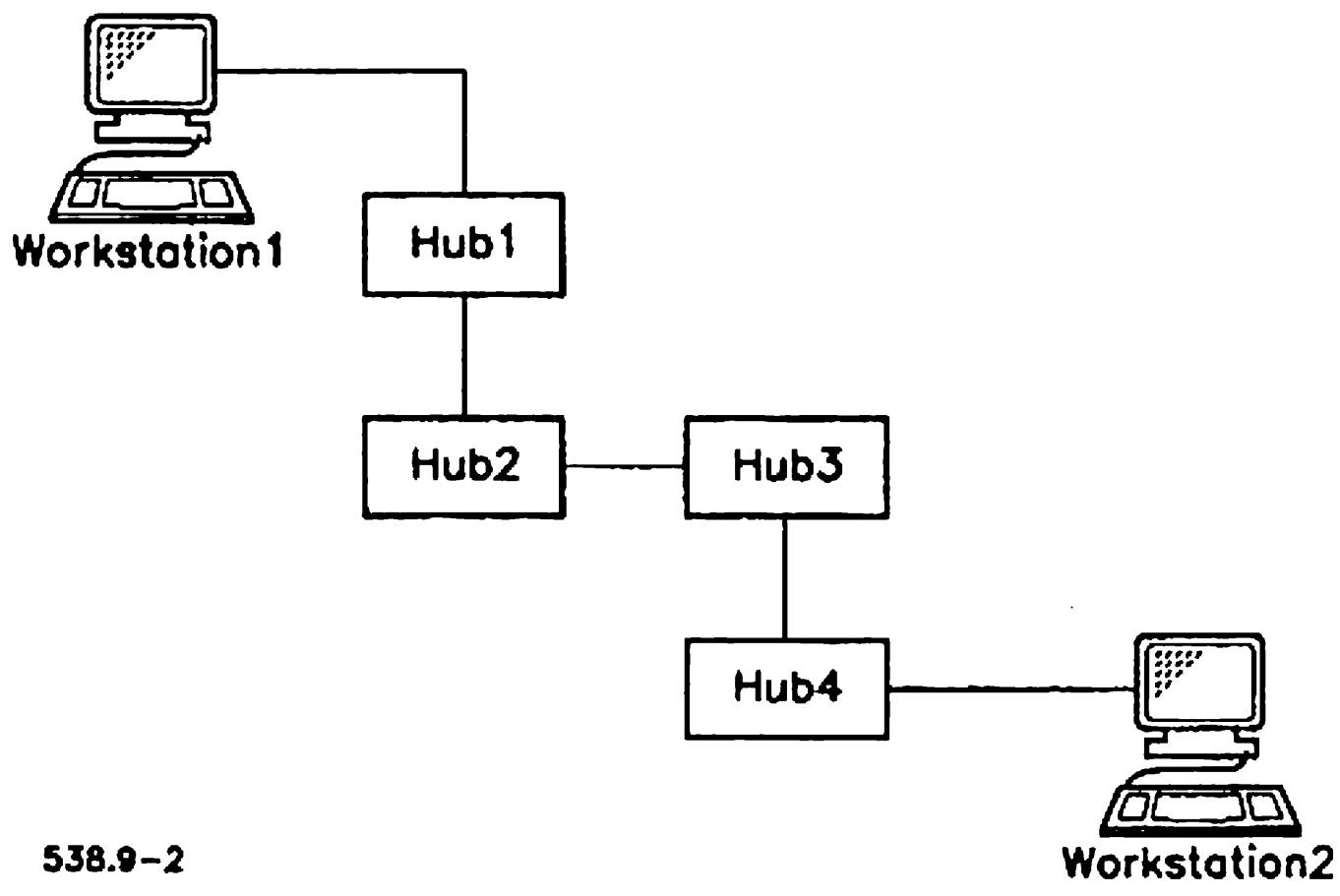
Note: *These maximums include all of the cable between hub and workstation, including the cable between punchdown blocks and wall outlet, and between wall outlet and workstation.*

The 100 meters of cable between hub and workstation are frequently divided in this way: 7 meters between hub and punchdown blocks, 90 meters between punchdown blocks and wall outlet, and 3 meters between wall outlet and workstation.

Maximum Number of Hubs

A maximum of 4 hubs are allowed between any two workstations in a single Ethernet network (see Figure 9–2).

Figure 9–2. 10BaseT Hub Maximums



Maximum Number of Workstations

A maximum of 1024 workstations are allowed in a single Ethernet network.

10BaseT Wiring Rules

In planning the network, make sure that you follow these general rules:

1. There must be a single cable path between any two workstations: cable loops are not allowed.
2. There must be no bridge taps in the cable: the twisted pair cabling must be straight-through. Be sure to check for bridge taps if you use existing cabling in a building.
3. Never use 10BaseT cable outside a building.
4. There must be one and only one MAU at each end of the 10BaseT cable.

Installing 10BaseT Hubs

To install a hub, you must

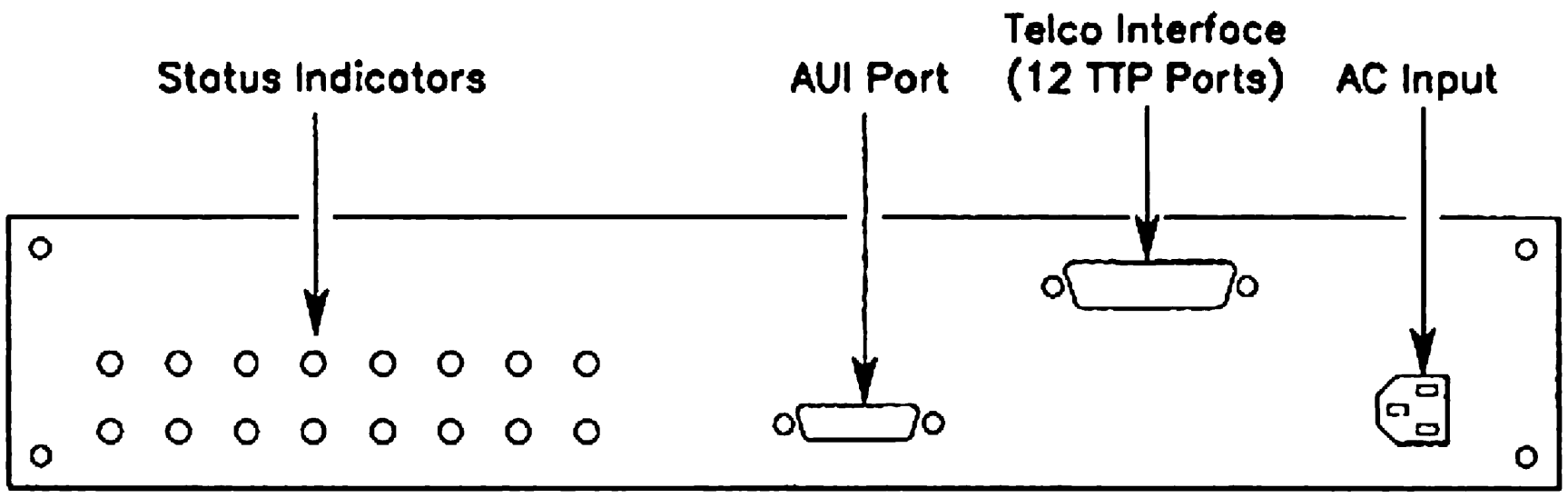
- Know about hubs in general
- Prepare the wiring closet and mount the hub
- Connect the hub to the 10BaseT cables

About 10BaseT Hubs

A 10BaseT hub is a multiport repeater: it receives data in one port, and retransmits the data to the other hub ports. (It does not retransmit to the input port.)

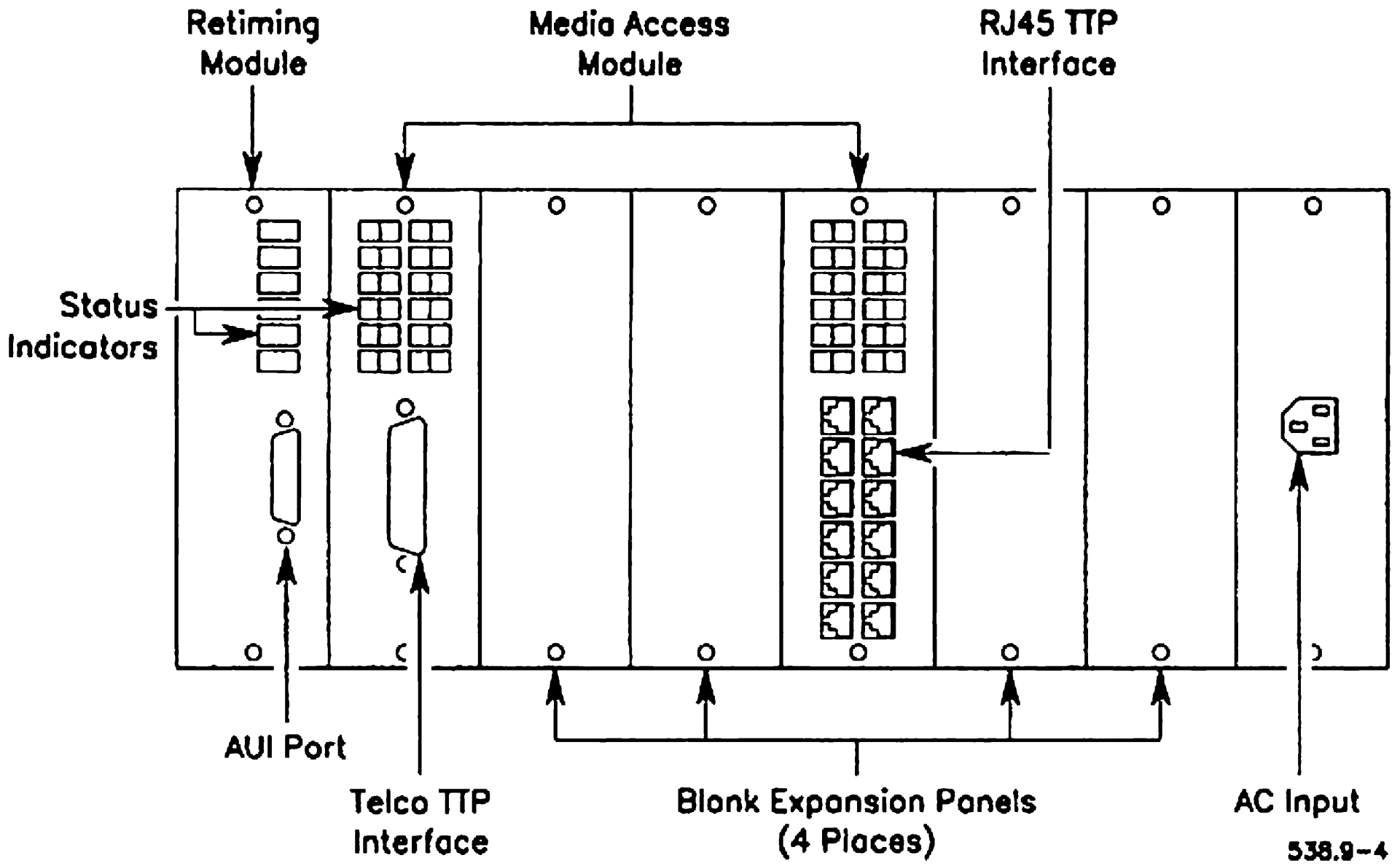
There are two basic types of 10BaseT hub: the fixed capacity hub (also called a "concentrator") and the modular hub. The fixed capacity hub is usually less expensive and is used in installations where future expansion is not anticipated (see Figure 9–3).

Figure 9–3. Fixed Capacity Hub



The modular hub can be expanded by the addition of modules that provide addition ports, bridge functions, or network management functions (see Figure 9–4). This type of hub can be expanded from 12 to 100 ports.

Figure 9–4. Modular Hub



Both fixed capacity and modular hubs have AUI connectors that can be connected to non 10BaseT Ethernet MAUs. This allows a hub to connect to a fiber optic, 10Base2, or 10Base5 cable segment.

Hub port access is provided either through RJ45 or through a 50-pin telco connector, depending on your requirements.

Preparing the Wiring Closet and Mounting the Hub

To prepare the wiring closet for the hub, make sure that

1. The wiring closet conforms to the standards described in the *Unisys Building Wiring Guide.*
2. There is a 115V or 220V ac outlet within 6 feet of the place where you plan to install the hub.
3. There is at least 3 inches clearance at the back and on the sides of the hub. There must be enough clearance in front of the hub to connect cables, read the LEDs, and set switches.

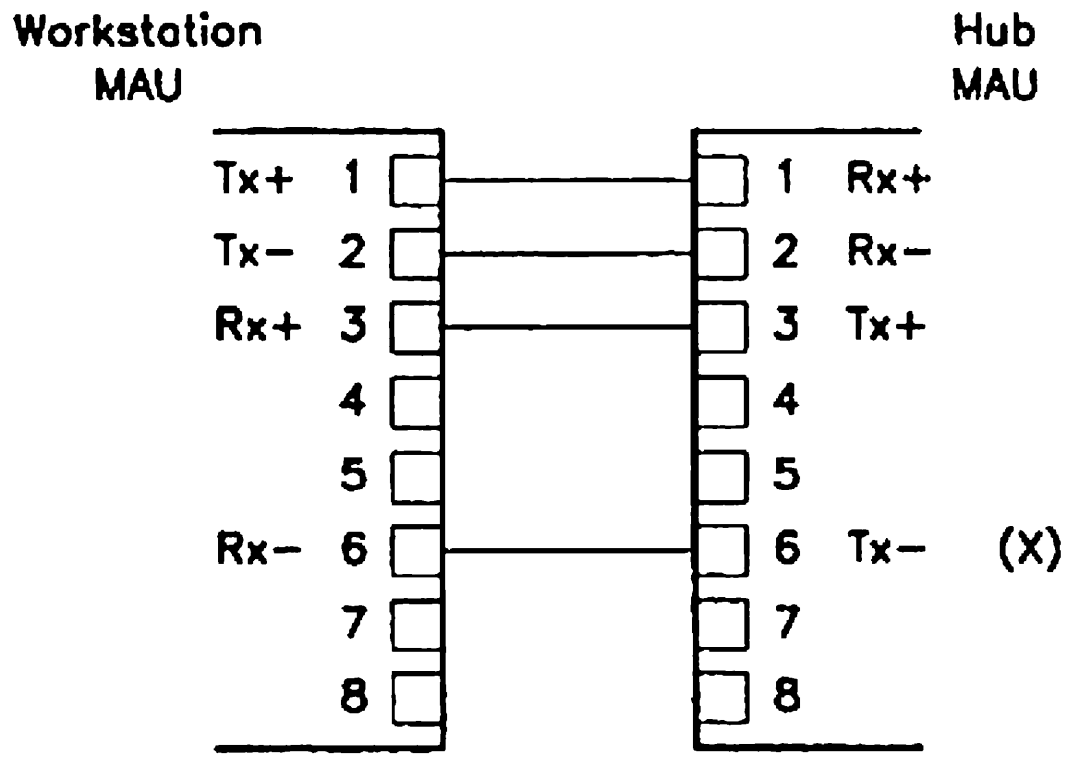
4. There are no flammable materials located near the hub.
5. The wiring closet has a standard 19-inch equipment rack for the hub.
6. Mount the hub following instructions provided with the hub.

Connecting the Hub to Cabling

The key factor to consider when you connect a hub to 10BaseT cabling is wire pair crossover. That is, the transmit/receive pairs at the hub MAU must connect to the receive/transmit pairs at the workstation MAU (see Figure 9–5).

Note: *In 10BaseT, pins 1 and 2 and 3 and 6 are used.*

Figure 9–5. 10BaseT Crossover



Normally, the crossover is incorporated in the hub MAU as shown in Figure 9–6. (An "X" on a hub's RJ45 ports indicates that the hub crosses the pairs.) Check your hub documentation if you are unsure if the hub crosses the wire pairs.

To connect the hub,

1. Determine whether the hub has a built-in MAU that provides wire pair crossover (most do).
2. If crossover is performed at the hub, connect the wiring so that the wiring from the hub to the wall outlet is straight through, not crossed.
3. If crossover is not performed at the hub, you must cross the wire pairs using punchdown blocks (see Figure 9–6) or special line cords (see Figure 9–7).

Figure 9–6. Crossover at Punchdown blocks

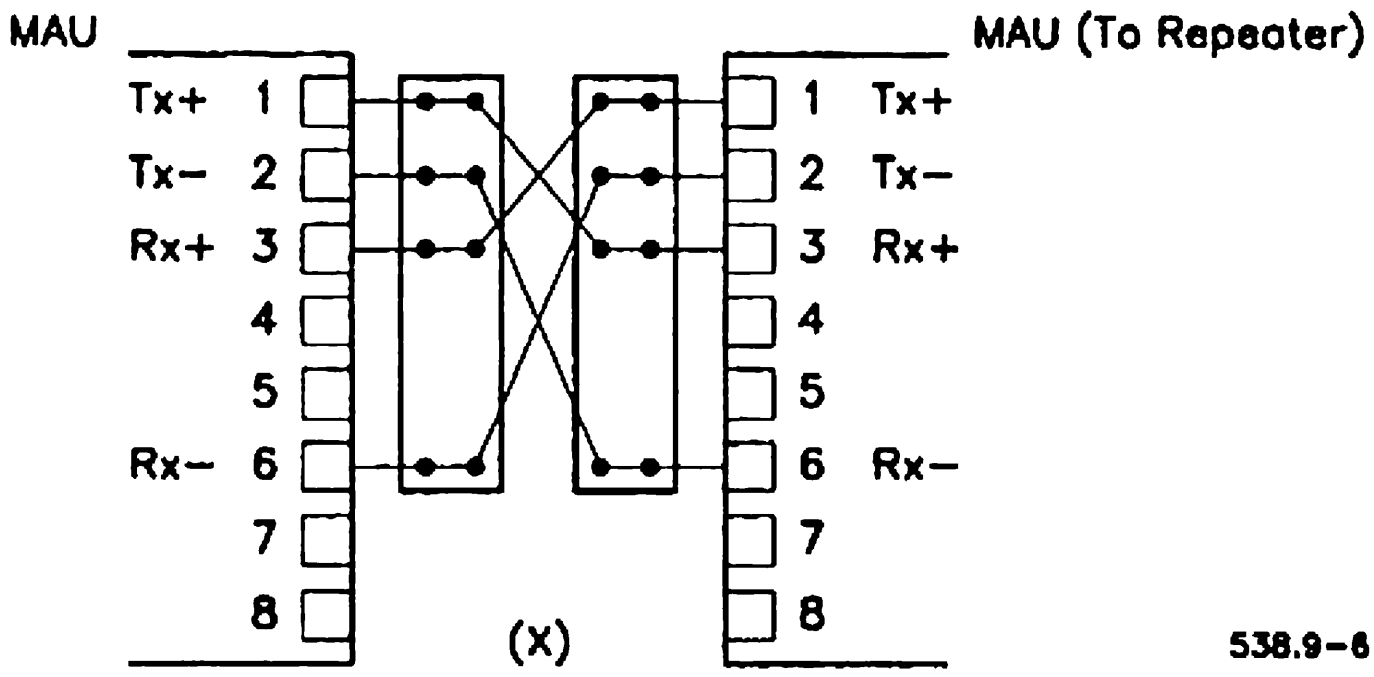
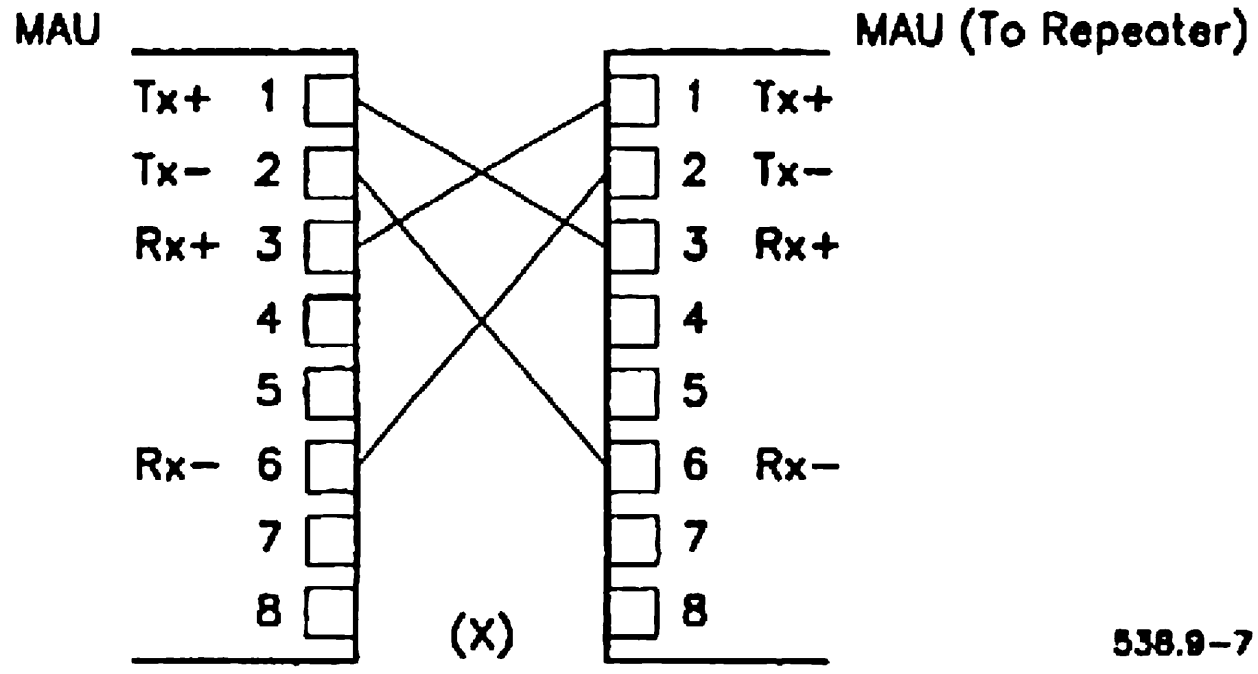


Figure 9–7. Crossover in Line Cord



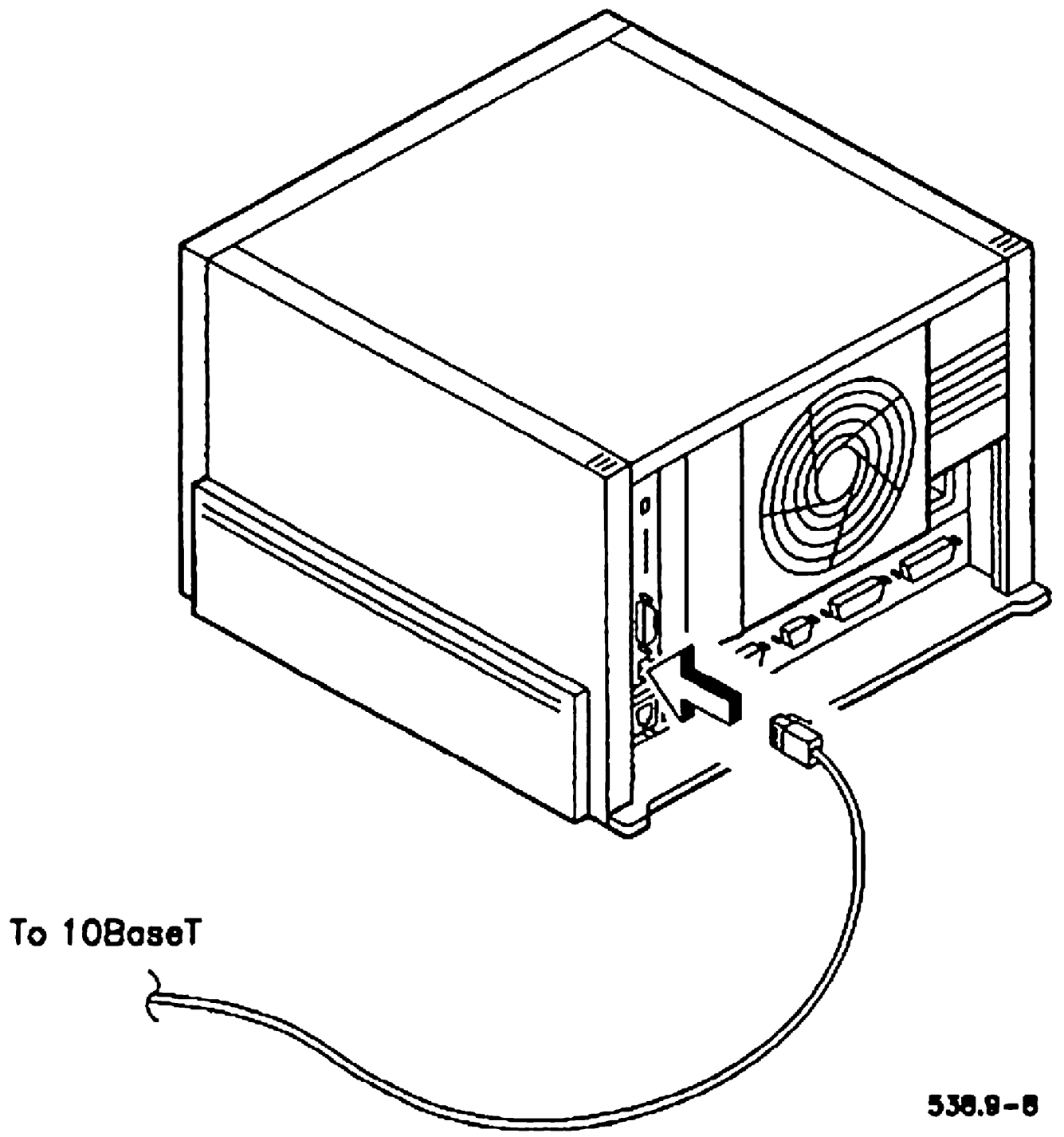
4. Make sure that Link Integrity is enabled at the hub.

Connecting a Cluster to 10BaseT

To connect a Series 5000 server to a 10BaseT network,

1. Install an Ethernet adapter in the cluster server.
2. Connect the adapter to the 10BaseT wall outlet (see Figure 9–8) using a straight-through 10BaseT cable with RJ45 connectors. (See Appendix A for information about this cable.)
3. Power on hub and workstation, and check the Link Integrity LED at the rear of the Ethernet adapter. If the physical connection between hub and adapter has been made properly, the LED should stay lit.
4. Install IDMSS software in the server, along with any additional network software that is required (see Appendix C, "Network Software," for more information).

Figure 9–8. Connecting SuperGen to 10BaseT



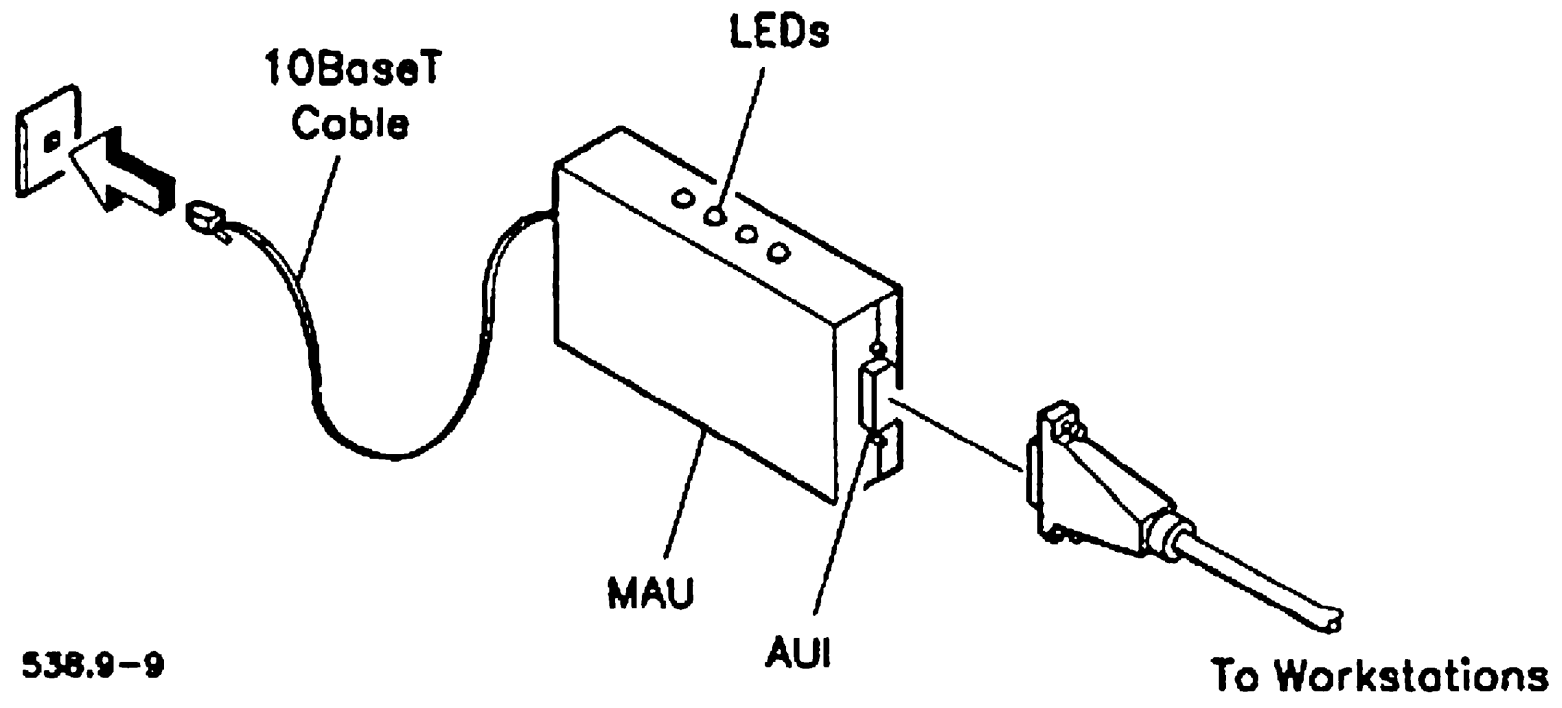
To connect a non-Series 5000 server to a 10BaseT network,

1. Install the the B25-EN3 Ethernet adapter module on the cluster server.

Note: *If the cluster uses a shared resource processor as a server, the Ethernet module must be installed on a cluster workstation, and XE-LAN Relay (or a new version of BNet II) software must be installed in the server.*

2. Connect a freestanding 10BaseT MAU to the 10BaseT wall outlet using a straight-through 10BaseT cable (see Figure 9–9).
3. Set the signal quality error (SQE) switch on the MAU to the ON position.
4. Connect the B25-EN3 Ethernet module to the 10BaseT MAU, using an AUI cable.
5. Power on hub and workstation, and check the Link Integrity LED on the MAU. If the physical connection between hub and MAU has been made properly, the LED should stay lit.
6. Install IDMSS software in the server, along with any additional network software that is required (see Appendix C, "Network Software," for more information).

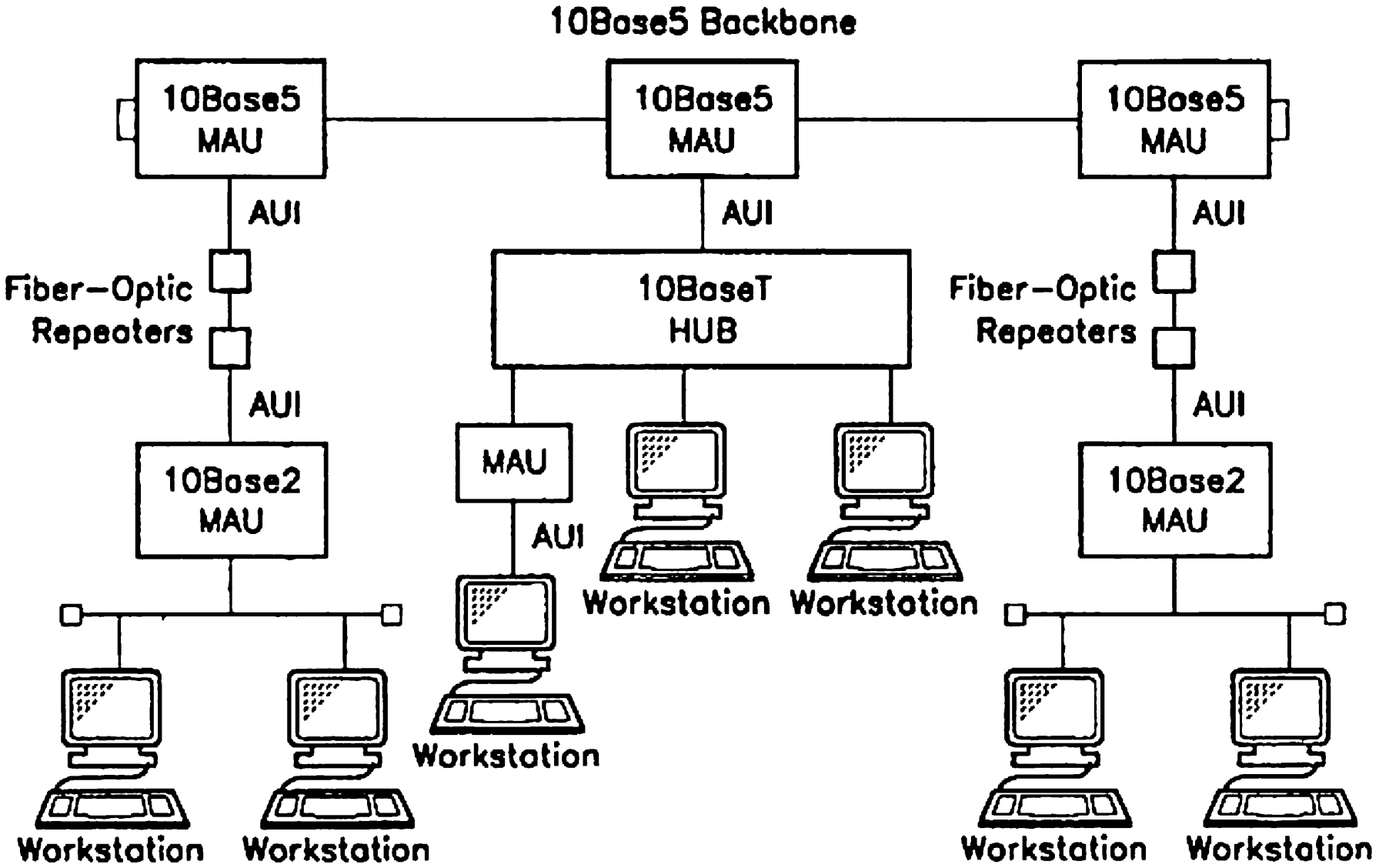
Figure 9–9. Connecting a non-SuperGen to 10BaseT



Hybrid Networks

A hybrid Ethernet network is an Ethernet network that has cable segments of diverse media type. A network that has 10BaseT, 10Base2, 10Base5, and fiber optic segments, for example, is a hybrid network (see Figure 9–10).

Figure 9–10. Hybrid Network



Configuration Rules for Hybrid Networks

When you plan a hybrid network, make sure you follow these basic rules:

1. The number of workstations must not exceed 1024.
2. There can be only one cable path between any two workstations.
3. Repeaters must be used to connect segments.
4. There can be a maximum of four repeaters or hubs between any two workstations.
5. There can be a maximum of 5 cable segments between any two workstations. Of these, a maximum of 3 can be multidrop segments; the other 2 must be link segments.
6. If there are four repeaters or hubs between any two workstations, the maximum segment length of fiber optic cable is 500 meters.
7. If there are less than four repeaters or hubs between any two workstations, the maximum segment length of fiber optic cable is 1000 meters.

Section 10
Requirements for a Token Ring Network

Introduction to Section 10

This section describes the hardware and software required for connecting a CTOS cluster to a token ring network. Normally, only the cluster server has a token ring module; the other workstations in the cluster access the network via the server's token ring module.

Cluster Servers

Any CTOS workstation that has a hard disk, except B21, B22, and B27 workstations, can be used as a server in a cluster that is connected to a token ring network.

Shared resource processors **cannot** be used as a server in a cluster that is connected to a token ring network. Token ring modules are not available for shared resource processors.

Cluster Workstations

Any CTOS workstation can be used in a cluster that is connected to a token ring network.

Token Ring Module

One token ring module is required for each server connected to a token ring network.

Cable

Token ring uses two-pair 150 Ohm shielded twisted pair cable. (See Appendix A, "Cables," for specifications.) There are several variations of token ring cable: these variations are frequently called IBM type 1, type 2, type 6, or type 9 cable.

Wire Center

The Unisys implementation of token ring requires the use of wire centers. A wire center is a 19-inch rack mounted box with connectors for 8 workstations. Wire centers are available from your Unisys representative.

Repeaters

Repeaters are installed in pairs; a minimum of two repeater pairs is normally required. Contact your Unisys representative about the availability of repeaters.

Software Requirements

The following CTOS software is required for a token ring network:

- Server and workstation operating system
- Intelligent Data Module System Service (IDMSS)
- Network software (see Appendix C, "Network Software")

Section 11
Installing a Token Ring Network

Introduction to Section 11

This section provides general information about token ring site preparation, installation planning, configuration, and installation. It contains information about the following topics:

- Basic site preparation
- Planning the installation
- Configuring the network
- General installation procedures
- Modifying an existing network
- Connecting a cluster to a token ring network

Note: *For more information, see the related documentation listed at the front of this manual in "About This Guide."*

Basic Site Preparation

To prepare your site for an installation, you must make sure that

- The planned installation meets all applicable safety and electrical codes
- Wiring closets are prepared for the wire centers
- Any preinstalled cable meets the specifications listed in Appendix A, "Cables"
- Building ownership issues are resolved
- A qualified network installer is employed

Safety and Electrical Code Requirements

Make sure that the installation complies with local safety and electrical codes. Contact your local building code authority for requirements.

Preparing Wiring Closets

Each wiring closet should have enough room for a standard 19-inch distribution rack. (If possible, all of the wire centers in one wiring closet should be installed in the same rack.) Make sure that there is sufficient room to connect cable between wire centers.

Preinstalled Cable

If preinstalled cable is to be used, determine its type: type 1, type 2, type 6, or type 9. (See Appendix A, "Cables".

Note: *A single network can make use of several different types of cable, provided that you use the same type of cable between any two wire centers and between a wire center and a workstation.*

Building Ownership Issues

Some of the building ownership issues are listed below:

- Does the customer own the building or lease the building? Some lease arrangements may impose restrictions on cable installations
- Will some type of operator's license be required?
- If more than one company in a building uses the network, who will be the network administrator? Who will maintain the network?

Who Should Install the Network

Only qualified technical personnel should install or modify a token ring network. Electricians and construction personnel may be required.

Planning the Installation

To plan a token ring network, you should

1. Conduct a site survey.
2. Obtain floor plans or building plans.
3. Identify workstation locations.
4. Identify wiring closet locations.
5. Determine how many wire centers are required.
6. Select a network configuration.
7. Identify repeater locations (optional).
8. Identify cable routes.
9. Determine the required cable lengths.
10. Complete and maintain network planning documents.

Each of these steps are described below in more detail.

Conducting a Site Survey

In a site survey, an installation planner assesses the building to determine where to install cable, taking under consideration the location of power sources, risers, conduits, cable trays, fire walls, etc., as well as the existence of special hazards or restrictions. Normally, a site survey requires the assistance of the building site manager, or some other building authority who has a thorough knowledge of the building.

Obtaining Floor Plans

A current set of floor plans should be obtained from the building facilities manager or other appropriate source. The floor plans are useful for showing the layout of the ring trunk cable, wiring closets, workstations, lobe cable, and repeaters.

Identifying Workstation Locations

On the floor plans, mark the locations where workstations are to be installed. If possible, group workstations in multiples of eight because each wire center supports 8 workstations. Identify each group of eight workstations on the floor plan with a different character (for example, A-1, A-2 . . . A-8, B-1, B-2 . . . B-8, and so on).

Note: *No ring can have more than 260 workstations.*

Identifying Wiring Closet Locations

On the floor plans, mark the locations where wiring closets are to be installed. (A wiring closet is a work area that contains one or more wire centers.)

Wiring closet locations must be planned to minimize the distances from workstations to wire centers. (See "Configuring the Network" later in this section.) In addition, a wiring closet must have ac power outlets.

Determining the Number of Wire Centers

To determine the total number of wire centers required for the ring, divide the total number of workstations in the ring by eight (round up to the nearest whole number). *No ring can have more than 33 wire centers.*

On the marked floor plans, indicate how many wire centers you plan to install in each wiring closet. Also indicate the number of 9-foot cables and 32-foot cables used in each wiring closet.

Note: *Wire centers installed in the same distribution rack are connected by 9-foot cables; wire centers installed in different distribution racks (in the same wiring closet) are connected by 32-foot cables.*

Selecting a Network Configuration

After determining the workstation and wiring closet locations, determine whether you need a single wiring closet or several wiring closets, and whether you need to use repeaters or bridges. (See "Configuring the Network" later in this section.)

Identifying Repeater Locations (Optional)

On the floor plans, mark the location of required repeaters. (See "Configuring the Network" later in this section.)

Note: *When you are considering the maximum number of workstations in a network (260), remember that each repeater counts as one workstation.*

Identifying Cable Routes

Based on the marked floor plans, chart the layout of the ring trunk cable connecting wiring closets. (Be sure to indicate cable lengths.) Then chart the layout of the lobe cable connecting workstations to wire centers.

When you plan the cable layout, follow these guidelines:

- Don't exceed the maximum length allowed for the ring trunk cable or lobe cable (see "Configuring the Network" later in this section)
- Route cable separately from ac power cable to minimize electromagnetic interference; token ring cable should be kept the following distances from power cables:
  - 3 inches (75 mm) from ac cables with 2 kVA or less
  - 12 inches (300 mm) from ac cables with 2 kVA to 5 kVA
  - 40 inches (1 meter) from ac cables with 5 kVA or greater
  - 5 inches (130 mm) from fluorescent fixtures

Determine Cable Lengths

Using the marked floor plans, calculate the length of ring trunk cable required to connect wiring closets (do not include the 9-foot and 32-foot cables linking wire centers in the same wiring closet). The total ring trunk cable length must not exceed the limits allowed for the network. (See "Configuring the Network" later in this section.)

Calculate the length of each lobe cable, and compare it to the maximum lobe length allowed for the ring.

Maintaining Network Documentation

Identify each wire center, distribution rack, workstation, lobe cable, and ring trunk cable with a label, and mark the floor plans accordingly.

Date and keep the final version of the marked floor plans as an "as-built" record of the network. Copies of this version may be made and used as working copies when the network is modified.

All of the marked floor plans and other network documentation can be maintained by the network administrator.

Configuring the Network

There are four ways to configure a ring. You can use

- A single wiring closet
- Multiple wiring closets
- Bridges
- Repeaters

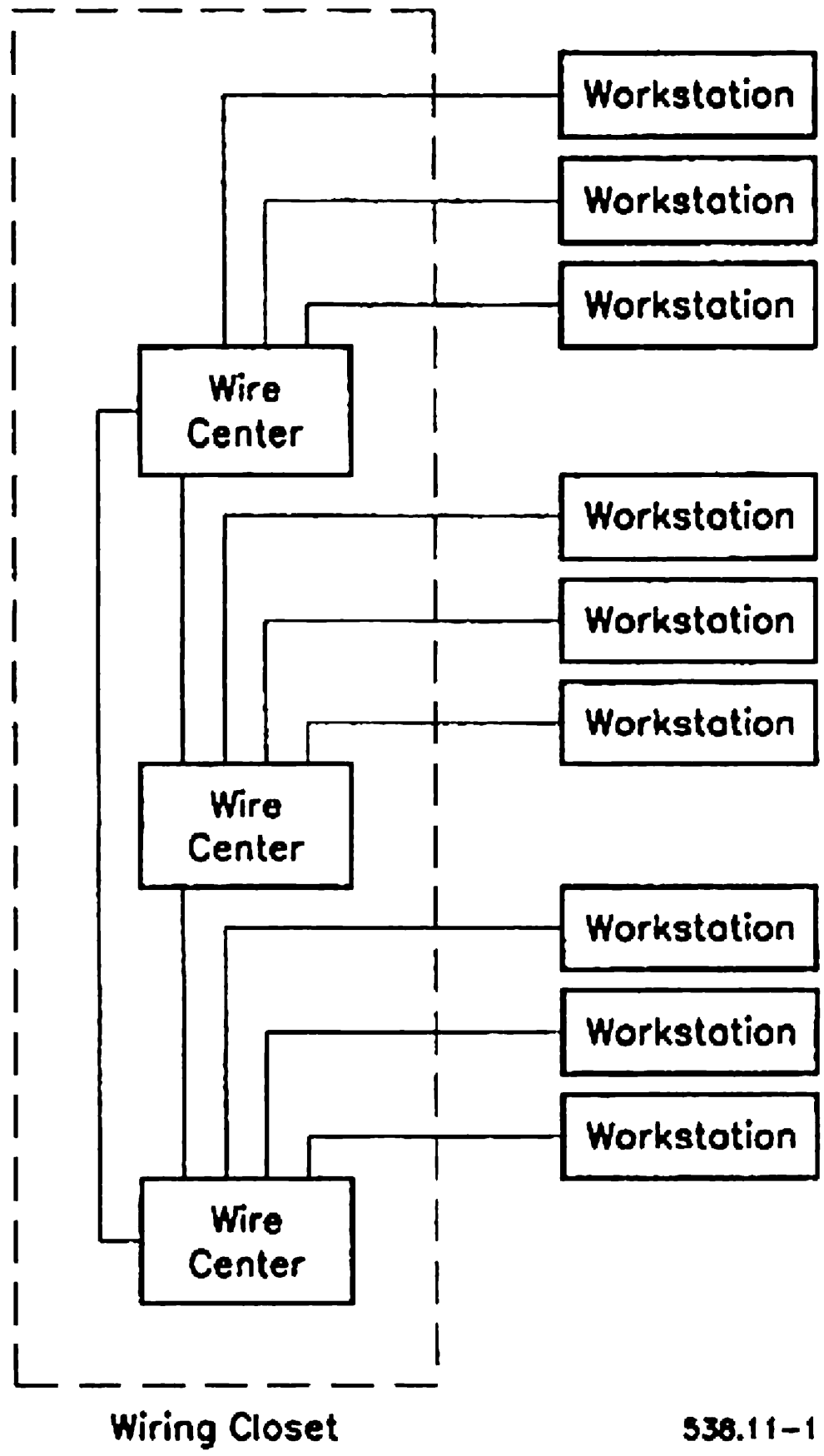
These four configurations differ in several ways, including the physical area that can be covered and the maximum length of the ring trunk cable. Each of these configuration methods is described below.

Note: *Whatever the ring configuration you choose, make sure that your design leaves room for future expansion.*

Using a Single Wiring Closet

If the workstations in a ring are grouped close together, it may be possible to use a single, central wiring closet. In this ring configuration, all of the lobe cables from the workstations lead to one central wiring closet (see Figure 11–1).

Figure 11–1. Token Ring with Single Wiring Closet



Maximum Lobe Length

The key factor in a ring with a single wiring closet is the maximum distance allowed between a wire center and a workstation. This distance is called the maximum lobe length. Table 11–1 shows the maximum lobe length for each type of cable.

Table 11–1. Maximum Lobe Length

Cable Type	Maximum Lobe Cable Length*
Type 1	100 m
Type 2	100 m
Type 6	75 m
Type 9	75 m

* No cable between a workstation and a wire center can exceed this limit.

How to Obtain Greater Lobe Length Maximums

The maximum lobe lengths listed in Table 11–1 assume a ring with the maximum number of workstations and wire centers installed (260 and 33, respectively). If your particular ring has fewer workstations installed, you may be able to use longer lobe cables.

Note: *Using longer lobe cables may restrict the future expansion of your network.*

If you need to use longer lobe cables than allowed in Table 11–1 above, use the formulas listed in Table 11–2 to determine the lobe length limits that apply to your ring.

Table 11–2. Lobe Length Formulas

Cable Type	Formula
Type 1/ Type 2	Max Lobe Length = 1280ft - (16.5ft x S* + 33ft x L**)
Type 6/ Type 9	Max Lobe Length = 960ft - (16.5ft x S* + 33ft x L**)

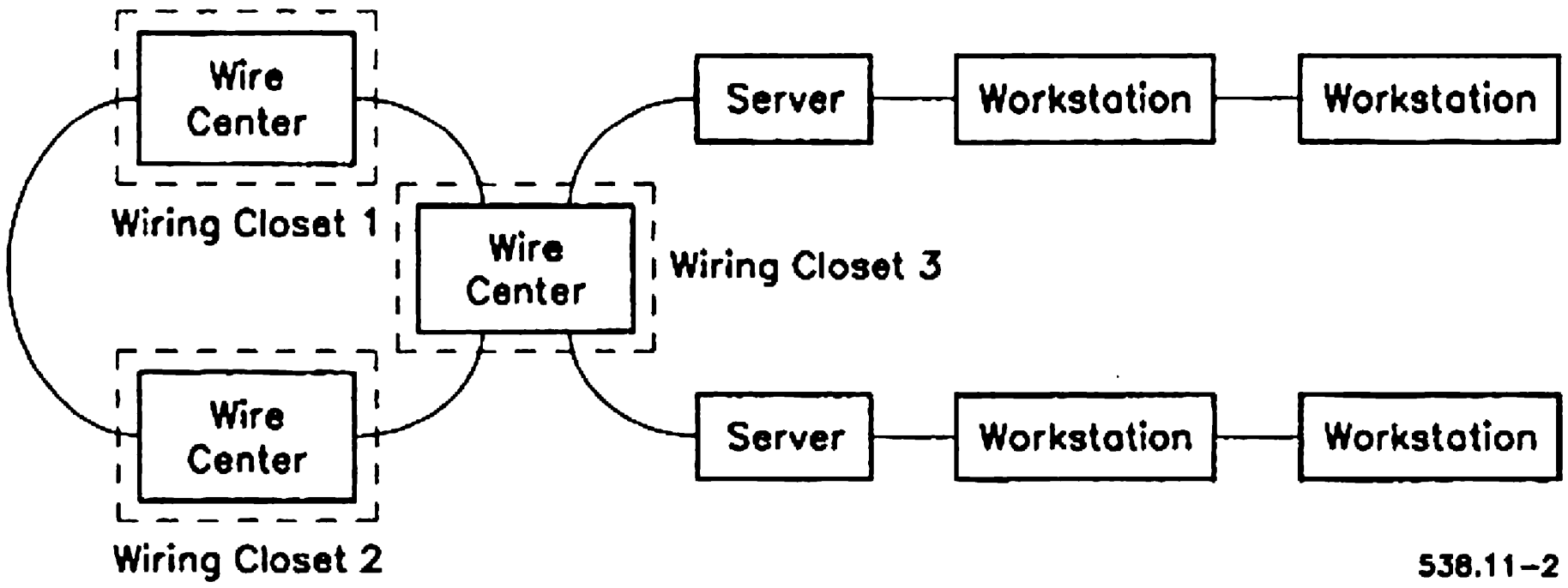
* S = the number of 9-foot cables used to connect wire centers (in the same rack)

** L = the number of 32-foot cables used to connect wire centers (in different racks)

Using Multiple Wiring Closets

If your ring must connect workstations dispersed over a larger area than can be served by a single wiring closet, you may have to distribute several wiring closets throughout the ring (see Figure 11–2). Install each wiring closet near groups of workstations.

Figure 11–2. Token Ring with Multiple Wiring Closets



The Maximum Drive Distance

The key factor to consider in a ring with several wiring closets is the maximum drive distance. The maximum drive distance is the total length of the cable connecting the wiring closets, not including the cable connecting wire centers in the same wiring closet.

The maximum drive distance varies from ring to ring, since the maximum allowed for any particular ring depends on the number of wire centers, wiring closets, and the maximum lobe length.

Note: *The maximum drive distance is normally limited to a few hundred feet at the most. To overcome these limitations you may have to use repeaters and/or fiber optic cable.*

Table 11–3 shows the formulas for determining the maximum drive distance.

Table 11–3. Maximum Drive Distance Formulas

Cable Type	Formula
Type 1/ Type 2	Drive distance = 1280ft - (28.5 x W* + 15 x C** + 33 x T*** + L****)
Type 6/ Type 9	Drive distance = 960ft - (28.5 x W* + 15 x C** + 33 x T*** + L****)

* W= the number of wire centers in the ring

** C = the number of wiring closets in the ring

*** T = the number of 32-foot cables used to connect wire centers in different racks

**** L = the maximum lobe length for the ring

Note: *The formulas assume the use of only one type of cable. If the installation uses both Type 1 and Type 6 cable, you can use modified formulas. If you use the Type 6 formula, be sure to multiply any length of Type 1 cable by a factor of 3/4 before using it in the formula. If you use the Type 1 formula, be sure to multiply any length of Type 6 cable by a factor of 4/3 before using it in the formula.*

How to Obtain Greater Maximum Drive Distances

According to the formulas provided in Table 11–3, you can increase the maximum drive distance in several ways, if a greater drive distance is required. You can

- Use fewer wire centers
- Use fewer wiring closets
- Decrease the lobe lengths for the ring

Likewise, to increase the maximum lobe length , you can decrease the maximum drive distance, using the formulas in Table 11–3.

Note: *If you require a greater drive distance than is possible with the multiple wiring closet configuration, you may have to use repeaters or bridges.*

Using Bridges

In a bridged ring configuration, several individual rings are connected together by means of bridges. This allows you to create large networks while keeping network maintenance to a minimum.

Note: *The limitations that apply to rings with a single wiring closet or with multiple wiring closets also apply to each of the rings in a bridged ring network.*

The bridge itself can be a file server, a dedicated bridge, or a workstation that also performs bridging functions. However, all three types of bridge require bridge software.

Note: *If a server is used as a bridge, it must have two separate Token Ring modules, along with the appropriate software.*

You can connect rings with three types of bridge:

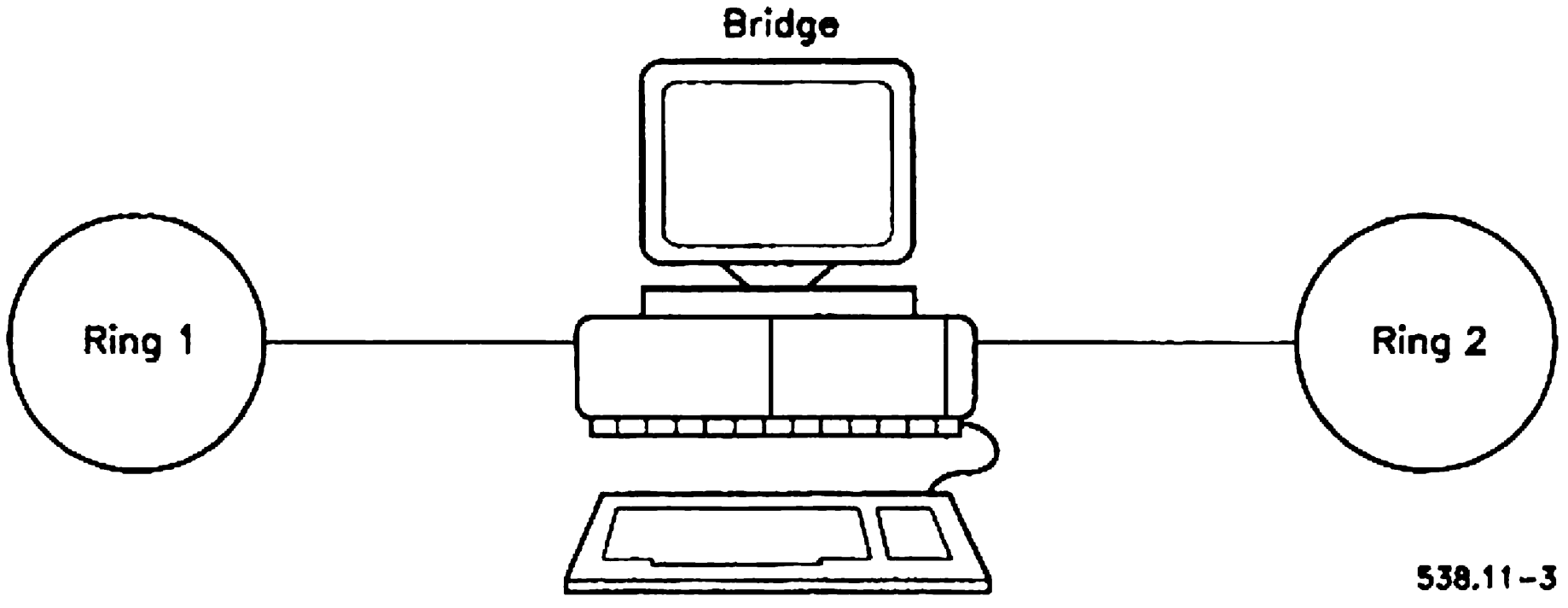
- Simple bridge
- Parallel bridges
- Backbone bridge

Each of these type of bridging connection is described below.

Simple Bridge

In a simple bridge connection, two rings are joined by a single bridge (see Figure 11–3). This type of connection is useful if most of the network traffic stays within the individual rings.

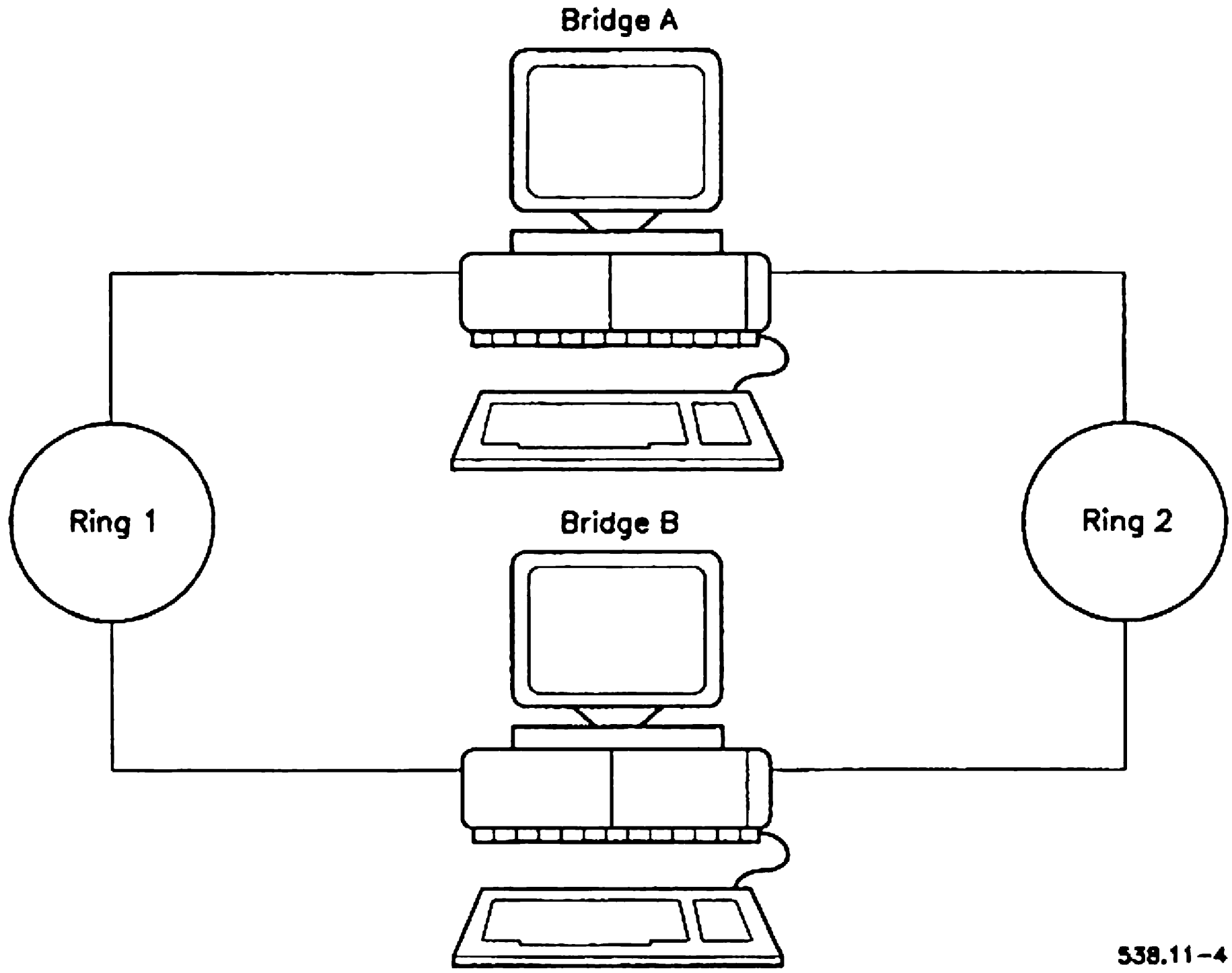
Figure 11–3. Simple Bridge



Parallel Bridge

In a parallel bridge connection, two rings are joined by two or more bridges (see Figure 11–4). This type of connection is useful when much of the network traffic flows between rings.

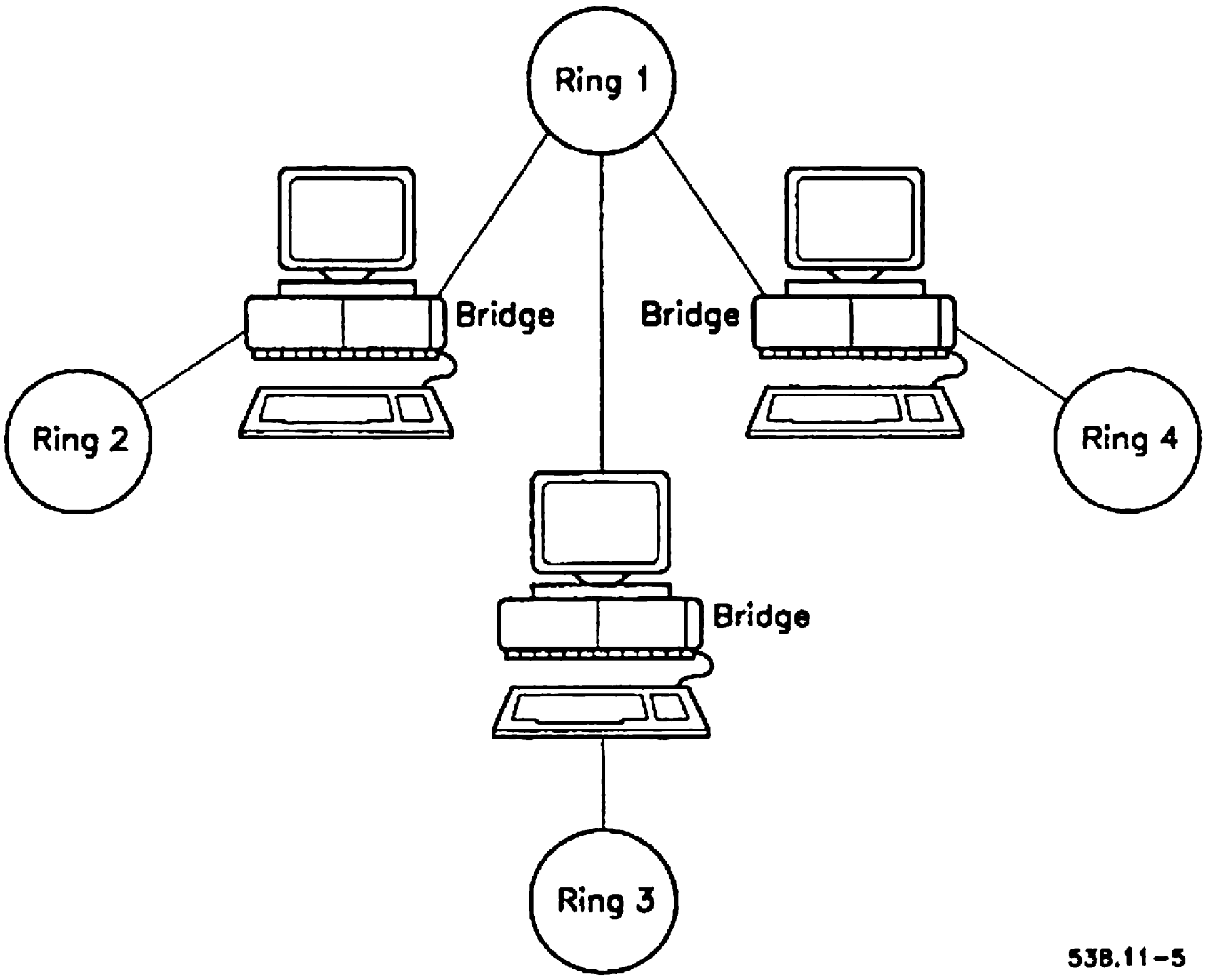
Figure 11–4. Parallel Bridge



Backbone Bridge

In a backbone bridge connection, individual rings are bridged to a main backbone ring (see Figure 11–5). This type of connection is useful for providing direct access to common resources (host computers, print servers, file servers, etc.) that are frequently accessed by the other rings.

Figure 11–5. Backbone Bridge



Using Repeaters

Repeaters are wire centers that also have signal repeating functions (signal reclocking and amplification); they are always installed in wiring closets with the other wire centers. Repeaters are installed to extend the ring over a larger area.

Note: *Repeaters are always placed on the main ring path, never on lobe cables.*

There are two types of repeaters:

- Copper
- Fiber optic

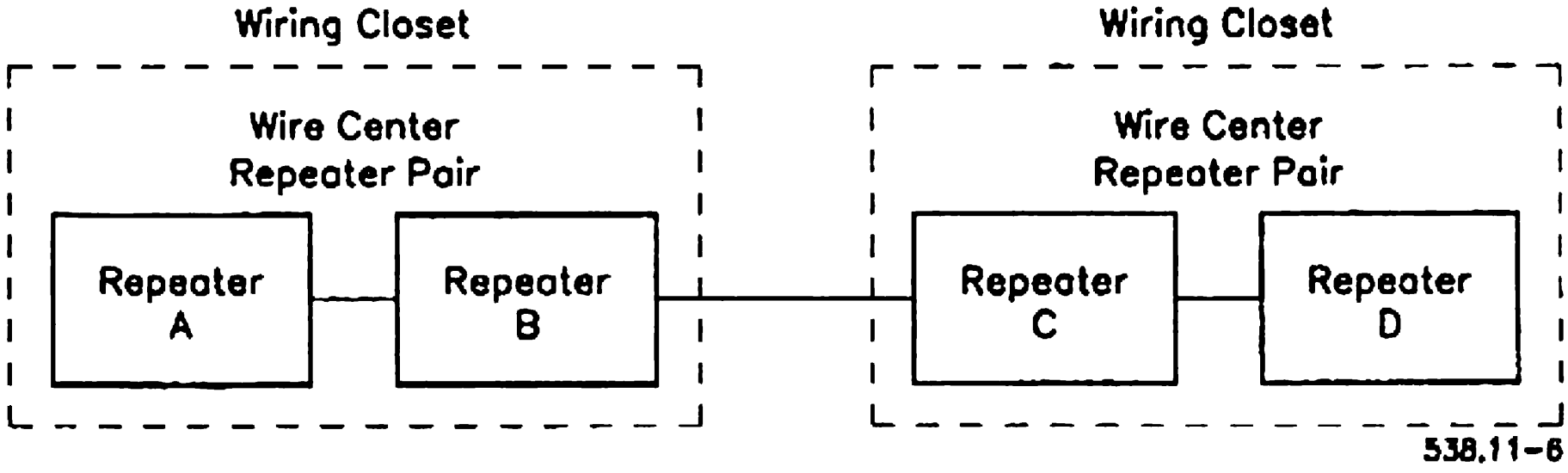
The configuration rules applying to each type of repeater are described below in more detail.

Note: *When you are considering the maximum number of workstations in a network (260), remember that each repeater counts as one workstation.*

Copper Repeaters

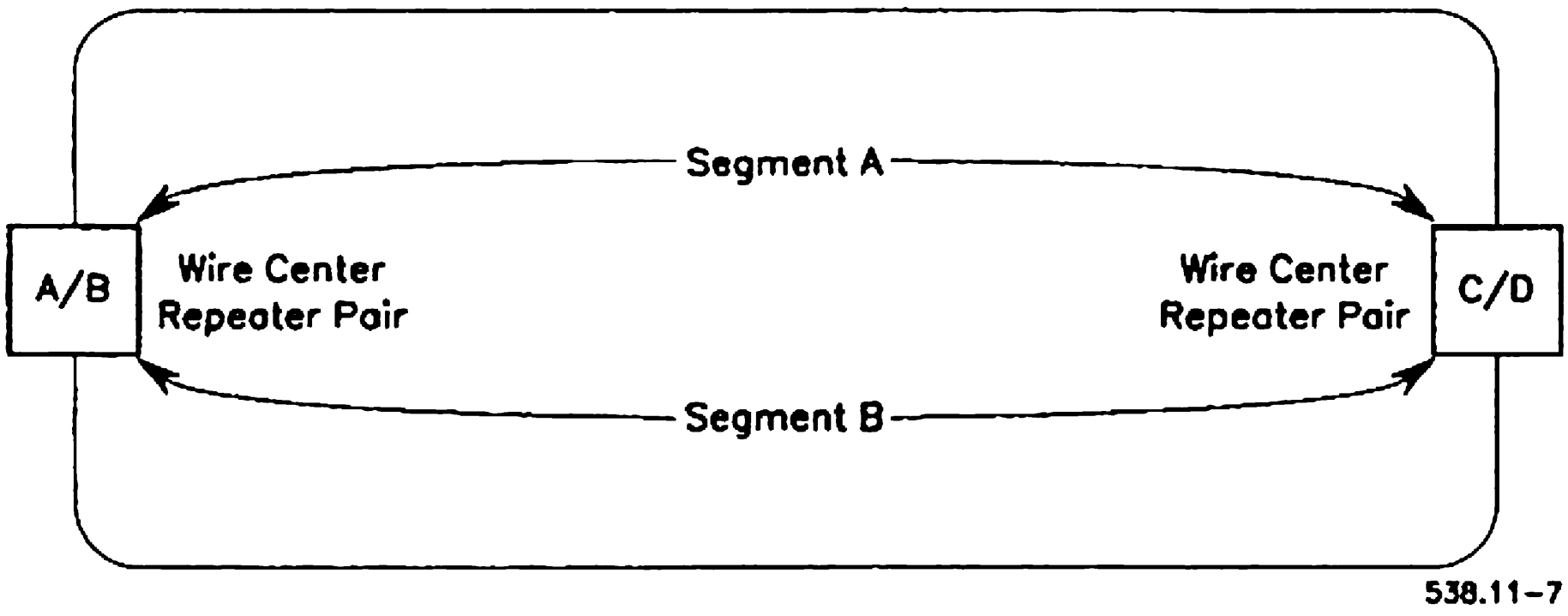
In a repeated ring, repeater pairs are installed to increase the maximum drive distance. Copper repeaters must be installed in sets of two pairs, with one pair of repeaters at each end of a cable link (see Figure 11–6).

Figure 11–6. Repeater Pairs



When using repeaters, treat each cable segment between two repeater pairs as a separate ring when you calculate the maximum drive distance (see Figure 11–7). For example, cable segment A is counted as one ring, and cable segment B is counted as a separate ring. This has the effect of increasing the maximum drive distance.

Figure 11–7. Repeaters and Maximum Drive Distances



When you design a ring using repeaters, make sure that the ring does not exceed the maximum drive distance allowed for each cable segment between two repeater pairs. To do this, you must complete the following procedures:

- Calculate the maximum drive distance allowed for each cable segment
- Calculate the actual drive distance

Calculating Maximum Drive Distances (Repeated Ring)

The formulas for calculating the maximum drive distance for a cable segment between two repeater pairs are provided in Table 11–4.

Table 11–4. Maximum Drive Distance (Repeaters)

Cable Type	Formula
Type 1/ Type 2	Maximum drive distance = 1280 ft - (28.5 x W* + 15 x C** + 33 x T***)
Type 6/ Type 9	Maximum drive distance = 960 ft - (28.5 x W* + 15 x C** + 33 x T***)

* W= the number of wire centers within the ring segment (don't count the repeaters).

** C = the number of wiring closets within the ring segment.

*** T = the number of 32-foot cables used to connect wire centers within the ring segment.

Note: *The formulas assume the use of only one type of cable. If the installation uses both Type 1 and Type 6 cable, see the note under Table 11–3.*

Calculating Actual Drive Distances (Repeated Ring)

To calculate the actual drive distance of a cable segment between two repeater pairs,

1. Determine the length of the longest lobe cable in the cable segment.
2. Determine the length of cable connecting the two repeaters in each repeater pair. Determine which of these two cables is the longest.
3. Divide the length of each cable connecting repeater pairs by two. Compare the resulting lengths with the lobe cable in step 1: if the lobe cable is longer than either of these, go to step 4; if the lobe cable is shorter, skip to step 5
4. Calculate the actual drive distance as follows:

   Actual drive distance = L* + C**

   * L = the length of the longest lobe cable.

   ** C = the length of the cable between the two wire pairs (do not count the 9-foot and 32-foot cables used to connect wire centers in the same wiring closet).

5. Calculate the actual drive distance as follows:

   Actual drive distance = R*/2 + C**

   * R = the length of the longest of the two repeater-to-repeater cables.

   ** C = the length of the cable between the two wire pairs (do not count the 9-foot and 32-foot cables used to connect wire centers in the same wiring closet).

Fiber Optic Repeaters

Fiber optic repeaters are required where fiber optic cable is used in a ring. Fiber optic cable is useful for the following types of installation:

- Rings that extend over large areas
- Rings that connect buildings
- Rings that have cable routed near sources of high energy emissions

One fiber optic repeater must be installed at each end of a fiber optic cable segment.

Maximum Drive Length for Fiber Optic Ring Segments

The fiber optic cable between two repeaters cannot exceed two kilometers. If you need a longer length, install one repeater at 2 kilometer intervals on the cable.

Note: *You must calculate the maximum drive length for the rest of the ring separately.*

General Installation Procedures

When you install a token ring network, consider the following factors:

- Safety procedures
- Network grounding
- Ring trunk cable and wire center installation procedures
- Repeater installation procedures
- Labelling network components

These procedures are described in more detail below.

Safety Procedures

Installation or service personnel should consult and be familiar with local, national, and international safety regulations governing cable installation and servicing procedures.

WARNING

Cable installers may be exposed to potential shock hazards. Therefore, only qualified electrical personnel should install cable. Sound installation and safety practices must be followed at all times.

Network Grounding

The cable shields must be connected at all cable and equipment connection points so that a completely grounded system is formed by the cable. In addition, there must be a common ground for all equipment attached to the ring.

Installing Ring Trunk Cable and Wire Centers

A ring is formed by connecting wire centers with ring trunk cable. The cable must connect the Ring Out port on the first wire center to the Ring In port on the second wire center. This process is repeated until the required number of wire centers is installed.

After the last wire center is installed, a cable should connect the Ring Out port on the last wire center to the Ring In port of the first wire center in the ring. This completes the ring.

Note: *The ring can function if the last wire center is not connected to the first wire center (an open ring configuration). However, although leaving the first and last wire centers unconnected allows the ring to extend over a wider area, this practice is not recommended. An open ring is more susceptible to outages, makes fault isolation more difficult, and generally does not perform as well as a true ring.*

If possible, install all of the wire centers in one wiring closet in the same distribution rack.

If possible, use the same type of ring trunk cable; this will simplify network planning, maintenance, and expansion. However, you can mix cable types, provided that there is only one type of cable between any two wire centers, or between a wire center and a workstation.

Installing Repeaters

Install the first pair of repeaters in the wiring closet that has the most wire centers. Install the second pair of repeaters in a wiring closet as far away as possible without exceeding drive distance limitations (see "Configuring the Network" later in this section).

The repeater pair should be installed either as the first wire centers in a wiring closet or as the last wire centers in the wiring closet. This will simplify network planning and expansion.

Note: *When you are considering the maximum number of workstations in a network (260), remember that each repeater counts as one workstation.*

Labelling Network Components

Lable wire centers, ring trunk cable between wire centers, lobe cables, repeaters, and workstations with unique identification codes when they are installed. (Cable labels should also include the length of the cable.) Mark the identification codes and lengths on the network floor plans, cable schedules, or other documentation.

Modifying an Existing Network

A ring network can be modified in five ways:

- By removing or adding workstations from the ring
- By removing or adding wire centers
- By removing or adding repeaters
- By splitting one ring into separate rings
- By combining separate rings into a single ring

Note: *Obtain the permission of the network administrator before modifying a network. Update network floor plans and other documentation to reflect any changes.*

Removing or Adding Workstations

A workstation can be removed or added to a token ring network without affecting network operation. To remove a workstation, power off the workstation and disconnect the lobe cable from the workstation. Update the network documentation.

To add a workstation, connect a lobe cable from the wire center to the token ring adapter on the workstation. Make sure that the workstation addition does not cause ring limits to be exceeded. (See "Configuring the Network" later in this section.) Update the network documentation.

Removing or Adding Wire Centers

To remove a wire center, disconnect all lobe cables and ring trunk cables connected to it, and remove the wire center from the distribution rack. Make sure that you close the ring by connecting the wire centers on both sides of the removed wire center. Connect the lobe cables to another wire center as required. Update the network documentation.

Before adding a wire center, make sure that the addition is within the limits allowed by the ring configuration. Then determine the best location for the wire center. Connect ring trunk cable and lobe cable as required. Update the network documentation.

Removing or Adding Repeaters

Remove repeaters only if several wire centers are being removed, or if the ring is being split into two or more rings. To remove repeaters, follow the procedure for removing a wire center.

To add repeaters, follow the procedures for adding a wire center.

Splitting a Ring Into Separate Rings

When you split a ring into two or more rings, make sure that each new ring has a complete ring path. If possible, verify the correct operation of each ring. Update the network documentation.

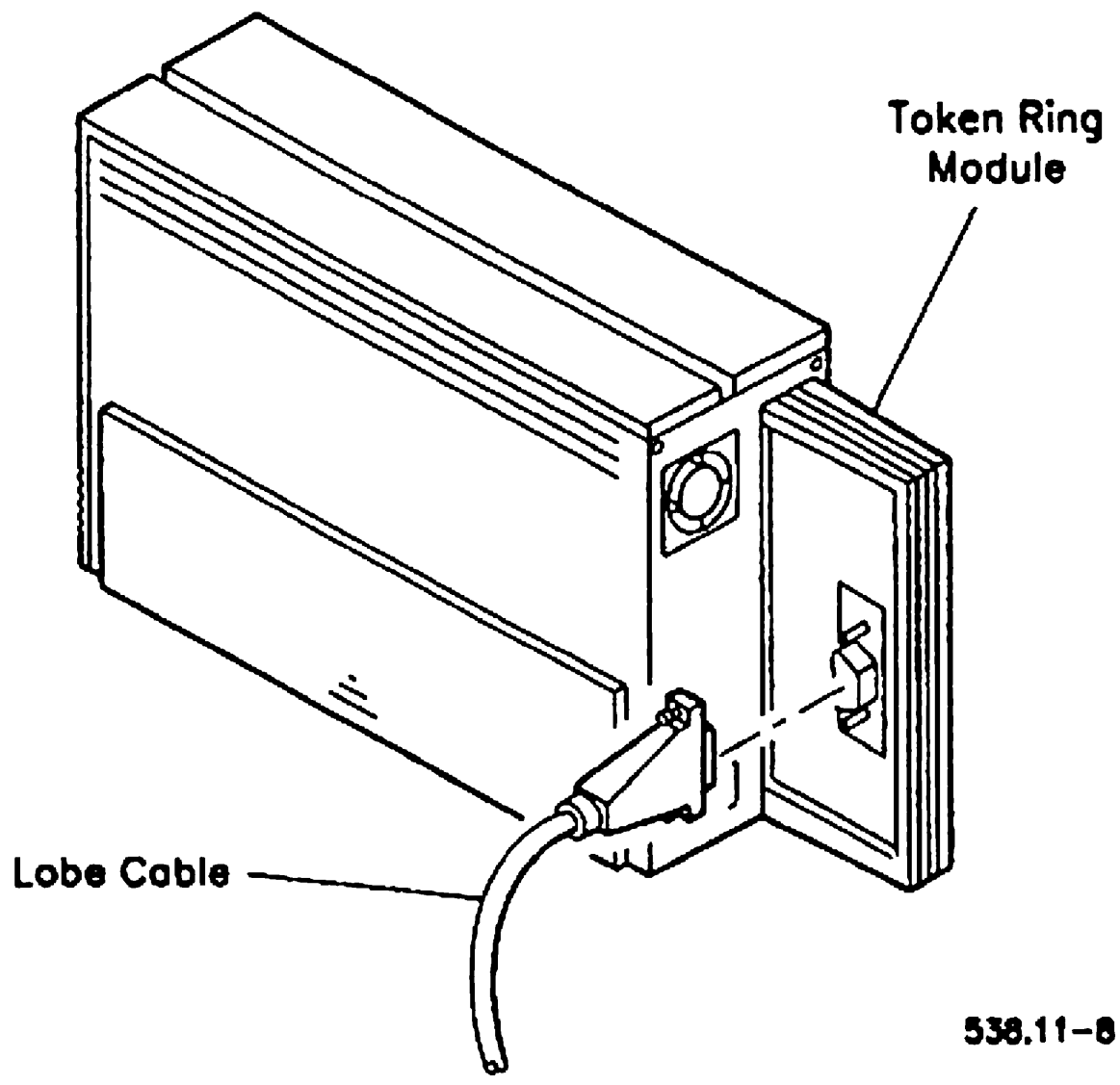
Combining Separate Rings Into a Single Ring

When you combine two or more rings into one ring, make sure that no ring size limits are exceeded. You may have to add repeaters. Make sure that there is a complete ring path. If possible, verify the correct operation of the ring. Update the network documentation.

Connecting a Cluster to a Token Ring Network

To connect a cluster to a token ring network, install a token ring module in the cluster server, and connect the module to a lobe cable (see Figure 11–8).

Figure 11–8. Connecting a Token Ring Module



Install IDMSS software in the server, along with any additional network software that is required (see Appendix C, "Network Software" for more information).

Note: *If the cluster has a shared resource processor server, you cannot connect the cluster to a token ring network. No token ring module is available for shared resource processors.*

Part III

Section 12
Introduction to Wide Area Networks

Introduction to Section 12

This section introduces three interfaces that are used in the CTOS environment to connect to wide area networks (WANs). These interfaces are X.21, RS-232, and integrated services digital network (ISDN). This section provides information about

- What a WAN is
- WAN connections using X.21
- WAN connections using RS-232
- WAN connections using ISDN

What is a Wide Area Network?

A wide area network (WAN) is a network that connects computers, terminals, or local networks at a regional, national, or international level. Any network connection that exceeds a 2.5 km area can be considered a WAN. WANs are normally connected through public telephone networks.

Due to the distances spanned by the network, WANs typically have much lower data rates and much higher error rates than LANs.

Connecting to a WAN

In the CTOS environment, three interfaces are available for connection to a WAN: X.21, RS-232, and ISDN. They differ significantly in many respects, but the main differences are speed and data integrity. Each of these interfaces is described in more detail below.

WAN Connections Using X.21

The X.21 electrical interface is a standard that applies to signals between a computer X.21 port and an X.21 DCE (Data Circuit-terminating Equipment), a device capable of transmitting data at high rates over digital data lines. (The X.21 interface is capable of data transmission rates up to 56 Kbps.)

Although the X.21 interface supports circuit switching, it is often used to link X.25 packet switched networks.

WAN Connections Using RS-232

The RS-232 standard was first published by the AEIA in 1962 as a general purpose electrical interface between DTEs and DCEs. RS-232 supports synchronous or asynchronous data transmission in full duplex or half duplex mode. Although this interface can support data rates up to 20 kilobits per second, its normal transmission medium (analog telephone networks) effectively limit the data rates to 9.6 kilobits per second.

RS-232 is a much-used interface, despite efforts to replace it with superior interfaces (RS-422 and RS-449). Most computer systems are equipped with this interface. Because of its popularity, modems designed for this RS-232 are plentiful and inexpensive.

RS-232 is chiefly used over public telephone (analog) networks in transmitting lower volumes of data.

RS-232 is an electrical interface used or supported by many networking applications. Some of these applications are listed below:

- ASCII terminals
- Poll/Select terminals
- UNISCOPE terminals
- RJE
- X.25
- SNA
- BNA
- DCA

RS-232 is frequently used to connect a CTOS cluster or workstation to

- Other clusters
- Non-CTOS computer systems
- RS-232 devices

WAN Connections Using ISDN

In the past, voice, telex, and data were routed through different types of networks. With ISDN, these different types of network are integrated into one network that provides transmission and switching facilities for digitized voice, fax, video, data, and other applications. The end-to-end digital connections are made through the various public telephone networks that have replaced older analog switching systems with the required digital systems.

An ISDN network makes use of the standard twisted pair cables that connect phone service subscribers to the local telephone office. (Digital signals are transmitted over the cables instead of the analog signals the cabling was designed for.) Using echo cancellation techniques, the full-duplex, 64Kbps ISDN channels permit simultaneous reception and transmission of digitized voice and data.

A CTOS cluster connects to an ISDN network through an ISDN adapter on the cluster server and a local NT1 interface in the building. The CTOS implementation of ISDN supports basic rate ISDN: namely, two "B" channels and one "D" channel. (A "B" channel has a bandwidth of 64Mbps, and is used for data; a "D" channel is 16Mbps and is used for control.)

Section 13
Requirements for Using X.21

Introduction to Section 13

This section describes the hardware and software required to use the X.21 interface in networking.

In order to connect to an X.25 network, the cluster server must have an X.21 port. This port is provided by an X-Bus module or by some processor boards designed for shared resource processors. Normally, the X.21 interface is connected to an X.21 DCE.

Cluster Servers

Any workstation with a hard disk (except B21 or B22 workstations) can be used as a server in a cluster connected to another network by the X.21 network. Shared resource processors can also be used as cluster servers.

Cluster Workstations

Any CTOS workstation can be used as a workstation in a cluster that is connected to another network by the X.21 interface.

Personal Computers

PCs with a ClusterCard installed can be used in a cluster that is connected to another network by the X.21 interface.

Communication Modules

The B25-ID2 X-Bus communications module provides an X.21 port for CTOS workstations. A workstation requires this module if the workstation is used as a server in a cluster connected to another network by the X.21 interface.

Processor Boards

Several processor boards designed for shared resource processors provide X.21 ports:

- GP processors boards
- CP processors boards
- TP processors boards
- FP processors boards

A shared resource processor must have one of these processor boards in order to connect to another network via the X.21 interface.

Data Communication Equipment (DCE)

You need an X.21 DCE to link a cluster to another network. Consult your Unisys representative about the availability of this DCE and the DCE cable.

Software Requirements

The following software is required:

- Server or workstation operating system
- Intelligent Data Module System Service (IDMSS) for B25-ID2 module
- X.25 gateway software (required for connecting a cluster to an X.25 packet switched network); see Appendix C, "Network Software" for more information

Section 14
Using the X.21 Interface

Introduction to Section 14

This section shows how to connect an X.21 DCE to the X.21 port on the B25-ID2 communications module: it also describe the signals used by the X.21 electrical interface. These signals pass over a straight-through cable to an X.21 DCE for transmission to X.25 networks.

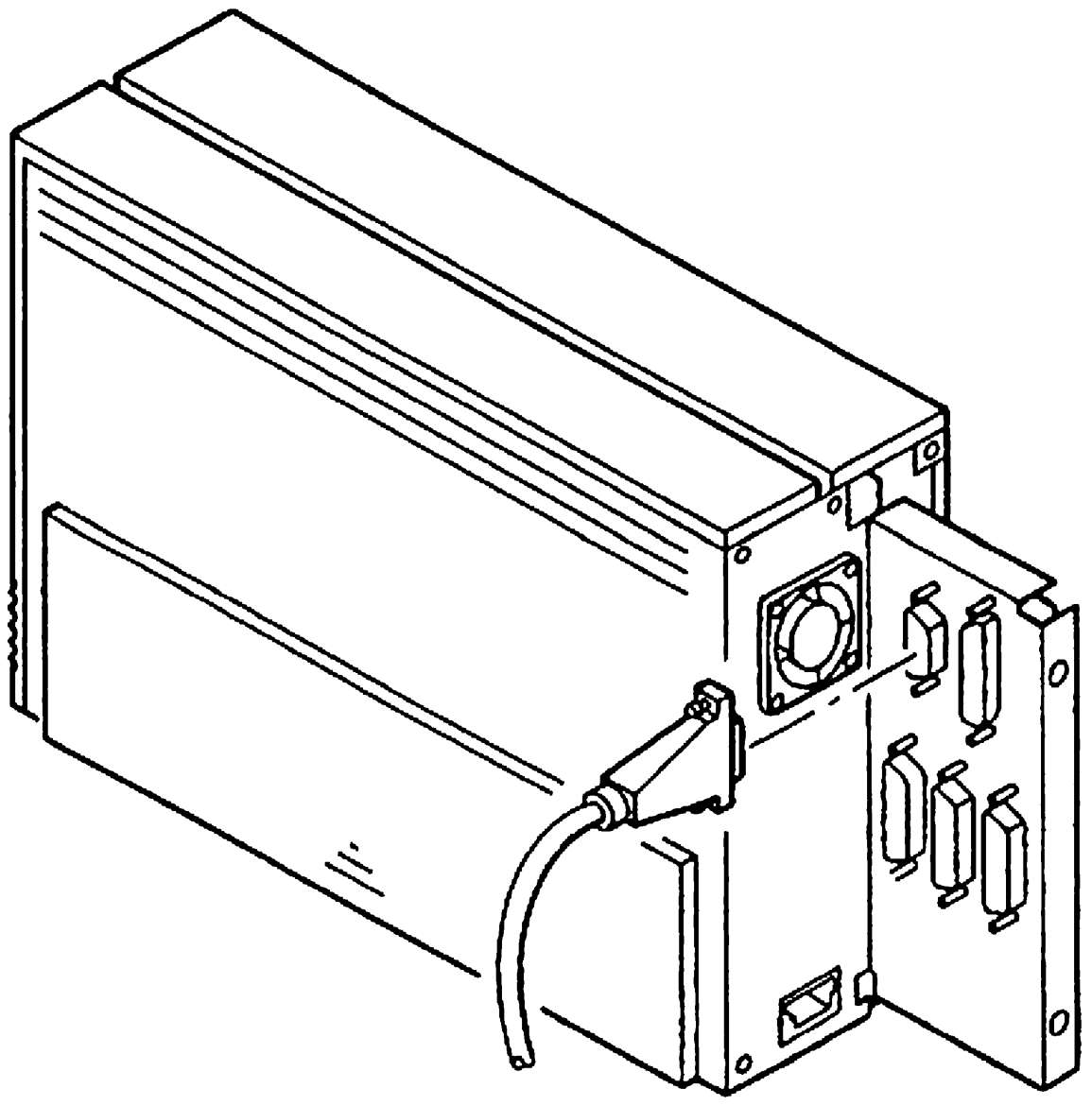
Connecting to an X.25 Network

To connect a cluster to remote X.25 networks, you normally have to connect an X.21 DCE to the cluster server's X.21 port and install the software required to communicate with the remote systems.

Connecting to an X.21 DCE

To connect an X 21 DCE, locate the 15-pin X.21 port on the B25-ID2 or B25-DCX module installed in the cluster server. Connect an X.21 cable to this port (see Figure 14–1), then connect the other end of the cable to the X.21 DCE.

Figure 14–1. Connecting the X.21 Port



538.14–1

X.21 Signals

The signal pinouts from the X.21 port are listed in Table 14–1 below. Refer to the documentation provided with the X.21 DCE to determine which signals are required.

Table 14–1. X21 Signals

Pin	Circuit Description
1	Frame Ground
2	Transmit (A)
3	Control (A)
4	Receive (A)
5	Indication (A)
6	Signal Element Timing (A)
7	Not Used
8	Signal Ground
9	Transmit (B)
10	Control (B)
11	Receive (B)
12	Indication (B)
13	Signal Element Timing (B)
14	Not Used
15	Not Used

Section 15
Requirements for Using RS-232

Introduction to Section 15

This section describes the hardware and software required to connect a cluster to other clusters or to non-CTOS networks using the RS-232 interface.

Typical hardware requirements include a cluster server or cluster workstation, RS-232 cable, and a modem.

Cluster Servers

Any CTOS workstation with a hard disk can be used as a server in a cluster that is connected to other networks through the RS-232 interface. Shared resource processors can also be used.

Cluster Workstations

Any CTOS workstation can be used in a cluster that is connected to other networks through the RS-232 interface.

Communications Modules

Although all CTOS workstations provide an RS-232 port, you can use a port expander X-Bus module. This module provides four bidirectional RS-232 ports. You can install a maximum of two such modules per workstation.

Note: *The combined baud rate of the four RS-232 ports on the port expander module cannot exceed 9600. For example, if three ports are each operating at 2400 baud (for a combined baud rate of 7200), the remaining port must operate at 2400 baud or less.*

Cable

You'll need RS-232 cable to connect RS-232 devices to a CTOS workstation or server. See Section 15, "Using the RS-232 Interface," for a description of the different cable types.

Modems

The most common way to connect networks via the RS-232 interface is to use a modem. Modems can be used for short or long distance connections, normally over public telephone lines (leased-line or dial-up). Refer to the *CTOS Modem Service Operations and Programming Guide* for a list of CTOS supported modems.

Software Requirements

The following software is required:

- Server or workstation operating system
- Network, emulator, or application software (required for connecting a cluster to other clusters or to other networks: see Appendix C, "Network Software")
- Modem system service for modems
- Generic Print System (GPS) for most printers

Section 16
Using the RS-232 Interface

Introduction to Section 16

This section describes two common uses of the RS-232 interface in the CTOS environment:

- Using RS-232 to connect a cluster to other clusters
- Using RS-232 to connect a cluster to non-CTOS systems

Connecting a Cluster to Other CTOS Clusters

There are two ways to connect clusters using the RS-232 interface:

- By modem
- By a direct cable connection

Widely dispersed clusters are frequently connected by modem over leased lines or over dial-up public telephone lines. Clusters located closer together can be connected directly by RS-232 cable, which allows for faster transmission speeds and eliminates the need for modems. (However, the total length of the RS-232 cable cannot exceed 50 feet.)

Connecting Clusters By Modem

To connect a cluster to other clusters by modem,

1. Connect a modem to each cluster server. Make sure that there are no more than 50 feet of RS-232 cable between the modem and the server. (See the *CTOS Modem Service Operations and Programming Guide* for a list of supported modems.) Connecting the modem to the cluster server will allow any workstation in the cluster to use the modem to access other clusters.

Note: *You can also connect a modem to a cluster workstation. However, only that workstation will be able to use that particular modem.*

The maximum number of modems that can be installed in a given server or workstation depends on the number of RS-232 ports available. However, additional software limitations may be imposed by the modem service or by the network software.

2. If you intend to use asynchronous transmission, install the modem service. (See the *CTOS Modem Service Operations and Programming Guide* for more information.) If you intend to use only synchronous transmission, you don't need to install the modem service. (Instead, you must install the HDLC synchronous media service provided by BNet II software.)

3. Install CTOS BNet II network software. (See the *CTOS BNet II Installation, Configuration, and Administration Guide* for information on installing and using BNet.) BNet logically extends the CTOS operating system over a network of CTOS clusters. This allows each cluster workstation to access other connected clusters under the CTOS operating system.

Note: *If you must disconnect a modem, disconnect the RS-232 cable from the workstation or server before disconnecting the modem. Otherwise, the system may hang or fail.*

Connecting Clusters By Direct Cable Connection

You can use a direct RS-232 cable connection instead of using a modem. However, the length of the cable cannot exceed 50 feet.

To directly connect a cluster to other clusters by an RS-232 cable, perform the following steps:

1. If you intend to use asynchronous transmission, use an asynchronous crossed cable (see Appendix A) to connect the cluster server to another cluster server. Then install the modem service, but do not install a modem. (See the *CTOS Modem Service Operations and Programming Guide.*)

2. If you intend to use synchronous transmission, use a synchronous crossed cable (see Appendix A) to connect the cluster server to another cluster server. Be sure to install the BNet HDLC synchronous media service when you install the BNet II software.

3. Install CTOS BNet II network software. (See the *CTOS BNet II Installation, Configuration, and Administration Guide* for information on installing and using BNet.) BNet allows each cluster workstation to access other connected clusters under the CTOS operating system.

Note: *If you must disconnect the RS-232 cable, disconnect the cable simultaneously from both servers: otherwise, the system may hang or fail.*

Connecting a Cluster to Non-CTOS Systems

A cluster can be connected to non-CTOS computer systems by modem or by a direct RS-232 cable connection. Although the hardware connection rules are the same as those for connecting clusters by modem or by RS-232 cables, the software requirements differ substantially.

In order to communicate with a non-CTOS system over RS-232 links, the cluster server or cluster workstation normally uses some sort of terminal emulation software. However, other options are also available. (See Appendix C, "Network Software.")

Note: *All RS-232 cables connected to a workstation should be connected to an RS-232 device or to another workstation. Otherwise, if one cable end is left free or unconnected, spurious interrupts may be generated, and the workstation may hang or fail.*

Section 17
Requirements for Using ISDN

Introduction to Section 17

This section describes the hardware and software required to connect a cluster to other clusters or to non-CTOS networks using the ISDN interface.

Typical hardware requirements include a cluster server or cluster workstation, an ISDN adapter, an NT1 interface (available from your local telephone company), and a standard phone cable (to connect to the NT1 interface).

Cluster Servers

Any NGEN (B25) 286 or 386 workstation with a hard disk can be used as a server in a cluster that is connected to other networks through the ISDN interface.

Note: *Shared resource processors and Series 5000 workstations cannot be used as servers if you want to connect to an ISDN network.*

Cluster Workstations

Any CTOS workstation can be used in a cluster that is connected to other networks through the ISDN interface.

ISDN Adapters

A B25-DN1 or B25-DN2 adapter must be installed in the server. This module provides an 8-pin modular jack (RJ45) for connecting to an NT1 interface.

The B25-DN1 is an adapter card that fits into an internal X-bus slot. The B25-DN2 is an X-bus module.

Note: *These ISDN adapters support basic rate ISDN: two B channels and one D channel.*

NT1 Interface

One NT1 interface is required for each ISDN adapter. The NT1 interface converts the 2-wire U interface from the local ISDN exchange to the 4-wire interface required by the ISDN adapter.

Two varieties of NT1 are widely available:

- A standalone (desktop) version that is installed near the ISDN adapter at the cluster server
- A rack-mounted module that is installed in the telephone wiring closet and that supports several ISDN adapters

Cable

You need a standard telephone cable to connect the ISDN adapter to the NT1 interface.

Software Requirements

The following software is required:

- Server operating system
- Intelligent Data Module System Software (IDMSS) for B25-DN1 and B25-DN2 adapters
- CTOS ISDN Service (provides Q.931 and LAPD)
- XVT/CH 2.0 (required if you want to use the status monitor for the ISDN service)

Section 18
Using the ISDN Interface

Introduction to Section 18

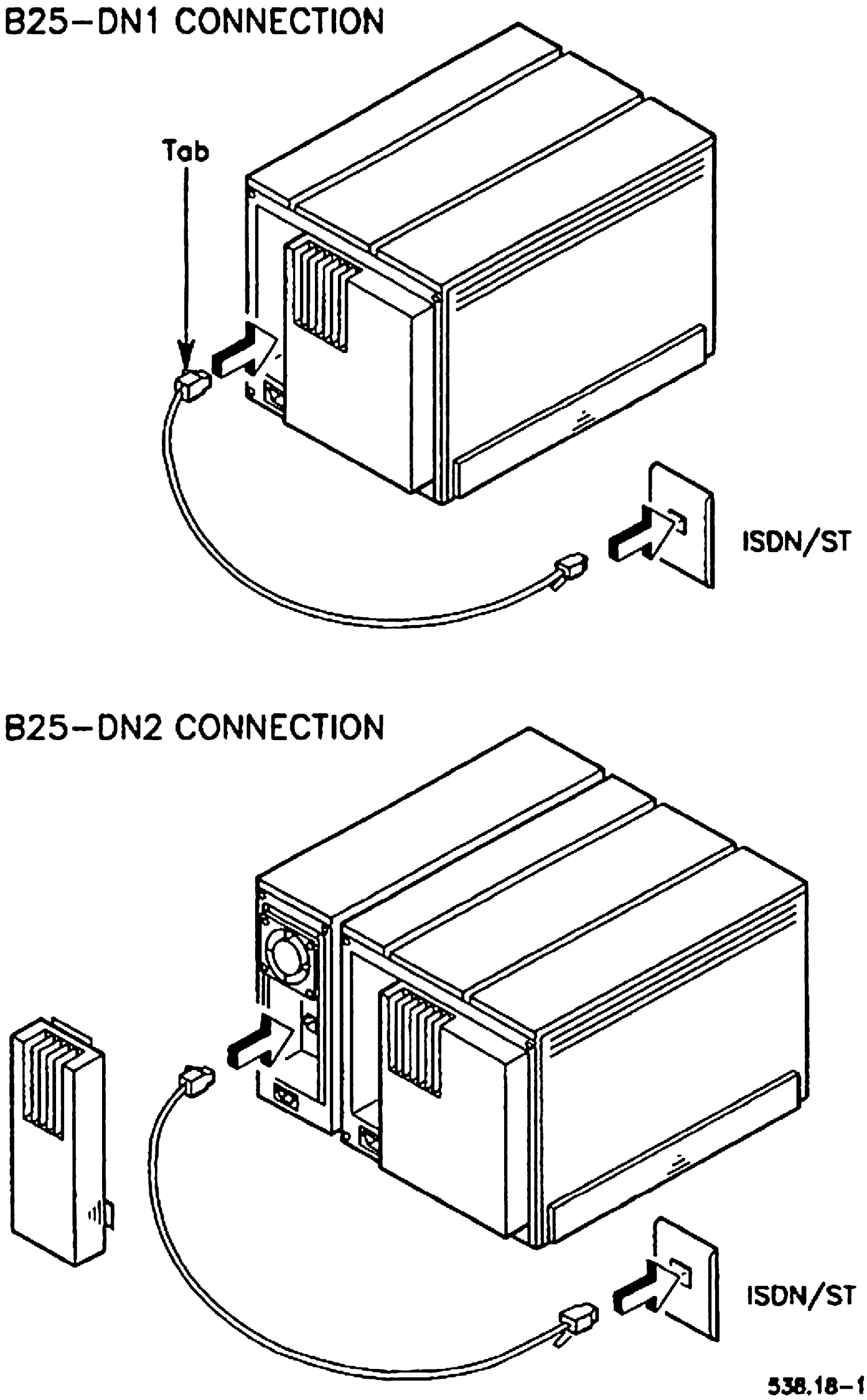
This section tells how to connect a CTOS cluster to an ISDN network.

Connecting a Cluster to ISDN

To connect a cluster to an ISDN network,

1. Make sure your facility is connected to the local ISDN exchange. Normally, this is done by the local telephone company.
2. Connect NT1 interfaces to the local ISDN exchange. (Normally, the local ISDN customer is responsible for the NT1 interfaces.) Follow the documentation provided with the NT1 interface when you install the NT1 units.
3. Install a B25-DN2 ISDN module on the cluster server. If the cluster server has an internal X-bus slot available, you can use the B25-DN1 ISDN adapter card instead of the ISDN module.
4. Install the IDMSS software on the server.
5. Install the ISDN Service software on the server.
6. If you want to use the ISDN status monitor, install the XVT/CH 2.0 service.
7. Using an ISDN cable, connect the ISDN adapter to the NT1 interface (see Figure 18–1).

Figure 18–1. Connecting ISDN



Appendix A
Cables

Introduction to Appendix A

This appendix provides key specifications, connector pin assignments, and drawings for the following cable:

- Cluster cable, terminators, and adapter cables
- TeleCluster cables (unshielded twisted pair) and adapter cables
- 10BaseT Ethernet cable
- Token ring cable
- Parallel printer and scanner cables
- RS-232 serial cables: printer and scanner cables, modem cables, asynchronous and synchronous crossed cables

Note: *This appendix does not provide the complete cable specifications. For the complete cable specifications, consult your Unisys representative.*

This appendix does not provide cable information for specific printers (see the *CTOS Generic Print System Administration Guide*). Nor does this appendix provide information about keyboard or video cables; consult your Unisys representative if you need information about these cables.

Where to Find Cable

Your Unisys representative is the best source for reliable cable. However, if you want to use cable from another source, make sure it meets the key specifications listed in this appendix. (For best results, refer to the complete cable specifications available from your Unisys representative.)

Cluster Cable

There are two types of Cluster cable: standard cable (100 Ohm), and extended length cable (140 Ohm). Both types support the 3.7 Mbps cluster speed, but extended length cable can be used over greater distances.

The specifications for each type are listed in tables. Connector pinout are provided below the tables, as well as a cable drawings

Cable Specifications

Tables A–1 and A–2 list the key specifications for both cluster cable types.

Table A–1. Standard (100 Ohm) Cable Specifications

Category	Specification
Impedance	100 Ohm +/- 10 Ohms @ 2 MHz
Attenuation	14 dB/K ft max @ 2 MHz
Far-end	Min: 50 dB/K ft from 1 MHz crosstalk to 10 MHz
Wire	Four 24 AWG conductors,stranded recommended,(2 twisted pair) plus drain wire
Conductor resistance	Max: 26.2 Ohm/K ft @ 20C
Wire color code	One pair is black/white; the other pair is green/red
Shield	Aluminized polyester/tinned copper braid, 90% braid coverage

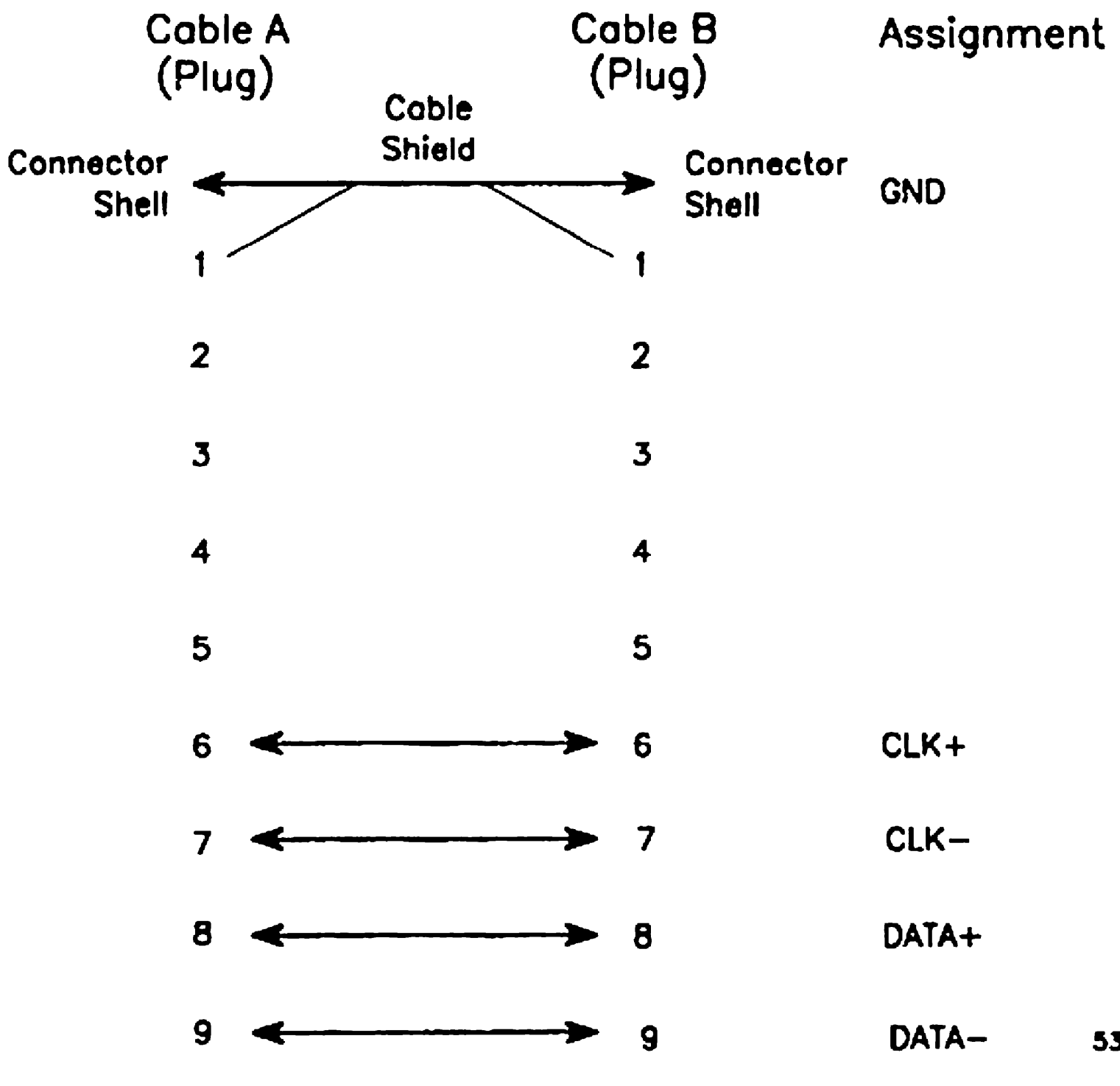
Table A–2. Extended Length (140 Ohm) Cable Specifications

Category	Specification
Impedance	140 Ohm +/- 10 Ohms @ 2 MHz
Attenuation	5 dB/K ft max @ 2 MHz
Far-end crosstalk	Min: 50 dB/K ft from 1 MHz to 10 MHz
Wire	Four 22 AWG conductors, stranded recommended, (2 twisted pair) plus drain wire
Conductor resistance	Max: 16.7 Ohm/K ft @ 20C
Wire color code	One pair is blue/white; the other pair is green/red
Shield	Aluminized polyester/tinned copper braid, 85% braid coverage

Cluster Cable Connector Pin Assignments

The signals for cluster cable are shown below (see Figure A–1).

Figure A–1. Cluster Cable Pin Assignments

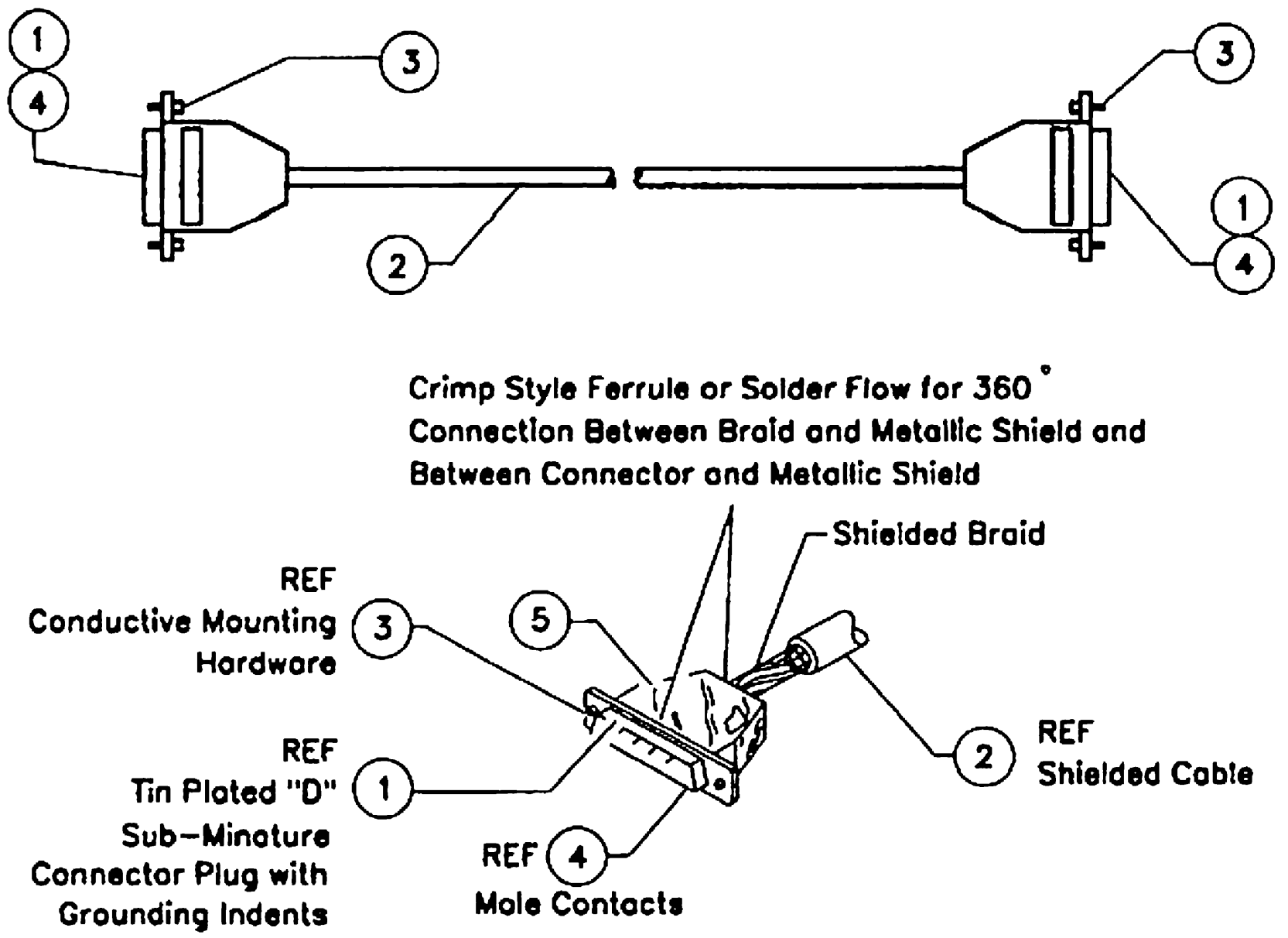


Cluster Cable Drawing

A drawing for cluster cable is provided below (see Figure A–2).

Note: *Connect the cable shield to the connector shell. Connect the drain wire to connector pin 1.*

Figure A–2. Cluster Cable Drawing



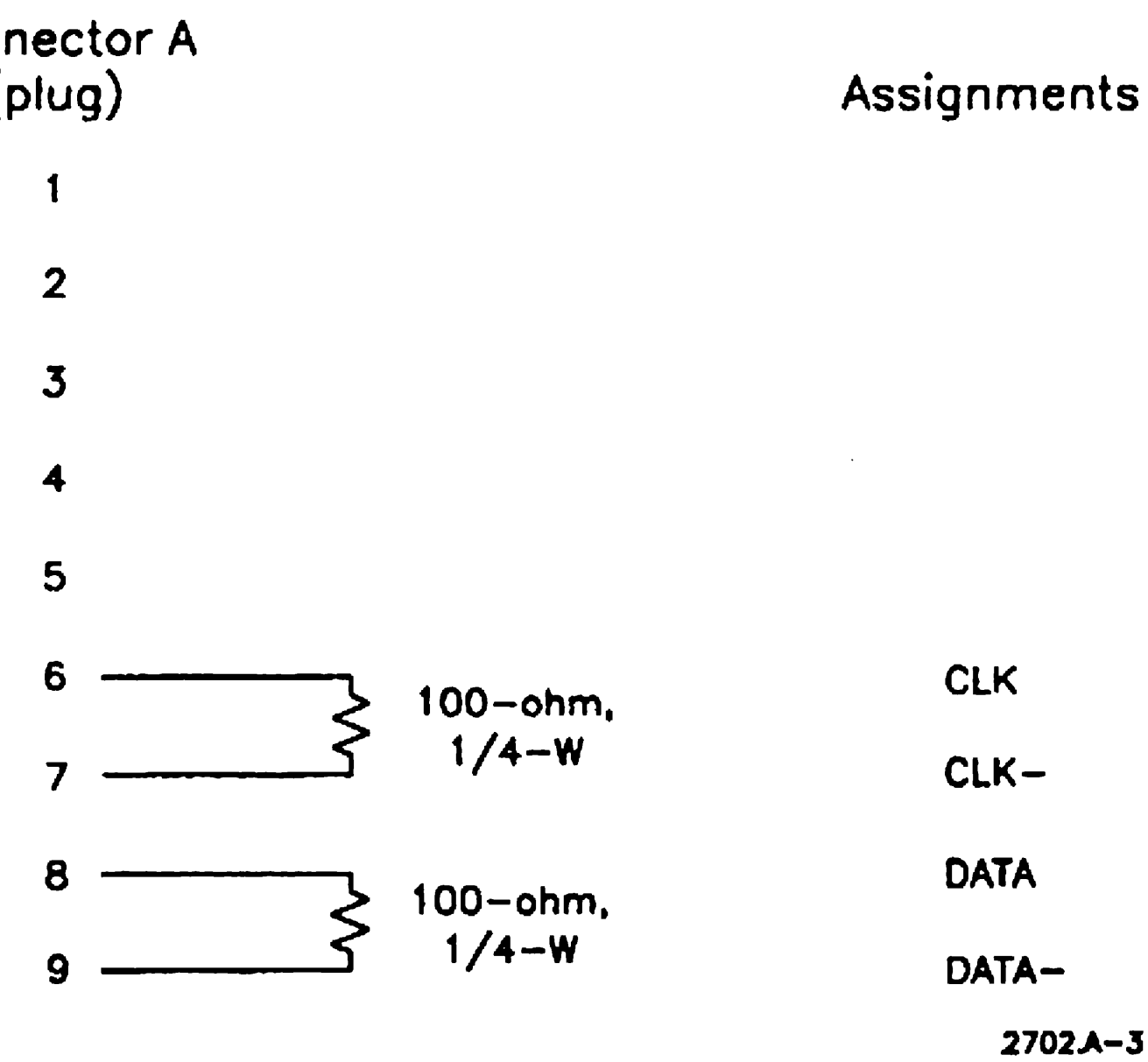
Cables

Item	Quantity	Description
1	2	9-pin D-type plug assembly (male). Use AMP part number 205204-4 or equivalent.
2	As Needed	4-conductor twisted pair shielded cable, stranded conductors recommended.
3	4	Screw and retainer, male
4	8	Connector contacts. Use AMP part number 66507-3 or equivalent.
5	As Needed	Copper foil

Cluster Cable Terminator Pin Assignments

The pin assignments for 100 ohm cluster cable terminators are shown below (see Figure A–3). The 140 ohm terminators are identical except that 140 ohm resistors are used, rather than 100 ohm resistors.

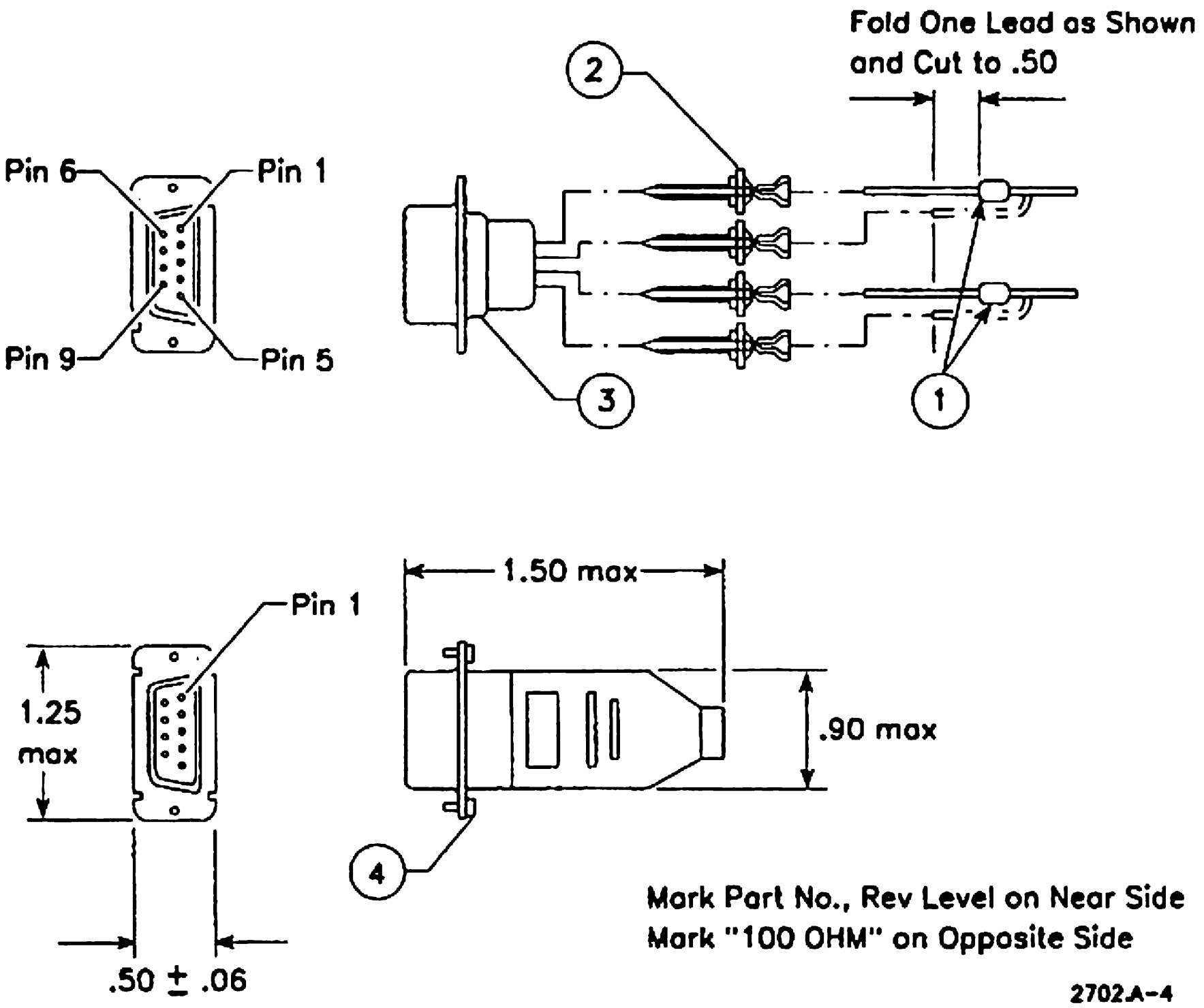
Figure A–3. Terminator Pin Assignments



Cluster Cable Terminator Drawing

A drawing for cluster cable terminators is provided below (see Figure A–4).

Figure A–4. Terminator Drawing

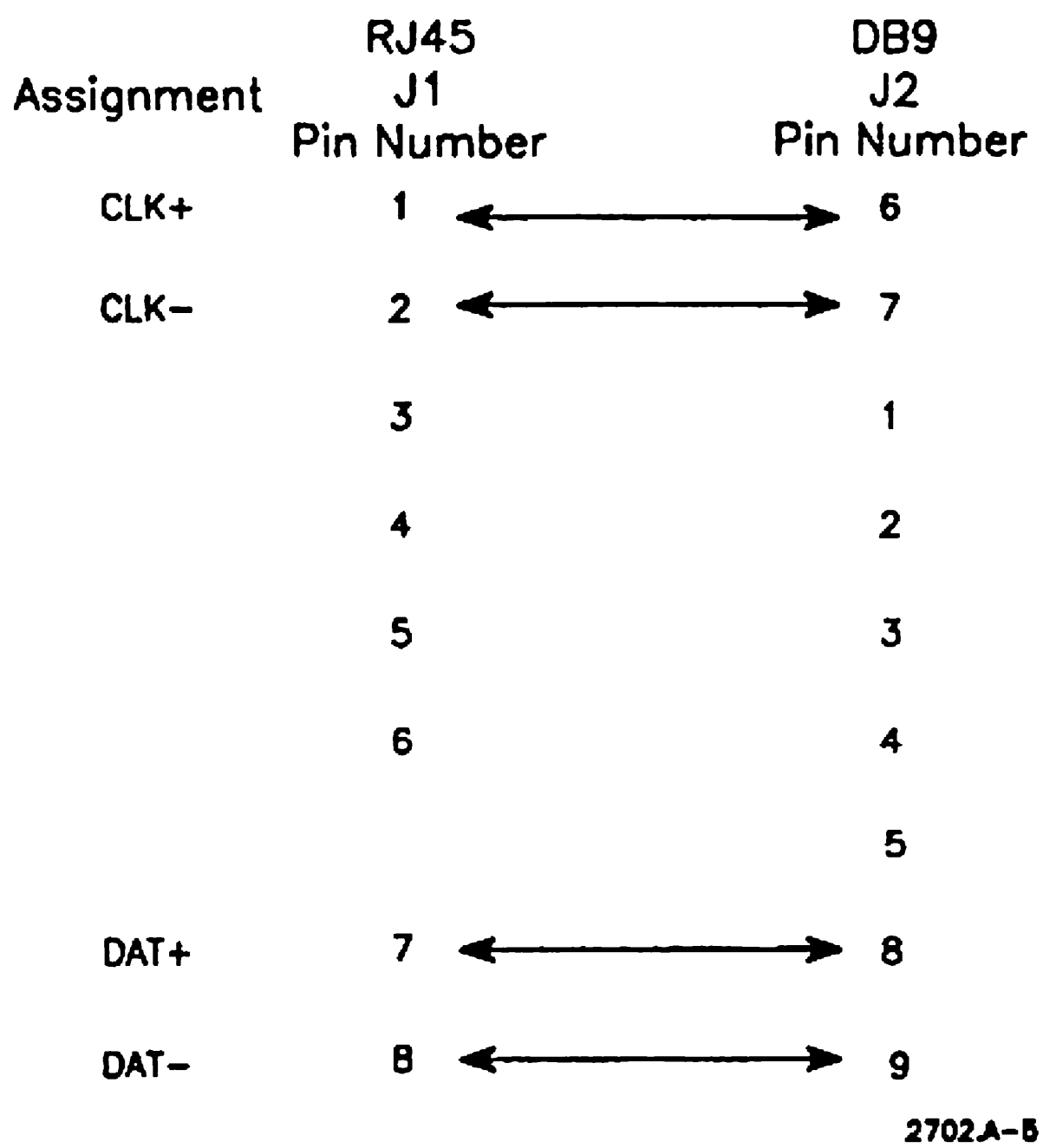


Item	Quantity	Description
1	2	100 ohm, 1/4-W resistor (140 ohm resistor for 40 ohm terminators)
2	4	Connector contacts. Use AMP part number 66507-3 or equivalent.
3	1	9-pin D-type plug assembly (male). Use AMP part number 205204-4 or equivalent.
4	2	Screw and retainer, male.

ClusterCard Adapter Cable Pin Assignments

The DB9-RJ45 adapter cable is required for connecting cluster cable to AT-bus ClusterCards (see Figure A–5). The pin assignments are shown below.

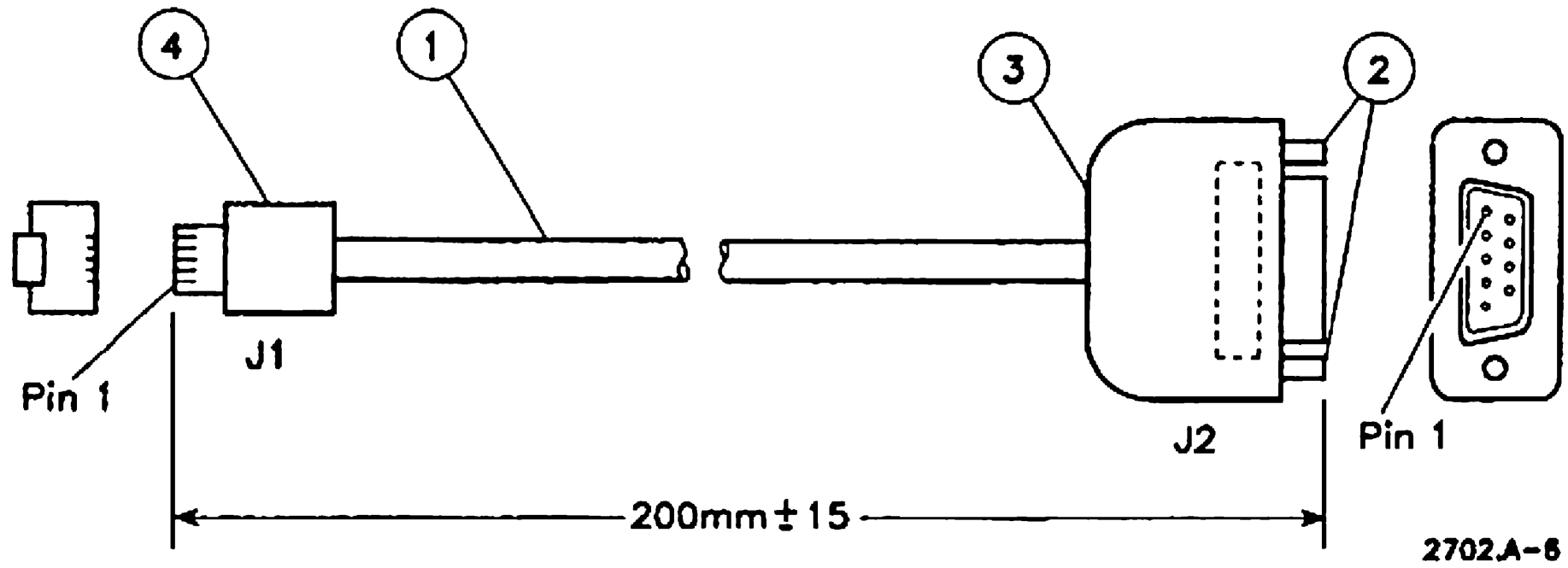
Figure A–5. DB9-RJ45 Adapter Pin Assignments



ClusterCard Adapter Cable Drawing

The DB9-RJ45 adapter cable is shown below (see Figure A–6).

Figure A–6. DB9-RJ45 Adapter Drawing

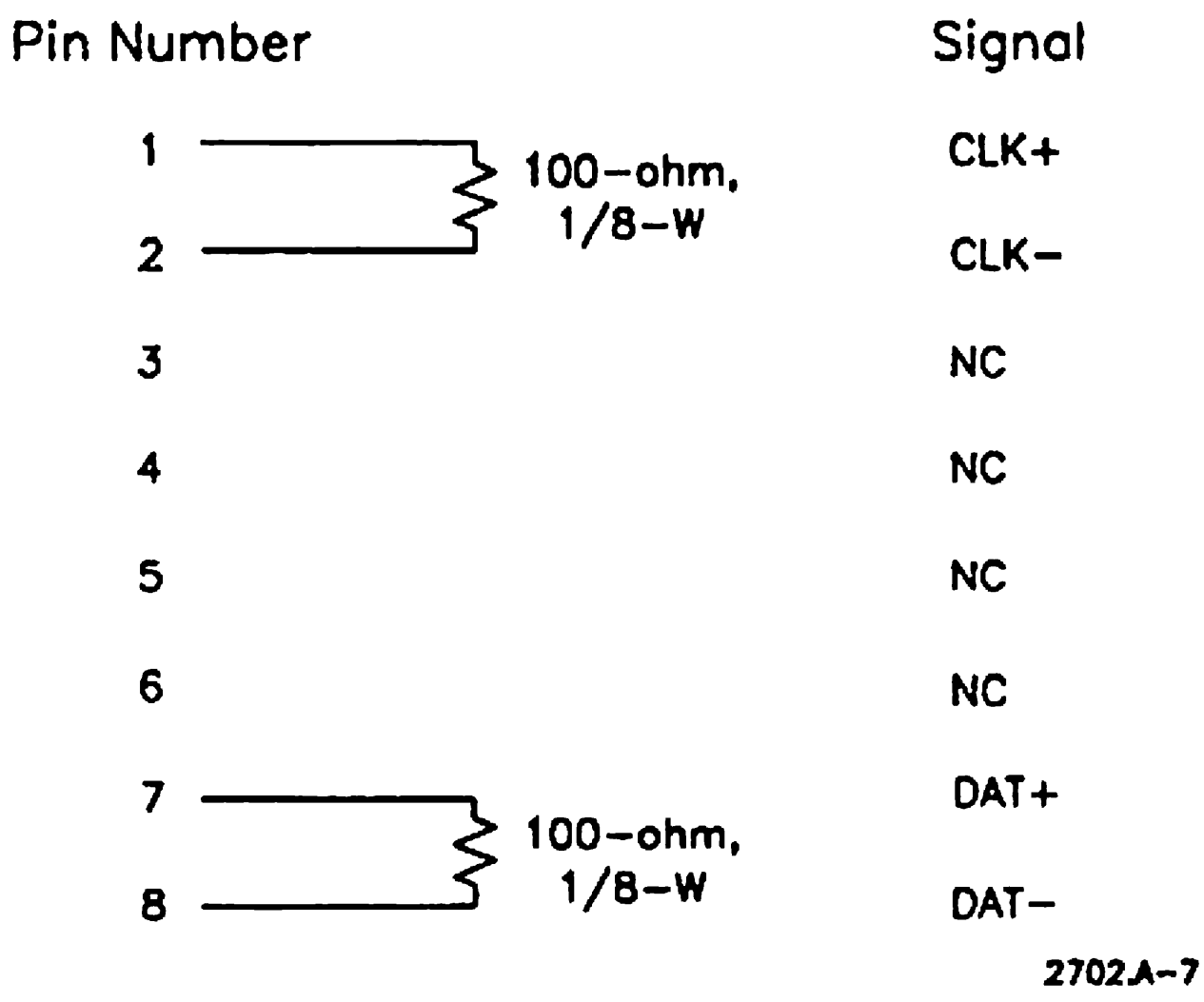


Item	Quantity	Description
1	As Needed	Two twisted pair cable, 28 AWG, stranded conductors, with foil and braid shield.
2	2	Fixed #4-40 female screwlocks.
3	1	Molded 9-pin D-subconnector, female.
4	1	8-position shielded RJ45 connector (must mate with AMP receptacle part number 555153-3

ClusterCard RJ45 Terminator Pin Assignments

A 100 ohm RJ45 terminator is required for an AT-bus ClusterCard that is at the end of a cluster daisy chain. The pin assignments are shown below (see Figure A–7).

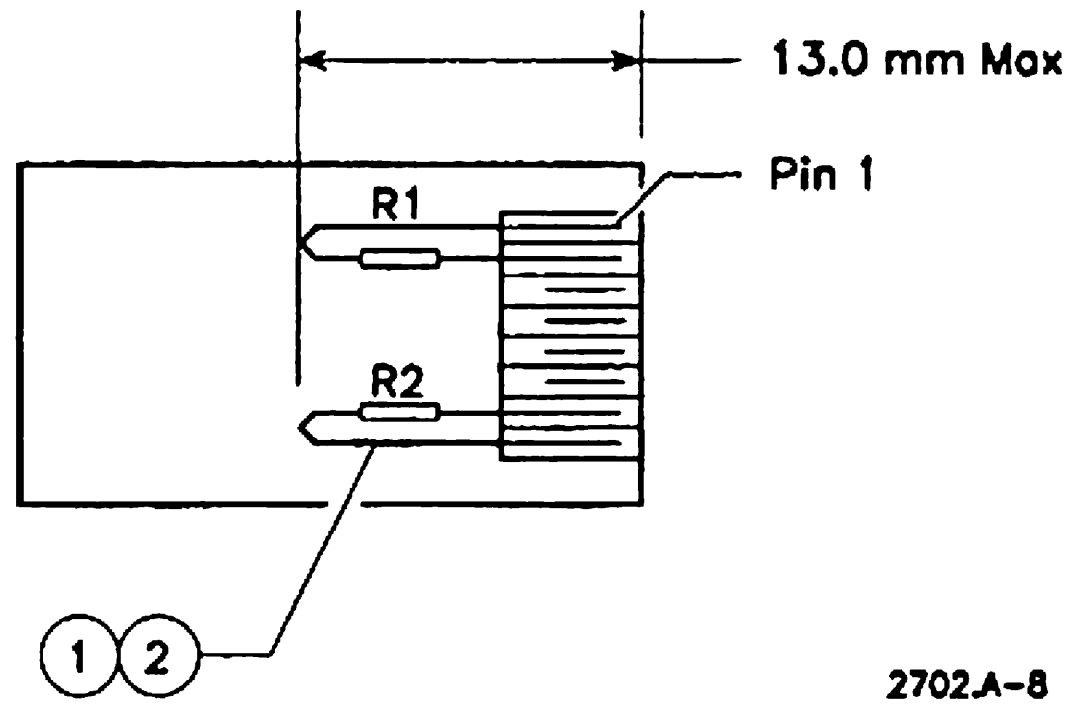
Figure A–7. RJ45 Terminator Pin Assignments



ClusterCard RJ45 Terminator Drawing

The 100 ohm RJ45 terminator is shown below (see Figure A–8). Insulated tubing should be placed over the leads of each resistor to prevent shorting. Crimp the resistor leads through the tubing.

Figure A–8. RJ45 Terminator Drawing



Item	Quantity	Description
1	2	100 ohm resistor, 1/8W, 2% carbon film with 26 AWG leads.
2	1	8 position modular jack, RJ45. Part must mate with AMP part number 555153-1

Unshielded Twisted Pair (TeleCluster)

You can use three sizes of unshielded twisted pair (UTP) for Advanced TeleCluster: all three sizes support the 3.7 Mbps cluster speed, but the larger cable can be used over greater distances. (See Section 5, "Installing TeleCluster," for more information.)

Cable Specifications

Tables A–3, A–4, and A–5 list the key specifications for TeleCluster cables..

Table A–3. 22 AWG UTP Cable Specifications

Category	Specification
Impedance	100 Ohm +/- 15 Ohms from 1 MHz to 4 MHz
Attenuation	Max: 6.5 dB/K ft @ 1 MHz 14.2 dB/K ft @ 4 MHz 26.0 dB/K ft @ 10 MHz
Near-end Crosstalk	Min: 41 dB/K ft @ 1 MHz 32 dB/K ft @ 4 MHz 26 dB/K ft @ 10 MHz
Wire	22 AWG solid copper conductors (twisted pairs, 2 turns per foot)
Conductor Resistance	Max: 17.6 Ohm/K ft @ 20C

Table A–4. 24 AWG UTP Cable Specifications

Category	Specification
Impedance	100 Ohm +/- 15 Ohms from 1 MHz to 4 MHz
Attenuation	Max: 7.8 dB/K ft @ 1 MHz 16.0 dB/K ft @ 4 MHz 30.0 dB/K ft @ 10 MHz
Near-end Crosstalk	Min: 41 dB/K ft @ 1 MHz 32 dB/K ft @ 4 MHz 26 dB/K ft @ 10 MHz
Wire	24 AWG solid copper conductors (twisted pairs, 2 turns per foot)
Conductor Resistance	Max: 28.6 Ohm/K ft @ 20C

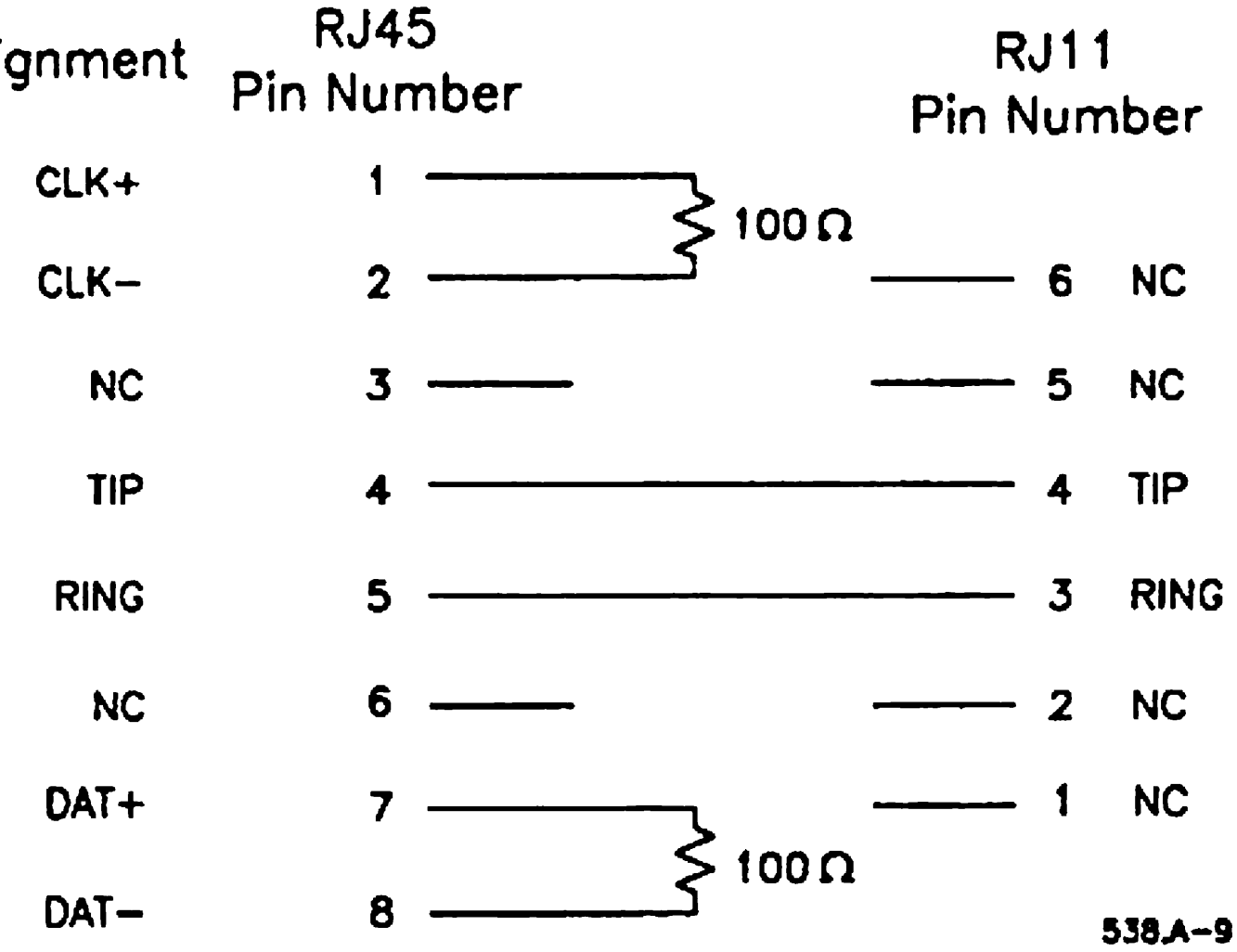
Table A–5. 26 AWG UTP Cable Specifications

Category	Specification
Impedance	100 Ohm +/- 15 Ohms from 1 MHz to 4 MHz
Attenuation	Max: 8.6 dB/K ft @ 1 MHz 18.6 dB/K ft @ 4 MHz 34.9 dB/K ft @ 10 MHz
Near-end Crosstalk	Min: 41 dB/K ft @ 1 MHz 32 dB/K ft @ 4 MHz 26 dB/K ft @ 10 MHz
Wire	26 AWG solid copper conductors (twisted pairs, 2 turns per foot)
Conductor Resistance	Max: 44.7 Ohm/K ft @ 20C

RJ11-RJ45 TeleCluster Adapter Cable Pin Assignments

The RJ11-RJ45 adapter cable can be used to connect the AT-bus ClusterCard to an RJ11 modular wall jack in a TeleCluster network. The pin assignments are shown below (see Figure A–9).

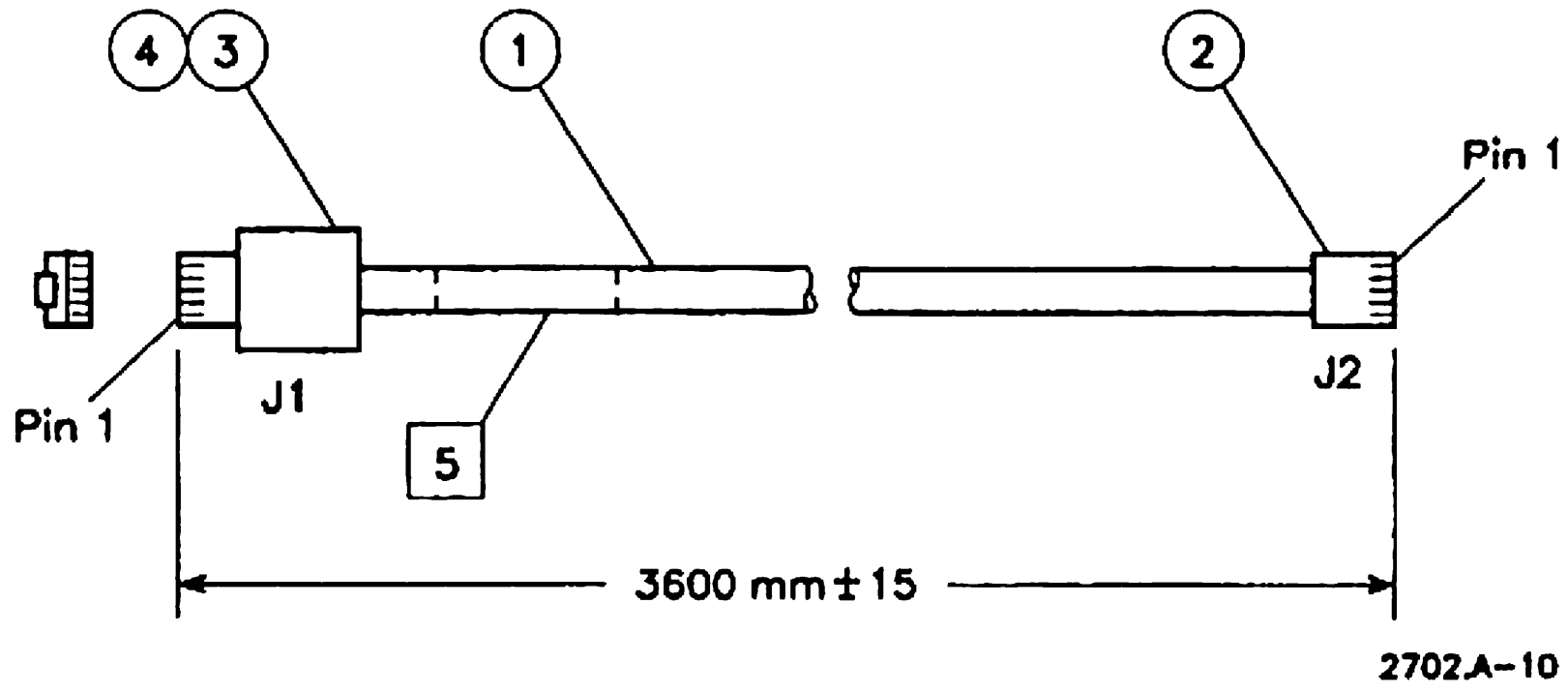
Figure A–9. RJ11-RJ45 Adapter Pin Assignments



RJ11-RJ45 TeleCluster Adapter Cable Drawing

The RJ11-RJ45 adapter cable is shown below (see Figure A–10). Insulated tubing should be placed over resistor leads to prevent shorting. The cable drain wire and foil shield **must** be connected to the connector shield at J1.

Figure A–10. RJ11-RJ45 Adapter Drawing



Item	Quantity	Description
1	As Needed	26 AWG stranded, 4-wire flat cable with foil shield.
2	1	6-position modular connector (RJ11), unshielded
3	1	8 position shielded modular connector (RJ45). Part must mate with AMP part number 555153-3
4	2	100 ohm resistor, 1/8W, 2% carbon film with 26 AWG leads.

Ethernet Cable

Complete specifications for 10Base5 and 10Base2 coaxial cable, MAUs, and AUI drop cables are provided in the following documents:

- *ANSI / IEEE Standard 802.3–1988*
- *International Standard ISO 8802-3: 1989*

RJ45-RJ45 10BaseT Cable (Workstation to Wall Outlet)

To connect a SuperGen Series 5000 workstation to a 10BaseT hub, a 10BaseT cable is required. This cable connects the Ethernet adapter in the workstation to the RJ45 wall outlet used for the 10BaseT network.

The cable should be LAN grade unshielded twisted pair, with 8-pin modular connectors (RJ45) on each end.

RJ45-RJ45 10BaseT Cable Specifications

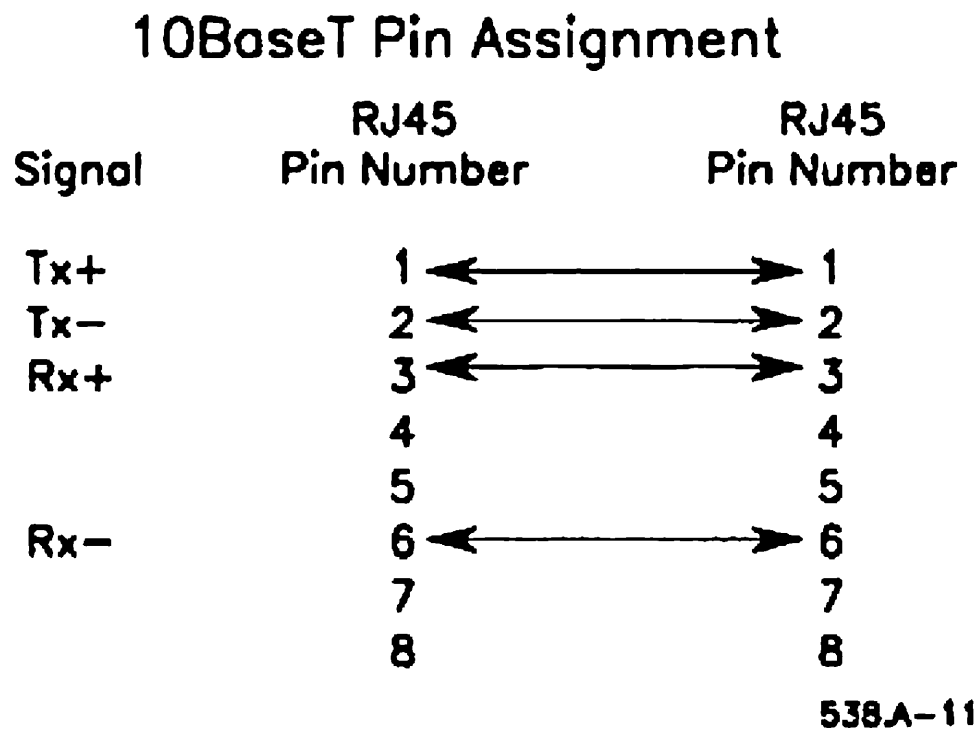
Table A–6. 10BaseT Cable Specifications

Category	Specification
Impedance	100 Ohm +/- 15 Ohms @ 10 MHz
Attenuation	Max: 8 dB/K ft @ 1MHz 30 dB/K ft @ 10 MHz
Near-end Crosstalk	Min:26 dB/K ft @ 10 MHz
Wire	Four 24 AWG solid conductors (2 twisted pair)
Capacitance	19 pF/ft
Wire Color code	Transmit pair (pins 1 and 2) are white/green and green white; Receive pair (pins 3 and 6) are white/orange and orange/white
Shield	Unshielded

RJ45-RJ45 10BaseT Pin Assignments

The pin assignments for the 10BaseT cable are shown in Figure A–11.

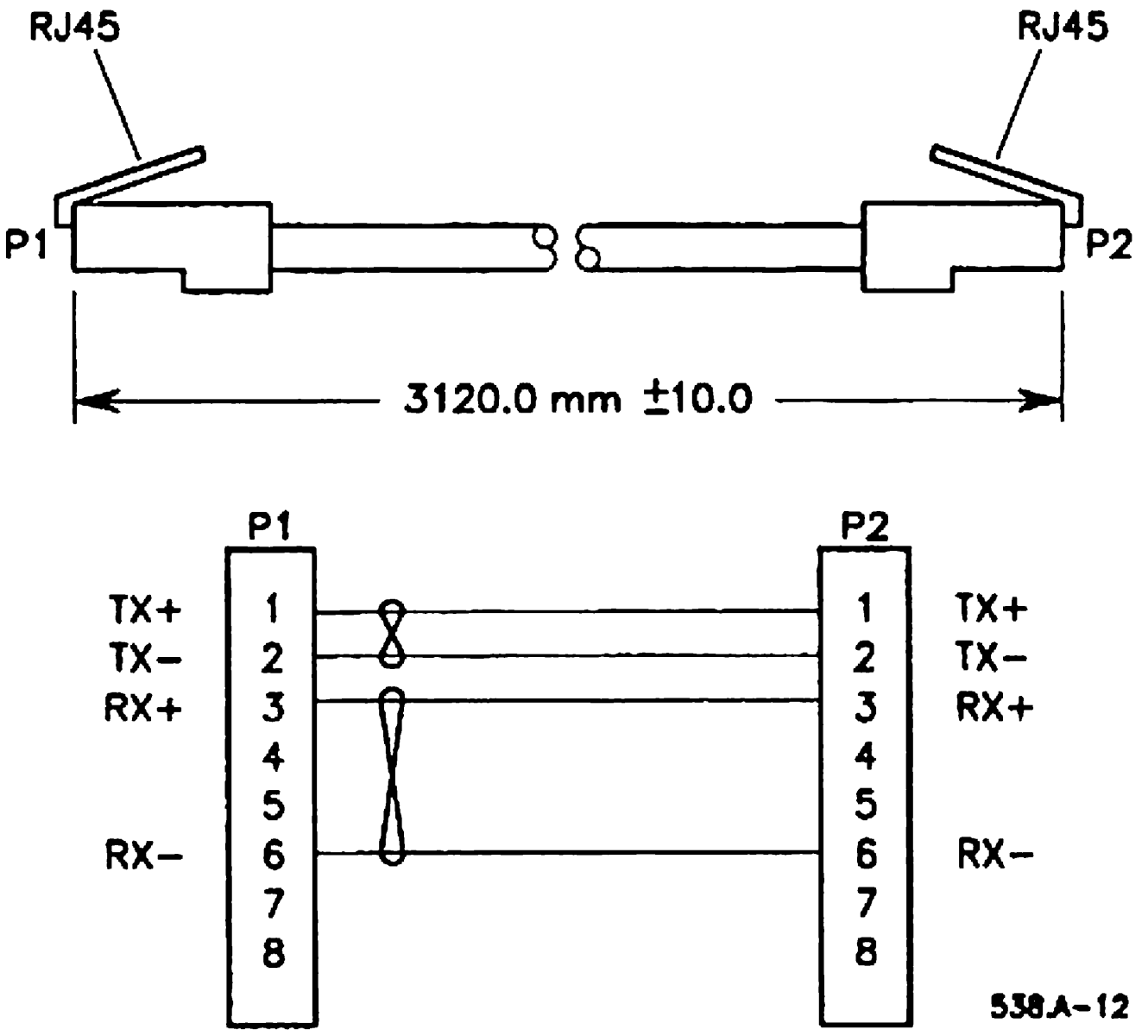
Figure A–11. 10BaseT Cable Pin Assignments



RJ45-RJ45 10BaseT Cable Drawing

The drawing for the 10BaseT cable is shown in Figure A–12.

Figure A–12. 10BaseT Cable Drawing



Token Ring Cable

The cable most commonly used for token ring is IBM Type 1, Type 2, Type 6, or Type 9 cable. Tables A–6 through A–10 list the specifications.

Table A–7. Type 1 Cable Specifications

Category	Specification
Impedance	150 Ohm +/- 15 Ohms, 1 MHz to 4 MHz
Attenuation	Max: 6.7 dB/K ft @ 4 MHz 13.7 dB/K ft @ 10 MHz
Near-end Crosstalk	Min:58 dB/K ft, 3 to 5 MHz; 40 dB/K ft, 12 to 20 MHz
Wire	Four 22 AWG, solid, (2 twisted pair)
Resistance	Max: 17.4 Ohm/K ft @ 20C
Color code	Pair 1 red/green; pair 2 orange/black
Shield	Aluminized tape wrapped each pair, tinned copper braid with 65% braid coverage

Table A–8. Type 2 Cable Specifications (Data Pairs)

Category	Specification
Impedance	150 Ohm +/- 15 Ohms from 1Mb/s to 4 Mb/s
Attenuation	Max: 6.7 dB/K ft @ 4 MHz 13.7 dB/K ft @ 10 MHz
Near-end Crosstalk	Min: 58 dB/K ft, 3 to 5 MHz; 40 dB/K ft, 12 to 20 MHz]
Wire	Four 22 AWG, solid, (2 twisted pair)
Resistance	Max: 17.4 Ohm/K ft @ 20C
Color code	Pair 1 red/green; pair 2 orange/black
Shield	Aluminized tape wrapped around each pair, tinned copper braid with 65% braid coverage

Table A–9. Type 2 Cable Specifications (Voice Pairs)

Category	Specification
Impedance	100 Ohm +/- 25 Ohms from 1 Mb/s to 4 Mb/s
Attenuation	Not specified
Near-end Crosstalk	Min: 33 dB/K ft from 3 MHz to 5 MHz
Wire	Eight 22 AWG solid conductors (4 twisted pair)
Conductor	Max: 17.4 Ohm/K ft @ 20C
Wire Color code	Pair 1: blue, pair 2: orange, pair 3: green, pair 4: brown
Shield	braid covers data pairs; voice pairs are next to data pairs but outside of braid

Table A–10. Type 6 Cable Specifications

Category	Specification
Impedance	150 Ohm +/- 15 Ohms from 1 Mb/s to 4 Mb/s
Attenuation	Max: 10.0 dB/K ft @ 4 MHz 20.1 dB/K ft @ 10 MHz
Near-end Crosstalk	Min: 52 dB/K ft from 3 MHz to 5 MHz, 34 dB/K ft from 12 MHz to 20 MHz
Wire	Four 26 AWG stranded conductors (2 twisted pair)
Conductor Resistance	Maximum: 46.0 Ohm/K ft @ 20C
Wire Color code	Pair 1 is red/green; pair 2 is orange/black
Shield	Aluminized tape wrapped around each pair, tinned copper braid with 65% braid coverage

Table A–11. Type 9 Cable Specifications

Category	Specification
Impedance	150 Ohm +/- 15 Ohms from 1 Mb/s to 4 Mb/s
Attenuation	Max: 10.0 dB/K ft @ 4 MHz 20.1 dB/K ft @ 16 MHz
Near end Crosstalk	Min: 52 dB/K ft from 3 MHz to 5 MHz; 34 dB/K ft from 12 MHz to 20 MHz
Wire	Four 26 AWG solid or stranded conductors (2 twisted pair)
Conductor Resistance	Max: 46.0 Ohm/K ft @ 20C
Wire Color code	Pair 1 is red/green; Pair 2 is orange/black
Shield	Aluminized tape wrapped around each pair, tinned copper braid with 65% braid coverage

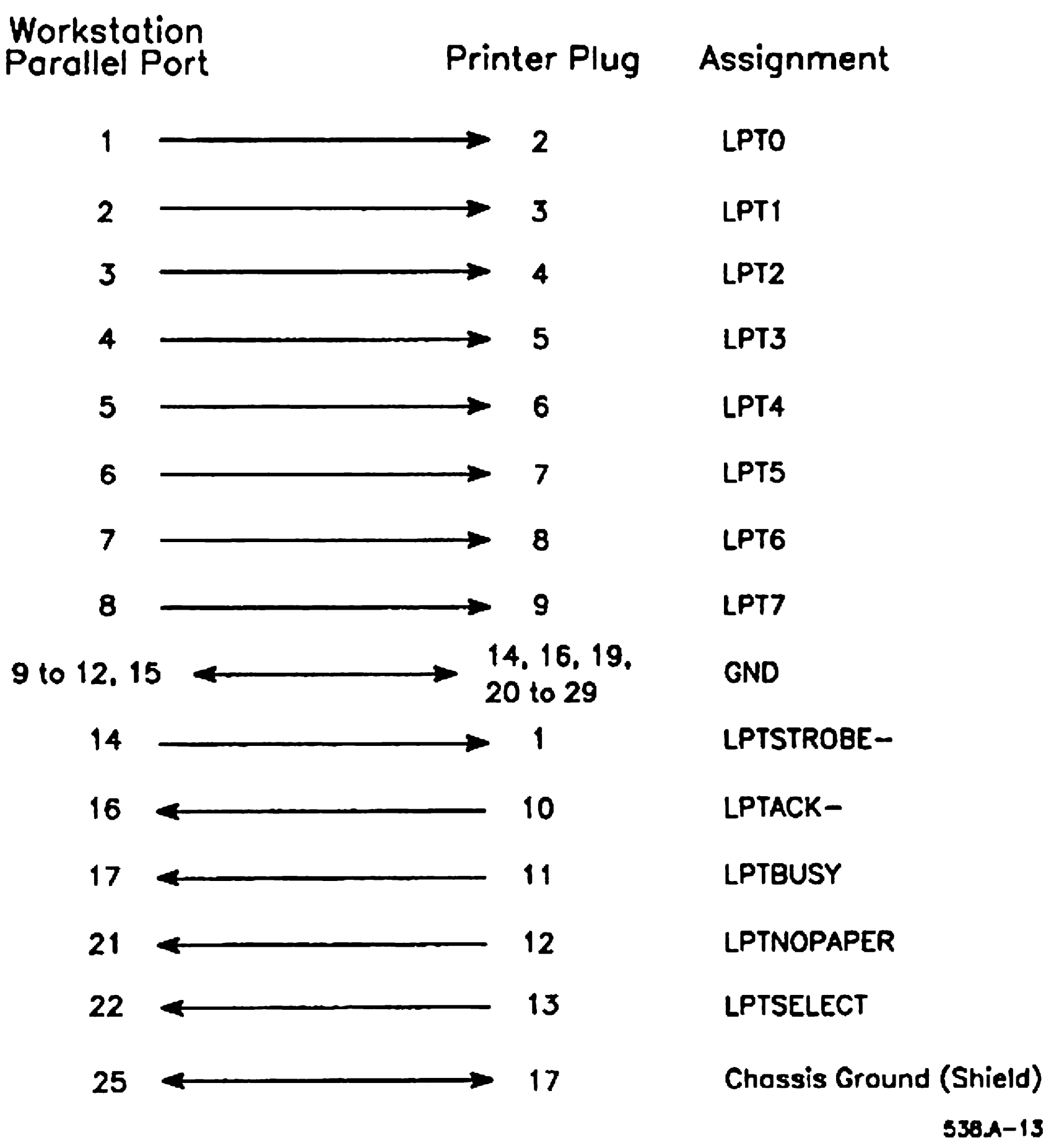
Parallel Cables

CTOS workstations and servers all provide at least one parallel port for use with parallel devices. The pin assignments and cable drawings for CTOS-compatible parallel cables are provided below.

Parallel Printer Cable Pin Assignments

The pin assignments for a parallel printer cable are shown below (see Figure A–13).

Figure A–13. Parallel Printer Cable Pin Assignments

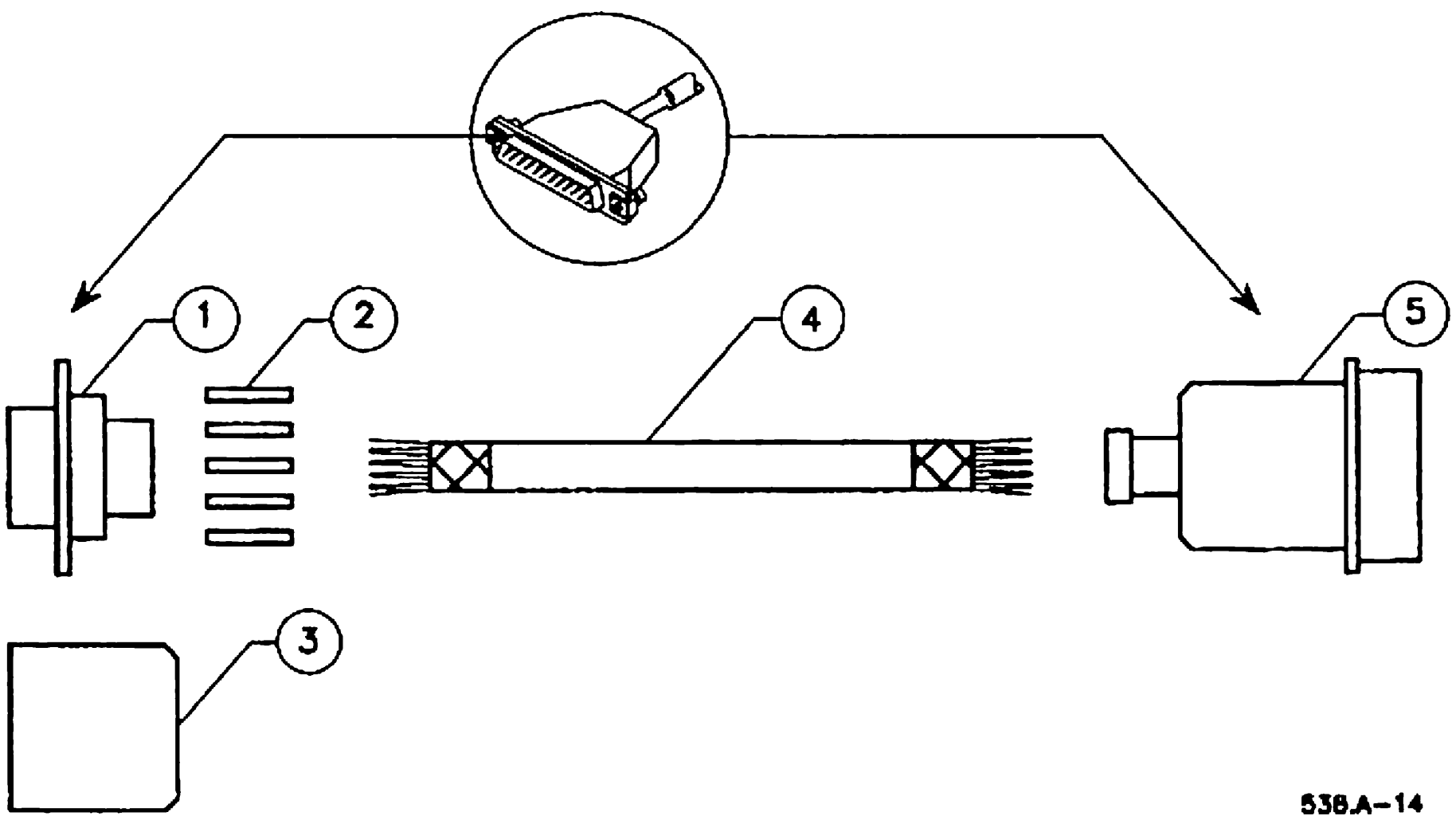


Parallel Printer Cable Drawing

A parallel printer cable drawing is provided below (see Figure A–14). In constructing the cable, follow these guidelines:

1. Use a tin-plated connector (don't use metal chromate).
2. Connect the chassis ground to the shield drain wire at both ends of the cable.
3. Use a metal backshell.
4. Strip the vinyl insulation back at the 36-pin printer connector so that the metal strain relief clamps down on the conducting shield.
5. Connect all four unused conductors in the cable to a ground at both ends of the cable.

Figure A–14. Parallel Printer Cable Drawing



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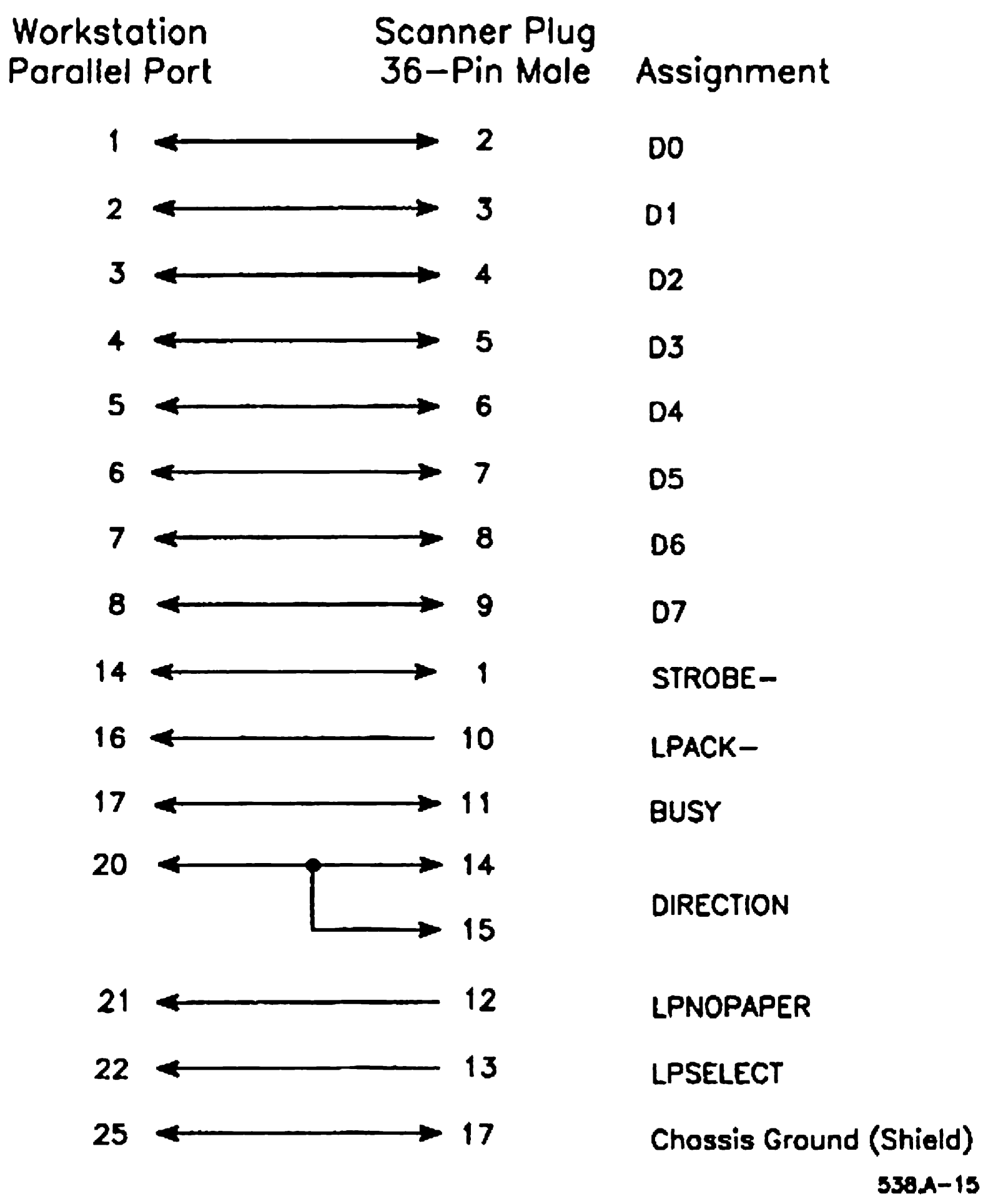
Item	Quantity	Description
1	1	25-pin D-type plug assembly (male). Use AMP part number 207464-2 or equivalent.
2	25	Connector contacts. Use AMP part number 66507-93 or equivalent.
3	1	Connector shell and strain relief. Use AMP part number 207908-7 or equivalent
4	As Needed	25-conductor (or 30-conductor) shielded cable.
5	1	36-pin "Blue Ribbon" type connector assembly (male). Use AMP part number 57-30360 or equivalent.

Parallel Scanner Cable Pin Functions

The pin functions for a parallel scanner cable are shown below (see Figure A–15).

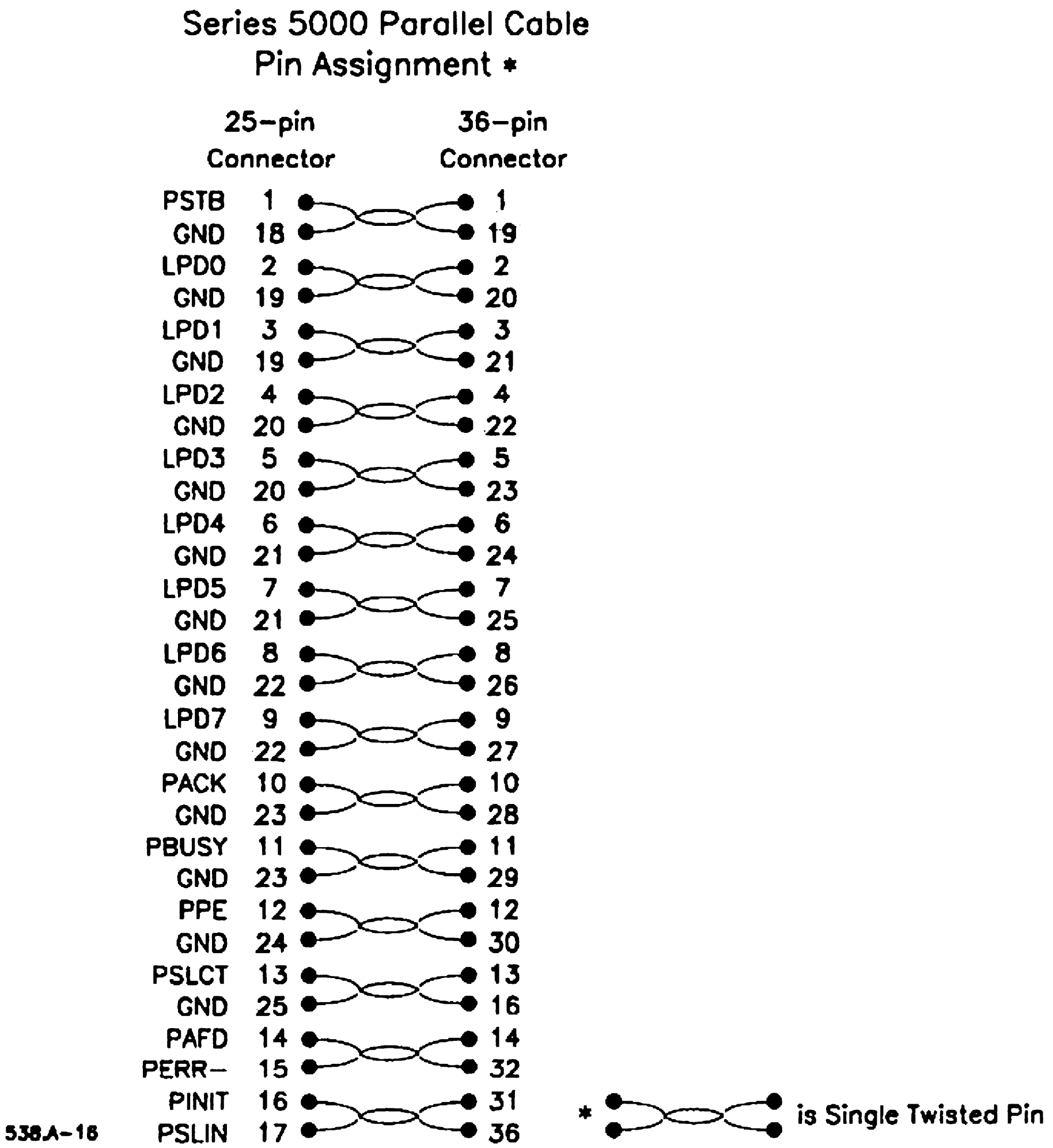
Figure A–15. Parallel Scanner Cable Pin Assignments



Series 5000 Parallel Cable Pin Assignments

The pin assignments for a Series 5000 parallel cable are shown below (see Figure A–16).

Figure A–16. Series 5000 Parallel Cable Pin Assignments

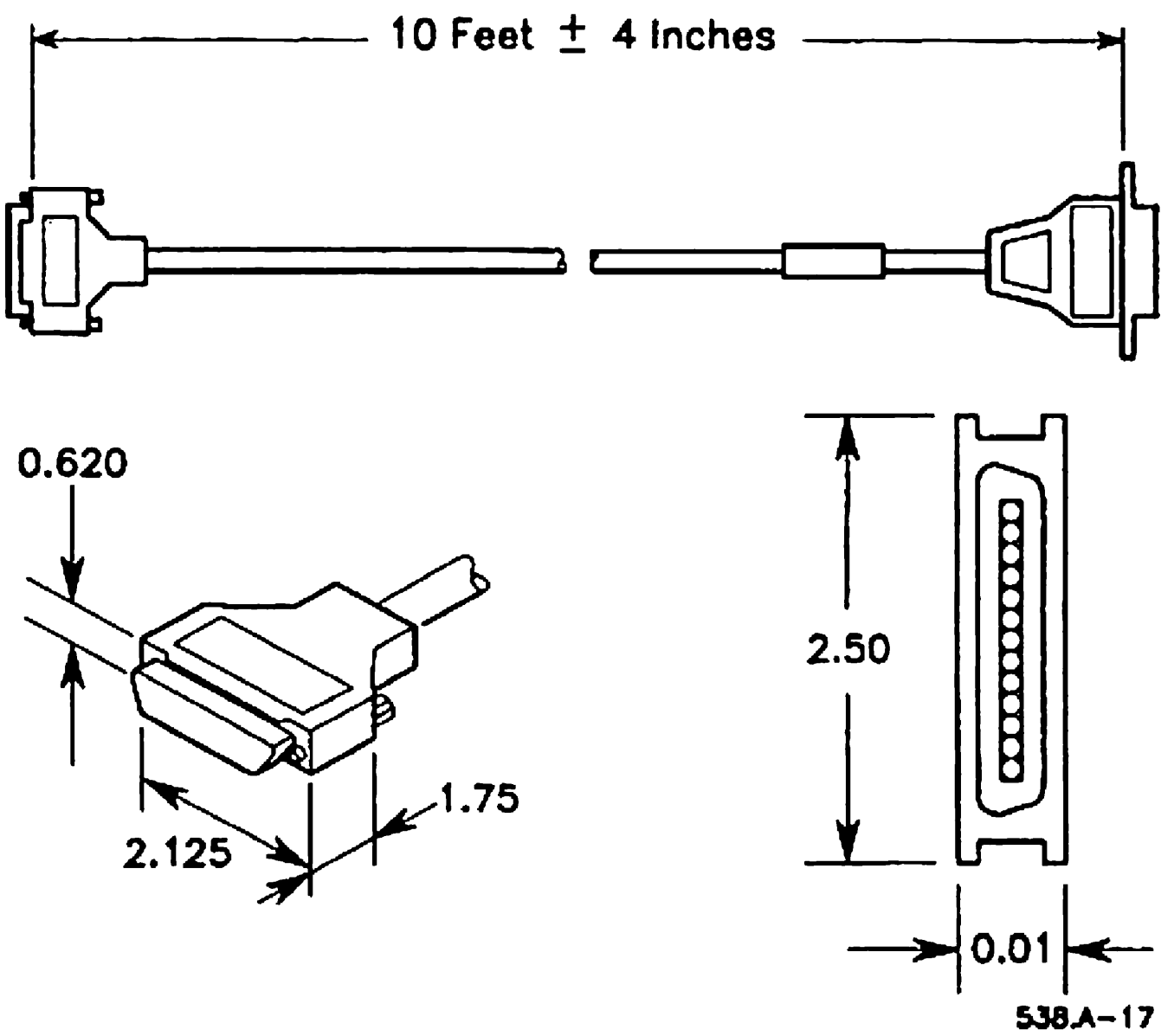


Parallel Printer Cable Drawing

A parallel printer cable drawing is provided below (see Figure A–17). In constructing the cable, follow these guidelines:

1. Use a tin-plated connector (don't use metal chromate).
2. Connect the chassis ground to the shield drain wire at both ends of the cable.
3. Use a metal backshell.
4. Strip the vinyl insulation back at the 36-pin printer connector so that the metal strain relief clamps down on the conducting shield.
5. Connect all four unused conductors in the cable to a ground at both ends of the cable.

Figure A–17. Series 5000 Parallel Cable Drawing



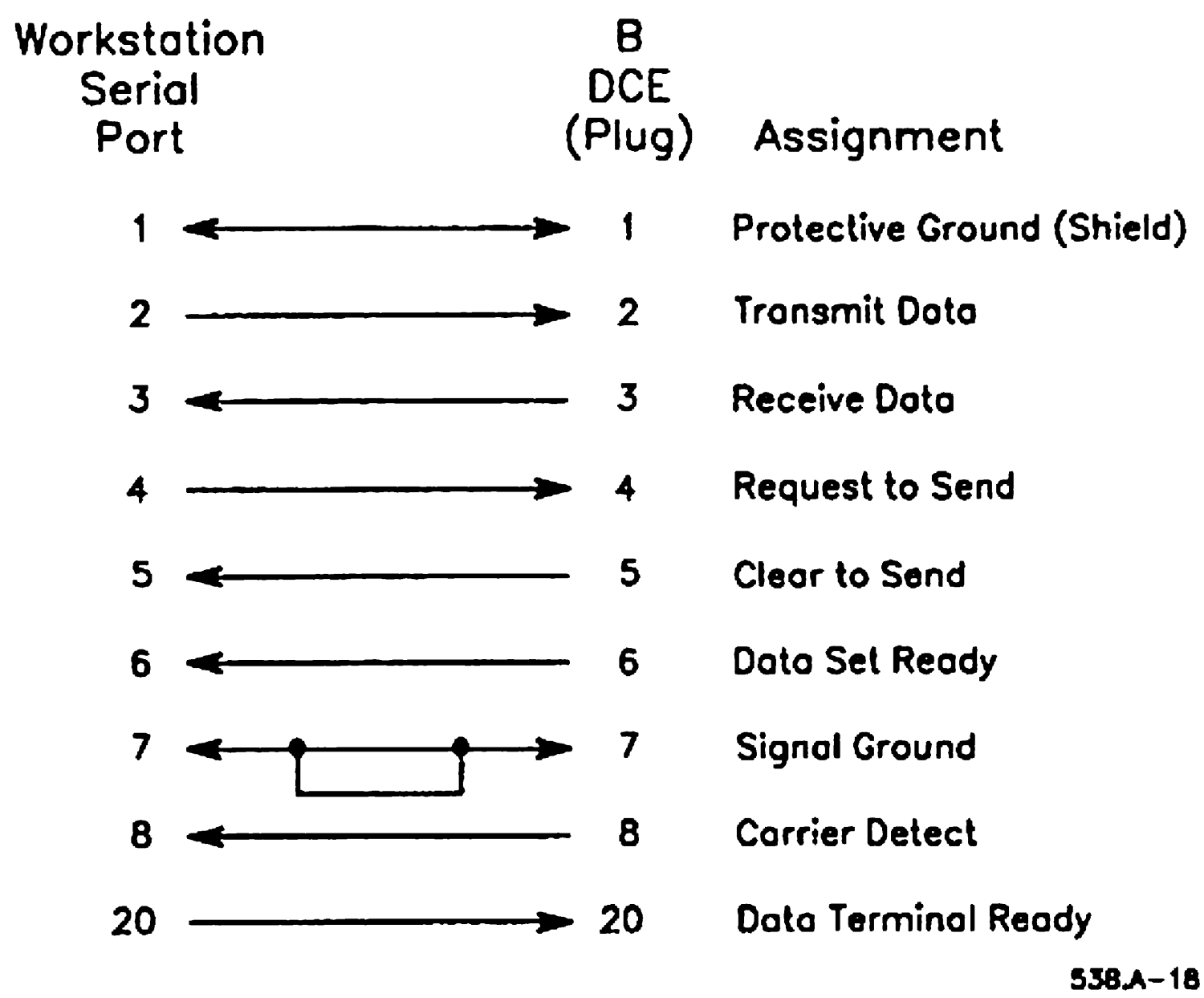
Serial Cables

CTOS workstations and servers all provide at least one RS-232 serial port for use with serial devices. The pin assignments and cable drawings for CTOS-compatible serial cables are provided below.

Modem Cable Pin Assignments (Straight Cable)

Pin assignments for a straight cable are listed below (see Figure A–18). A straight cable is used to connect a modem (DCE) to a workstation.

Figure A–18. Modem Cable Pin Assignments

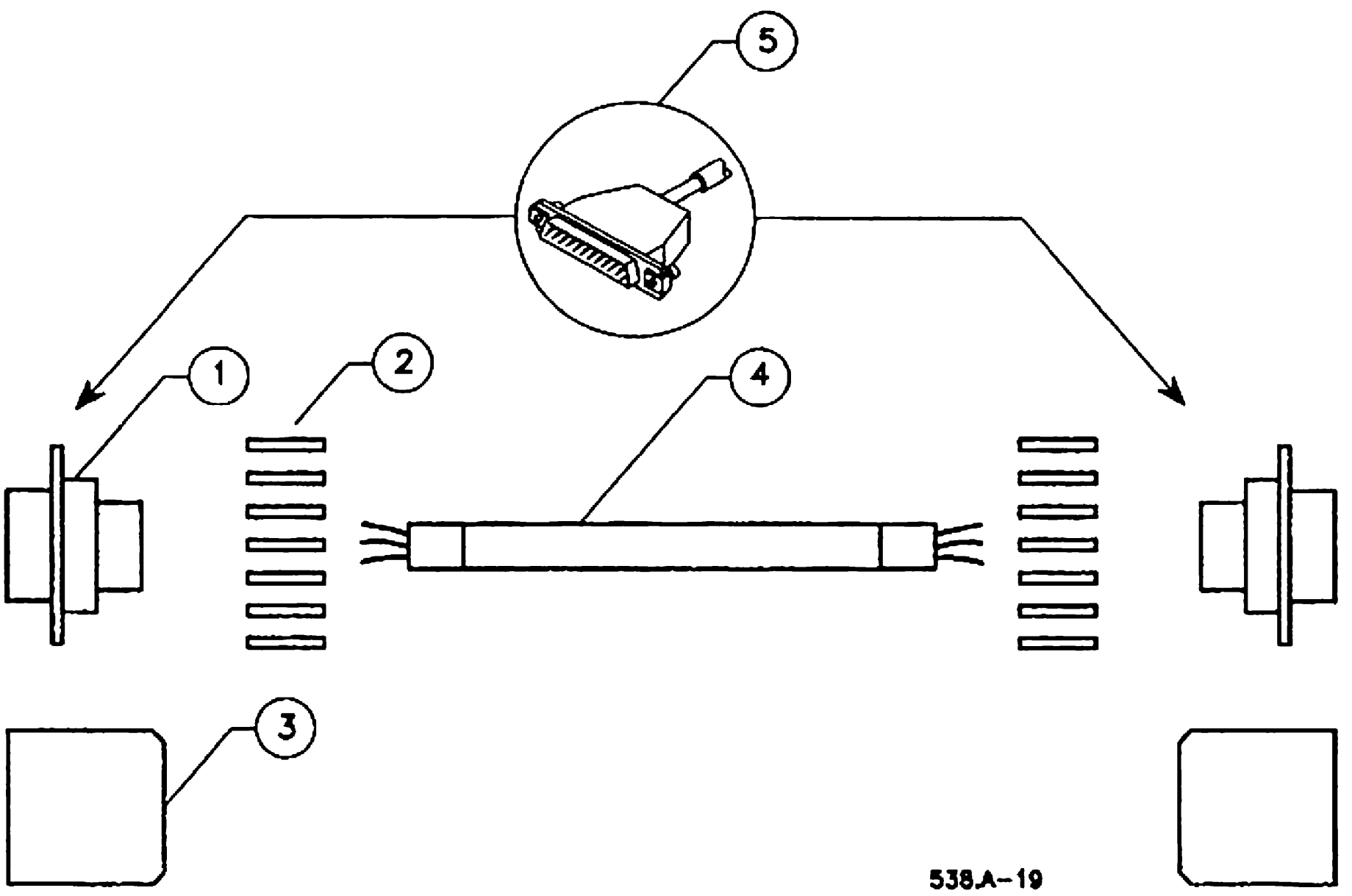


Modem Cable Drawing (Straight Cable)

A drawing for a straight cable is provided below (see Figure A–19). In constructing a straight cable, follow these guidelines:

1. Use a tin-plated connector (don't use yellow chromate).
2. Use a metal backshell.
3. Do not remove the ground wire.
4. Connect Pin 1 to the shield drain wire at both ends of the cable.
5. The additional conductor in the cable must be terminated at both ends to signal ground (Pin 7).

Figure A–19. Modem Cable Drawing



Item	Quantity	Description
1	2	25-pin D-type plug assembly (male). Use AMP part number 205208-2 or equivalent.
2	30	Connector contacts. Use AMP part number 66507-3 or equivalent.
3	2	Connector shell with strain relief. Use AMP part number 207908 or equivalent.
4	As Needed	15-conductor shielded cable.

Asynchronous Crossed Cable Pin Assignments

An asynchronous crossed cable is used to connect 2 workstations or a workstation and other data terminal equipment (DTE), such as a plotter or terminal. It is used for asynchronous communication only. The pin assignments are listed below (see Figure A–20). If the DTE uses XON/XOFF, see Figure A–21.

Figure A–20. Asynchronous Crossed Cable Pin Assignments

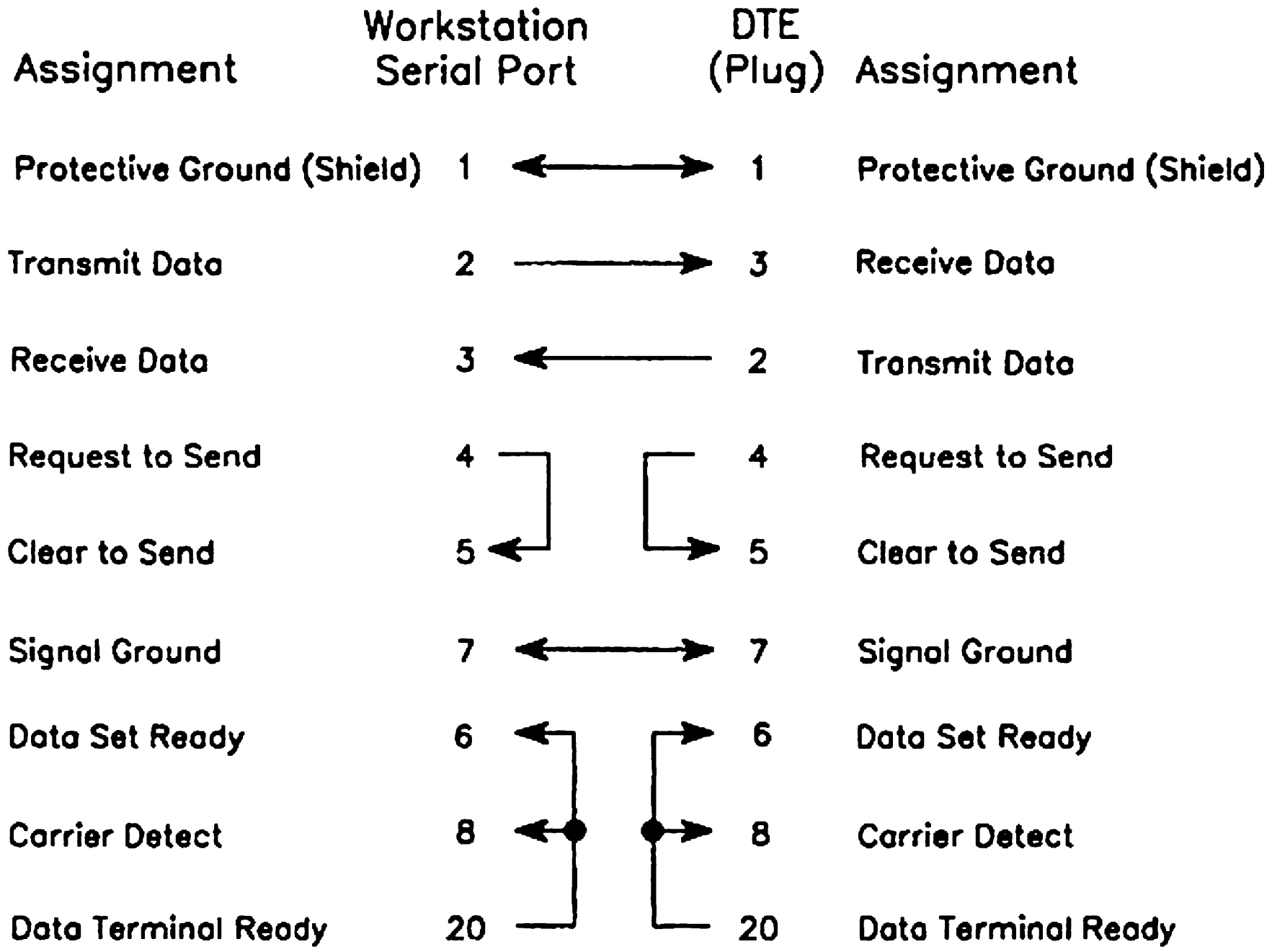


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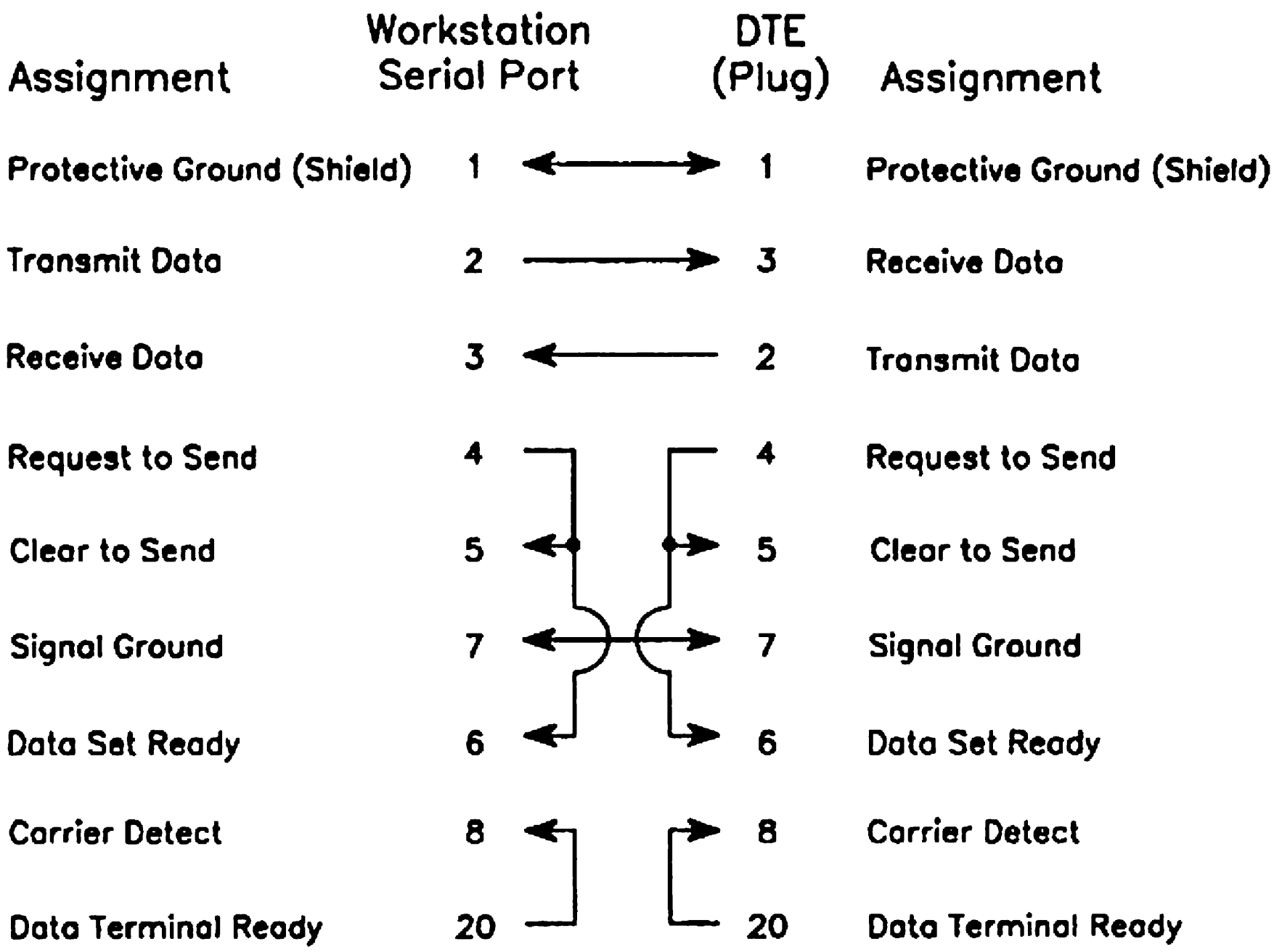
Figure A–21. Asynchronous Crossed Cable for XON/XOFF



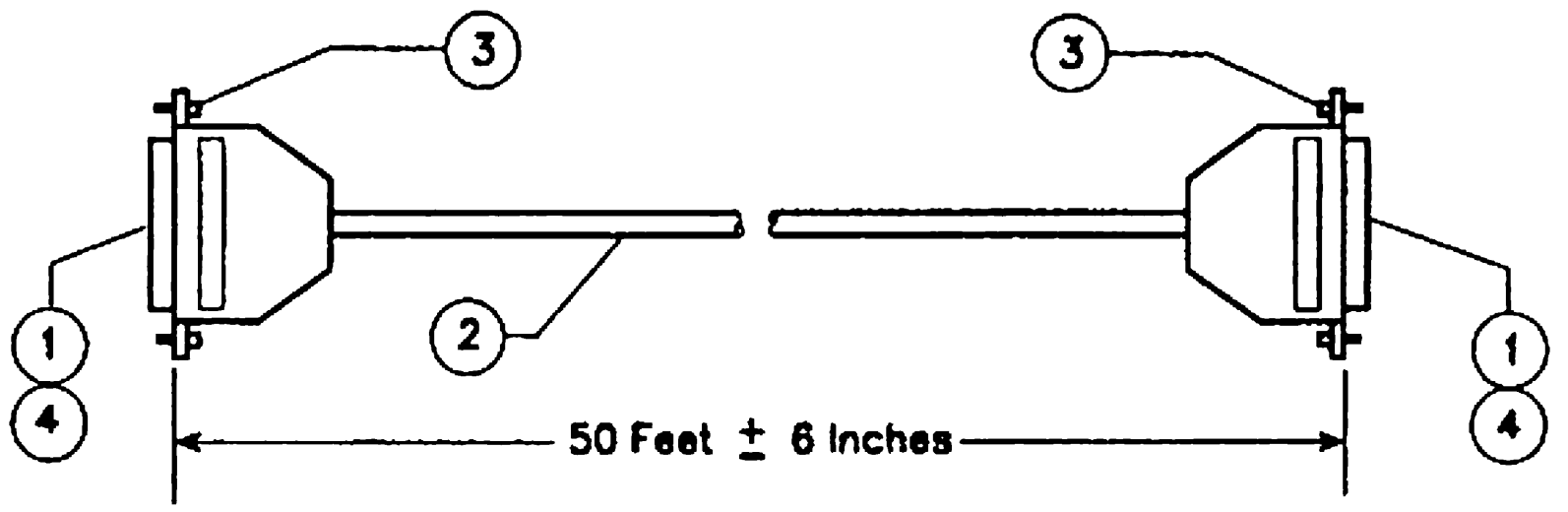
538A–21

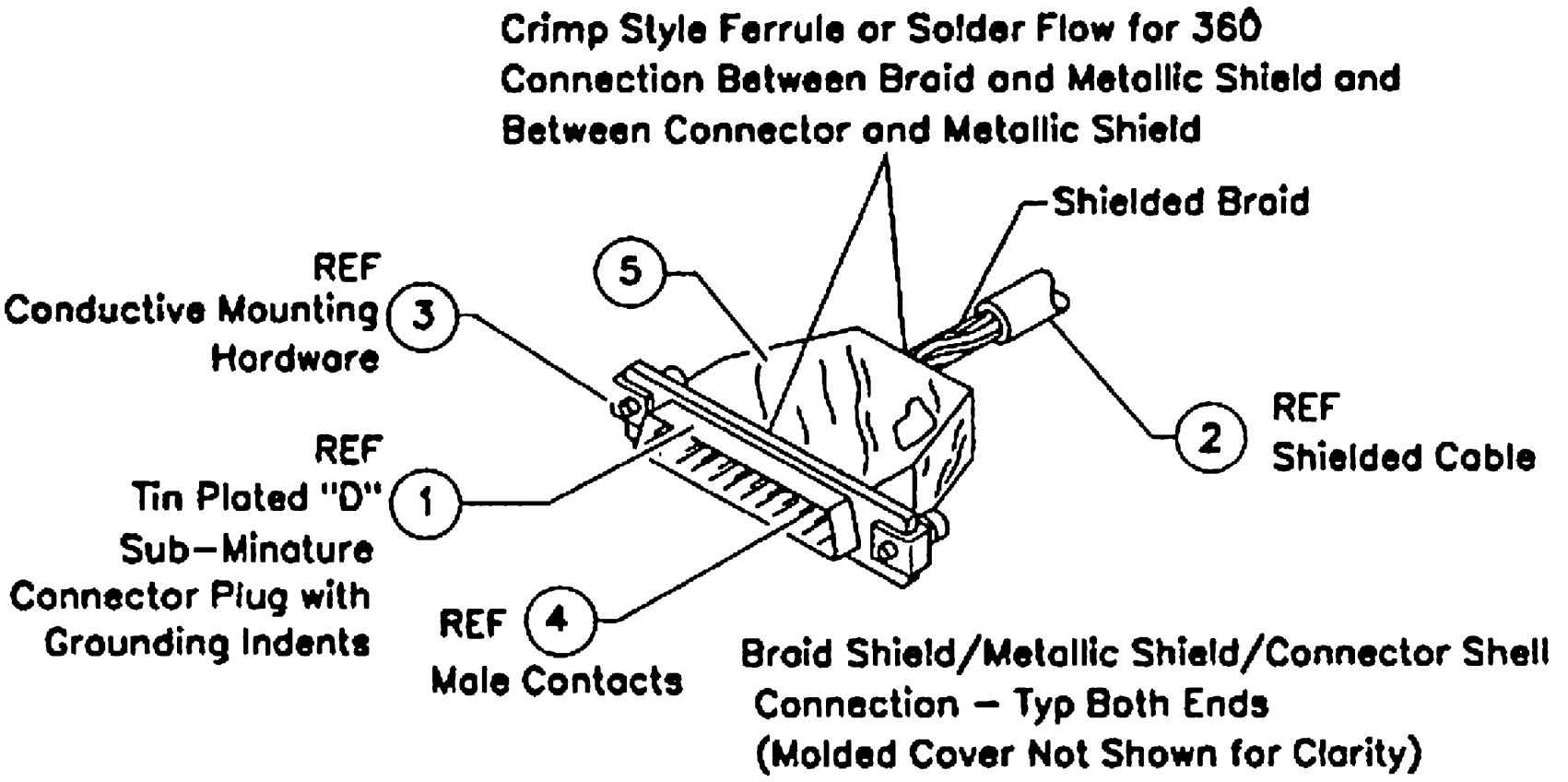
Asynchronous Crossed Cable Drawing

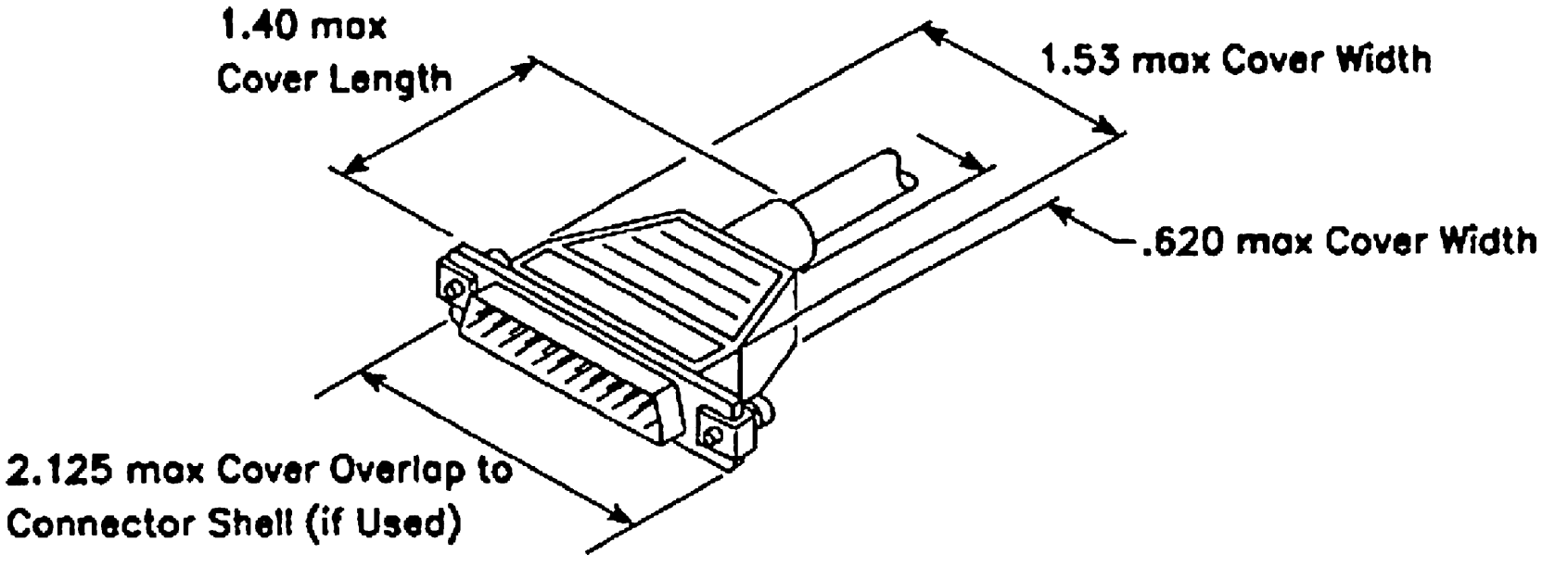
A drawing for an asynchronous crossed cable is provided below (see Figure A–22). In constructing an asynchronous crossed cable, follow these guidelines:

1. Use a tin-plated connector (don't use yellow chromate).
2. Use a metal backshell.
3. Do not remove the ground wire.
4. Connect Pin 1 to the shield drain wire at both ends of the cable.
5. Make sure the primary conductors are fully encompassed by the inner mold. (The inner mold must provide strain relief.)
6. Make sure the copper foil shield covers the inner mold.
7. Make sure the cable jacket is fully encompassed by the molded cover. (The molded cover must provide strain relief for the cable jacket.)

Figure A–22. Asynchronous Crossed Cable Drawing







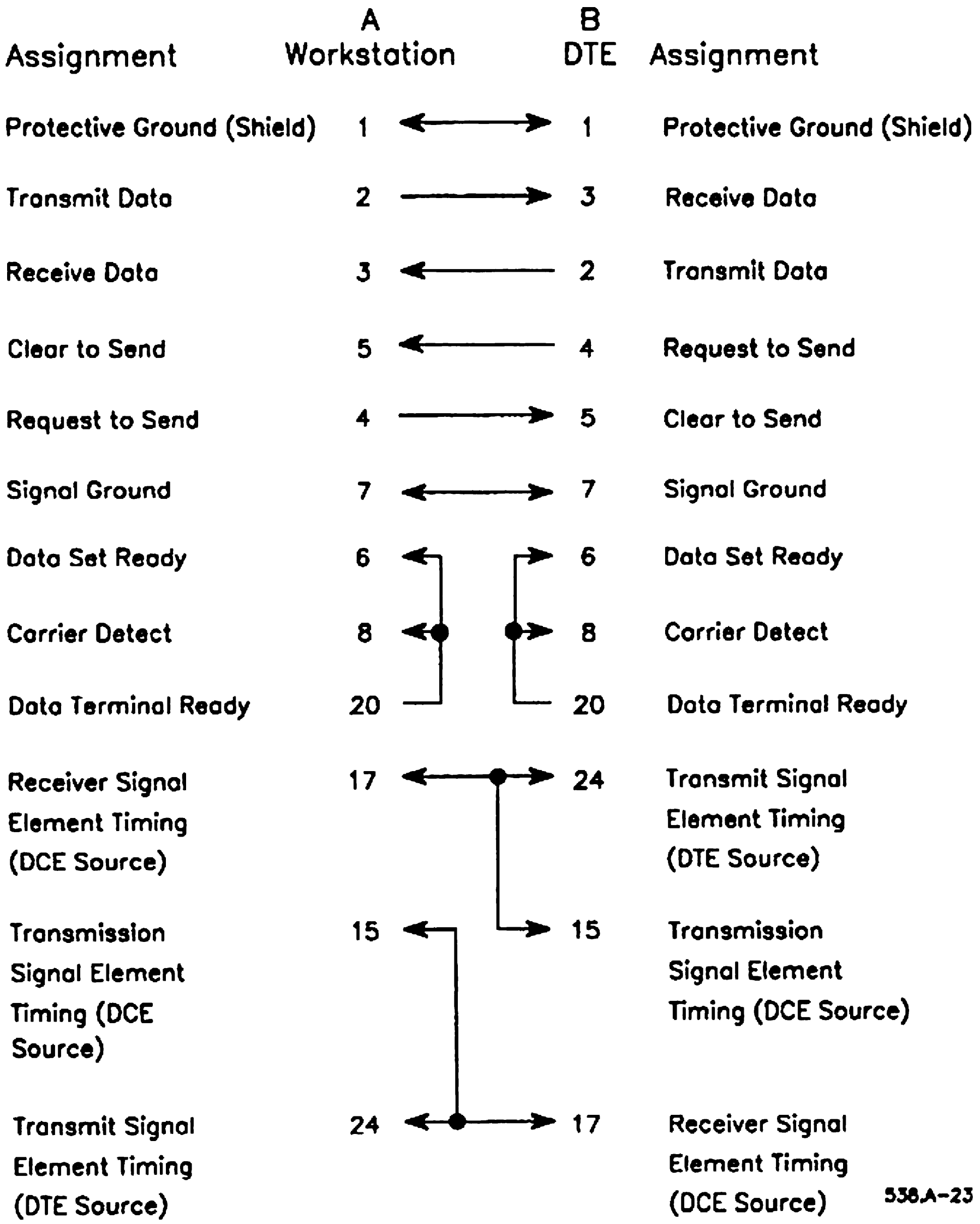
Molded Cover Construction – Typ Both Ends 538A–22

Item	Quantity	Description
1	1	25-pin D-type plug assembly (male). Use AMP part number 207464-2 or equivalent.
2	As Needed	3-conductor shielded cable. (50 feet max)
3	4	Screw and retainer, male.
4	14	Connector contacts. Use AMP part number 66507-3 or equivalent.
5	As Needed	Copper foil.

Synchronous Crossed Cable Pin Assignments

A synchronous crossed cable is used to connect 2 workstations or a workstation and other data terminal equipment (DTE), such as a plotter or terminal. It has the clock lines required for synchronous communication. The pin assignments are listed below (see Figure A–23).

Figure A–23. Synchronous Crossed Cable Pin Assignments



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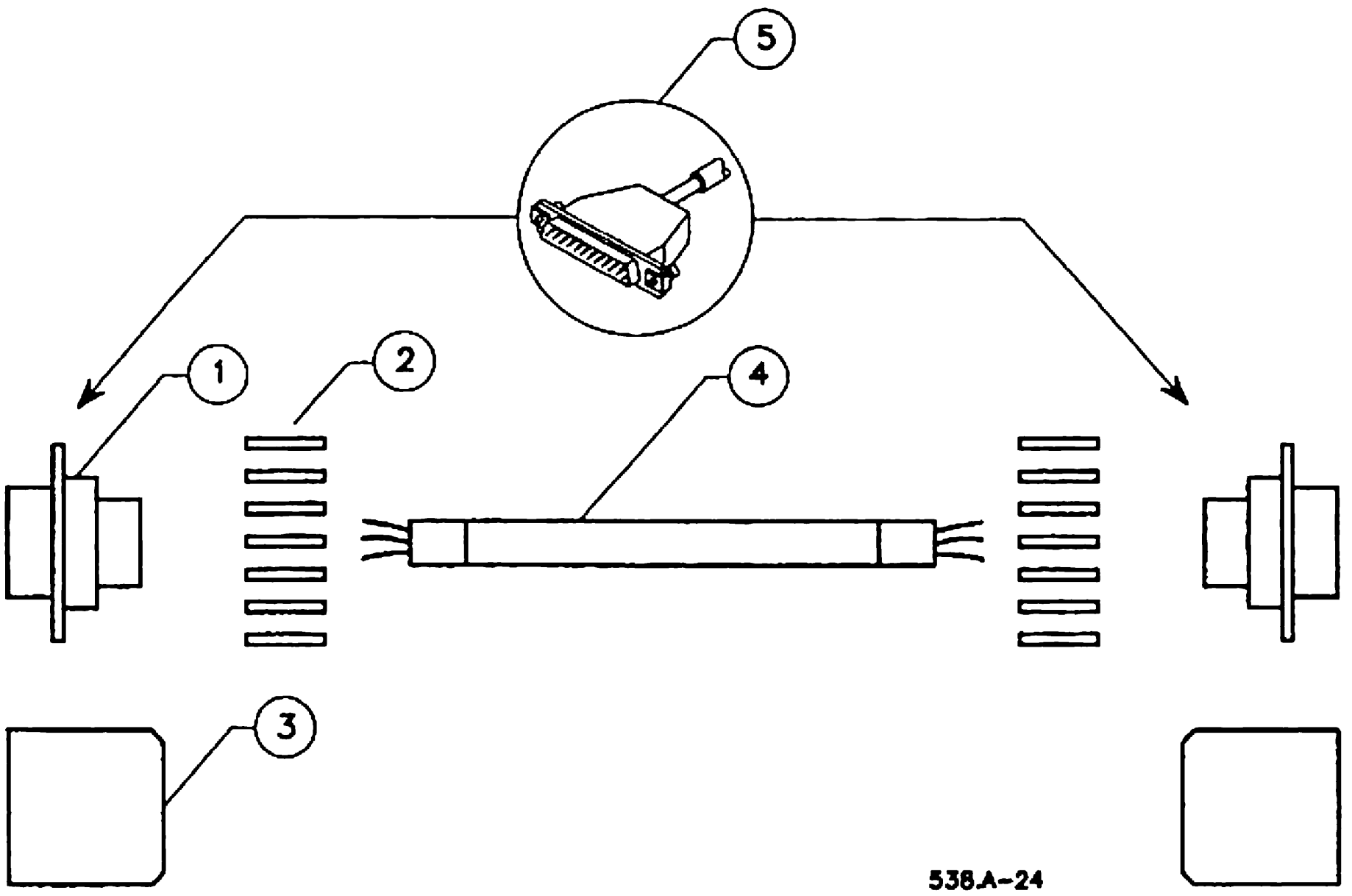
Synchronous Crossed Cable Drawing

A drawing for a synchronous crossed cable is provided below (see Figure A–24). In constructing a synchronous crossed cable, follow these guidelines:

1. Use a tin-plated connector (don't use yellow chromate).
2. Use a metal backshell.
3. Do not remove the ground wire.
4. Connect Pin 1 to the shield drain wire at both ends of the cable.

Figure A–24. Synchronous Crossed Cable Drawing

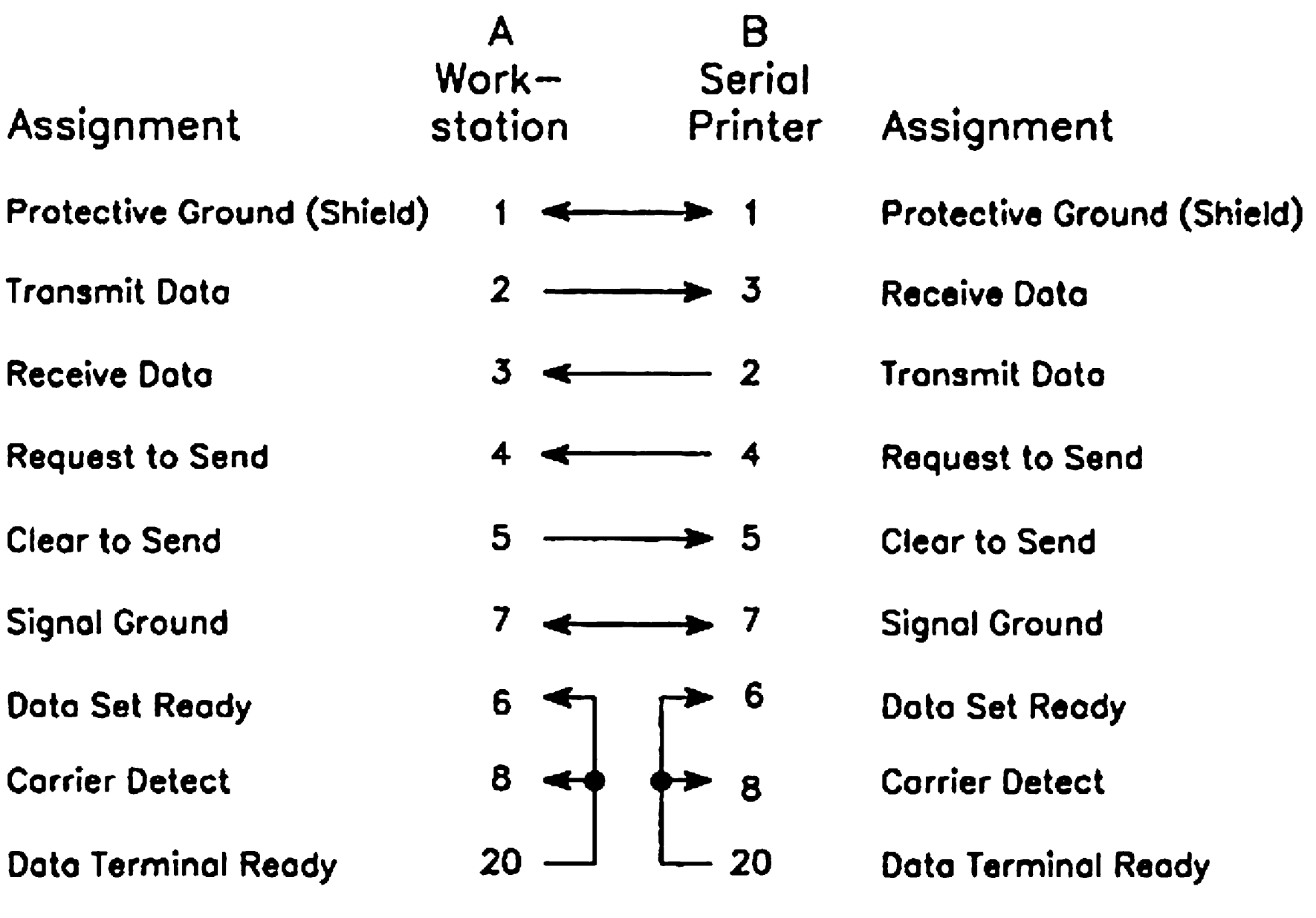


Item	Quantity	Description
1	2	25-pin D-type plug assembly (male). Use AMP part number 207464-2 or equivalent.
2	24	Connector contacts. Use AMP part number 66507-6 or equivalent.
3	2	Connector strain reliefs. Use AMP part number 207908-7 or equivalent.
4	As Needed	7-conductor shielded cable. (50 feet max)
5	As Needed	Copper foil.

Serial Printer or Scanner Cable Pin Assignments

The pin assigments for a serial printer or scanner are listed below (see Figure A–25).

Figure A–25. Serial Printer/Scanner Cable Pin Assignments

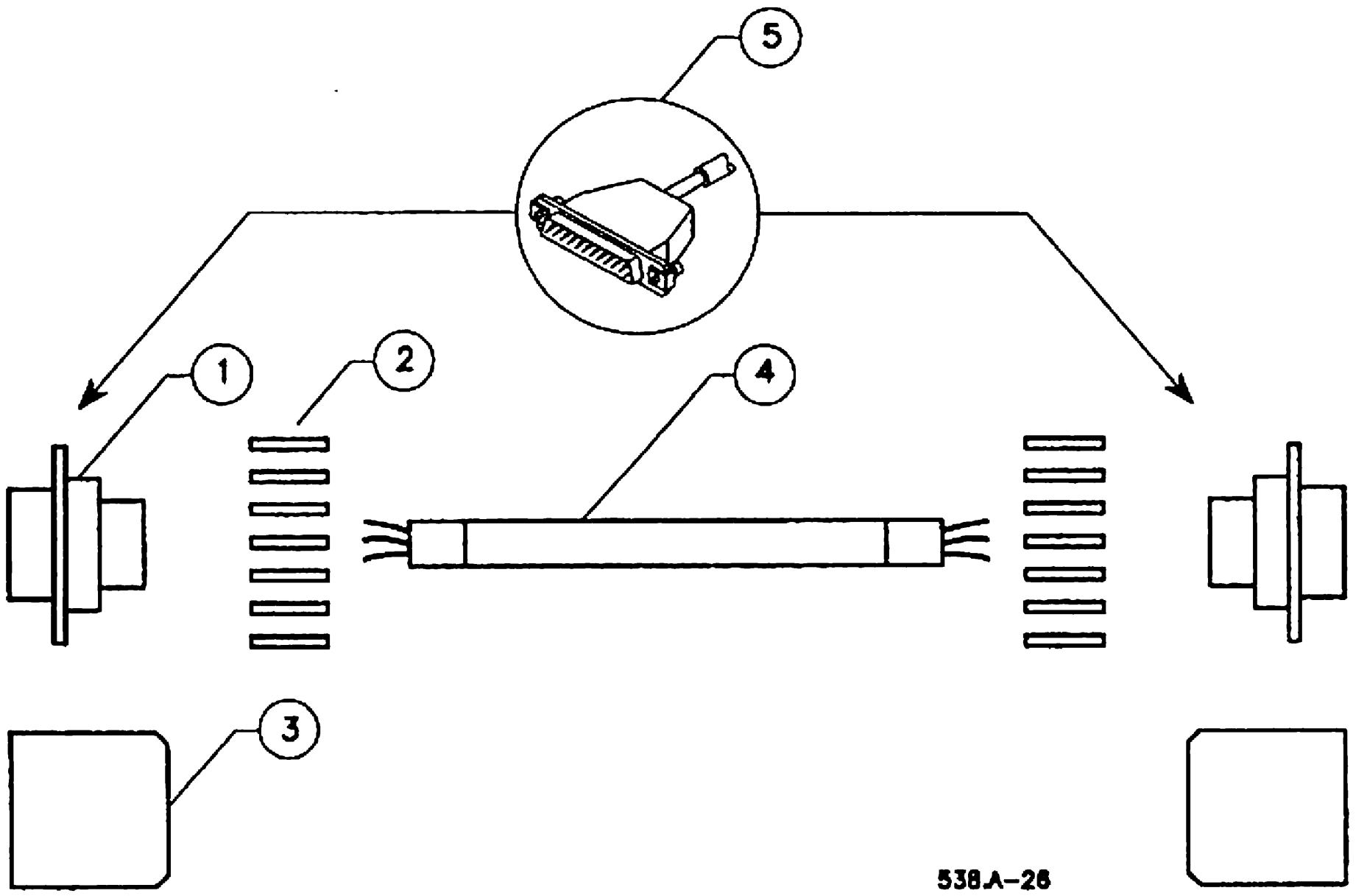


Serial Printer or Scanner Cable Drawing

A drawing for a serial printer or scanner cable is provided below (see Figure A–26). In constructing the cable, follow these guidelines:

1. Use a tin-plated connector (don't use yellow chromate).
2. Use a metal backshell.
3. Do not remove the ground wire.
4. Connect Pin 1 to the shield drain wire at both ends of the cable.

Figure A–26. Serial Printer/Scanner Cable Drawing

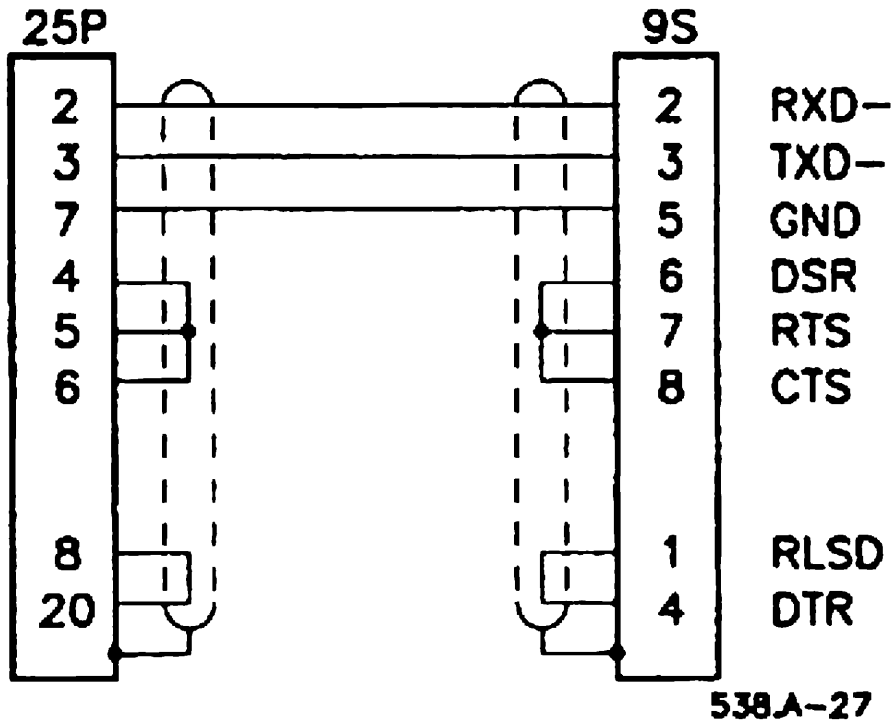


Item	Quantity	Description
1	2	25-pin D-type plug assembly (male). Use AMP part number 207464-2 or equivalent.
2	18	Connector contacts. Use AMP part number 66507-3 or equivalent.
3	2	Connector strain reliefs. Use AMP part number 207908-7 or equivalent.
4	As Needed	3-conductor shielded cable.
5	As Needed	Copper foil.

Series 2000/5000 Serial Cable Pin Assignments

Figure A–27 shows the pin assigments for the DB9-DB25 serial cable used by the 9-pin serial port on the Series 2000 and Series 5000 workstations.

Figure A–27. Series 2000/5000 Serial Cable Pin Assignments

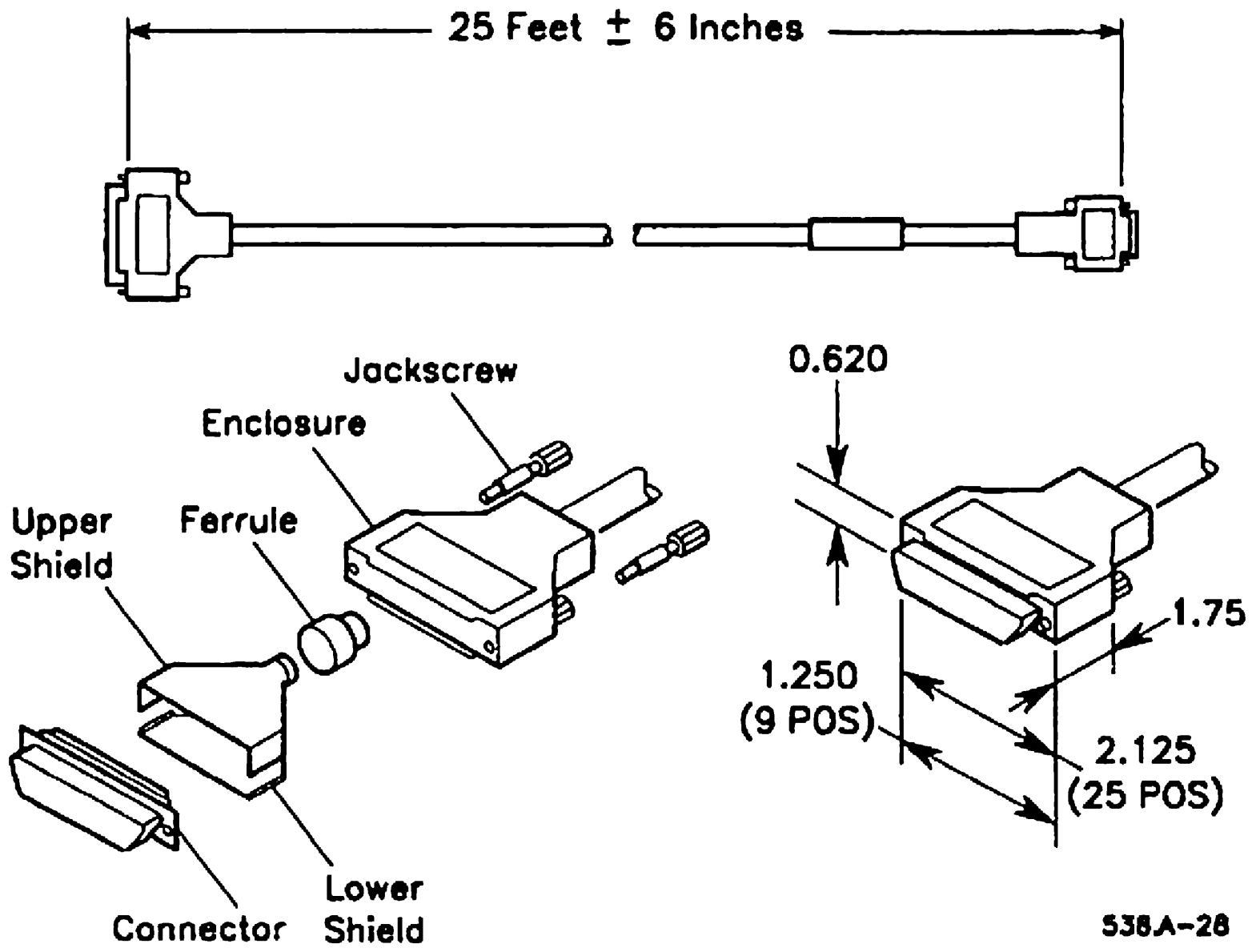


Series 2000/5000 Serial Cable Drawing

A drawing for a serial printer or scanner cable is provided below (see Figure A–28). In constructing the cable, follow these guidelines:

1. Use a tin-plated connector (don't use yellow chromate).
2. Use a metal backshell.
3. Do not remove the ground wire.
4. Connect Pin 1 to the shield drain wire at both ends of the cable.

Figure A–28. Series 2000/5000 Serial Cable Drawing

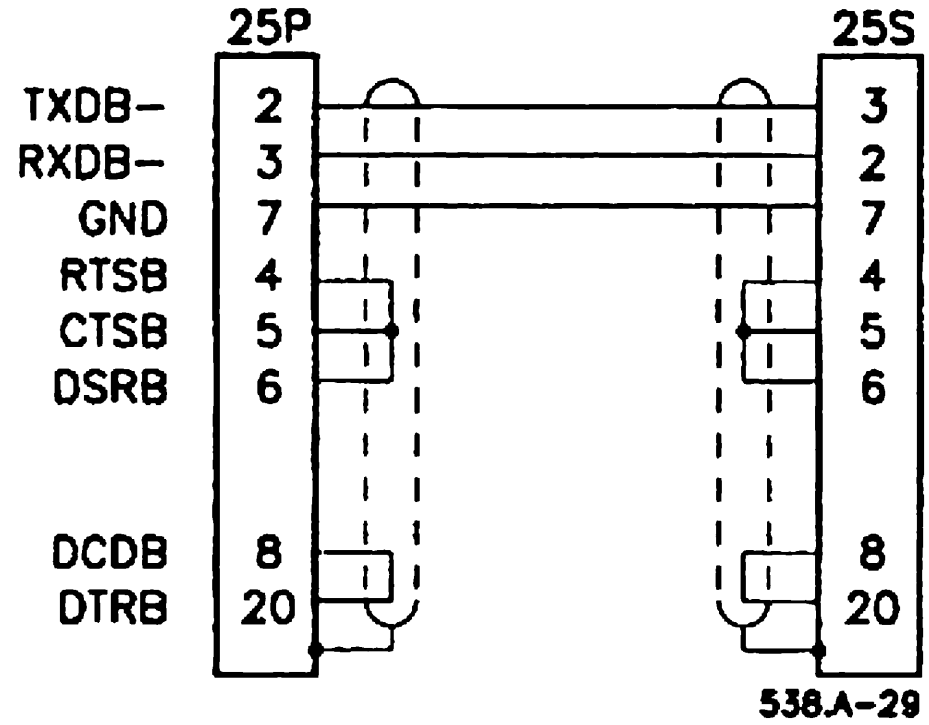


Item	Quantity	Description
1	2	25-pin D-type plug assembly (male). Use AMP part number 207464-2 or equivalent.
2	18	Connector contacts. Use AMP part number 66507-3 or equivalent.
3	2	Connector strain reliefs. Use AMP part number 207908-7 or equivalent.
4	As Needed	3-conductor shielded cable.
5	As Needed	Copper foil.

Series 5000 Serial Cable Pin Assignments

Figure A–29 shows the pin assigments for the serial cable used by the 25-pin serial ports on the Series 5000 workstations.

Figure A–29. Series 5000 25-Pin Serial Cable Pin Assignments

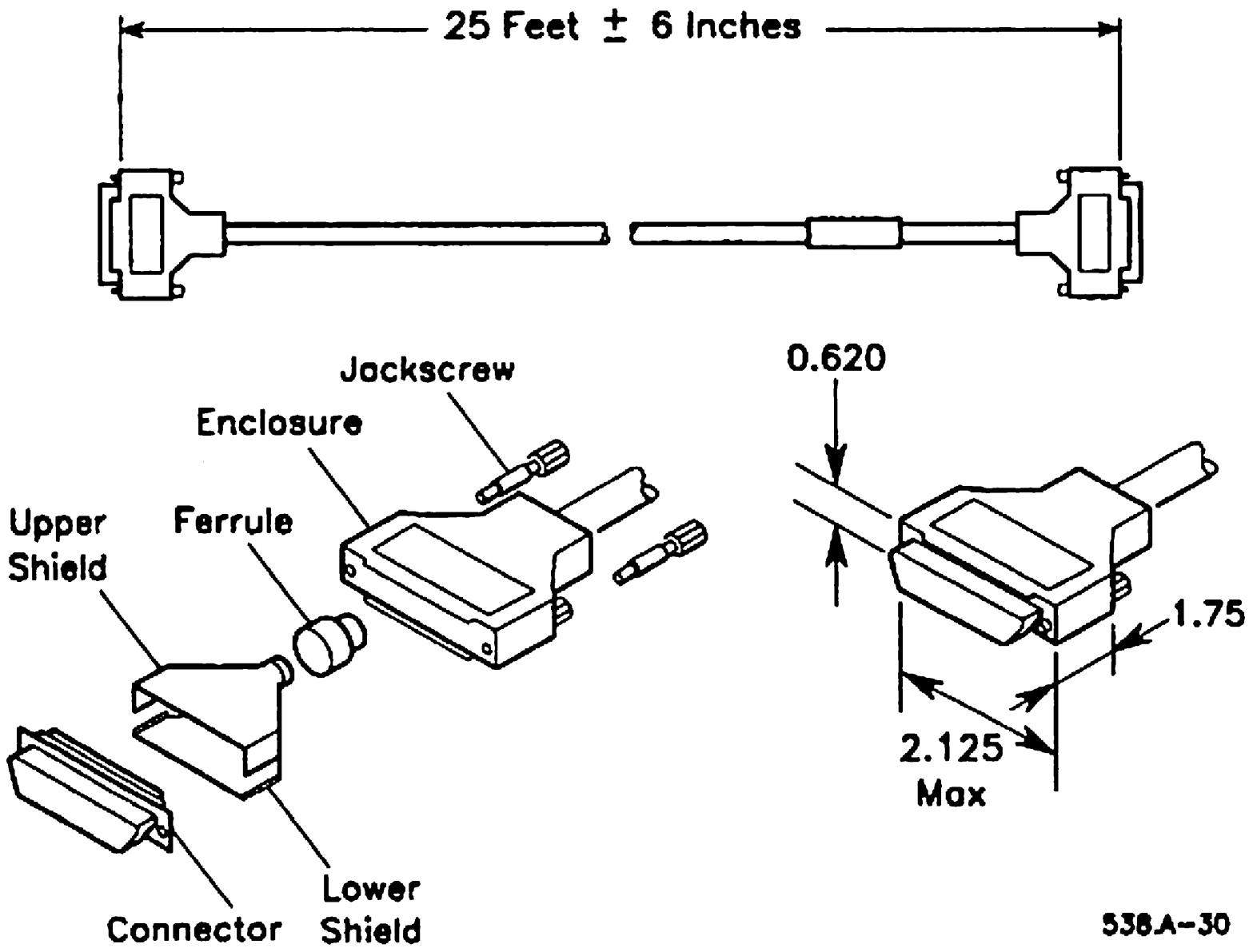


Series 5000 Serial Cable Drawing

A drawing for a serial printer or scanner cable is provided below (see Figure A–30). In constructing the cable, follow these guidelines:

1. Use a tin-plated connector (don't use yellow chromate).
2. Use a metal backshell.
3. Do not remove the ground wire.
4. Connect Pin 1 to the shield drain wire at both ends of the cable.

Figure A–30. Series 5000 Serial Cable Drawing



Item	Quantity	Description
1	2	25-pin D-type plug assembly (male). Use AMP part number 207464-2 or equivalent.
2	18	Connector contacts. Use AMP part number 66507-3 or equivalent.
3	2	Connector strain reliefs. Use AMP part number 207908-7 or equivalent.
4	As Needed	3-conductor shielded cable.
5	As Needed	Copper foil.

Appendix B
Workstations and Servers

Introduction to Appendix B

The following tables describe each CTOS workstation and server, along with its type of cluster communication port (RS422 or RS485), maximum cluster speed, and +5V support for TeleCluster adapters.

Table B1. Workstation Cluster Speeds

Unisys Product Name	Convergent Product Name	Rev Levels	Max Cluster Speed (Mbps)
XE520	SRP	All	1.8
XE530	XE530	All	3.7
Series 2000	Series 2000	All	3.7
Series 5000	Series 5000	All	3.7
B39	386i	All	3.7
B38CPU	CP-003	AA–AJ	1.8
B38CPU	CP-003	AJ–Later	1.8
B38MCP	CP-003/287	AA–AJ	1.8
B38MCP	CP-003/287	AJ–Later	1.8
B38EV	CP-0A3	AA–AK	3.7
B38EV	CP-0A3	AK–Later	3.7
B38MEV	CP-0A3/287	AA–AK	3.7
B38MEV	CP-0A3/287	AK–Later	3.7
B38EXP	B38EXP	All	3.7

continued

Table B1. Workstation Cluster Speeds (cont.)

Unisys Product Name	Convergent Product Name	Rev Levels Affected	Max Cluster Speed (Mbps)
B38GXP	B38GXP	All	3.7
B38GXL	B38GXL	All	3.7
B28CPU	CP-002	AA–AJ	1.8
B28CPU	CP-002	AJ–Later	1.8
B28MCP	CP-002/287	AA–AJ	1.8
B28MCP	CP-002/287	AJ–Later	1.8
B28EV	CP-0A2	AA–AK	3.7
B28EV	CP-0A2	AK–Later	3.7
B28MEV	CP-0A2/287	AA–AK	3.7
B28MEV	CP-0A2/287	AK–Later	3.7
B28EXP	CP-0E2	All	3.7
B28EX1	None	All	3.7
B28LCW	CM-004	All	3.7
B28LC1	None	All	3.7
B27	CM-002	All	1.8
B26	CP-001	All	1.8
B22	AWS	All	307 Kbps
B21	IWS	All	307 Kbps

Table B2. Workstation Cluster Ports

Unisys Product Name	Convergent Product Name	Rev Levels Affected	Cluster Port*
XE520	SRP	All	RS422
XE530	XE530	All	RS485
Series 2000	Series 2000	All	RS485
Series 5000	Series 5000	All	RS485 (RJ45)
B39	386i	All	RS485
B38CPU	CP-003	AA–AJ	RS422
B38CPU	CP-003	AJ–Later	RS485
B38MCP	CP-003/287	AA–AJ	RS422
B38MCP	CP-003/287	AJ–Later	RS485
B38EV	CP-0A3	AA–AK	RS485
B38EV	CP-0A3	AK–Later	RS485
B38MEV	CP-0A3/287	AA–AK	RS485
B38MEV	CP-0A3/287	AK–Later	RS485
B38EXP	B38EXP	All	RS485
B38GXP	B38GXP	All	RS485
B38GXL	B38GXL	All	RS485
B28CPU	CP-002	AA–AJ	RS422

continued

Table B2. Workstation Cluster Ports (cont.)

Unisys Product Name	Convergent Product Name	Rev Levels Affected	Cluster Port*
B28CPU	CP-002	AJ–Later	RS485
B28MCP	CP-002/287	AA–AJ	RS422
B28MCP	CP-002/287	AJ–Later	RS485
B28EV	CP-0A2	AA–AK	RS485
B28EV	CP-0A2	AK–Later	RS485
B28MEV	CP-0A2/287	AA–AK	RS485
B28MEV	CP-0A2/287	AK–Later	RS485
B28EXP	CP-0E2	All	RS485
B28EX1	None	All	RS485
B28LCW	CM-004	All	RS485
B28LC1	None	All	RS485
B27	CM-002	All	RS422
B26	CP-001	All	RS422
B22	AWS	All	RS422
B21	IWS	All	RS422

* Cluster ports use a DB9 connector except for SuperGen Series 5000 workstations, which have cluster ports with RJ45 connectors.

Table B3. Workstation +5V Support

Unisys Product Name	Convergent Product Name	Rev Levels	TeleCluster +5V Support
XE520	SRP	All	No
XE530	XE530	All	No
Series 2000	Series 2000	All	NA*
Series 5000	Series 5000	All	NA*
B39	386i	All	Yes
B38CPU	CP-003	AA–AJ	No
B38CPU	CP-003	AJ–Later	No
B38MCP	CP-003/287	AA–AJ	No
B38MCP	CP-003/287	AJ–Later	No
B38EV	CP-0A3	AA–AK	No
B38EV	CP-0A3	AK–Later	Yes
B38MEV	CP-0A3/287	AA–AK	No
B38MEV	CP-0A3/287	AK–Later	Yes
B38EXP	B38EXP	All	Yes
B38GXP	B38GXP	All	Yes
B38GXL	B38GXL	All	Yes
B28CPU	CP-002	AA–AJ	No

*These workstations have built-in TeleCluster adapters.

continued

Table B3. Workstation +5V Support (cont.)

Unisys Product Name	Convergent Product Name	Rev Levels Affected	TeleCluster +5V Support
B28CPU	CP-002	AJ–Later	No
B28MCP	CP-002/287	AA–AJ	No
B28MCP	CP-002/287	AJ–Later	No
B28EV	CP-0A2	AA–AK	No
B28EV	CP-0A2	AK–Later	Yes
B28MEV	CP-0A2/287	AA–AK	No
B28MEV	CP-0A2/287	AK–Later	Yes
B28EXP	CP-0E2	All	Yes
B28EX1	None	All	Yes
B28LCW	CM-004	All	Yes
B28LC1	None	All	Yes
B27	CM-002	All	No
B26	CP-001	All	No
B22	AWS	All	No
B21	IWS	All	No

Appendix C
Network Software

Introduction to Appendix C

This appendix provides information about some of the CTOS software required for connecting clusters to other clusters and to host mainframe computers. Of course, it doesn't cover all possible networking solutions.

Note: *For more detailed information about software, refer to the documentation listed in "About This Guide" in this guide.*

Several CTOS software products allow a cluster to communicate with other clusters and with non-CTOS computer systems and networks. These software products fall into two general groups:

- Cluster-to-cluster communication
- Cluster-to-host mainframe communication

Software products that allow clusters to communicate with Unix systems and TCP/IP networks are also available.

Cluster-to-Cluster Communication

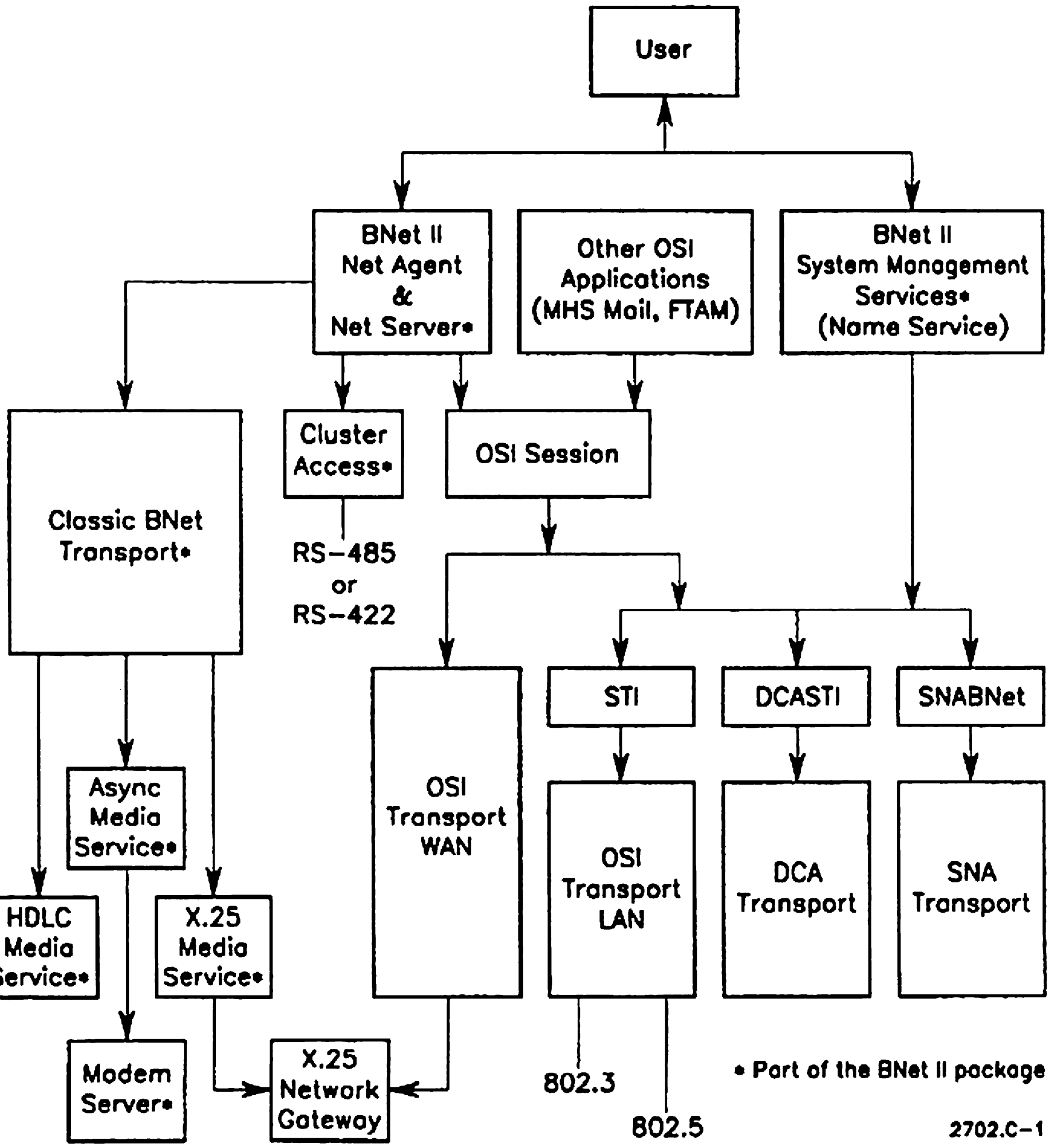
In a CTOS cluster, workstations in a cluster can access the files and resources of the cluster server. In addition, workstations in one cluster can access the files and resources of other cluster servers, provided that the clusters are physically connected, and that the appropriate network software has been installed.

Clusters can be physically connected by RS-232 lines (modem or direct cable), by Ethernet or by token ring LANs. Clusters can also be connected through an SNA network, through a DCA network, through an X.25 network, or through a combination of these connection methods.

The network software required to support a network of clusters varies somewhat, depending on the way one cluster is connected to another. However, BNet is always required.

For example, two clusters connected together by a modem via RS-232 ports may require only BNet software; whereas two clusters connected by an Ethernet LAN may require additional networking software. Figure C-1 and the following paragraphs describe the required software.

Figure C-1. CTOS Network Software



Using RS-232 Lines

Clusters connected through the RS-232 interface (via modem or via interface require only the BNet II software package.

Using an X.25 Network

Clusters connected through an X.25 network require X.25 Gateway software in addition to BNet II software.

Note: *IDMSS software is also required for any cluster server or workstation that uses the B25-ID2 module.*

Using Ethernet or Token Ring LANs

In addition to BNet II software, clusters connected by Ethernet or token ring LANs require the following software:

- OSI Session
- OSI Session/Transport Interface (STI)
- OSI Transport LAN
- IDMSS (for the LAN module)

Using SNA Networks

In addition to BNet II software, clusters connected through an SNA network require the following software:

- OSI Session
- SNA BNet
- SNA Transport

Using DCA Networks

In addition to BNet II software, clusters connected through a DCA network require the following software:

- OSI Session
- DCA Session/Transport Interface (DCASTI)
- DCA Transport

Cluster-to-Host Communication

Several software products enable or facilitate cluster to host mainframe communication. Some of these products support communication with Unisys mainframes, some products support communication with IBM mainframes.

Cluster-to-Unisys Mainframe Communications

CTOS clusters can communicate with Unisys A-series or V-series mainframes in a variety of ways. One common way to do this is to use BMulti poll/select software to handle the communication protocols, and then run a variety of applications over BMulti.

BMulti

With BMulti software installed in a cluster server, the entire cluster can access Unisys A-series or V-series mainframes over RS-232 lines (modem or direct cable) or over TDI lines. In addition, new versions of BMulti include a BMulti/X.25 service that allows a server to access mainframes over X.25 networks.

Note: *To connect to an X.25 network, the server must have an X.21 port. This port is supplied by the B25-ID2 X-Bus module; it is also supplied by XE-520 CP or TP boards and by XE-530 GP/SI and GP/CI boards.*

After BMulti has been installed in the cluster server, application software must be installed in the server before files and resources can be used by the cluster. Some of these applications are

- Printer Pass-Through (provides access to printer resources)
- BTOS Terminal Emulator (provides access to host applications)
- File Transfer Service (FTS)
- Data Transfer System (DTS)

Cluster-to-IBM Mainframe Communications

CTOS clusters can communicate with IBM SNA networks when SNA Transport software is installed in the server to supply data link layer protocols. Application software must also be installed to provides file and resource access.

SNA Transport

With SNA Transport software installed in a cluster server, the entire cluster can access token ring LANs, X.25 networks, and hierarchical or peer-to-peer SNA networks.

Note: *To connect to an X.25 network, the server must have an X.21 port. This port is supplied by the B25-ID2 X-Bus module; it is also supplied by XE-520 CP or TP boards and by XE-530 GP/SI and GP/CI boards.*

After SNA Transport has been installed in the cluster server, application software must be installed in the server before files and resources can be used by the cluster. Some of these applications are

- Enhanced SNA 3270 Emulator (allows workstations to communicate with IBM SNA host)
- ClusterShare SNA 3270 Emulator (allows PCs in a cluster--with ClusterCard installed--to communicate with IBM SNA host)
- SNA Remote Job Entry (RJE)
- SNA Logical Unit Interface Service (LUIS)

Cluster-to-UNIX/DEC Communication

CTOS workstations can connect to and interact with application programs running on DEC VAX computers, Unisys U6000 systems, and Sun Microsystems workstations.

To do this, CTOS Virtual Terminal Emulator (VTE) software must be installed in the CTOS workstation. VTE software is designed to run over RS-232 lines, X.25 lines, or TCP/IP connections.

Note: *If X.25 links are used, CTOS X.25 Gateway software is also required. If TCP/IP connections are used, the CTOS TCP/IP Gateway software is required.*

Cluster-to-TCP/IP Network Communication

CTOS workstations can participate in commercial TCP/IP networks or in a PDN or DDN X.25 network by using CTOS TCP/IP software. Connection to those networks is accomplished by using Ethernet links or X.25 links.

Network Enhancement Software

The CTOS Multiple Gateway Server (MGS) greatly increases the efficiency of certain types of networks. Multiple Gateway Server software allows multiple copies of a communication service to be installed on a server. In an SNA environment, for example, this would allow access to several SNA hosts, or would allow one SNA host to be accessed over several different communications lines.

Along with SNA applications, MGS software can be used with other communication services, such as SNA Transport, BMulti, and X.25 Gateway.

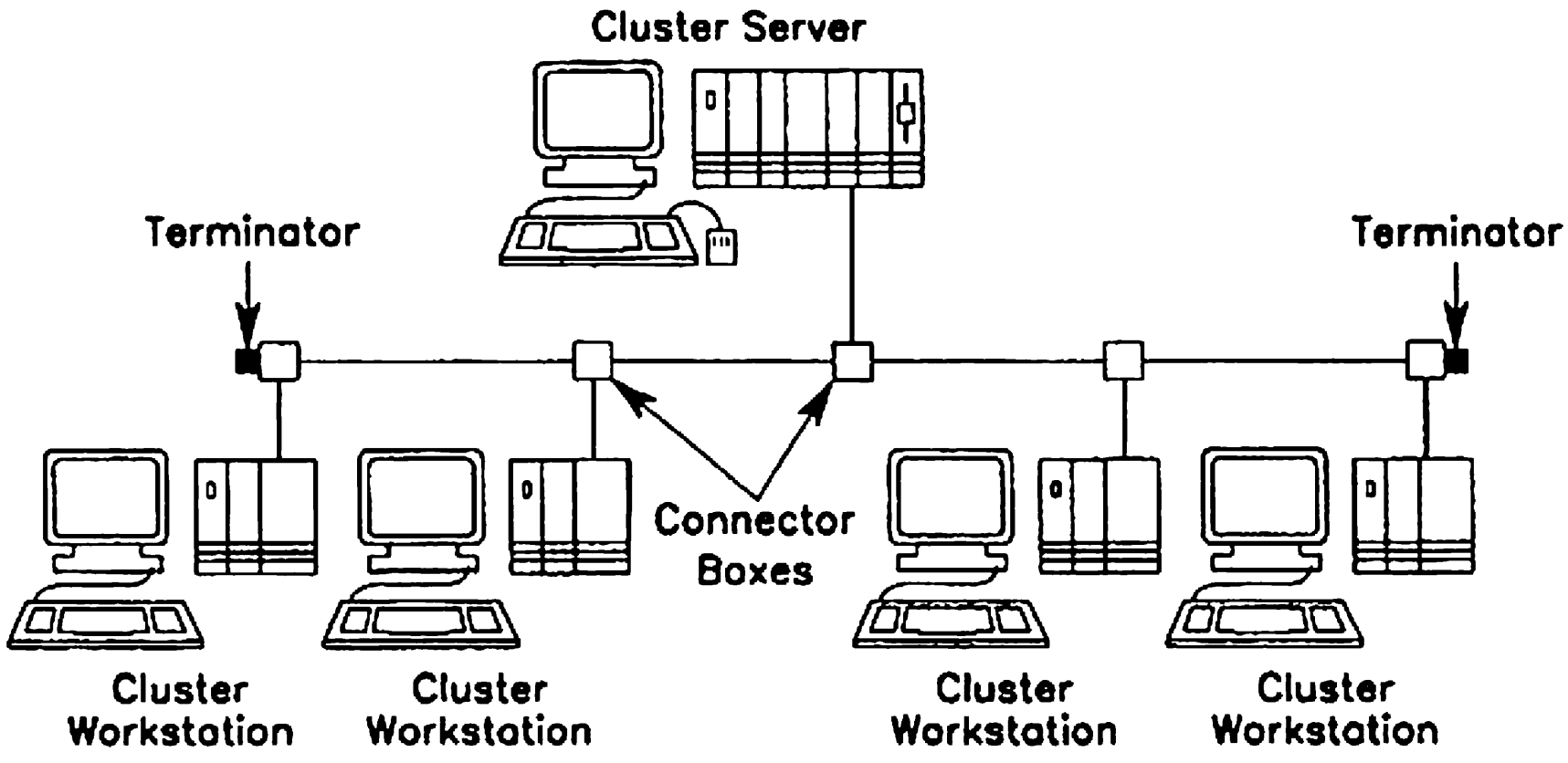
Appendix D
Spur Clusters

Introduction to Appendix D

Spur clusters are similar to the daisy-chain clusters described in Sections 1, 2, and 3: the requirements are the same and the cable length rules are the same. However, spur clusters are not daisy-chained.

Instead, spur clusters use a backbone cluster cable with spur connector boxes (or TeleGartner Y boxes) attached to the backbone cable. A spur cable connects workstations to the connector boxes (see Figure D–1). This allows a workstation to be removed from or added to the cluster without disrupting normal cluster activity.

Figure D–1. A Spur Cluster



Note: *TeleCluster provides the same flexibility as a spur cluster, at a lower cabling cost (since TeleCluster uses existing telephone cabling.) Consequently, you may want to use TeleCluster rather than a spur cluster.*

Cable Lengths

Spur clusters follow the same cable length requirements as daisy-chain clusters. However, each spur connector box or TeleGartner Y switch box reduces the maximum lengths by an additional 1%.

In addition, the spur cable must be at least 3 feet long, but no greater than 10 feet long, and there must be at least 10 feet between spur connector boxes or between TeleGartner Y switch boxes.

There must be at least 25 feet of cable between workstations (total cable length, backbone cable and spur cable).

Note: *One terminator is required at each end of the backbone cable.*

Cable Types

Spur clusters use the same cable types as daisy-chain clusters. (See Section 3, "Installing a Daisy-Chain Cluster.")

Cluster Speeds

Spur clusters that use spur connector boxes support a maximum cluster speed of 1.8 Mbps. (The 3.7 Mbps speed is not allowed with spur boxes!)

If you want to run a spur cluster at 3.7 Mbps, you must use TeleGartner Y switchboxes instead of spur connector boxes. (For availability, see "TeleGartner 'Y' Switchboxes" later in this appendix.)

Installing Spur Cable

The spur cable is connected at one end to the spur connector box. The other end of the spur cable is attached to one of the workstation's RS-422 or RS-485 ports. (Either port can be used.) The remaining RS-422 or RS-485 port does not require a terminator.

Spur Connector Boxes

To obtain spur boxes, contact your Unisys representative for a list of sources.

Spur boxes must be manufactured according to the following specifications:

1. Corresponding wires from each of the three cables must be joined together at one point, such as at a terminating block.
2. The box must be a complete shield (all metal). If metal boxes are not available, use only good quality metal-coated plastic boxes. Using conductive coating instead of metal coating is not allowed, because this can cause intermittent network failures.

   If metal-coated plastic boxes are used, the single-point ground connection to the conductive box must include a nut, bolt, and washer.
3. A means must be provided to connect cable shields to the inside of the spur box.
4. The connection from the cable shield to the spur box must be as short as possible, and must not exceed 0.5 inches.
5. Unshielded wire length inside the spur box must be kept to a minimum, and must not exceed 1.5 inches.
6. Cables connected to the spur box must have strain relief.
7. Pin 1 of the spur box connectors must be attached to the connector housing, the frame ground in the spur box, and the cable shield. You must use 20 AWG or larger wire for these connections.
8. Spur boxes must conform to local codes.

TeleGartner "Y" Switchboxes

If you want to run a spur cluster at the 3.7 Mbps cluster speed, you must use the TeleGartner Y switchbox, model CAGB8M and corresponding connector model CAGS8. Other makes of the switchbox are not recommended.

The TeleGartner product is available worldwide. Contact your Unisys representative for a list of sources.

Appendix E
Two-Wire Direct Interface (TDI)

Introduction to Appendix E

Two-Wire Direct Interface (TDI) is a connection method used primarily for terminal-to-host communication. CTOS workstations can be used as terminals, provided that they use the proper protocol software and terminal emulation software. (The host is typically a Unisys A series or V series mainframe, but other hosts can be used).

Protocols

TDI operates in half-duplex mode and requires an asynchronous link level protocol. Any asynchronous protocol can be used if the TDI network is point-to-point; multipoint networks (more than one terminal) require the Unisys Poll/Select protocol.

Note: *Unisys terminals commonly use a 7-bit ASCII character with an even parity bit.*

Hardware Requirements

Typical installations include a host and terminals connected by TDI cabling. CTOS workstations require an RS-232 to TDI converter or an X-Bus module that supports TDI.

Hosts

Some of the Unisys host systems that support TDI are listed below:

- A series mainframes
- V series mainframes
- B x800 and B x900 mainframes
- B 1700, B1800, B1900 (with front end communications processor)
- CP 2000, (with front end comunications processor)
- CP 9500 (with terminal multiplexer)
- CTOS workstations

Terminals

Some of the Unisys terminals that support TDI are listed below:

- CTOS workstations
- T27
- Unisys PCs (or other PC compatibles)
- ET 1100
- MT 983, MT 985
- TD 830 family

TDI Cable

TDI uses two-wire shielded cable. One wire is used for reference ground, and the other is used for transmitting and receiving data. The cable connector is a 25-pin D connector, frequently female.

TDI Module

CTOS workstations require the B25-ID2 module, which supports TDI, or the B25-DCA module, which is an RS-232-to-TDI converter.

Software Requirements

CTOS workstations require terminal emulation software and BMulti software. See Appendix C, "Network Software," for more information.

PC compatibles require terminal emulation software.

Cable Length Limits

A TDI network can have a maximum of 1000 feet of cable when using a 9600 bps transmission rate. Using faster transmission speeds will further reduce this maximum allowed length (see Table E–1).

Table E–1. TDI Maximum Cable Length

Transmission Speed	Maximum Cable Length
9600 bps	1000 ft
19200 bps	500 ft
38400 bps	250 ft

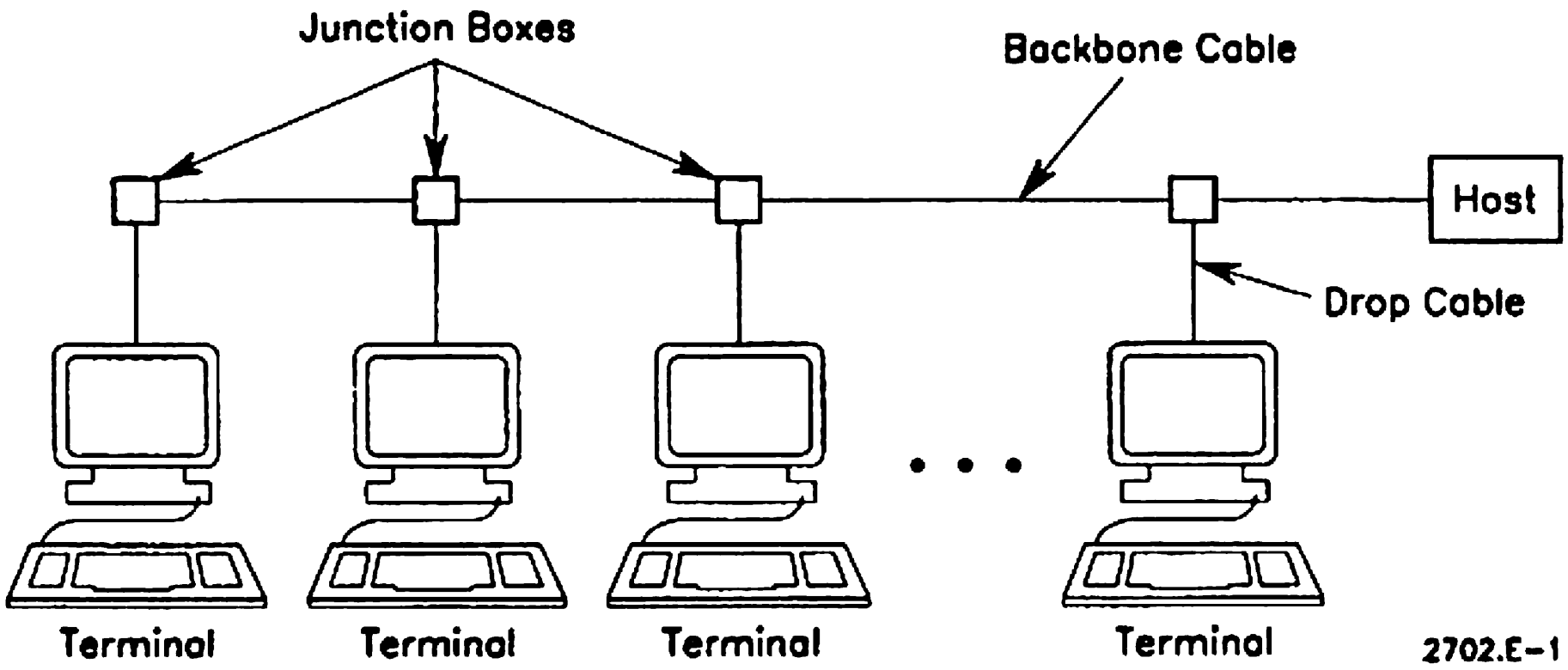
Maximum Number of Terminals

A TDI network can have a maximum of 9 terminals and 1 host. Reducing the number of terminals does not increase the maximum allowed cable lengths.

Network Configuration

A TDI network uses a bus configuration. In a bus configuration, junction boxes are installed on the backbone cable, with a short drop cable connecting each terminal to a junction box (see Figure E–1).

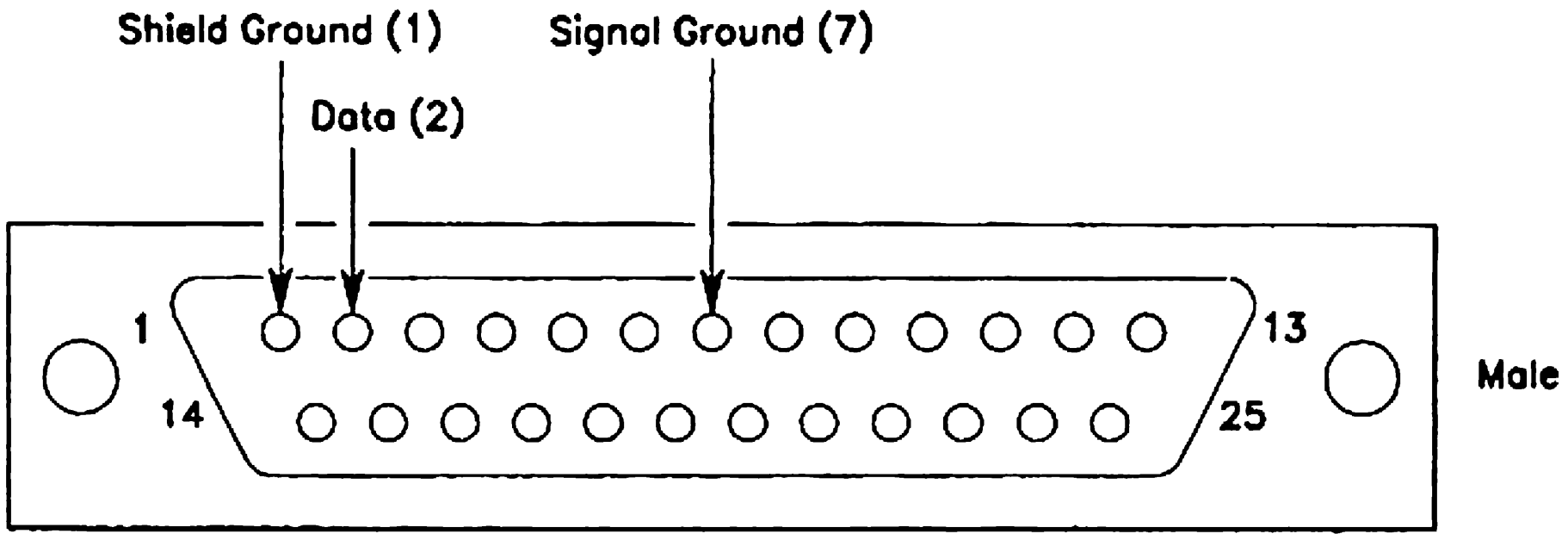
Figure E–1. A TDI Network



There are three guidelines for installing a TDI bus network:

1. Metal junction boxes should be used at each drop location. Cable shields should be attached to the junction box.
2. Connectors on the drop cables must match the connectors on the junction box and on the terminal. The drop cable as well as the backbone cable must be a TDI shielded twisted pair cable. The connector pinouts are shown below (see Figure E–2).
3. For the sake of consistency, use the cable's black wire as TDI Ground (this wire should be connected to pin 7 of the 25-pin D connector). Use the remaining wire as TDI Data (this wire is connected to pin 2).

Figure E–2. TDI Connector and Signals



2702.E–2

Installation Guidelines (Grounding)

Several guidelines should be followed to ensure a successful installation. These guidelines are primarily concerned with the proper grounding of the TDI cable (signal ground and shield ground) and the host and terminals (logic ground and safety ground).

The guidelines for proper grounding are as follows:

1. The host and terminals should be powered from the same distribution panel and use the same safety ground.
2. The TDI cable signal ground and shield ground must be kept separate; they must not be tied together at any point along the cable.
3. All cable segment shields must be tied together.
4. The TDI cable shield ground should be tied to safety ground at only one point in the network to minimize ground loop noise. Normally the shield ground is tied to safety ground at the host, not at the terminal. (This is achieved by leaving pin 1–safety ground–of the terminal TDI connector open.)
5. The logic ground of the host must be internally connected to the frame safety ground. This keeps the TDI cable shield ground and signal ground at nearly the same potential.
6. The TDI cable signal ground (pin 7) must connect to the logic ground at each terminal and at the host.

Appendix F
Old and New TeleCluster Product Compatibility

Introduction to Appendix F

The original TeleCluster product was designed to use the same telephone wire pair as the telephone voice signals. Voice circuitry in the TeleCluster hub and in the TeleCluster adapters provided the necessary filtering.

However, the newer Advanced TeleCluster product is not designed to use the same wire pair as the voice signals, but instead uses a separate wire pair. (Consequently, Advanced TeleCluster hubs or adapters have no voice circuits.)

Using Voice/Data with Advanced TeleCluster

In general, voice/data TeleCluster products can be used in an Advanced TeleCluster network, which is a network that uses a separate wire pair for data. However, in this situation, the voice capabilities of the voice/data products would not be available.

However, because Advanced TeleCluster does not provide the required voice circuits, Advanced TeleCluster products cannot be used in a voice/data TeleCluster network, which is a network in which data travels through the same wire pair as telephone signals.

Note: *For instructions on using voice/data TeleCluster products, refer to the documentation that was shipped with the products.*

Using Voice/Data Hubs in Advanced TeleCluster Networks

Voice/data hubs can be used in an Advanced TeleCluster network and they can support the 3.7 Mpbs cluster speed–provided that only B25-TA3 TeleCluster adapters are used in the network. (The use of any other adapters require the slower 1.8 Mbps cluster speed.)

Note: *The 24-channel voice/data hub will work at 3.7 Mbps. However, it has not been qualified for this speed by regulatory agencies.*

Using Voice/Data Adapters in Advanced TeleCluster Networks

Voice/data TeleCluster adapters (B25-TA1/TA2) can be used in any combination with the new data-only adapters (B25-TA3/TA4). However, the server must have a data-only adapter (B25-TA3).

If any voice/data adapters are used in an Advanced TeleCluster network, the maximum cluster speed is 1.8 Mbps.

Note: *If voice/data adapters (B25-TA1/TA2) appear to malfunction in a TeleCluster that also uses data-only adapters (B25-TA3/TA4), you may have to reverse tip and ring at the malfunctioning voice/data adapters.*

Daisy-Chaining Older Hubs with Modular Hubs

Note: *Only the new modular hub supports the 3.7 Mbps cluster speed when daisy-chained. A TeleCluster network that has one of the older hubs (voice/data or intelligent hub) is limited to the 1.8 Mbps speed.*

The following daisy-chain combinations are allowed:

- If a nonmodular (voice/data hub or intelligent hub) hub is daisy-chained to a modular hub, the maximum number of hubs allowed in the TeleCluster network is 2.
- If nonmodular hub is daisy-chained to a nonmodular hub, the maximum number of hubs allowed in the TeleCluster network is 2.

Maximum Distance Between Daisy-Chained Hubs

If a *nonmodular* hub is daisy-chained to another TeleCluster hub, the maximum cable length between the hubs is 600 feet.

Glossary

A

AUI cable

Attachment Unit Interface cable is the drop cable that connects a workstation to an MAU (Media Access Unit) in an Ethernet network. The maximum length of an AUI cable is 50 meters.

asynchronous

Asynchronous refers to a transmission method in which each data character is marked with start and stop bits so that a receiving station can correctly interpret the incoming data. *See also* "Synchronous."

attenuation

Attenuation refers to the decrease in the power, current, or voltage of an electrical signal as the signal travels in a transmission medium between two points. Attenuation is normally expressed in decibels (dBs).

B

BMulti

BMulti is the software for the Unisys version of the poll-select protocol. BMulti generally runs over RS-232 or TDI lines.

BNet

BNet is a Unisys network software product that allows the CTOS operating system to be used over a network of CTOS clusters. Using BNet, workstations in one cluster can access the resources and files of other clusters. BNet is media independent, and can be used over a wide variety of network links.

bridge

A bridge is a communication link that joins networks of a similar type. For example, separate rings in a token ring network can be linked by one or more bridges. The bridge can be a file server, workstation, or a dedicated bridge. Bridges normally require bridging software.

bridge clips

A bridge clip is a metal clip that connects lines in a punchdown block. It acts as a wire jumper to connect prongs on a punchdown block. Normally, bridge clips should not be used for permanent connections.

bridge taps

A bridge tap is a second cable pair connected in parallel with the main twisted pair cable. The tap connection can occur at any location along the main cable. This is not allowed for TeleCluster or Advanced TeleCluster.

C

CCITT

The Consultative Committee for International Telegraphy and Telephony. An international group that recommends standards.

cluster

A cluster is a network made up of CTOS workstations and a CTOS server connected via their RS-422 or RS-485 ports.

cluster cable

Cluster cable is a shielded twisted pair (two pair) cable used to connect workstation RS-422 or RS-485 ports in a cluster. There are two types of cluster cable: 100 Ohm and 140 Ohm. The 140 Ohm cable supports greater distances than 100 Ohm cable. However, 100 Ohm cable must be used when daisy-chaining to a TeleCluster adapter.

ClusterCard

ClusterCard is an adapter card for PC compatibles that allows PC compatibles to be connected to a cluster. Two versions are available: XT-bus versions and AT-bus versions.

ClusterShare

ClusterShare is the software required for the proper operation of ClusterCard adapters. The software is installed in the cluster server and in the PC with the ClusterCard.

cluster speed

Cluster speed, also called "cluster line speed," refers to the rate at which data passes through the cluster. Three speeds are supported: 307 Kbps, 1.8 Mbps, and 3.7 Mbps.

cross-connect

A cross-connect is a connection between two wires that is made by connecting both wires to positions on a punchdown block.

CSMA/CD

Acronym for Carrier Sense Multiple Access with Collision Detect. This refers to the access method used in Ethernet networks to resolve contentions between workstations wishing to use the network.

D

daisy chain

A method of passing signals along a bus. Signals are sent up and down the bus, passing through each workstation on the bus. (In a daisy-chain cluster, the bus is the cluster cable that connects the workstations and server.)

DCA

Acronym for Distributed Communications Architecture. This is a layered architecture consistent with the OSI (Open Systems Interconnection) 7-layer model.

DCE

Acronym for Data Circuit-terminating Equipment. This term refers to devices placed at the ends of communication lines. A modem is a common type of DCE.

distribution rack

Distribution racks are used in wiring closets to hold various types of equipment. Also called "equipment racks."

DTE

Acronym for Data Terminal Equipment. This device is usually a workstation or server that is connected to a DCE.

E

EIA

Electronic Industries Association. A standards group in the United States.

Ethernet

A local area network, standardized by IEEE 802.3, that uses the CSMA/CD access method. This type of network supports data rates up to 10 Mbps.

Ethernet module

An X-Bus module that allows CTOS/BTOS workstations to become part of an Ethernet network.

F

full duplex

Refers to a data transmission mode that supports simultaneous transmission in both directions.

G

gateway

A gateway is a communication link between different networks that can convert from one protocol to another protocol, thus enabling information to be passed between the networks.

ground

Refers to the method used in AC power lines to neutralize (make less positive) one side of the power line by connecting it to a metal rod driven into the ground. Also called AC safety ground.

H

half duplex

Refers to a data transmission mode that supports transmission in both directions, but not simultaneously.

hub

In an Advanced TeleCluster network, the intelligent device that routes and controls data transmissions between the server and workstations in the cluster.

host

The primary or controlling computer in a multicomputer system. Frequently, the host is a mainframe and the other systems connected to the host function as terminals.

I

IEEE

Acronym for Institute of Electrical and Electronics Engineers, a professional organization and a standards group.

impedance

The combined effect of resistance, capacitance, and inductance on a signal at a particular frequency. It is normally expressed in ohms.

intelligent data module

An X-Bus data communication module that has a microprocessor to control data communication functions.

L

LAN

Acronym for local area network. Although this normally refers to Ethernet or token ring networks, it can refer to any network located within a 2.5 kilometer area.

link segment

A point-to-point cable segment that joins multidrop cable segments in an Ethernet network. Other than the repeaters used at the ends of the link segment for segment interconnection, no equipment can be attached to a link segment.

lobe cable

In the Unisys implementation of token ring, lobe cable is the cable that connects a workstation to a wire center.

M

MAN

Acronym for Metropolitan Area Network. Refers to broadband networks that extend city-wide. This type of network spans greater distances than a LAN, but is still restricted to a particular region, unlike the more global WANs.

MAU

Acronym for Media Access Unit. The MAU taps into the main Ethernet cable, and an AUI drop cable connects the MAU to a workstation or other device.

modem

MOdulator/DEModulator. A modem converts digital signals from a transmitting workstation to analog signals that can be carried over public telephone lines. At the destination end, a modem converts the analog signals back to digital for the receiving workstation.

N

node

A point where a device is connected to a communication line in a network.

O

operating system

A program that controls the operation of all the other programs in a computer.

OSI

Acronym for Open Systems Interconnection. This 7-layer model helps define network protocol standards to simplify communication between diverse types of computers. From lowest to highest level, the layers are: physical, data link, network, transport, session, presentation, and application.

P

PBX

Acronym for Private Branch Exchange. This refers to a telephone exchange located on a customer's premises. The exchange establishes circuits between local users and the public telephone network.

poll-select

A generic term for a protocol in which the host communicates with devices that have unique addresses, or unique group addresses. The host polls the devices and selects a particular address.

potential difference

Voltage.

protocol

A set of specifications that control data format, timing, sequencing, access, and error correction so that a sender and a receiver can communicate. A sending system and a receiving system must use the same protocol.

punchdown block

A wire connection assembly that enables wires to be connected without splicing. Positions on the block are connected (punched down) to establish the connection.

R

repeater

Repeaters receive a signal and retransmit it, amplifying it and retiming it so the signal can travel over a greater distance.

RS

Short for Recommended Standard; a standard published by the EIA.

RS-232

An EIA standard specifying the electrical interface between a DTE and a DCE.

RS-422

An EIA standard specifying a balanced digital interface allowing up to 16 devices to be attached to a common bus.

RS-485

An enhancement to RS-422. RS-485 is the same as RS-422, but allows up to 32 devices to be attached to a common bus.

S

server

In a CTOS cluster, the server provides resources for all the workstations in the cluster. The server's data communication resources, disk storage resources, tape drive, and other resources are all available to workstations in the cluster. The only server resources that are not available are the keyboard and the monitor.

shared resource processor (SRP)

A multiprocessor computer that is always used as a server.

SNA

Acronym for Systems Network Architecture. This is an IBM proprietary architecture based on the SDLC protocol.

spur box

A connector box installed on the main cluster cable. A drop cable connects a workstation to the spur box. A workstation can be connected to or disconnected from the spur box without affecting the operation of the cluster.

spur cluster

A cluster that uses spur boxes and drop cables.

synchronous

A transmission method in which blocks of data characters are marked by a sync character. The sync character tells the receiving station where the first bit of data begins; the receiving station can then correctly group every eight bits into the appropriate data character. Because this method does not mark each data character, it is about %20 more efficient than asynchronous transmission. Synchronous transmissions require clocking, asynchronous transmissions do not.

T

TCP/IP

Acronym for Transmission Control Protocol/Internet Protocol. A protocol developed by the US Department of Defense.

TeleCluster adapter

An adapter that converts data in RS-485/RS-422 format to a format that can travel over unshielded twisted pair cable.

thicknet

Common name for the 10Base5 Ethernet cable specified in IEEE 802.3. More workstations can be attached to it than to thinnet cable, and it can be used over greater distances. However, due to its larger diameter, it is not as flexible as thinnet.

thinnet

Common name for the 10Base2 Ethernet cable specified in IEEE 802.3.

U

unshielded twisted pair

The standard telephone cable used in the United States. The wires are twisted to reduce crosstalk and produce a uniform characteristic impedance.

W

WAN

Acronym for wide area network. Refers to networks that extend over larger regional, national, or international areas.

wire center

In the Unisys implementation of token ring, wire centers are connected either in the same wiring closet or in different closets to form the main ring path. Workstations are then connected to the wire centers by lobe cables.

wiring closet

In a token ring network, a wiring closet is any location that has one or more wire centers. In general, however, a wiring closet refers to any room that has punchdown blocks. Typically, all of the telephone lines in one floor of a building are routed to a single wiring closet, and each of the wiring closets is routed to the central PBX.

workstation

A desktop computer that can function as a standalone system or be connected to a cluster.

X

X-Bus

A Unisys proprietary bus that provides the connections between modules. Used in CTOS/BTOS modular workstations.

X.21

A CCITT standard that specifies the electrical interface between an X.21 port and an X.21 DCE.

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