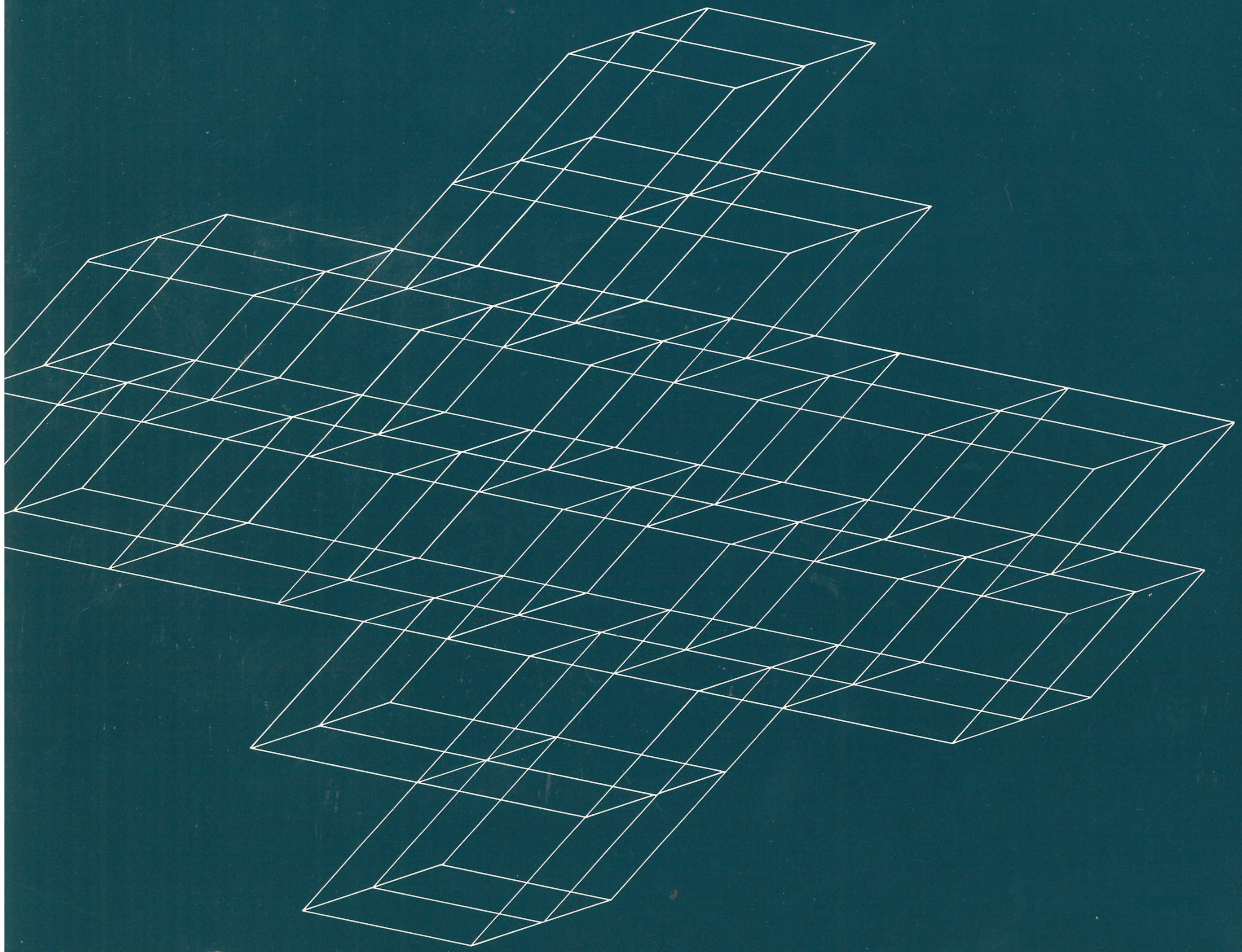
Bridge
Communications
Inc.

Series/1 Installation Guide



BRIDGE COMMUNICATIONS, INC.

SERIES/1
PLANNING AND INSTALLATION GUIDE

09-0022-04

May 1986

Comments on this publication or its use are invited and should be directed to:

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** WARNING **

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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Part Number	Date	Description	Affected Pages
09-0022-00	01/84	Initial Release	Superseded
09-0022-01	06/84	Second Release	Superseded
09-0022-02	09/84	Third Release	Superseded
09-0022-03	09/85	Fourth Release	Superseded
09-0022-04	04/86	Fifth Release (reflects the following product releases: LanSwitch/1, SIO-16 module, NCS/150 with TCP/IP protocols, NCS/1, and GS/6 with the IP protocol)	All

PREFACE

This guide provides the information necessary to prepare a site for and install any Series/1 server within a Bridge Communications system environment.

This guide is intended to be used in conjunction with the *Connection Service User's Guide* and the *Network Management Guide,* which describe the Connection Service commands and provide the information necessary for software configuration and the operation and management of the Bridge server products.

This *Planning and Installation Guide* was prepared with the following assumptions of reader knowledge:

1. The network planner should be familiar with basic concepts of Local Area Networks.
2. The network planner should be familiar with the Bridge Communications product line information provided in the *Product Line Overview.*
3. The network installer should be familiar with standard procedures for installation and for providing power and grounding according to specifications listed in this guide.
4. The network installer should be familiar with the lines and equipment being interfaced to the Series/1 server.

The information in this guide is grouped into seven major sections:

Section 1.0	Introduction: Provides an overview of the Bridge Communications product line, describes the purpose and scope of this guide, and offers recommendations on how to use it.
Section 2.0	Functional Description: Describes the features, capabilities, and services provided by the Series/1 servers; lists the applicable products' functional modules; describes the hardware and software modules; and discusses the theory of operation of these products.
Section 3.0	Preinstallation Planning: Provides external physical descriptions of the Series/1 servers and lists their environmental requirements.
Section 4.0	Cable, Modem, and Line Interface Requirements: Describes in detail the device cables, modems, and lines that may be connected to the Series/1 products and indicates requirements or restrictions.
Section 5.0	Unpacking and Installation: Outlines the procedures for unpacking, installing, and cabling a Series/1 server; describes all applicable hardware configuration jumpers; provides a system checkout procedure; and recommends steps for preventive maintenance.
Section 6.0	System Modification: Describes the modifications that may be made to the Series/1 server products.
Appendix A	Power-on Diagnostics: Lists all the boards in the Series/1 servers and describes their self-test diagnostics, including any error messages they generate.
Appendix B	Bootstrap Procedure: Describes the three bootstrap options (automatic bootstrap, floppy bootstrap, and network bootstrap) and the procedure for implementing each.

REFERENCES

The following publications describe the Bridge Communications, Inc., product line:

[1] *Product Line Overview* (Bridge Communications, Inc.)

[2] *Connection Service User's Guide* (Bridge Communications, Inc.)

[3] *Network Management Guide* (Bridge Communications, Inc.)

[4] *Series/100 Planning and Installation Guide* (Bridge Communications, Inc.)

[5] *Series/200 Planning and Installation Guide* (Bridge Communications, Inc.)

[6] *IVECS Installation and Operation Guide* (Bridge Communications, Inc.)

[7] *NCS/150 Installation and Operation Guide* (Bridge Communications, Inc.)

[8] *NCS/1 Installation and Operation Guide* (Bridge Communications, Inc.)

[9] *Software Technical Reference Manual* (Bridge Communications, Inc.)

[10] *Cable Guide* (Bridge Communications, Inc.)

The following publications describe Ethernet, the Xerox Network System protocols, the TCP/IP protocols, and X.25 standards:

[11] *The Ethernet, A Local Area Network: Data Link Layer and Physical Layer Specifications,* Version 1.0 (Digital Equipment Corporation, Intel Corporation, and Xerox Corporation, 1980)

[12] *The Ethernet, A Local Area Network: Data Link Layer and Physical Layer Specifications,* Version 2.0 (Digital Equipment Corporation, Intel Corporation, and Xerox Corporation, 1982)

[13] *IEEE Standard 802.3 CSMA/CD Access Method and Physical Layer Specifications,* Draft Document (The Institute of Electrical and Electronics Engineers, Inc., 1985)

[14] *Internet Transport Protocols,* XSIS 028112 (Xerox Corporation, 1981)

[15] *Courier: The Remote Procedure Call Protocol,* XSIS 038112 (Xerox Corporation, 1981)

[16] *TCP/IP Internet Protocol Transition Workbook* (SRI International, 1982)

[17] *Ethernet Address Resolution Protocol,* RFC-826 (SRI International, 1982)

[18] *Internet Protocol,* RFC-791 (SRI International, 1982)

[19] *Internet Control Message Protocol,* RFC-792 (SRI International, 1982)

[20] *User Datagram Protocol,* RFC-768 (SRI International, 1982)

[21] *Transmission Control Protocol,* RFC-793 (SRI International, 1982)

[22] *Telnet Protocol,* RFC-764 (SRI International, 1982)

[23] *Name Server Protocol,* IEN-116 (SRI International, 1982)

[24] *Draft Revised CCITT Recommendation X.25,* COM VII No. 489 (CCITT Study Group VII, 1980)

Other related specifications include:

[25] *Intel Multibus* Specification,* 9800683-03 (Intel Corporation, 1981)

[26] *Intel iSBX* Bus Specification,* 142686-002 (Intel Corporation, 1981)

[27] *ATTACH** User Guide,* 10211X07 (ABLE Computer, 1983)

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* Multibus and iSBX are trademarks of Intel Corporation.

** ATTACH is a trademark of ABLE Computer.

CONTENTS

TABLES

FIGURES

1.0 INTRODUCTION

This publication provides the information necessary to plan for and install the Bridge Communications, Inc., Series/1 server products.

This section defines the purpose and scope of the publication and provides an overview of the product line of which the Series/1 servers are a part.

1.1 Purpose and Scope

This publication is designed for the system planner who needs a technical overview of the Series/1 server and for the system installer who needs specific installation instructions. It is intended to be used in conjunction with the *Connection Service User's Guide* and the *Network Management Guide* (references [2] and [3], respectively). These guides contain the information necessary for software configuration and for the operation and management of a Series/1 server.

The information in this publication has been prepared to fulfill the needs of the customer who primarily uses the turnkey services provided by the Series/1 servers. Turnkey services are automatically included in each server and require no programming or other enhancement.

For detailed information about non-turnkey features available on the Series/1 servers, see reference [9].

1.2 How to Use This Guide

Three discrete phases lead to the operation of a network system. This guide is divided into sections that provide the information necessary during each phase:

- *System Planning.* Section 2.0 provides a description of the Series/1 server products' capabilities and architectures.
- *Preinstallation Planning.* Sections 3.0 and 4.0 provide the information required for the preinstallation planning process.
- *Installation/Maintenance/Modification.* Sections 5.0 and 6.0 provide the information necessary for the installation, hardware configuration, maintenance, and modification of a Series/1 server.

1.3 Bridge Communications Product Line

Bridge Communications' Series/1 product line consists of Ethernet-based system products. Ethernet is a packet-switched Local Area Network (LAN) providing communication capability to and interconnection between various types of data processing equipment.

The Ethernet technology is described in detail in references [11] through [13], which specify the physical level and data link level protocols.

Bridge products support one of two sets of high-level protocols: Xerox Network Systems (XNS) protocols and Transmission Control Protocol/Internet Protocol (TCP/IP). Communication between members of the same set is supported; however, communication between the two sets of protocols is not. The XNS protocols are described in references [14] and [15]; the TCP/IP protocols are described in references [16] through [23].

The Bridge Communications product line includes six product families. These families are designated Series/1, Series/100, Series/200, Integrated VAX Ethernet Communications Server, Network Control Servers, and PC products.

The Series/1 product family consists of the following products, which are described in this guide:

- The Communications Server/1 (CS/1) connects up to 48 individual devices to XNS or TCP/IP local area networks.
- The LanSwitch/1 (LS/1) is a modular, high-performance data switch that connects up to 64 individual devices to XNS or TCP/IP local area networks.
- The Gateway Server/1 (GS/1) connects an XNS local area network to a network with an X.25 interface.
- The Gateway Server/3 (GS/3) connects two or more geographically distant XNS or TCP/IP local area networks by means of a medium- to high-speed communications link.
- The Gateway Server/4 (GS/4) connects two XNS local area networks.
- The Gateway Server/6 (GS/6) connects either XNS or TCP/IP local area networks over a single 6 MHz broadband channel.

The Series/100 product family includes the following products, which are described in reference [4]:

- The Communications Server/100 (CS/100) is functionally similar to the CS/1, providing network services to a wide range of asynchronous and synchronous devices on a maximum of 14 ports.
- The Gateway Server/300 (GS/300) connects two or more geographically distant XNS local area networks by means of a medium- to high-speed communications link.

The Series/200 product family consists of the following product, which is described in reference [5]:

- The Communications Server/200 (CS/200) is functionally similar to the CS/1, providing network services to a wide range of asynchronous, bit-synchronous, and byte-synchronous devices on a maximum of 10 ports.

The Integrated VAX Ethernet Communications Server product family consists of the following product, which is described in reference [6]:

- The Integrated VAX Ethernet Communications Server (IVECS) is a single-board Ethernet Communications Server that allows a VAX* minicomputer to attach directly to a local area network. It permits up to 64 terminal connections to the VAX over the network. No modifications or additions are required in the host hardware or software.

* VAX is a trademark of Digital Equipment Corporation.

The Network Control Server product family consists of the following products:

- The Network Control Server/150 (NCS/150) provides bootstrap service, configuration and macro file services, clearinghouse service, real-time clock service, and session and error statistics reporting service (audit trail) across either XNS or TCP/IP networks to servers running the same high-level protocols. The NCS/150 is described in reference [7].
- The Network Control Server/1 (NCS/1) is functionally similar to the NCS/150. The NCS/1 is based on a Sun Microsystems 2/120 Deskside SunStation.* The NCS/1 provides expanded services in a Bridge XNS network environment. The NCS/1 is described in reference [8].

The PC products allow IBM** Personal Computers or compatible systems to connect directly to an XNS Ethernet network. The PC products allow directly attached PCs to share files among PCs or to access mainframes and minicomputers attached to the Ethernet network via Bridge Communications, Inc., server products. The EtherSeries product family consists of the following:

- EtherLink*** is a circuit board that occupies an expansion slot of an IBM PC or compatible computer. EtherLink connects workstations and servers to the network.
- EtherTerm*** provides a PC with the ability to access remote mainframes, minicomputers, and public data networks. EtherTerm is available in both single-user and server versions.
- EtherStart is a hardware upgrade to EtherLink that allows a diskless networked PC to receive its operating system, drivers, and EtherSeries software from the PC network server.
- EtherShare*** network software allows a hard-disk equipped IBM PC or compatible with an EtherLink board to function as a PC network server.
- EtherPrint*** software allows the PC users on the Ethernet network to share up to two parallel printers and one serial printer that are attached to the PC network server.
- EtherMail*** provides electronic mail services for the PC network.

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* SunStation is a trademark of Sun Microsystems, Inc.

** IBM is a registered trademark of International Business Machines Corporation.

*** EtherLink, EtherTerm, EtherShare, EtherPrint, and EtherMail are trademarks of 3Com, Inc.

2.0 FUNCTIONAL DESCRIPTION

This section provides a functional description of the services offered by the Bridge Series/1 products, lists the features and capabilities of each product, and describes both the overall system architecture and the individual hardware and software modules.

2.1 Service Overview

The two major services provided by the Series/1 servers are the Connection Service and the Interconnection Service. The following sections describe these services.

2.1.1 Connection Service

The Connection Service is available to a user (interacting with the server via a terminal device) or to a host computer. This standard service requires no programming on the part of the customer. The goal of the Connection Service is to provide a friendly, highly reliable interface for the user, and a simple, fast interface for the host.

The Connection Service allows the user to establish a virtual circuit (logical connection) between two terminal devices, between a terminal device and a host, or between two hosts. The name "terminal device" is used generically to indicate any terminal-like device. The user or device may actually be a computer emulating a terminal or a process feeding such a terminal emulator.

The user (or terminal emulator) specifies the name of the device to which the circuit is to be established. Once the circuit is established, all information is passed reliably between the two devices.

Figure 2-1 illustrates the CS/1 Connection Service configured as a "terminal switch," allowing terminal devices to communicate with multiple hosts. This service also provides a mechanism for host-to-host data transfer.

Figure 2-2 (A) shows the sequence of events initiated by a user request for a virtual circuit to a host computer. Figure 2-2 (B and C) shows how this service is extended via the GS/1 Connection Service.

The Connection Service provides protocol processing through the session level and takes care of all acknowledgements, duplicate filtering, sequencing, retransmission, and flow control.

The Connection Service allows a terminal or host connected to a network via a CS/1 to establish virtual connections with a host or terminal on an X.25 network, and vice versa. This service provides translation from XNS protocols to X.25 and X.29 protocols. The GS/1 acts as a shared packet assembly/disassembly (X.25 PAD Server) when used in conjunction with the CS/1.

The Connection Service allows multiple simultaneous connections on each port, up to a maximum of eight connections on a single port.

Connection Service commands allow users to:

- Establish and terminate a virtual circuit to another device
- Examine and alter configuration parameters (e.g., device type, baud rate, parity, flow control)
- Send and receive in-band and out-of-band signals (e.g., interrupts)
- Switch among multiple sessions
- Assign and use logical names
- Examine error and traffic statistics
- Establish automatic X.25 connections

The Connection Service commands are available to each port configured to support an asynchronous terminal. For character-synchronous and bit-synchronous terminal ports, the functions provided by the Connection Service commands (e.g., forming connections) must be performed remotely by a "third-party" terminal connected to an asynchronous port.

Connection Service commands are described in detail in reference [2].

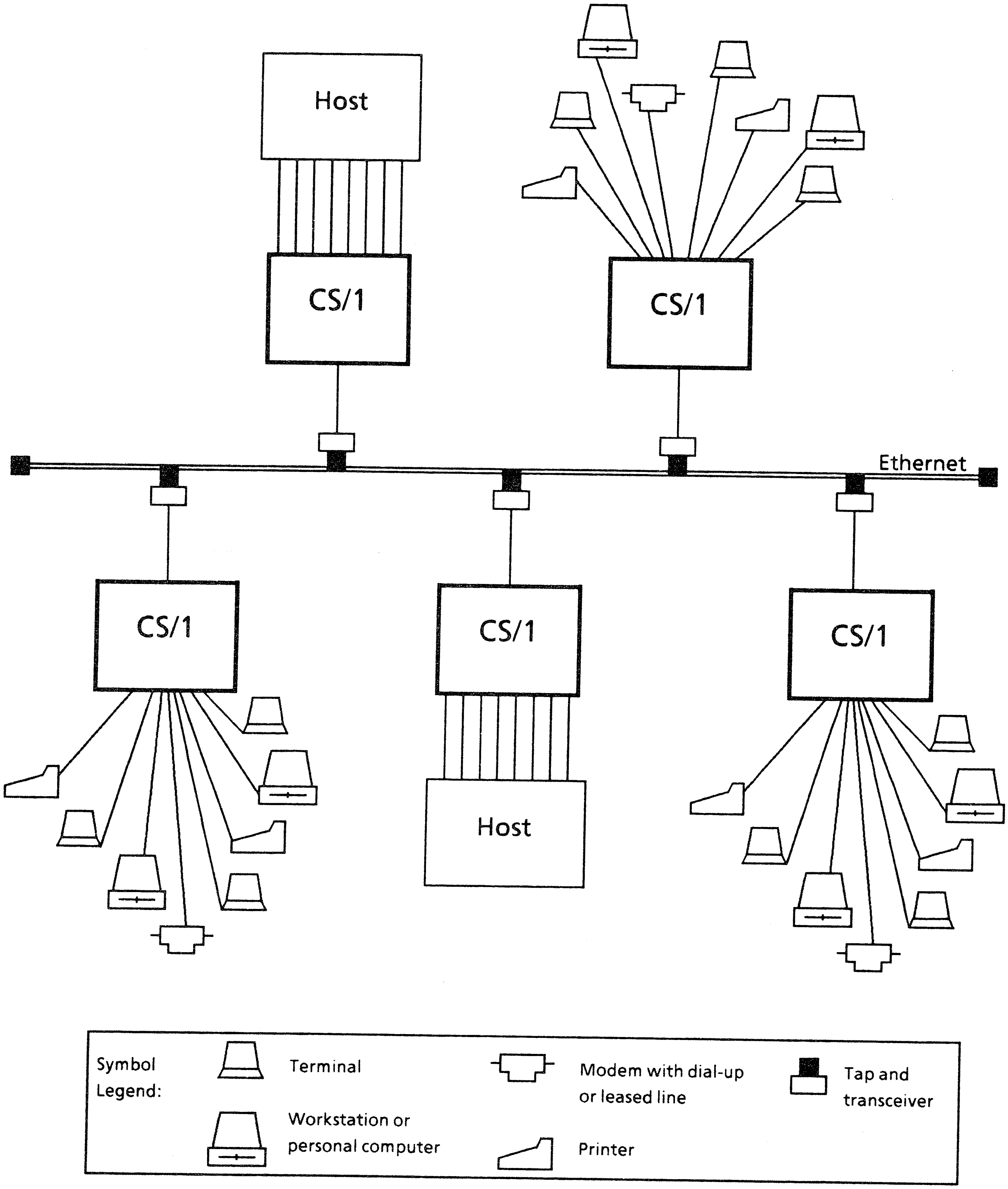
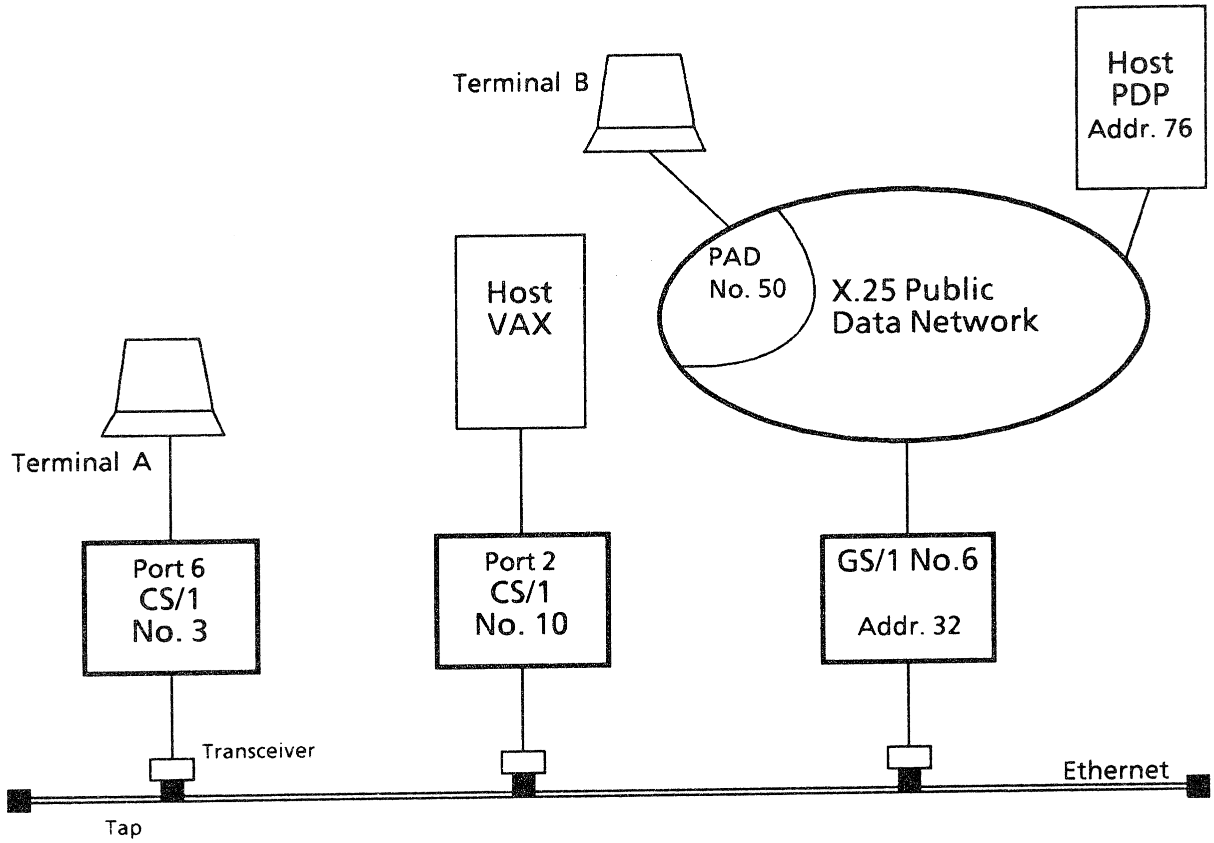


Figure 2-1 Connection Service



A) Terminal A to host VAX (CS/1 to CS/1)

1: User at terminal A enters "CONNECT VAX"
2: CS/1 No. 3 determines address of VAX
3: CS/1 No. 3 tells CS/1 No. 10 to open a connection on port 2
4: CS/1 No. 10 notifies host VAX of the connection request
5: CS/1 No. 10 tells CS/1 No. 3 that connection is open
6: CS/1 No. 3 outputs "Connected to VAX" to terminal A and all data is passed between terminal A and VAX

B) Terminal A to host PDP (CS/1 to GS/1)

1: User at terminal A enters "CONNECT PDP"
2: CS/1 No. 3 determines address of PDP
3: CS/1 No. 3 tells GS/1 No. 6 to open a connection to X.25 address 76
4: GS/1 No. 6 issues X.25 call to host PDP; host returns call accepted
5: GS/1 No.6 tells CS/1 No. 3 that connection is open
6: CS/1 No. 3 outputs "Connected to PDP" to terminal and all data is passed between terminal A and PDP

C) Terminal B to host VAX (GS/1 to CS/1)

1: Terminal B connects to GS/1 No. 6 (X.25 address 32) through PAD
2: User at terminal B types "CONNECT VAX"
3: GS/1 No. 6 determines address of VAX
4: GS/1 No. 6 tells CS/1 No. 10 to open a connection on port 2
5: CS/1 No. 10 notifies VAX of the connection request
6: CS/1 No. 10 tells GS/1 No. 6 that connection is open
7: GS/1 No. 6 outputs "Connected to VAX" to terminal B and all data is passed between terminal B and VAX

Figure 2-2 Virtual Circuit Establishment

2.1.2 Interconnection Service

Local Area Network systems are used to interconnect devices within a geographically limited area. In the case of Ethernet networks, for example, the maximum length of a single network is 2.5 kilometers. Extending the services provided by a Local Area Network over a wider geographic area requires internetwork gateways. The communications protocols accomplish internetwork routing functions in a manner transparent to the user.

Bridge Communications offers four Series/1 internetwork gateway products, which differ in the means by which they interconnect Ethernet networks.

- Gateway Server/1 (GS/1)

  The GS/1 interconnects two or more XNS Ethernet networks via an X.25-based, packet-switched, long-haul network; the full X.25 protocol set (X.25 Levels 1 to 3) is used as an XNS Level 0 protocol.

  The GS/1 uses the medium of an X.25 network to transmit packets between two Ethernet networks that both use the IDP protocol.

  The GS/1 Interconnection Service is typically used where resources or data are to be shared between devices located on two or more geographically distant XNS Ethernet networks. For example, a corporation with headquarters in New York and regional sales offices in Chicago and Los Angeles has an XNS Ethernet in each location for local area communication within each office. On each of the three Ethernet networks, a GS/1 is connected via modem lines to an X.25-based Public Data Network (PDN). This interconnection enables virtual circuits to be created from any device (in any of the three locations) to any other device, thus providing all three office locations with mutual access to shared data and resources.

- Gateway Server/3 (GS/3)

  The GS/3 interconnects two or more XNS or TCP/IP Ethernet networks via direct connection, switched or leased telephone lines, or other medium- to high-speed, point-to-point communication links.

  The GS/3 Interconnection Service might be used by a corporation with offices in several buildings within the same city. The buildings are too far apart to connect via a single Ethernet coaxial cable (maximum length 2.5 km) but near enough that the use of a PDN as connecting medium is impractical. In this case, the Ethernet in each office location includes a GS/3 connected via short-distance communication links to one or more of the Ethernets in the other locations.

- Gateway Server/4 (GS/4)

  The GS/4 links two XNS Ethernet networks via a transceiver connector on each network. The GS/4 Interconnection Service is best suited for environments such as high-rise buildings and large manufacturing areas, where the number of users increases daily. GS/4s can tap into existing networks in the building, allowing one area to communicate with any other area. As many as 16 GS/4s can be used on one Ethernet network.

- Gateway Server/6 (GS/6)

  The GS/6 uses a broadband trunk to connect two or more XNS or TCP/IP Ethernet networks. The GS/6 Interconnection Service can be used in a single-cable broadband environment that conforms to IEEE 802 channel standards. By combining the advantages of baseband communication with the distance capability of broadband communication, the GS/6 can extend the range of Ethernet networks to 40 miles, depending on the topology of the broadband network.

The GS/6 is typically used in a large industrial complex or campus environment, in which each building is served by a separate Ethernet network. In this type of environment, the advantages of using GS/6s rather than GS/3s include:

— Line speed. The GS/6 broadband network is capable of a data rate of 1M bps, while telephone lines (the typical communication links between GS/3s) have a maximum speed of 64K bps.

— Topology. The GS/6 broadband network has a broadcast trunk topology, and only one broadband network is needed to interconnect many Ethernet networks. The GS/3 communication link is a point-to-point link; each such link can interconnect only two Ethernet networks.

— Existing systems. The GS/6 broadband scheme can coexist with other broadband data, voice, or video transmission systems. The GS/6 modems usually can be integrated with an existing CATV network (depending on the transmit/receive frequency range used).

Figures 2-3 through 2-6 show the Interconnection Service provided by the GS/1, GS/3, GS/4, and GS/6, respectively.

The Bridge Gateway Servers each perform internetwork routing functions, based on information stored in a routing table of the remote networks to which they are attached.

For Gateway Servers running the XNS protocols, the routing table initially contains only the information entered by the network manager during system generation (described in reference [3]). As long as the server is powered on, it broadcasts its routing table at regular intervals to the Gateway Servers on all of the attached networks. On the basis of transmissions it receives from other servers, each Gateway Server expands its routing table dynamically to include all networks that can be reached through multiple hops across the other Gateway Servers. Each remote Ethernet number appears only once in a server's routing table, accompanied by the address of the first server in the path and the number of hops necessary to reach the remote Ethernet. The Gateway Server that keeps the routing table chooses the shortest available path to each destination network. If a shorter path appears, the server revises its table. For further information on the XNS Connection routing, see reference [14]. Gateway Servers running the IP protocol use static routing tables which are created and maintained by the network manager. As information becomes available (i.e., as networks are added or removed, or as shorter paths appear) the network manager updates the routing tables.

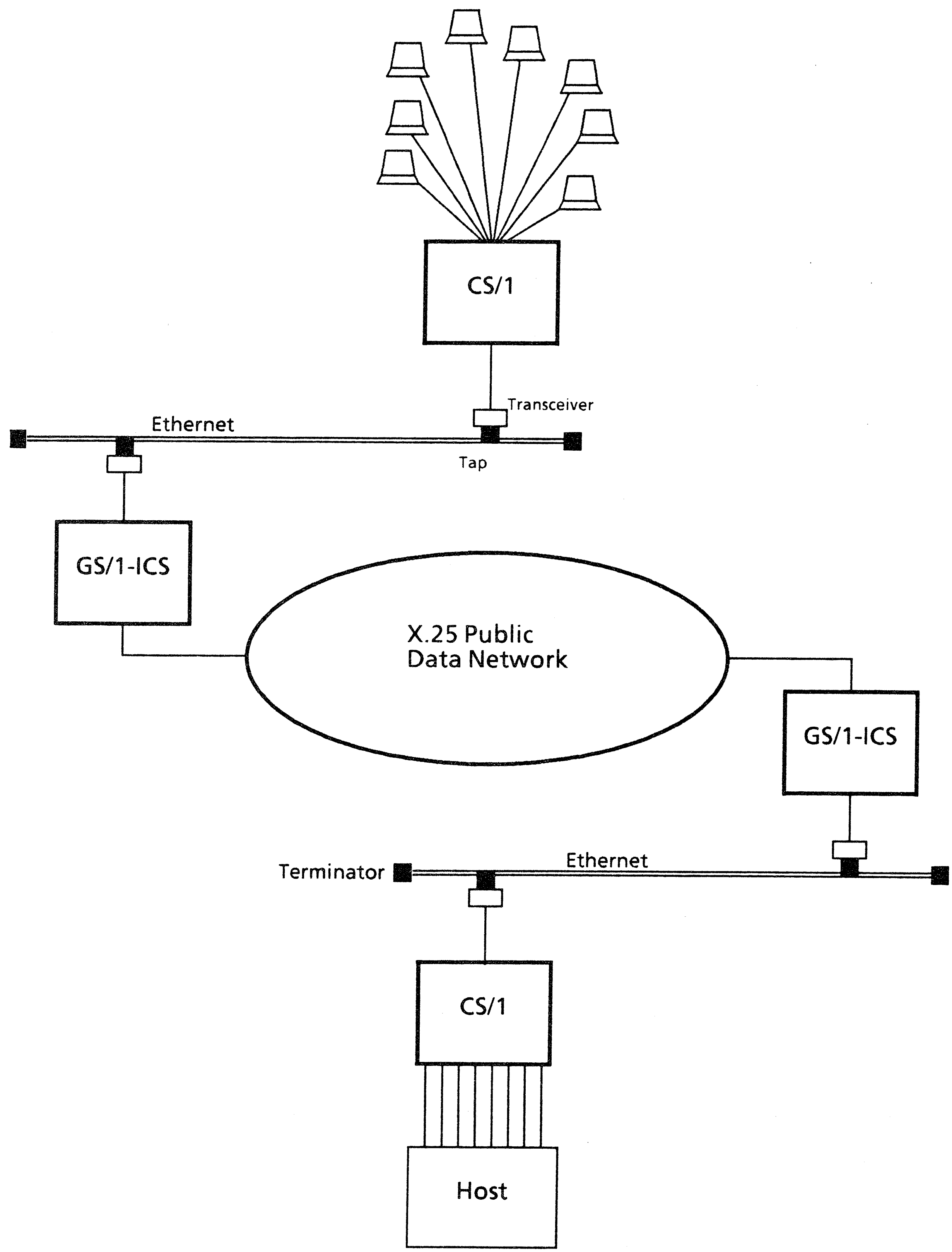


Figure 2-3 GS/1 Interconnection Service

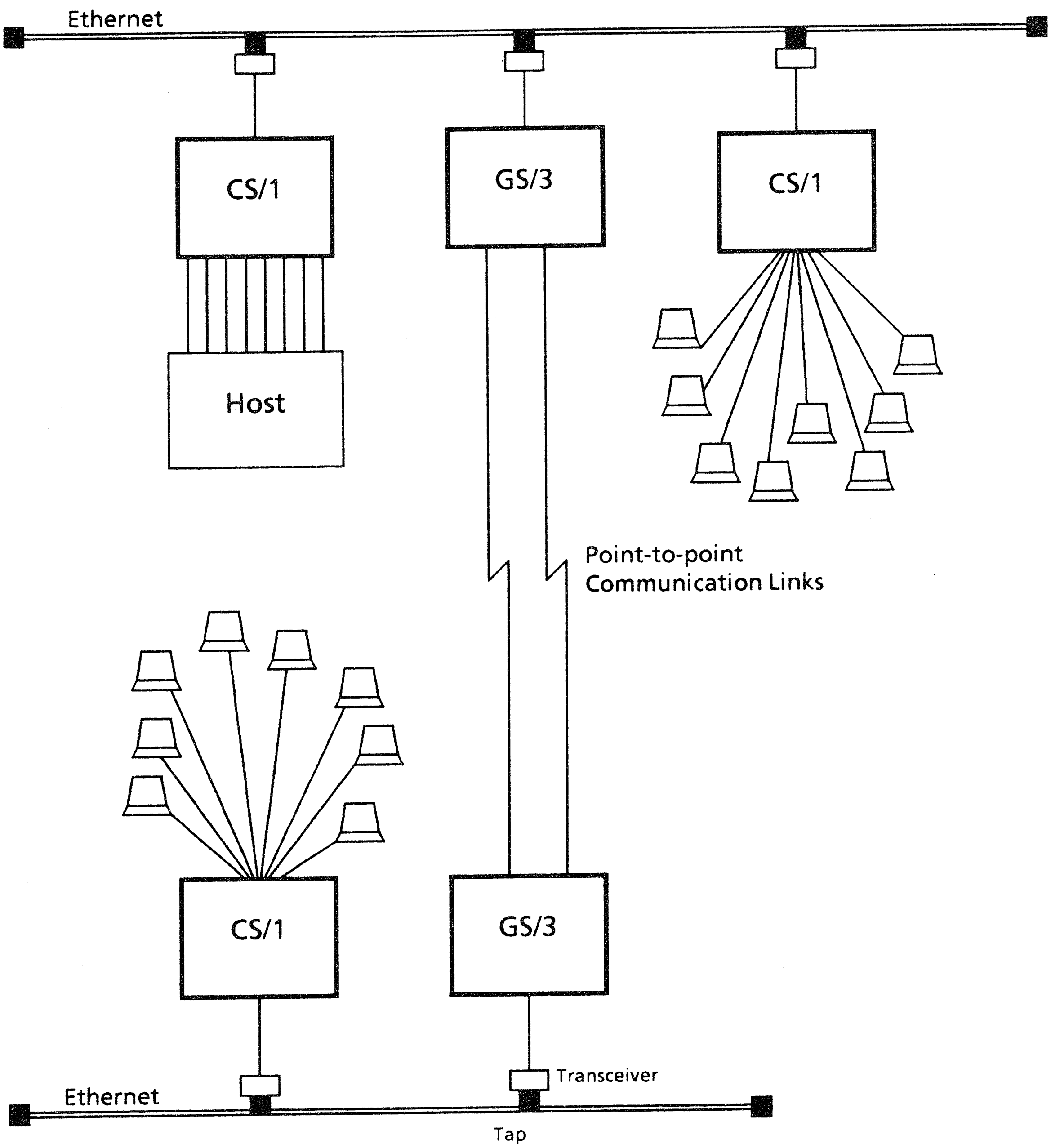


Figure 2-4 GS/3 Interconnection Service

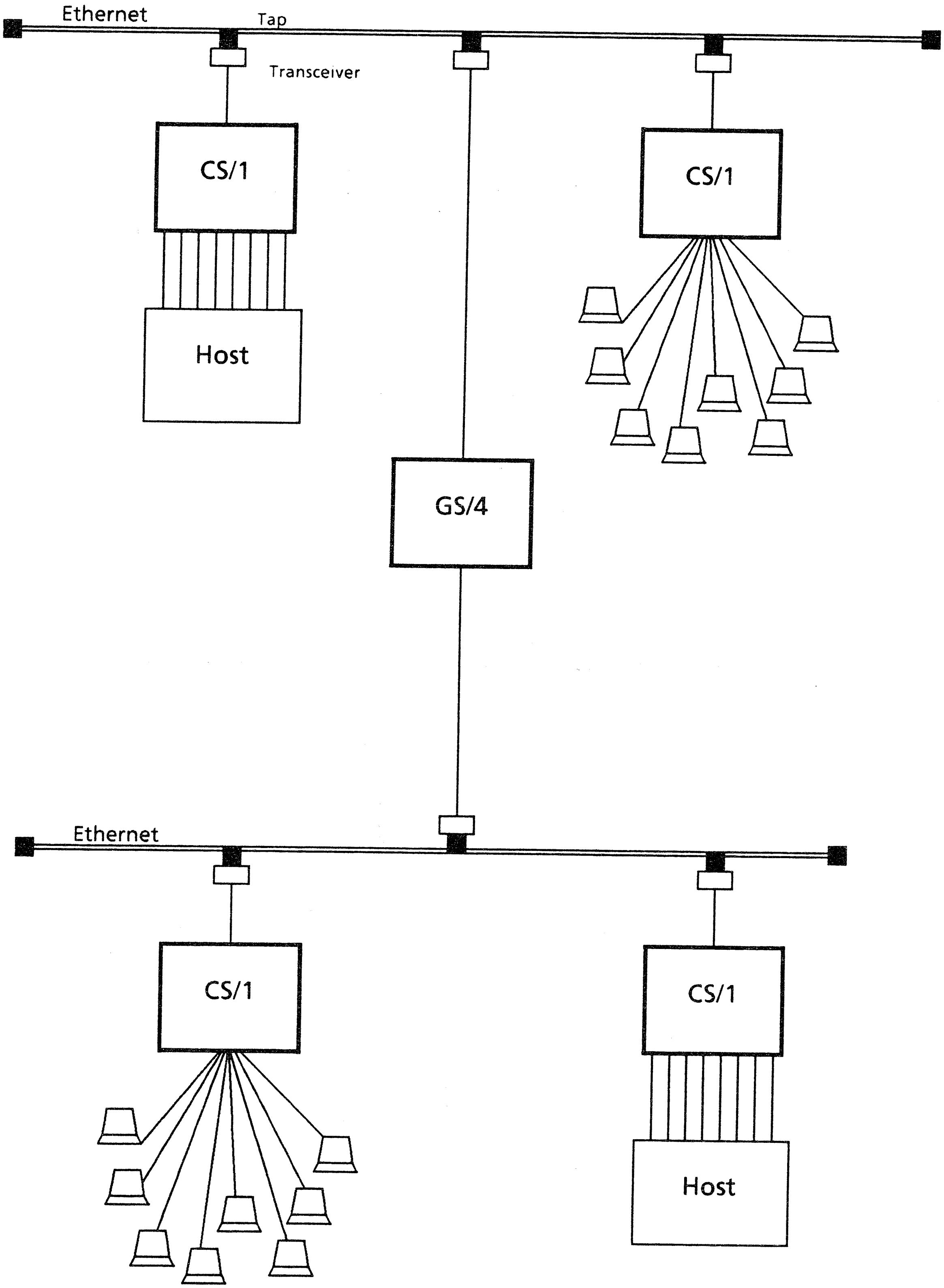


Figure 2-5 GS/4 Interconnection Service

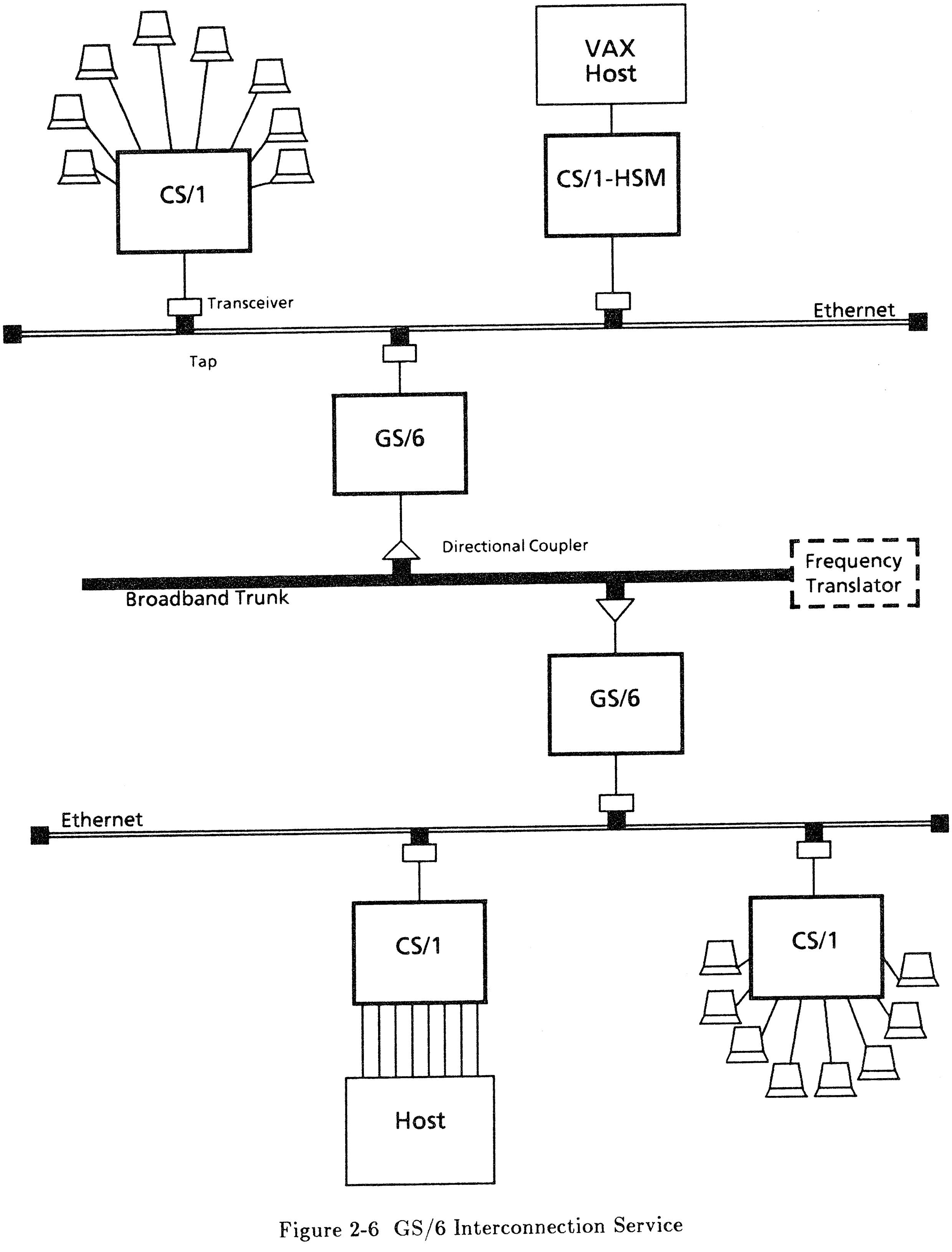


Figure 2-6 GS/6 Interconnection Service

2.2 Features and Capabilities

This section describes the features and capabilities of different models of the Series/1 server.

2.2.1 CS/1-A/BSC/SDLC and Features and Capabilities

The CS/1-A, CS/1-BSC, and the CS/1-SDLC provide full connectivity among a set of devices by implementing virtual connections among them over an Ethernet network. The CS/1-A is available with software that runs either XNS or TCP/IP protocols.

These Communications Servers automatically provide the Bridge Connection Service (see Section 2.1.1).

The CS/1-A (Asynchronous) supports asynchronous terminals, modems, hosts, printers, word processors, personal computers, and other devices with an RS-232-C interface (standard) or an RS-422 interface (optional).

The CS/1-BSC (Bisynchronous) supports most character-synchronous terminals, modems, and hosts.

The CS/1-SDLC supports most bit-synchronous terminals, modems, and hosts, with either SDLC or HDLC interfaces. SDLC refers to the Synchronous Data Link Control protocol, and HDLC refers to the High-level Data Link Control protocol.

A CS/1 may be ordered with any one of these three interface variations or with a combination of two or more variations installed in one unit.

The CS/1-A/BSC may be ordered with a special software package, called SPMUX, that emulates a Sperry MUX* (multiplexer) and provides communications for Sperry UTS* terminals. The SPMUX package is described in more detail in Section 2.2.4.

The CS/1-A, CS/1-BSC, and CS/1-SDLC interface variations offer a choice of two electrical protocols for serial communication: RS-232-C and RS-422. RS-232-C can be used for distances up to 200 feet at speeds up to 19.2K bps and is not recommended for noisy or industrial environments. RS-422 can be used for distances up to 4000 feet at speeds up to 64K bps and provides excellent noise protection and minimal RFI generation. RS-422 tolerates ground shifts up to 7 volts.

2.2.2 CS/1-HSM Features and Capabilities

The CS/1-HSM provides up to 64 virtual ports to a DEC** VAX host computer over one or two high-speed multiplexed lines. These virtual ports are available to devices attached to other servers on the same Ethernet or on an accessible Ethernet. The CS/1-HSM runs only the XNS protocols.

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* Sperry MUX and UTS are trademarks of Sperry Corporation.

** DEC is a trademark of Digital Equipment Coporation.

The CS/1-HSM package includes a Host Adapter Card (HAC), which is installed in the host computer in place of one or more of the DMF32* cards that usually provide terminal access. Each HAC can provide up to 64 ports, replacing up to eight DMF32 cards.

**** NOTE ****

> For the host to support a CS/1-HSM, it must be equipped with an asynchronous DMF32 driver.

Each CS/1-HSM can support one or two hosts, with a total combined maximum of 64 ports.

The CS/1-HSM package also includes a HAC cable, which connects the CS/1-HSM to the host.

2.2.3 CS/1-SNA Features and Capabilities

The CS/1-SNA provides an interface between an SNA host and an Ethernet network. Two versions of software are available on the CS/1-SNA: one version runs the XNS protocols; the other, the TCP/IP protocols.

The CS/1-SNA is compatible with Ethernet systems and with the IBM Systems Network Architecture (SNA) protocols. The CS/1-SNA Connection Service is available to asynchronous devices connected to an XNS Ethernet via a CS/1, CS/100, or other device. The Connection Service is also available to asynchronous devices running the TCP/IP protocols and connected to the Ethernet via any UNIX-based system that has TCP/IP capability, such as a Sun Microsystems workstation.

To the SNA host, the CS/1-SNA appears to be a 3274 model 51C cluster controller. Asynchronous terminals on the Ethernet emulate 3278 model 2 devices, and printers emulate 3287 SCS and 3287 DSC devices. In SNA terms, the CS/1-SNA looks like a Type 2 PU (physical unit) with Type 1, 2, or 3 LUs (logical units). Type 1 and 3 LUs are printers, and Type 2 LUs are terminals.

Each CS/1-SNA supports one synchronous port with a maximum of 24 LU-to-LU sessions. The CS/1-SNA can be connected directly to the IBM 37x5 front-end processor or to a Bell 208A or 208B modem. It has also been tested successfully with the Amdahl 4705 front-end processor. The CS/1-SNA supports line speeds up to 64K bps; the SDLC link can be half duplex or full duplex.

The CS/1-SNA uses an RS-232-C, D-Series connector, which is compatible with the CCITT X.21bis and V.24 specifications. An SIO module providing V.35 connectors is available as an option.

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* DEC and DMF32 are trademarks of Digital Equipment Corporation.

The CS/1-SNA supports the following asynchronous terminals:

- Beehive International BeeHive
- Digital Equipment Corporation (DEC) models VT100 (both the standard version and the one that performs 3270 special functions via the numeric keypad), VT220, VT240, and VT241
- Falco Data Products model 1078
- Honeywell models VIP 7200, 7201, 7305, 7801, and 7814
- IBM model 3101
- Lear Siegler models ADM1178 and ADM3A
- TeleVideo Systems model 925
- Xerox model 820

An IBM PC running EtherTerm emulates a DEC VT100 and, therefore, is also supported by the CS/1-SNA; however, in this application, only the XNS software is supported.

The CS/1-SNA supports the following asynchronous printers:

- DEC model LA100
- Diablo model 630
- Epson model RX-80
- Texas Instruments model 810.

2.2.4 Sperry MUX Features and Capabilities

A CS/1 containing SIO-STS modules or a combination of SIO-A and SIO-STS modules can support Sperry MUX (SPMUX) software. (Refer to Section 5.2 for a discussion of SIO modules.) SPMUX provides communication between Sperry Universal Terminal System (UTS) or other UTS-compatible terminals and Sperry DCP* host front-end processors. The SPMUX software is also capable of supporting asynchronous terminals.

The SPMUX Connection Service is available only to UTS terminals connected to an XNS Ethernet via SIO-STS modules in a CS/1 running the SPMUX software; the DCP host is connected to the Ethernet via a CS/1 containing SIO-SMS modules. Terminals attached to SIO-A modules in a CS/1 running SPMUX software use the standard Connection Service, and cannot make connections to the DCP host.

On the UTS terminal end, a CS/1 running the SPMUX software emulates Sperry multiplexer equipment. In the standard Sperry configuration, the multiplexer connects the terminal to the DCP either directly or via a modem and communication link. On the DCP host end, each line from the CS/1 emulates a communication link from a multiplexer, carrying multiplexed messages to and from UTS terminals.

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* DCP is a trademark of Sperry Corporation.

A CS/1 running SPMUX software supports up to 8 UTS terminals per SIO-ST board, for a maximum of 32 terminals; at the host end, each CS/1 can support up to 10 DCP ports. Performance tests indicate that in an installation running a Mapper* application, a ratio of 8 to 16 terminals per DCP port and a maximum of 10 DCP ports per CS/1 yields an average user response time of 3 to 8 seconds. Increasing the number of terminals per DCP port or increasing the number of DCP ports per CS/1 degrades user response time correspondingly.

The CS/1 running SPMUX software provides the capability of configuring ranges of terminal groups and mapping these groups to specific DCP port numbers. The CS/1 and the SPMUX software, with the DCP demultiplexer, ensure end-to-end data integrity.

UTS terminals are connected to the CS/1 with standard Sperry UTS device cables provided by the customer. The DCP is connected to the CS/1 with a special host adapter cable (CBL-SH-25) provided by Bridge Communications, Inc.

Refer to Section 3.1.7 for information on the SIO requirements of the CS/1 running the SPMUX software and to Figure 4-5 for the specifications of the host adapter cable.

2.2.5 GS/1 and CS/1-X.25 Features and Capabilities

The GS/1 (XNS Ethernet-to-X.25 Gateway) provides communication between devices connected to an Ethernet network and devices connected to an X.25 network (Connection Service), or between remote Ethernets connected by an X.25-based Public or Private Data Network (Interconnection Service). The CS/1-X.25 provides an interface to an X.25 host, allowing up to 48 virtual circuits on a single, high-speed line.

The GS/1 and CS/1-X.25 Connection Services are compatible with Ethernet systems that use the XNS Sequenced Packet Protocol (SPP) and with the standard X.25 protocol defined by the *CCITT Recommendation X.25* (reference [24]). The GS/1 has been tested and certified on a variety of X.25-based Public Data Networks (PDNs). Contact Bridge Communications, Inc., or an authorized representative for further information on specific PDNs.

The GS/1 Interconnection Service is available to devices connected to an Ethernet via a Bridge Communications Server, or other XNS-compatible device. The GS/1 and CS/1-X.25 Connection Service is available to devices connected to an Ethernet via a Bridge Communications Server, or other XNS-compatible device and to devices accessing the GS/1 via an X.25 PDN. When the GS/1 receives a packet destined for a remote Ethernet, it checks to see if an X.25 logical channel exists to the Gateway Server on the remote Ethernet. If a logical channel already exists, the GS/1 routes the traffic on that channel. If no logical channel exists, the GS/1 creates one.

Every 20 seconds, the GS/1 computes the traffic level on each logical channel to each destination. If one logical channel is overutilized, the server establishes an additional logical channel to the same destination. If several logical channels to one destination exist, and one or more of them is underutilized, the server terminates one logical channel. If a single, unused logical channel exists, the server targets it for possible termination. If the logical channel has still had no traffic within 300 seconds, the server terminates the channel.

* Mapper is a trademark of Sperry Corporation.

When establishing logical channels, the server balances the load as evenly as possible among the physical lines at both ends of the connection. When routing packets to a destination served by multiple logical channels, the server allocates sequential packets to the different channels on a round-robin basis.

Each GS/1 or CS/1-X.25 SIO module supports two synchronous ports, with a maximum aggregate transfer rate of 75.2K bps. The maximum transfer rate on any one port varies from 56K bps to 64K bps, depending on the maximum speed supported by the PDN. (For example, Tymnet supports speeds up to 56K bps, while Transpac supports speeds up to 64K bps.) The typical port speed combinations are one 56K bps port and one 19.2K bps port, or two 19.2K bps ports. Both servers support up to two SIO boards.

The GS/1 and CS/1-X.25 offer a choice of three electrical protocols for serial communication: RS-232-C, RS-422, and V.35. RS-232-C can be used for distances up to 200 feet at speeds up to 19.2K bps and is not recommended for noisy or industrial environments. RS-422 can be used for distances up to 4,000 feet at speeds up to 64K bps and provides excellent noise protection and minimal RFI generation. RS-422 tolerates ground shifts up to 7 volts. V.35 is designed specifically to interface with high-speed modems (e.g., Bell 303).. Distances up to 200 feet at speeds up to 64K bps are permissible; noise protection is similar to that with RS-232-C. Refer to Sections 4.4 and 4.5 for further information.

The standard GS/1 and CS/1-X.25 use an RS-232-C, D-Series connector, which is fully compatible with the CCITT X.21bis specification. CCITT X.21 connectors with RS-422 electrical protocols, RS-449 connectors with RS-422 electrical protocols, or V.35 connectors are available as options.

2.2.6 GS/3 Features and Capabilities

The GS/3 (Point-to-Point Gateway) acts as a server on the Ethernet, providing communication between devices on the local Ethernet and devices on another Ethernet via a medium- to high-speed, synchronous communication link. The GS/3 is similar to the GS/1, except that packets transmitted by the GS/3 to a GS/3 on another Ethernet are encapsulated in a simple HDLC framing protocol rather than in the full X.25 protocol set. Thus, the interface need not conform to X.25 PDN specifications in terms of data transfer speed, frame size, or other protocol considerations.

Two versions of software are available on the GS/3: one version runs the XNS protocols; the other, the IP protocol.

The GS/3 supports one service, the Interconnection Service, which provides transparent automatic routing of packets between two or more Ethernets. The full range of services available in a single-Ethernet network are thus available to devices located on interconnected Ethernets. The user may notice performance variations, depending on the speed of the link between the GS/3s, but otherwise perceives no difference in the services.

The particular type of communication link used between GS/3s depends on the distance between GS/3s, the customer's requirement for data transfer rates, and other factors. Section 4.5 describes the capabilities, requirements, and restrictions of the various types of communication links supported by the GS/3.

When a GS/3 is configured with multiple lines to the same remote GS/3, the Interconnection Service can perform load-balancing on those lines. The GS/3 is also failure-adaptive, and can automatically switch transmission from one line to another if a line becomes unavailable or congested. The server monitors response time and reliability on each line, automatically switching packets to different lines to optimize performance. If a line remains idle for the entire duration of the interval used by the packet-checking algorithm, the server sends a probe packet to test the line. If no acknowledgement is received, the GS/3 removes the line from the routing table until subsequent probes show that it is operational.

With XNS protocols, each GS/3 Serial I/O module provides two synchronous, full-duplex ports, with a maximum aggregate transfer rate of 75.2K bps. The maximum transfer rate on any one port is 64K bps. Up to four SIO modules may be installed, for a maximum of eight ports per GS/3. With the IP protocol, each GS/3 provides a synchronous full-duplex port, with a maximum aggregate transfer rate of 75.2K bps. The maximum transfer rate on the port is 64K bps. Up to two SIO modules may be installed for a maximum of four ports per GS/3.

The GS/3 offers a choice of three electrical protocols for serial communication: RS-232-C, RS-422, and V.35. RS-232-C can be used for distances up to 200 feet at speeds up to 19.2K bps and is not recommended for noisy or industrial environments. RS-422 can be used for distances up to 4,000 feet at speeds up to 64K bps and provides excellent noise protection and minimal RFI generation. RS-422 tolerates ground shifts up to 7 volts. V.35 is designed specifically to interface with high-speed modems (e.g., Bell 303). Distances up to 200 feet at speeds up to 64K bps are permissible; noise protection is similar to that with RS-232-C. Refer to Section 4.5 for further information. The standard GS/3 uses RS-232-C, D-Series connectors. CCITT X.21 connectors with RS-422 electrical protocols, RS-449 connectors with RS-422 electrical protocols, or V.35 connectors are available as options.

2.2.7 GS/4 Features and Capabilities

The GS/4 (Ethernet-to-Ethernet Gateway) interconnects two XNS Ethernet networks via a transceiver device on each network. The server provides communication between devices on both networks.

The GS/4 supports only the Interconnection Service, which provides transparent automatic routing of packets between two Ethernets. The full range of services is available to devices located on both Ethernets; the user perceives no difference in the services.

The GS/4 treats the Ethernets it connects as two separate networks. It forwards packets meant for one network to that network only, thus reducing the traffic on each network.

2.2.8 GS/6 Features and Capabilities

The GS/6 (Ethernet-to-Broadband Gateway) provides communication between devices on the local Ethernet and devices on other Ethernets via a broadband trunk.

Two versions of software are available on the GS/6: one version runs the XNS protocols, the other, the IP protocol.

The GS/6 supports only the Interconnection Service which provides transparent automatic routing of packets between two or more Ethernets. The full range of Bridge networking services is available to devices located on both Ethernets; the user perceives no difference in the services.

Each GS/6 supports one HSM-MDM board with one frequency-shift-keying (FSK) modulated RF port. The port supports a maximum data transfer rate of 1M bps (the rate on a single 6 MHz broadband channel).

2.3 System Architecture

Each Series/1 product consists of three basic functional modules: the Central Communications Processor (CCP) module and two external interface modules (I1 and I2). These basic modules are illustrated in Figure 2-7.

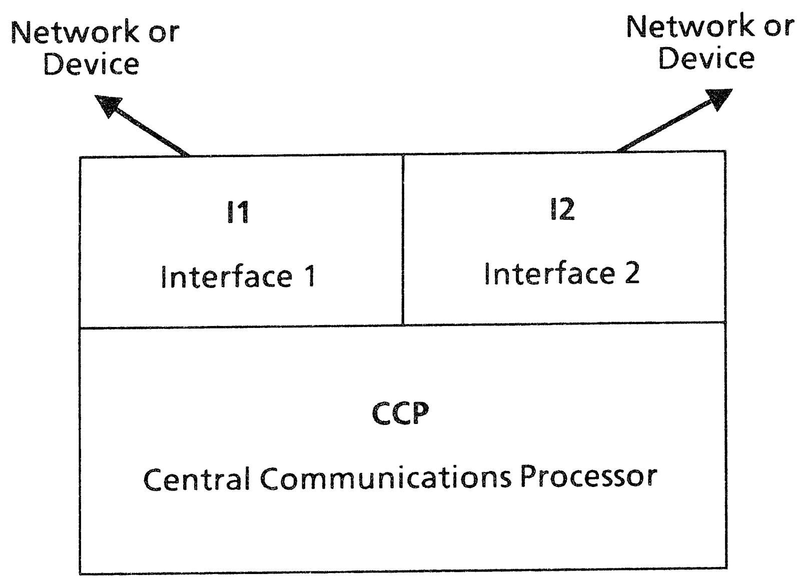


Figure 2-7 Basic Functional Modules

The CCP is made up of a Main CPU (MCPU) board, a multitasking kernel (the operating system), the communications protocol software, and support software. The CCP provides the internal interface between the two external interface modules.

The I1 module for Series/1 products is the Ethernet Controller module.

The I2 module for Series/1 products (except the GS/4 and GS/6) consists of an I/O module, and a serial device driver, an HDLC framing driver, or an SDLC framing driver. The GS/4 and GS/6 do not support I/O modules. The GS/4 I2 module is a second Ethernet Controller module; the GS/6's is a Broadband Driver module.

Figures 2-8 through 2-15 illustrate the basic functional modules of the Series/1 products.

The system hardware is described in Section 2.4, and the system software is described in Section 2.5.

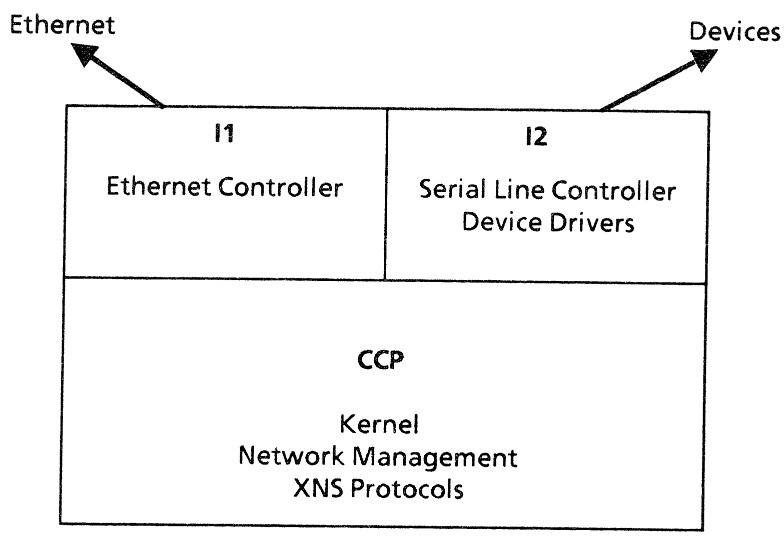


Figure 2-8 CS/1-A and GS/3 (with XNS protocols), CS/1-BSC/SDLC, and CS/1-HSM Functional Modules

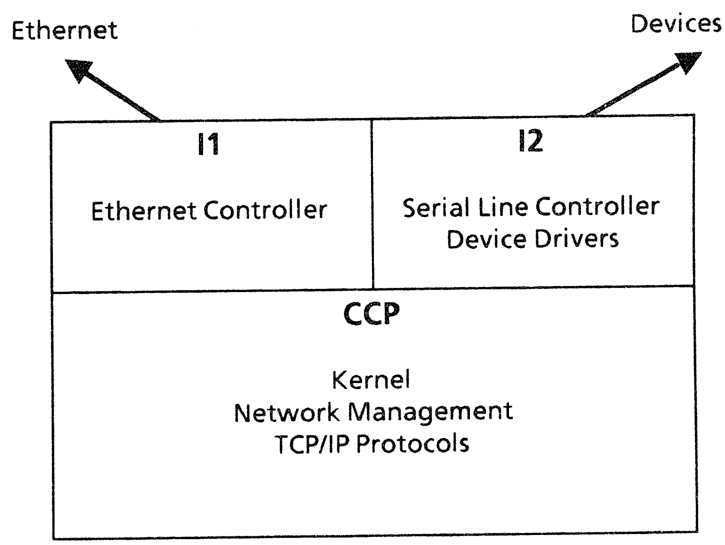


Figure 2-9 CS/1-A (with TCP/IP protocols) and GS/3 (with the IP protocol) Functional Modules

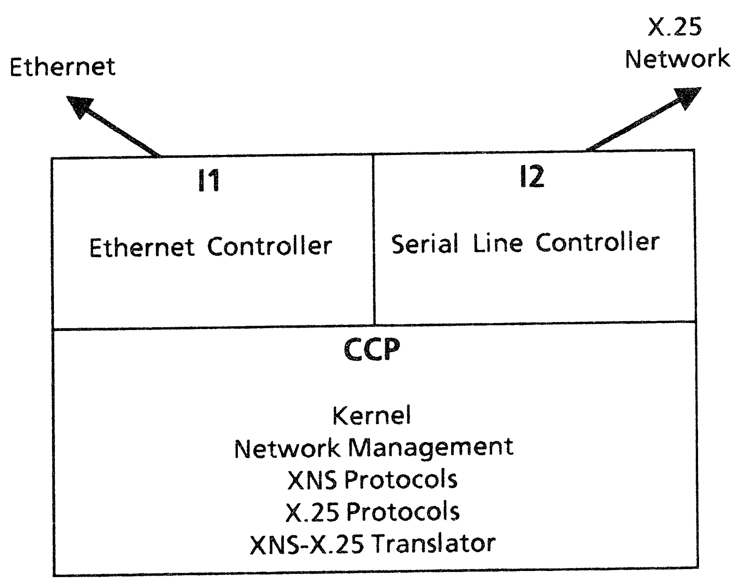


Figure 2-10 GS/1 and CS/1-X.25 Functional Modules

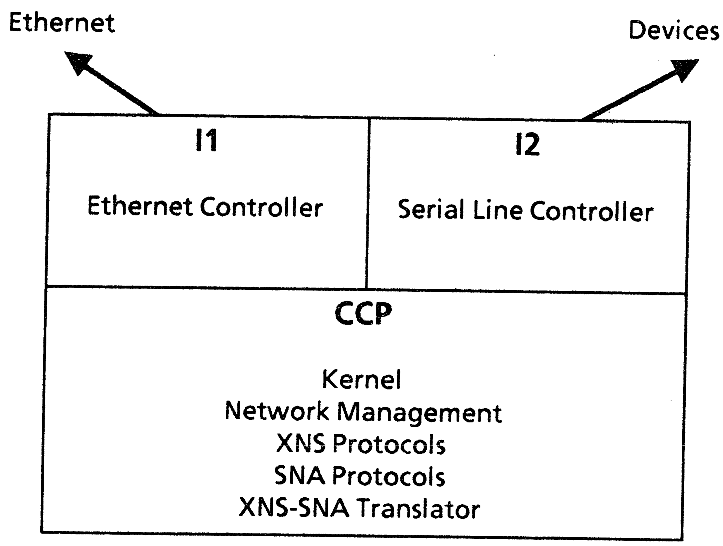


Figure 2-11 CS/1-SNA Functional Modules
(with XNS protocols)

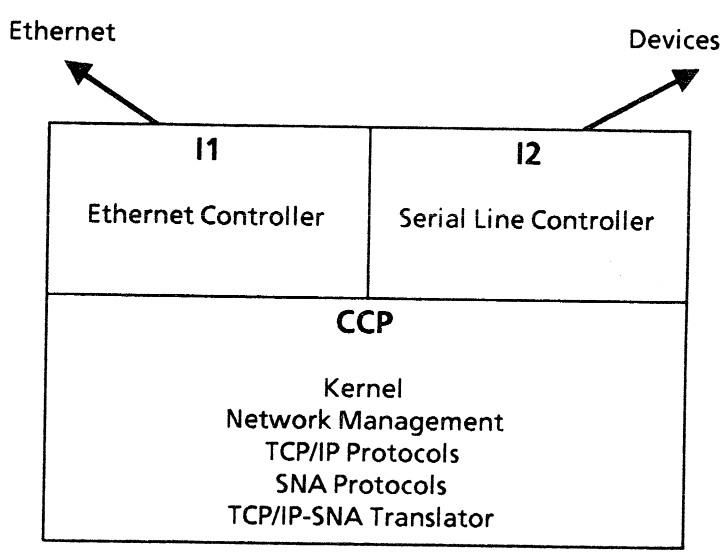


Figure 2-12 CS/1-SNA Functional Modules
(with TCP/IP protocols)

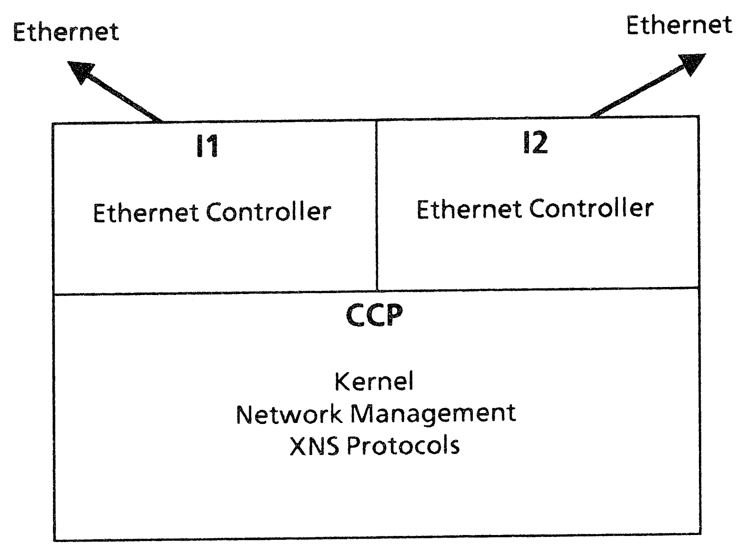


Figure 2-13 GS/4 Functional Modules

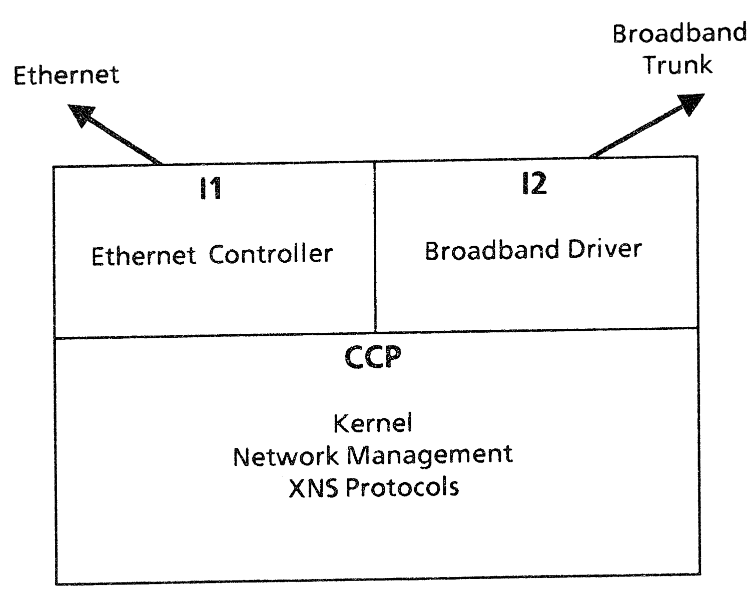


Figure 2-14 GS/6 Functional Modules
(with XNS protocols)

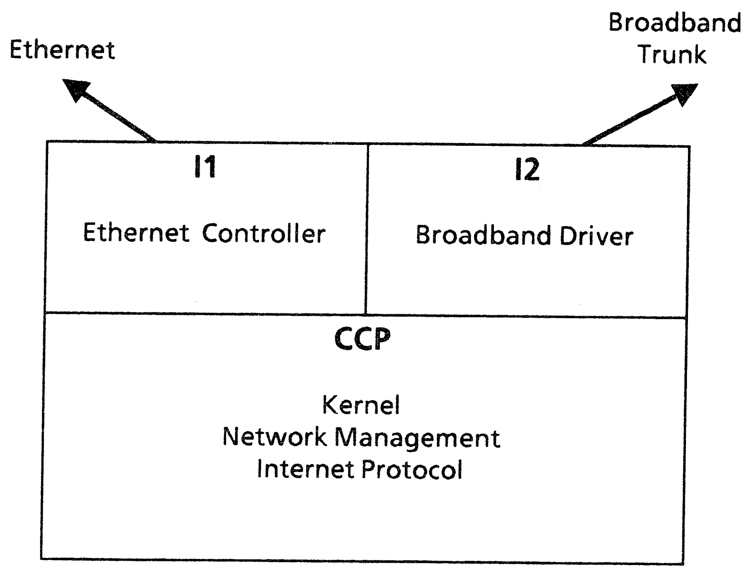
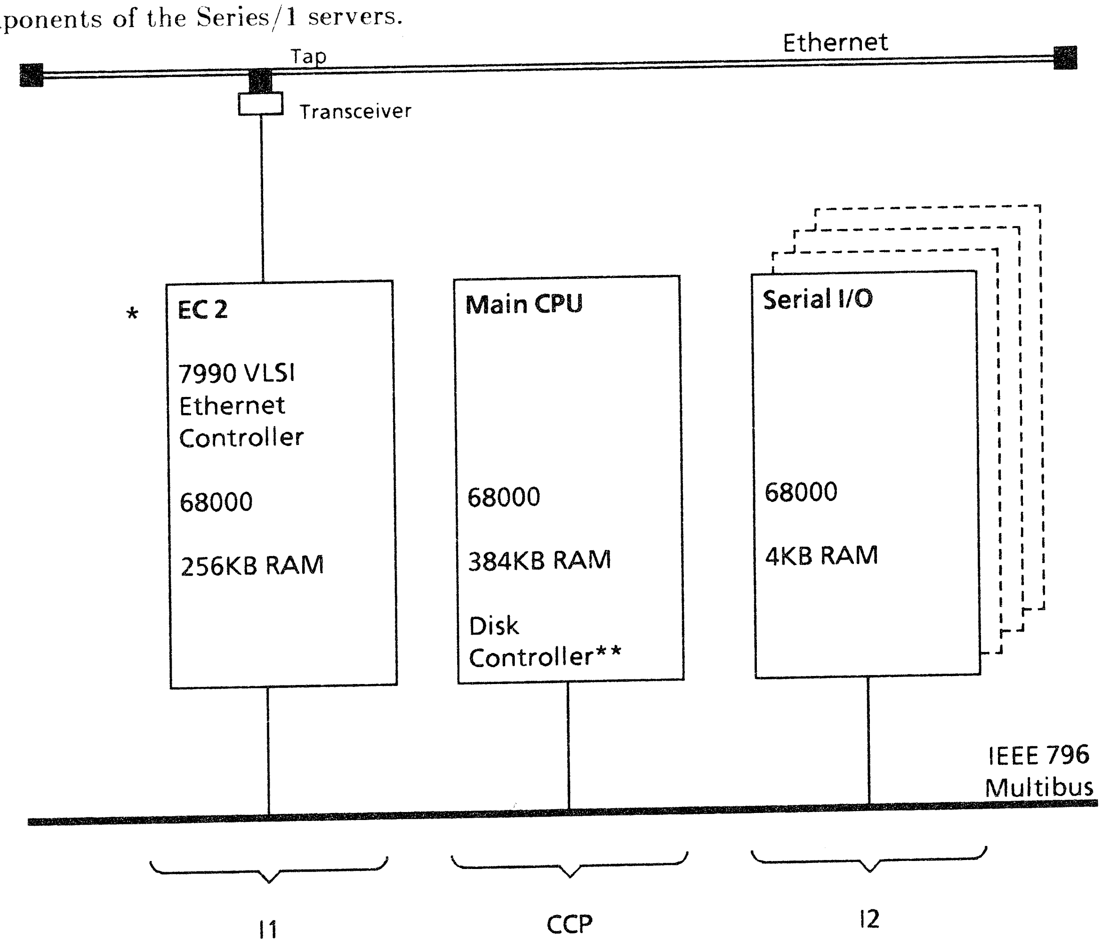


Figure 2-15 GS/6 Functional Modules
(with the IP protocol)

2.4 Hardware Modules

The Series/1 server hardware modules and their correspondence with the functional modules are illustrated in Figures 2-16 through 2-18. The braces delineate the functional modules; the hardware modules are boxed. The transceiver, tap, and coaxial cable are not typically included as part of the Series/1 server products, but are available separately from Bridge Communications, Inc. The interface cable connecting the server to the transceiver must be compatible with the transceiver, i.e., an Ethernet-compatible cable must be used with an Ethernet-compatible transceiver, and an IEEE 802.3-compatible cable must be used with an IEEE 802.3-compatible transceiver. The hardware modules are interconnected by an IEEE 796 Multibus-standard Main Backplane Interconnect (MBI) board (see reference [26]). The following sections describe the major modules, the MBI, and other miscellaneous hardware components of the Series/1 servers.



* Some systems may have a two-board I1 module (EC/1) with 128KB RAM.

** The disk controller is optional on the CS/1-A, CS/1-BSC, and CS/1-SDLC.

Figure 2-16 CS/1-A/BSC/SDLC, CS/1-SNA, CS/1-X.25, GS/1, and GS/3 Hardware Architecture

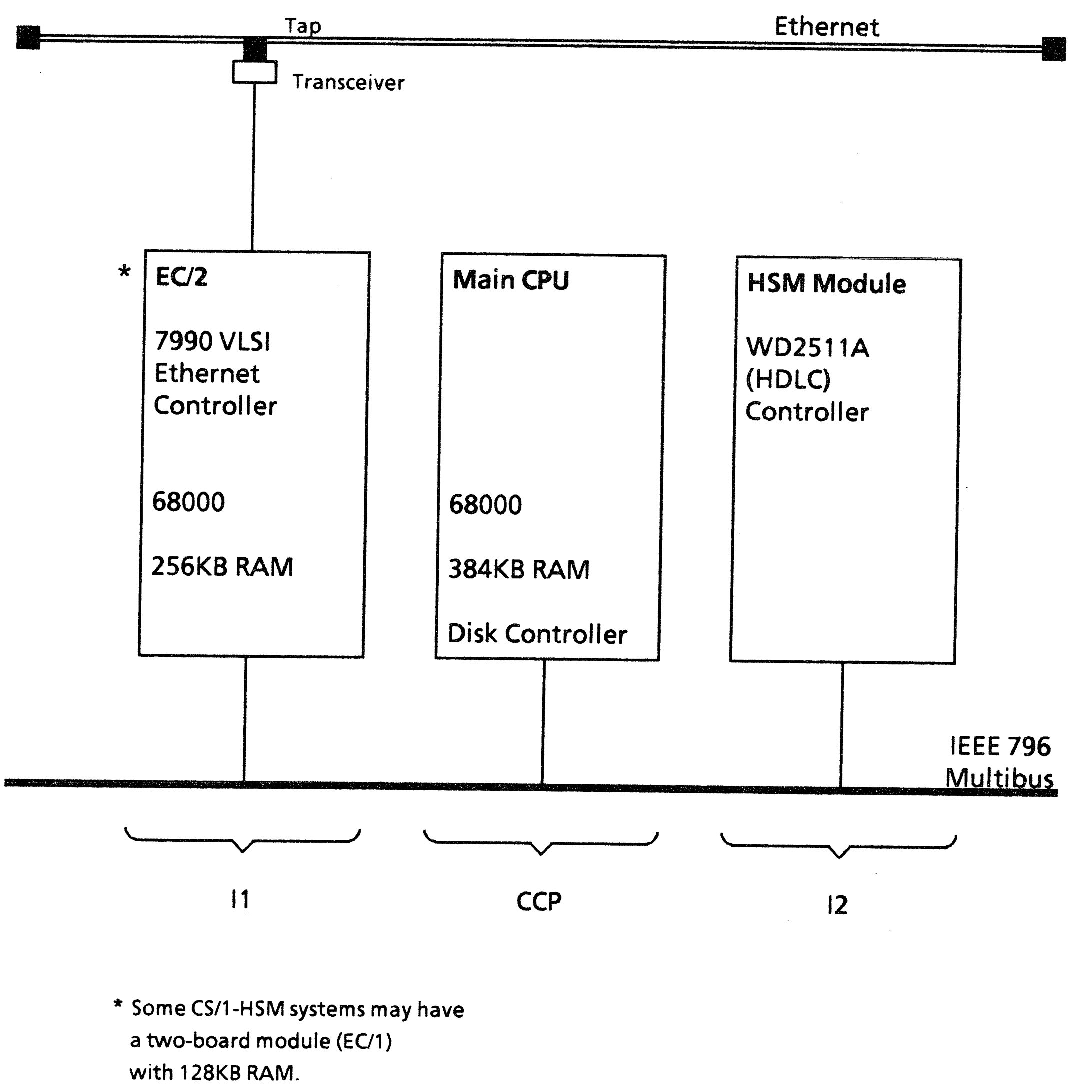


Figure 2-17 CS/1-HSM and GS/6 Hardware Architecture

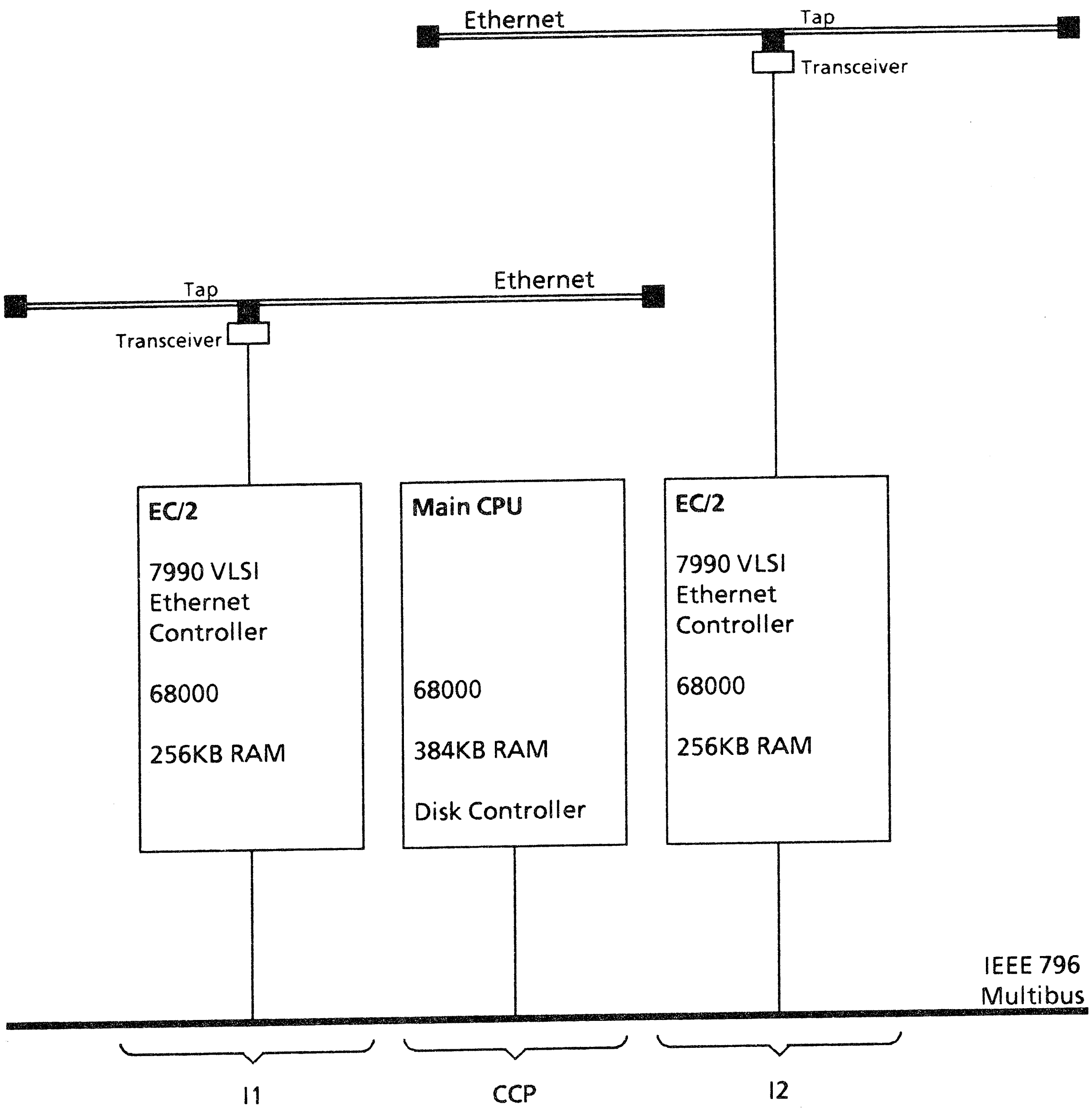


Figure 2-18 GS/4 Hardware Architecture

2.4.1 Ethernet Controller Module

The Ethernet Controller is a high-performance module that implements the Ethernet data link functions and buffers incoming packets from the Ethernet. The module contains self-test diagnostics, a monitor, and an optional console terminal interface.

The Ethernet Controller module also includes the Ethernet Backpanel Attachment (EBA) board. The EBA board contains the connectors for the MCPU board's console and download port interfaces, as well as the transceiver interface connector.

The module is available as the Ethernet Controller/1 (EC/1) or the Ethernet Controller/2 (EC/2). Current Series/1 products contain the EC/2 module; older versions of some of the products still contain the EC/1 module. (Refer to the release memo shipped with the unit to determine whether it contains an EC/1 or an EC/2.) However, Bridge does not recommend upgrading those products from the EC/1 to the EC/2, as both offer equivalent functions in most applications.

EC/1

The EC/1 consists of two Multibus boards: the Ethernet Transceiver Interface (ETI) board and the Ethernet Shared Buffer (ESB) board.

The primary function of the ETI board is to transmit and receive Ethernet packets to and from the transceiver. The transmit functions include serialization, packet preamble generation, CRC generation, collision detection, and Manchester encoding. The receive functions include deserialization, packet preamble stripping, address recognition, CRC checking, Manchester decoding, and packet-too-long detection. The board has discrete SSI and MSI integrated circuits. The ETI is connected to the ESB board through a private P2 Multibus connector, and derives only power and ground from the main P1 Multibus connector.

The ESB board is based on a 68000 microprocessor. It contains 128K bytes of triported RAM, 16K bytes of PROM, one general-purpose 16-bit timer, and a direct memory access (DMA) interface with data chaining. The ESB board is a Multibus slave and is capable of generating one Multibus interrupt. The ESB receives commands via Multibus address decoding and is capable of receiving a large number of back-to-back Ethernet packets. The ESB's processor performs all of the data link functions not handled by the hardware, as well as the buffer management functions necessary to accommodate data exchange between the DMA and the Multibus. The ESB is accessed from the Multibus through a byte-swapping scheme that allows efficient exchange of data with modules that have byte-positioning conventions different from the Ethernet conventions.

EC/2

The EC/2 module implements the functions of the EC/1 on a single board. It is based on a 68000 microprocessor for managing the data link controller and associated data buffers. It supports 256K bytes of memory, 16K to 64K bytes of EPROM, and one general-purpose 16-bit timer.

For OEM use, the EC/2 can support additional memory and two serial I/O ports via an optional DUEX board, and can connect directly to the Ethernet transceiver. The EC/2's Ethernet interface section has a 7990 VLSI Ethernet controller, which performs basic data link functions: data framing and decapsulation, serialization and deserialization, CRC generation and checking, and collision backoff and retransmission. The 7990 controller also provides programmable features such as Time Domain Reflectometry, chaining DMA, promiscuous mode, and loopback mode.

2.4.2 Main CPU Module

The main CPU module consists of a Main CPU (MCPU) board and an optional Floppy Disk Controller (FDC) board. The MCPU performs protocol processing and support functions and contains power-on self-test diagnostics and a monitor, as well as console terminal and download port interfaces.

The MCPU board is based on a 68000 microprocessor. It contains 384K bytes of RAM, 16K bytes of PROM (expandable to 32K bytes), two general-purpose 16-bit timers, two serial I/O ports used for console and download, and an iSBX interface. The iSBX interface is described in reference [27]. The MCPU is a Multibus master and is capable of receiving and generating interrupts.

The FDC board, if present, is piggybacked on the MCPU board via the iSBX interface.

In the CS/1-SNA, the MCPU module also includes the Shared Buffer Board (SBB), containing 256K bytes of Multibus RAM memory for 3270 screen buffer storage.

2.4.3 I/O Module

The primary function of the I/O module is to provide I/O device interfaces to the Bridge Series/1 products. The I/0 module differs depending on the product type. The module may be a Serial I/O (SIO) module or a high-speed multiplexer (HSM) module. Refer to Sections 6.3 and 6.4 for procedures on adding and replacing SIO and HSM boards and modules.

The SIO module is available in eight versions. Refer to Section 3.1.7 for detailed descriptions.

The CS/1-A, CS/1-BSC, and CS/1-SDLC support up to four SIO modules providing a maximum of 64 ports. The asynchronous, character-synchronous (BSC), and bit-synchronous (SDLC) SIO modules can be intermixed within one CS/1 unit.

The CS/1-SNA supports a single SIO module with one synchronous port, which can be configured for either full-duplex or half-duplex communication.

The GS/1, GS/3, and CS/1-X.25 provide up to two full-duplex, synchronous ports per SIO board. They can support up to four SIO modules, providing a maximum of eight ports.

Each SIO module consists of an SIO board, a Serial Backpanel Attachment (SBA) assembly and cable, a connector, and screws; the module contains self-test diagnostics but no monitor.

Each SIO board (except the SIO-16, discussed later in this section) is based on a 68000 microprocessor and contains 4K bytes of RAM, 16K bytes of PROM (expandable to 32K bytes), two general-purpose 16-bit timers, eight serial I/O ports, and an iSBX interface (see reference [27]). The SIO board is a Multibus master and is capable of generating one Multibus interrupt. This SIO board receives commands via Multibus address decoding. The iSBX interface can be used to add interfaces to the Series/1 server.

The **SIO-16 module** consists of an SIO-16 board, a Serial Backpanel Attachment (SBA-16) assembly and cable, a connector, screws, and a power cable for connecting the SBA-16 board to the MCPU board. The SIO-16 module is based on a 68000 microprocessor and contains 32K bytes of static RAM with no PROM. This module is tailored to support 16 asynchronous serial ports. The SIO-16 board acts as both a Multibus master and a Multibus slave device, and can generate one Multibus interrupt. The SIO-16 board receives commands via Multibus address decoding. The SIO-16 board does not contain an iSBX connector.

The CS/1-A can support up to four SIO-16 modules, each providing a maximum of 16 ports. Refer to Sections 3.1.7 and 5.2.6 for detailed descriptions of the SIO-16 module.

The **HSM module** is available in two versions: one (referred to as the HSM) for the CS/1-HSM and one (referred to as the HSM-MDM) for the GS/6. Refer to Section 5.2.8 for detailed descriptions of these versions.

Both versions are Multibus-compatible, HDLC serial communications boards, each with a single port. They are based on a Western Digital X.25 Packet Network Controller chip (WD2511A). The CS/1-HSM module consists of an HSM board, an SBA-HSM cable assembly, a Host Adapter Card (HAC) cable, and screws. The SBA assembly provides the connector for attaching the HAC cable. The GS/6 HSM board (HSM-MDM) is a modified HSM board with a higher data transfer rate (1M bps) and an interface to an RF modem.

The CS/1-HSM can support up to two HSM modules, each of which supports one interface to the HAC cable that connects to the host computer. The GS/6 supports one HSM-MDM module.

2.4.4 Miscellaneous Hardware Components

In addition to the board sets described in the previous sections, the Series/1 server contains a Main Backplane Interconnect (MBI) board and an optional floppy disk drive. The MBI board is designed to accommodate a maximum of eight Multibus-size boards. The floppy disk drive has an unformatted capacity of 500K bytes and a formatted capacity of 320K bytes.

The CS/1-HSM also requires a Host Adapter Card (HAC), which is installed in the host computer, and a HAC cable that connects the SBA assembly in the CS/1-HSM with the host.

2.5 Software Modules

This section briefly describes the Series/1 server software modules. Figures 2-19 through 2-30 illustrate the software modules and their relationship with the functional modules in various Series/1 products. For a complete discussion of the software modules, see reference [9].

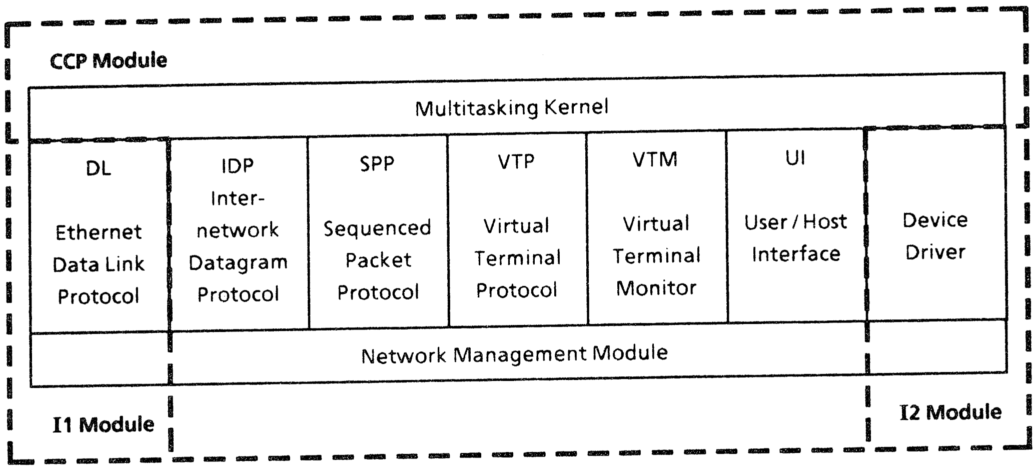


Figure 2-19 CS/1-A (with XNS protocols), CS/1-BSC/SDLC, and CS/1-HSM Software Architecture

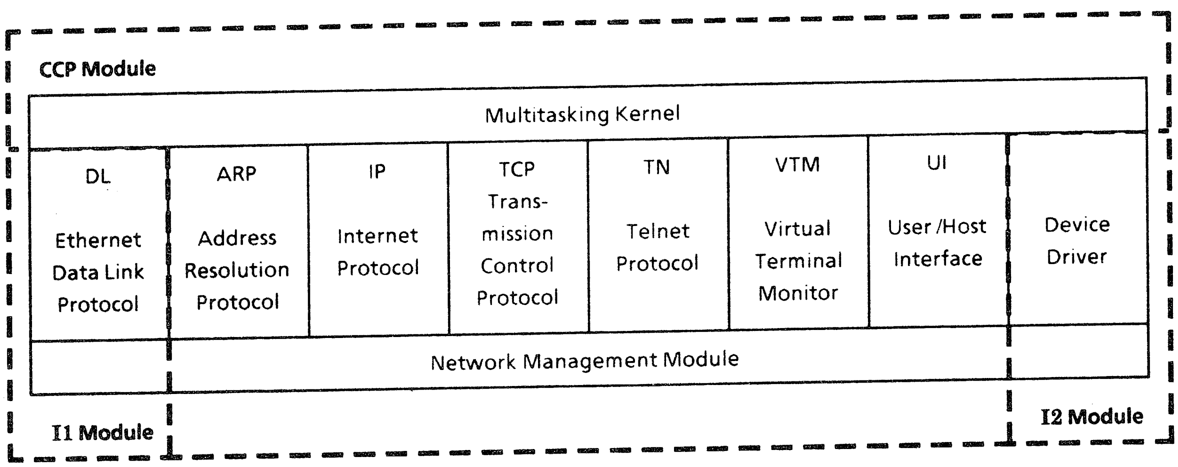


Figure 2-20 CS/1-A Software Architecture (with TCP/IP protocols)

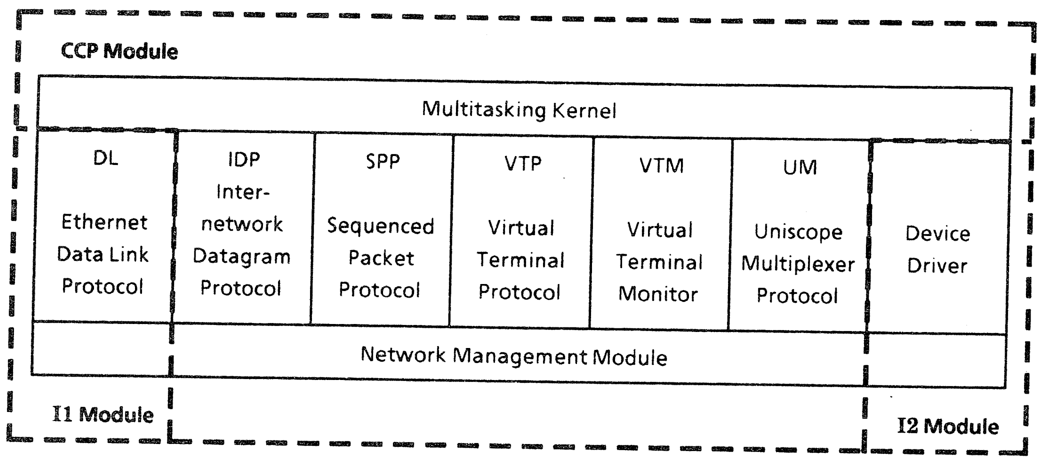


Figure 2-21 Architecture of CS/1-BSC Running SPMUX Software

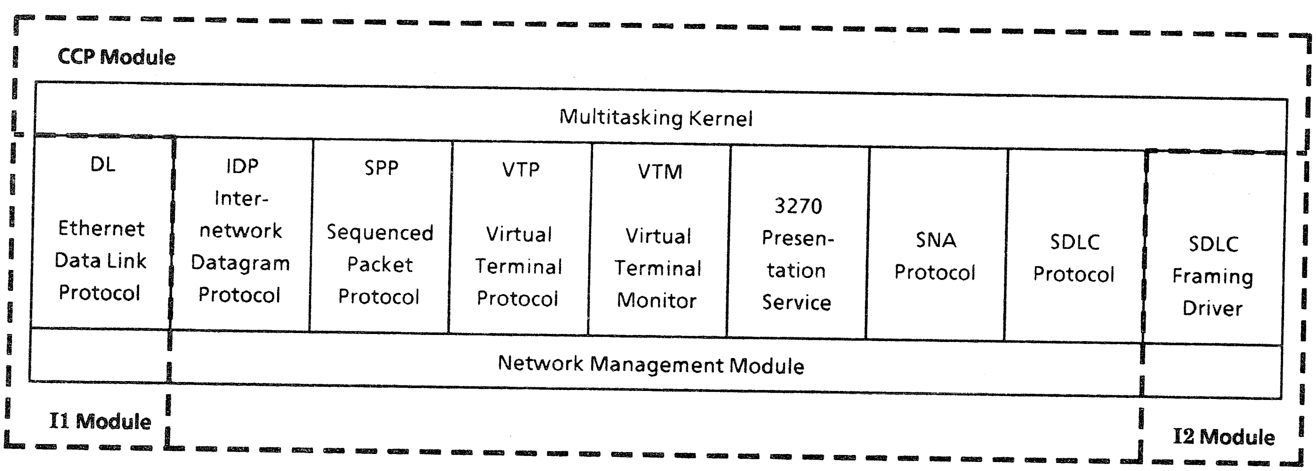


Figure 2-22 CS/1-SNA Software Architecture (with XNS protocols)

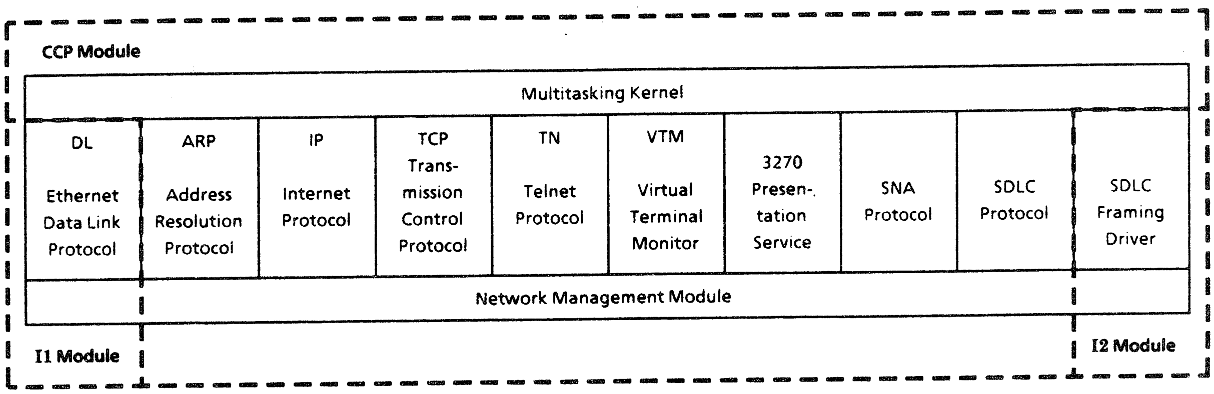


Figure 2-23 CS/1-SNA Software Architecture (with TCP/IP protocols)

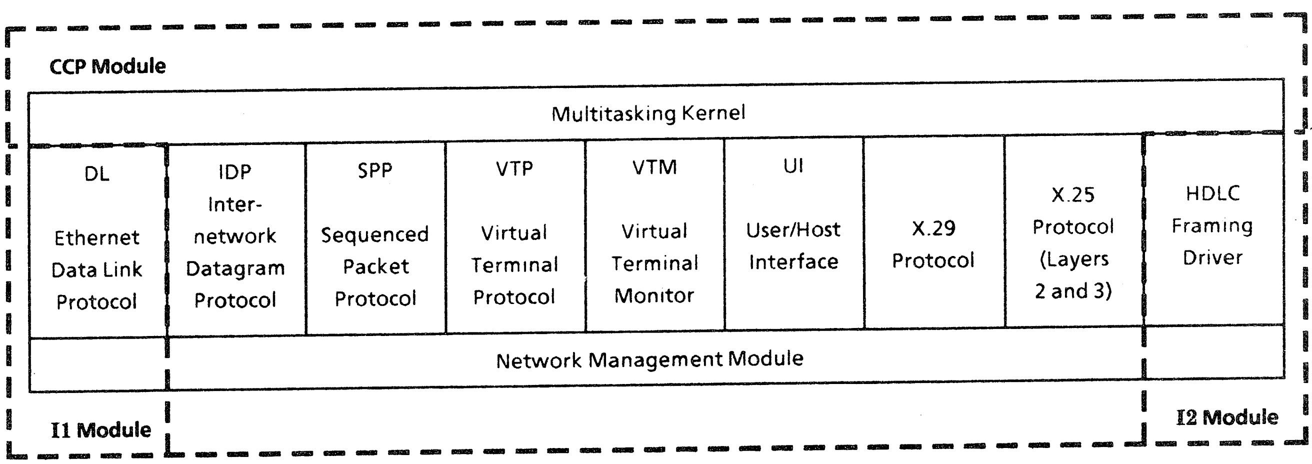


Figure 2-24 CS/1-X.25 and GS/1 Connection Service Software Architecture

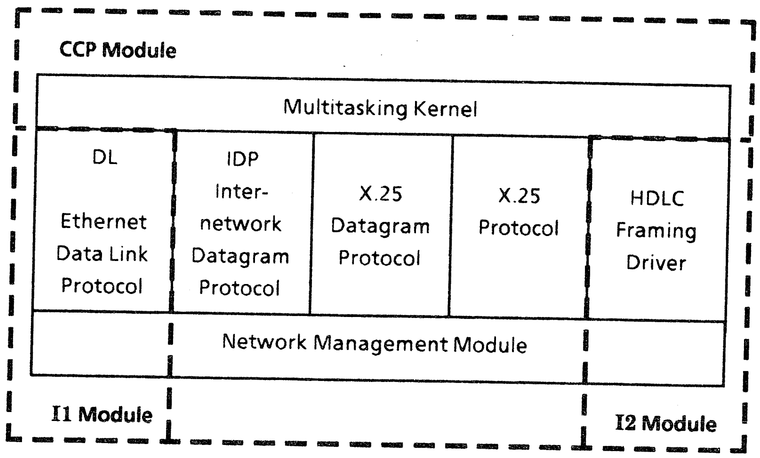


Figure 2-25 GS/1 Interconnection Service
Software Architecture

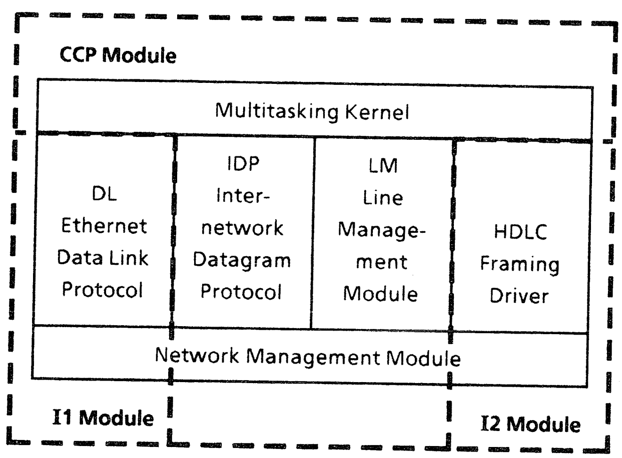


Figure 2-26 GS/3 Software Architecture
(with XNS protocols)

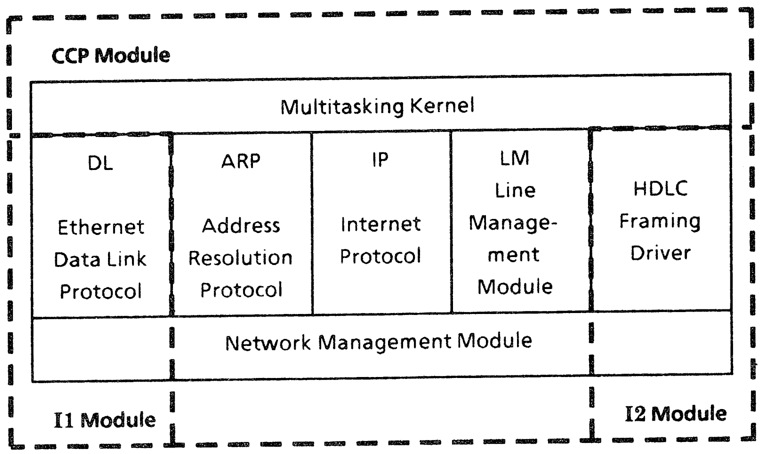


Figure 2-27 GS/3 Software Architecture
(with the IP protocol)

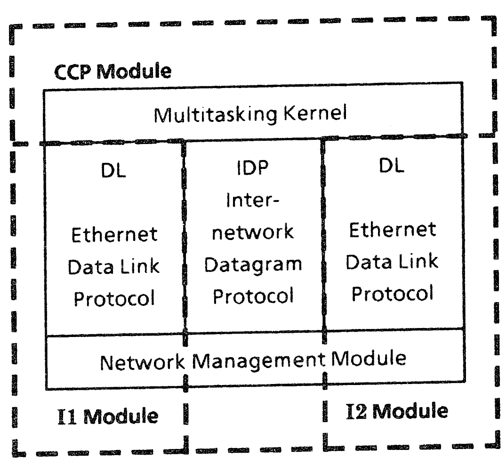


Figure 2-28 GS/4 Software Architecture

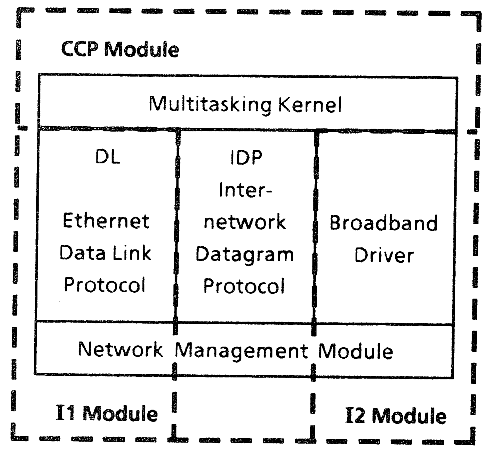


Figure 2-29 GS/6 Software Architecture
(with XNS protocols)

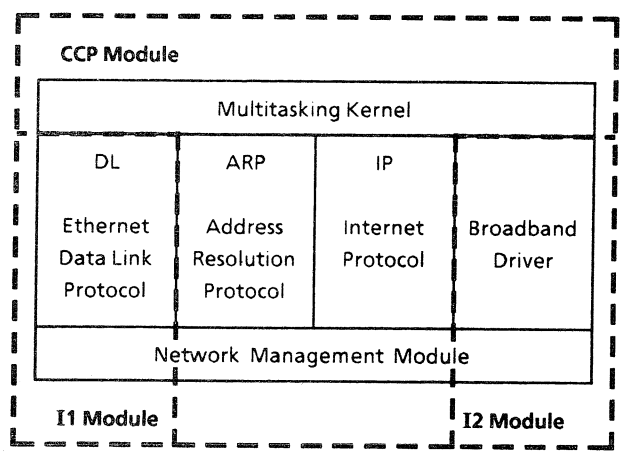


Figure 2-30 GS/6 Software Architecture
(with the IP protocol)

2.5.1 Common Software Modules

All Series/1 servers contain three common software modules:

- Multitasking Kernel module
- Network Management module
- Data Link module

The Kernel module provides a multiprocess environment for all protocol modules. It includes a message-based interprocess communication facility, a shared buffer manager, a storage allocator, an interrupt processing dispatcher, and time-of-day and alarm facilities. The Kernel resides on the MCPU board.

The Network Management module provides a variety of functions, including performance monitoring, error logging, network control, and configuration management. This module also resides on the MCPU board.

The Data Link (DL) module performs the functions of the Ethernet Data Link Protocol. These functions include transmitting and receiving frames; keeping statistics on network traffic, frame characteristics, and errors; and supporting diagnostic aids, including self-test diagnostics and higher-level testing. On a Series/1 server with an EC/1, the majority of the software resides as firmware on the ESB board; the remaining code resides as software on the MCPU board. On a Series/1 server with an EC/2, some of the code resides as firmware on the EC/2 board; most of the code resides as software on the MCPU board.

In addition to these major modules, all servers include the following miscellaneous software and firmware:

- Floppy disk driver (optional)
- PROM monitor/debugger
- Boot loader
- Self-test diagnostics

All Communications Servers also have a Device Driver module, which varies by server type.

On the CS/1-A, CS/1-BSC, and CS/1-SDLC, the module consists of an interrupt-based SIO driver that transfers data, attention, and flow control signals to and from devices attached to the SIO board using an asynchronous, character-synchronous, or bit-synchronous line protocol. On the CS/1-HSM, the Device Driver module consists of a high-speed, multiplexing protocol driver known as the AP process.

On the CS/1-A, CS/1-BSC, and CS/1-SDLC, the Device Driver software resides as firmware on the SIO board; the remaining software resides on the MCPU board. On the CS/1-HSM, all of the Device Driver software resides on the MCPU board.

On a CS/1-A with SIO-16 modules, the Device Driver software is soft-loaded when the server is booted, and then resides in RAM on the SIO-16 board.

The CS/1-SNA, CS/1-X.25, and most Gateway Servers have a Framing Driver module.

The module in the CS/1-SNA is an SDLC interrupt-based driver that passes data and flow control signals to and from the modems or lines attached to the SIO board. The majority of the software resides as firmware on the SIO board; the remaining software resides on the MCPU board.

The CS/1-X.25, GS/1, and GS/3 have an HDLC Framing Driver, which is an interrupt-based driver that transfers data and flow control signals to and from the modems or lines attached to the SIO board. The majority of the software resides as firmware on the SIO board; the remaining software resides on the MCPU board.

The GS/6's Broadband Driver module is an HDLC framing driver that transfers data to and from the broadband modem connected to the HSM-MDM board. The module resides as software on the MCPU board.

2.5.2 Common XNS Connection Service Modules

All servers that support XNS protocols contain the following modules:

- Internetwork Datagram Protocol module
- Sequenced Packet Protocol module
- Virtual Terminal Protocol and Virtual Terminal Monitor modules
- User/Host Interface module

The Internetwork Datagram Protocol (IDP) is the XNS Level 1 protocol. The IDP functions include addressing, routing, and delivering internetwork datagram packets. IDP provides a best-effort internetwork delivery service. Reliable delivery, sequencing, and flow-controlled transmission are the responsibility of the higher-level protocols located in both the originating and destination stations.

The Sequenced Packet Protocol (SPP) module provides reliable, sequenced, flow-controlled transmission of user packets across the internet system.

The Virtual Terminal Protocol (VTP) and Virtual Terminal Monitor (VTM) modules together constitute the Virtual Terminal module, which provides a virtual circuit service. The service includes name lookup, establishment of virtual circuits, negotiation of terminal parameters, reliable exchange of data, attention signaling, and synchronized disconnection. VTP implements a Virtual Terminal Protocol using XNS Courier protocol functions.

In addition, the CS/1-A running the XNS protocols, the CS/1-BSC, CS/1-SDLC, CS/1-HSM, CS/1-X.25, and GS/1 contain the User/Host Interface module.

The User/Host Interface (UI) module allows the terminal user and the host to control the interface to the server by specifying parameters that describe transmission and device characteristics.

2.5.3 CS/1-A with TCP/IP Connection Service Modules

The CS/1-A running the TCP/IP protocols contains the modules described in Section 2.5.1, the VTM and UI modules described in Section 2.5.2, and the following TCP/IP modules:

- Address Resolution Protocol module
- Internet Protocol module
- Transmission Control Protocol module
- Telnet module

The Address Resolution Protocol (ARP) module maps internetwork addresses into Ethernet addresses.

The Internet Protocol (IP) module provides the connectionless network layer protocol. IP performs the same function as the IDP module present in the XNS servers (refer to Section 2.5.2).

The Transmission Control Protocol (TCP) module is the connection-oriented transport protocol. The TCP module provides the same services as the SPP module present in servers that support the XNS Connection Service.

The Telnet module is the application protocol for interfacing to terminal devices. It provides the same services as the Virtual Terminal Protocol module present in the XNS servers.

2.5.4 CS/1-SNA Modules

The CS/1-SNA running the XNS protocols contains the modules described in Sections 2.5.1 and 2.5.2, and the following SNA modules:

- 3270 Presentation Service module
- SNA Protocol module
- SDLC Protocol module

The 3270 Presentation Service (PS) module performs the device-dependent functions required for emulation of a 3270 terminal or printer. The PS module interprets data streams directed to the device, formats screen images for presentation at the device, and processes keystrokes.

The SNA Protocol consists of a Data Flow Control (DFC) module, a Transmission Control (TC) module, and a Path Control (PC) module. The DFC module controls the direction of data flow, chains message units, governs send and receive modes, and assists in error management. The TC module constructs the message unit headers for processing by Path Control, assigns message sequence numbers, and controls the rate of data flow. The PC module performs segmenting and blocking and establishes the transmission path for each message.

The SDLC Protocol module handles the Synchronous Data Link Control functions, providing reliable transmission of frames between the CS/1-SNA and the front-end processor.

The CS/1-SNA running the TCP/IP protocols contains the modules described in Section 2.5.1, the VTM module described in Section 2.5.2, the TCP/IP modules described in Section 2.5.3, and the SNA modules described above.

2.5.5 SPMUX Module

The SPMUX module contains the common modules described in Sections 2.5.1 and 2.5.2, and a Uniscope Multiplexer (UM) module.

The UM module multiplexes messages from the attached terminals and transfers the messages to the VT module to be sent across the Ethernet to the remote host. In the reverse direction, UM demultiplexes messages sent by the remote host and transmits the messages to the appropriate serial port. UM also multiplexes and demultiplexes control information sent between terminal and host, and ensures end-to-end data integrity using an 8-bit LRC error-checking algorithm.

2.5.6 CS/1-X.25 and GS/1 Connection Service Modules

The CS/1-X.25 and the GS/1 Connection Service contain the modules described in Sections 2.5.1 and 2.5.2, and the following modules:

- X.29 Protocol module
- X.25 Protocol module

The X.29 Protocol module (abbreviated as X.29) provides the same services as the VTP and VTM modules, but using X.25 protocol functions. The services include establishment of virtual circuits, setting of terminal parameters, attention signaling, and synchronized disconnection.

The X.25 Protocol module (abbreviated as X.25) performs the encapsulation and decapsulation (on transmission and reception, respectively) necessary to send packet fragments on a virtual circuit across a PDN. The X.25 module resides on the MCPU board.

2.5.7 GS/1 Interconnection Service Modules

The GS/1 contains the modules described in Section 2.5.1; the Internetwork Datagram Protocol module described in Section 2.5.2; the X.25 Protocol module described in Section 2.5.6; and an X.25 DataGram Translator (XDG) module.

The XDG module translates the IDP datagram service into an X.25 connection service and, in the other direction, the X.25 connection service into an IDP datagram service. The XDG module is also responsible for load balancing. The module resides on the MCPU board.

2.5.8 GS/3 Modules

The GS/3 running the XNS protocols contains the modules described in Section 2.5.1, the Internetwork Datagram Protocol described in Section 2.5.2, and a Line Management module.

The Line Management module is responsible for load balancing and the packet-routing tasks necessary for automatic switchover of packet transmission from one line to another if one line becomes unavailable.

The GS/3 running the IP protocol contains the modules described in Section 2.5.1, the Address Resolution Protocol and Internet Protocol described in Section 2.5.3, and the Line Management module described above.

2.5.9 GS/4 Modules

The GS/4 contains the modules listed in Section 2.5.1 (including two Data Link modules) and no driver module. It also contains the Internetwork Datagram Protocol described in Section 2.5.2.

2.5.10 GS/6 Modules

The GS/6 running the XNS protocols contains the modules described in Section 2.5.1 and the Internetwork Datagram Protocol described in Section 2.5.2.

The GS/6 running the IP protocol contains the modules described in Section 2.5.1 and the Address Resolution and Internet protocols described in Section 2.5.3.

3.0 PREINSTALLATION PLANNING

This section describes the external physical specifications of the Series/1 products and provides information necessary for preinstallation planning.

Where information applies equally to all Series/1 products, the generic term "server" is used. Where information applies to only one Series/1 product, the server model is included for clarity.

3.1 Physical Description

This section lists the Series/1 server's external dimensions and weight; describes the external indicators, switches, cables, and connectors; and lists the connector pin assignments.

3.1.1 Exterior Dimensions

The exterior dimensions and weight of the server are as follows:

Height	9.5 in / 24.1 cm
Width	17.0 in / 43.2 cm
Depth	21.3 in / 54.1 cm
Weight	32.0 lb / 14.5 kg

Figure 3-1 shows the server's enclosure in its tabletop version. Figures 3-2 and 3-3 show detailed views of the front and back panels, respectively, indicating the positions of the switches, DB-25 connectors, and diagnostic LEDs (refer to Sections 3.1.2 through 3.1.9 for detailed descriptions). Figure 3-3 illustrates a CS/1-A with RS-232-C interfaces.

Gateway Servers or CS/1s equipped with other interface options may have different connector combinations. For example, three of the four backpanels on a GS/4 or GS/6 are blank because only one cable connector is needed for each model.

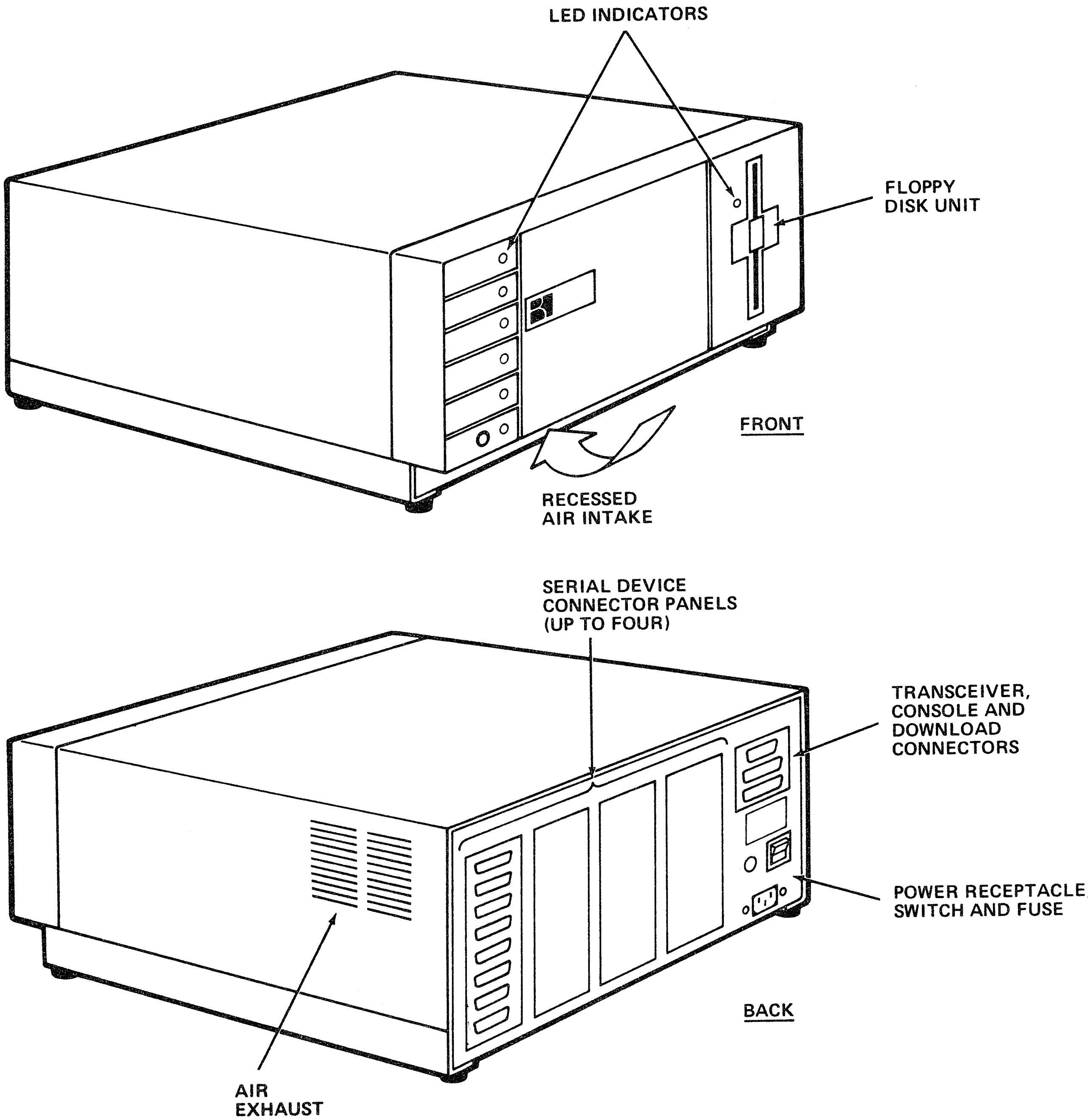


Figure 3-1 Series/1 Server Enclosure

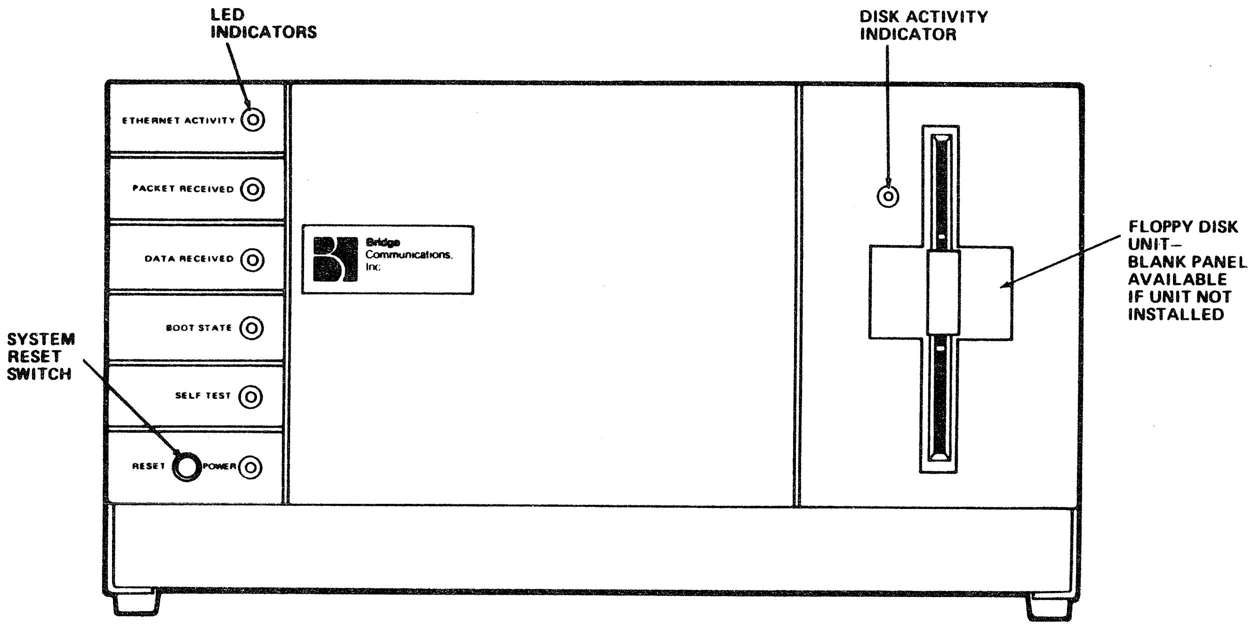


Figure 3-2 Series/1 Server Front Panel

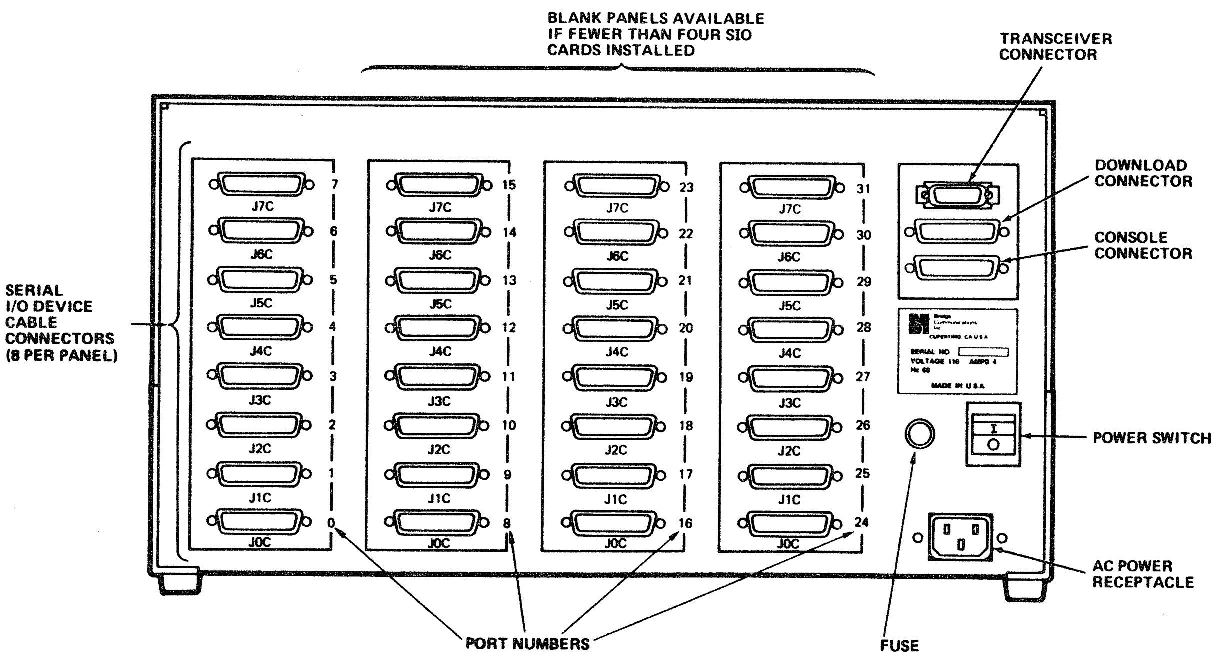


Figure 3-3 CS/1-A Back Panel

3.1.2 Front Panel LED Displays

The Series/1 server's front panel contains seven LED indicators that perform diagnostic functions both at power-on and while the server software is running. Table 3-1 lists the LEDs and their functions.

Table 3-1 Front Panel LED Indicators

Name	*Function*
Network Activity	Flashes when the server detects a packet on the network. Packet address need not match the server's address. Used to verify proper physical attachment to the coaxial cable and to indicate network load.
Packet Received	Flashes when the server detects a packet on the Network whose address field matches the server's address. Used to verify that packets are being received by the server.
Data Received	Flashes when the server detects data being received from one of the I/O ports. Used to verify proper physical attachment of I/O devices.
Boot State	On during software bootstrap from onboard diskette.
Self Test	On for approximately 10 seconds following reset or power-on. Remains lit longer only if self-test diagnostic fails; fault(s) may be further identified by removing top cover of unit and locating lit LED(s) on individual board(s). Flashes during operation to indicate no boot source present. Remains lit to indicate hard failure.
Power	On as long as power supply generates +5 VDC.
Disk Activity	On when diskette is being accessed. Diskette must not be removed from unit and Reset switch must not be pressed while this LED is lit.

3.1.3 Front Panel Reset Switch

The Reset switch is located at the lower left corner of the front panel (refer to Figure 3-2). Pressing the switch initiates a system reset. The system software and hardware are reinitialized, and the system executes self-test diagnostics and software bootstrap.

The switch is recessed into the front panel to reduce the likelihood of pressing it unintentionally.

3.1.4 AC Power Switch, Fuse, and Receptacle

The power switch, fuse, and power receptacle are located on the back panel (refer to Figure 3-3). Both sides of the AC line are switched, and the switch is marked according to the international convention. When the "I" side is pressed, the switch is on; when the "O" side is pressed, the switch is off.

The 120 VAC version of the Series/1 server is delivered with a 5-amp, 1-¼" x ¼", fast-blow, U.S. standard fuse. The 230 VAC version is delivered with a 3-amp, 20 mm x 5 mm, fast-blow, I.E.C. standard fuse. Replace these fuses only with fuses of identical rating and size.

Each server has an international CEE-22 AC power receptacle approved for 6-amp operation. The connector has three prongs, with chassis ground on the middle prong. The server is supplied with an 8-foot (2.4-meter) standard U.S. power cord set. Power cord connectors for use outside the U.S. are not supplied by Bridge Communications, Inc.

3.1.5 Transceiver Connector

The Series/1 server has a 15-pin, D-Series, subminiature female connector equipped with a slide lock (MIL-C-24308 or equivalent) located on the back panel (refer to Figure 3-3). The connector is the standard connector described in the Ethernet Version 1.0 or 2.0 Specification (references [11] and [12]) and in the IEEE 802.3 Specification (reference [13]). Because it connects directly to two transceivers, the GS/4 is equipped with two transceiver connectors.

Series/1 servers with an EC/1 must use an Ethernet-compatible transceiver. Servers with an EC/2 board may be attached to Ethernet-compatible or IEEE 802.3-compatible transceivers, and can also operate with Digital Equipment Corporation DELNI equipment.

As an option, Bridge Communications provides transceiver cables in lengths of 50 to 150 feet.

Tables 3-2 and 3-3 list the transceiver connector pin assignments.

Table 3-2 Ethernet Transceiver Connector Pin Assignments

Pin No.	*Function*
1	Chassis ground
2	Collision Presence +
3	Transmit +
4	Unused
5	Receive +
6	Power Return
7,8	Unused
9	Collision Presence -
10	Transmit -
11	Unused
12	Receive -
13	Power *
14,15	Unused
Shell	Chassis ground

* Current should not exceed 500 mA.

Table 3-3 IEEE 802.3 Transceiver Connector Pin Assignments

Pin No.	*Function*
1	Collision Shield
2	Collision Presence +
3	Transmit +
4	Receive Shield
5	Receive +
6	Power Return
7	Control Out + (Unsupported)
8	Control Out Shield
9	Collision Presence -
10	Transmit -
11	Transmit Shield
12	Receive -
13	Power *
14	Power Shield
15	Control Out - (Unsupported)
Shell	Chassis ground

* Current should not exceed 500 mA.

3.1.6 Console and Download Port Connectors

The Series/1 server has two 25-pin, D-Series, subminiature female connectors (RS-232-C DCE-type) for console and download cable attachment. Refer to Figure 3-3 for the location of the connectors. Cables for these connectors are supplied by the customer.

Table 3-4 lists the connector pin assignments. The console and download port connectors support data lines and ground only. Both ports support XON/XOFF flow control characters.

The baud rates of both ports are selectable via shorting plugs to 110, 300, 1200, or 9600 baud; the default baud rate for both ports is 9600 baud. Refer to Section 5.2.4 for the shorting plug settings.

The console port is preconfigured for 8 databits and no parity. These values may not be adjusted.

Table 3-4 Console/Download Connector Pin Assignments

Pin No.	*RS-232-C Name*	*Direction*	*Function*
1	AA	--	Shield
2	BA	In	Transmit Data
3	BB	Out	Receive Data
4-6	--	--	Unused
7	AB	--	Ground
8-25	--	--	Unused

3.1.7 Serial I/O Connectors

Serial I/O device connectors are arranged on modular Serial Backpanel Attachment (SBA) assemblies located on the back of the unit. The Series/1 server can accommodate up to four SBAs. If the server is configured with fewer than four SBAs, blank panel covers are mounted in place of any uninstalled SBAs. Cables for device connectors can be supplied by the customer; Bridge Communications, Inc., provides 25-foot device cables as an option.

The ports on different SIO module versions support different levels of functionality. The SIO module is available in eight versions:

- SIO-A for RS-232-C asynchronous devices
- SIO-16 for RS-232-C asynchronous devices
- SIO-ST for RS-232-C synchronous terminals and hosts
- SIO-SM for RS-232-C synchronous modems and hosts
- SIO-422 for RS-449 connectors with RS-422 electrical protocol
- SIO-H422 for RS-422 asynchronous terminals
- SIO-HS422 for X.21 connectors with RS-422 electrical protocol
- SIO-V.35 for V.35 electrical interfaces

Each version designator may have a one-character suffix indicating the type of driver supported by the module. For example, the SIO-STS module supports a bisynchronous driver for the CS/1-BSC; the SIO-SMH module supports an HDLC driver for the GS/3; and the SIO-H422A module supports an asynchronous driver for the CS/1-A.

Table 3-5 indicates which I/O module is standard on each Series/1 server and which modules are available as options.

Table 3-5 I/O Module Versions

Server Model	*Standard I/O Module*	*Optional I/O Modules*
CS/1-A/BSC/SDLC*	None	SIO-A SIO-16 SIO-H422A SIO-STS SIO-SMS SIO-422S SIO-V.35S SIO-HS422S
CS/1-SNA	SIO-SMS	SIO-422S SIO-HS422S SIO-V.35S
CS/1-X.25	SIO-SMS SIO-HS422S SIO-V.35S	SIO-422S
CS/1-HSM	HSM	None
GS/1	SIO-SMS	SIO-422S SIO-HS422S SIO-V.35S
GS/3	SIO-SMH	SIO-422H SIO-HS422H SIO-V.35H
GS/4	None**	None
GS/6	HSM-MDM	None

* For SPMUX connections, the CS/1 at the terminal end must be equipped with the SIO-STS module and the CS/1 at the host end must be equipped with the SIO-SMS module; no other versions may be used.

** The GS/4 connects to two Ethernet transceivers; it has no I/0 interface.

SIO-A Connectors

The SIO-A module is standard in the CS/1-A. The module is tailored to support eight asynchronous ports with two pairs of handshake control lines and has the following features:

- All ports support RS-232-C electrical protocols with no modifications. The ports have 25-pin, D-Series female connectors (RS-232-C DCE-type). These connectors, designated J0C through J7C, are designed specifically to interface with DTE devices (e.g., terminals or computers) with standard RS-232-C cables.
- Each port has identical baud rates for reception and transmission.
- All ports support control signals RTS, CTS, DTR, and DCD. DSR is tied to DCD.

Table 3-6 lists the serial I/O device connector pin assignments for the SIO-A module.

SIO-16 Connectors

The SIO-16 module is optional in the LS/1 and the CS/1-A.

The SIO-16 module is tailored to support 16 asynchronous ports with two modem control lines per port. The SIO-16 board has the following features:

- All ports support RS-232-C electrical protocols with no modifications. The ports are accessed via two 50-pin, 25-pair male cable connectors. The two connectors, designated J0 and J1, are designed to interface with DTE devices (e.g., terminals or computers) via 50-wire telephone style cables and an intermediate extender cable. Figure 4-14 in Section 4.1.2 illustrates the connector combinations offered as options by Bridge.
- Each SIO-16 port has identical baud rates for reception and transmission.
- All ports support control signals DCD and DTR.

Table 3-7 lists the pin assignments for connectors J0 and J1. The pin assignments for external end-point and intermediate level connectors used with the SIO-16 module are described in Section 4.1.2.

SIO-ST Connectors

The SIO-ST module is tailored to support eight synchronous DTE devices (usually terminals or hosts) with two pairs of handshake control lines. The SIO-STS version is standard in a CS/1-BSC running SPMUX software and in a CS/1-SDLC. It has the following features:

- All ports support RS-232-C electrical protocols with no modifications. All ports have 25-pin, D-Series female connectors (RS-232-C DCE-type). These connectors, designated J0C through J7C, are designed to interface with DTE devices.
- Each port has identical baud rates for reception and transmission.
- All ports support control signals RTS, CTS, DTR, and DCD. The DTR line from the device is connected to the DSR line to the device, but is not actively driven by the server. If the device is a host that requires DSR to be actively toggled during dynamic circuit establishment, the server must be equipped with an SIO-SM module instead of an SIO-ST module.

- Each port supports only one clock line out. Connected devices must always be configured for external clock on receive and transmit, and the server port must be configured for internal clock on receive and transmit.

Table 3-8 lists the serial I/O device connector pin assignments for the SIO-ST module.

SIO-SM Connectors

The SIO-SM module is tailored to support four synchronous DCE devices (usually modems) or DTE devices requiring DSR (usually hosts), with a full complement of clock and control lines.

The SIO-SMS (Synchronous driver) is standard in the CS/1-SNA, CS/1-X.25, and GS/1, and optional in the CS/1-BSC and CS/1-SDLC. The SIO-SMH is standard in the GS/3. The SIO-SM has the following features:

- All lines support RS-232-C electrical protocols with no modification. All ports have 25-pin, D-Series male connectors (RS-232-C DTE-type). These connectors, designated J0T through J3T, are designed specifically to interface with DCE devices (typically modems).

  An SIO-SMS port can also interface with DTE devices if the port's INTerfaceType parameter is set to DCE (refer to the *Network Management Guide,* reference [3], for a description of the INTerfaceType parameter). If a DTE device is attached to the SIO-SMS board, the special cable shown in Figure 4-5 must be used. The clock source shorting plugs on the SIO-SMS board are set by default for communication with a modem, and usually must be reconfigured for communication with a DTE device (refer to Section 5.2.5).

  An SIO-SMH can also interface with DTE devices if the synchronous modem eliminator cable shown in Figure 4-11 is used. Note that the clock source shorting plugs on the board are set by default for communication with a modem, and usually must be reconfigured for communication with a DTE device (refer to Section 5.2.5).

- The baud rate is identical for reception and transmission on each port if internal clock signals are used. Baud rate for reception can be different from baud rate for transmission if external clock signals are selected.

- All ports support clock lines RXC, TXC, and EXC.

- All ports support control lines RTS, CTS, DTR, DCD, and DSR.

Table 3-9 lists the serial I/O device connector pin assignments for the SIO-SM module.

SIO-422 Connectors

The SIO-422 module is tailored to support four ports with RS-422 electrical protocol and RS-449 connectors. The module is optimized for use with modems.

**** NOTE ****

Software limitations may make fewer ports available per module.

The SIO-422S (SDLC driver) is available as an option on the CS/1-BSC, CS/1-SDLC, CS/1-SNA, CS/1-X.25, and GS/1. The SIO-422H (HDLC driver) is available as an option on the GS/3.

All ports support RS-422 electrical protocols on data lines, clock lines, and one pair of handshake control lines. The connectors are 37-pin, D-Series male connectors (RS-449 DTE-type). Table 3-10 lists the serial device connector pin assignments for the SIO-422 module.

SIO-H422 Connectors

The SIO-H422 module is tailored to support eight asynchronous DTE devices with RS-422 electrical protocol.

The SIO-H422A (Asynchronous driver) module is available as an option on the CS/1-A.

All ports support data lines only, in accordance with CCITT Recommendation X.20. The connectors are 15-pin, D-Series male connectors (X.20 DTE-type). Table 3-11 lists the serial device connector pin assignments for this module. Cables compatible with these connectors must be supplied by the customer.

SIO-HS422 Connectors

The SIO-HS422 module is tailored to support four synchronous DCE devices with RS-422 electrical protocol and CCITT X.21 connectors.

The SIO-HS422H (HDLC driver) module is available as an option on the GS/3. The SIO-HS422S (SDLC driver) is available as an option on the CS/1-SDLC, CS/1-SNA, CS/1-X.25, and GS/1.

All of the lines indicated in the CCITT Recommendation X.21 specification are fully implemented, with the exception of the optional byte timing line (B). An additional clock line (St) has been implemented. The connectors are 15-pin, D-Series male connectors (X.21 DTE-type). Table 3-12 lists the serial device connector pin assignments for this module. Cables compatible with these connectors must be supplied by the customer.

SIO-V.35 Connectors

The SIO-V.35 module is tailored to support two ports with V.35 interfaces. The SIO-V.35S (SDLC driver) is available as an option for the CS/1-BSC, CS/1-SDLC, CS/1-SNA, CS/1-X.25, and GS/1. The SIO-V.35H (HDLC driver) is available as an option for the GS/3.

The SIO-V.35 module implements all data and control lines, as well as two pairs of handshake control lines, and has standard rectangular, 34-pin, M-Series V.35 connectors (female DTE-type). The connector pins are labeled with alphabetic characters in the ranges A through Z (upper case) and a through n (lower case).

Table 3-13 lists the serial device connector pin assignments for the SIO-V.35 module.

Table 3-6 SIO-A Connector Pin Assignments
DCE Connectors J0C through J7C

Pin No.	*RS-232-C Name*	*Bridge Name*	*Direction*	*Function*
1	AA	--	--	Chassis Ground*
2	BA	TXD/	In	Transmit Data
3	BB	RXD/	Out	Receive Data
4	CA	RTS	In	Request to Send
5	CB	CTS	Out	Clear to Send
6	CC	DSR	Out	Data Set Ready**
7	AB	GND	--	Signal Ground
8	CF	DCD	Out	Data Carrier Detect**
9-19	--	--	--	Unused
20	CD	DTR	In	Data Terminal Ready
21-25	--	--	--	Unused

* Cable shield should be connected to this pin.
** DSR and DCD are controlled by the same driver; in applications where DSR is needed, better electrical transmission is achieved if the signals are carried on only one wire, connected to both DSR and DCD at the device end.

Table 3-7 SIO-16 Connector Pin Assignments
SBA Connectors J0 and J1

Connector J0 Port No.	*Connector J1* Port No.	Pin No.	Signal Name	Direction	Function
0	8	1	GND	--	Signal Ground
0	8	2	GND	--	Signal Ground
0	8	3	DTR	In	Data Terminal Ready
0	8	26	RXD	Out	Receive Data
0	8	27	TXD	In	Transmit Data
0	8	28	DCD	Out	Data Carrier Detect
1	9	4	GND	--	Signal Ground
1	9	5	GND	--	Signal Ground
1	9	6	DTR	In	Data Terminal Ready
1	9	29	RXD	Out	Receive Data
1	9	30	TXD	In	Transmit Data
1	9	31	DCD	Out	Data Carrier Detect
2	10	7	GND	--	Signal Ground
2	10	8	GND	--	Signal Ground
2	10	9	DTR	In	Data Terminal Ready
2	10	32	RXD	Out	Receive Data
2	10	33	TXD	In	Transmit Data
2	10	34	DCD	Out	Data Carrier Detect
3	11	10	GND	--	Signal Ground
3	11	11	GND	--	Signal Ground
3	11	12	DTR	In	Data Terminal Ready
3	11	35	RXD	Out	Receive Data
3	11	36	TXD	In	Transmit Data
3	11	37	DCD	Out	Data Carrier Detect

(continued)

Table 3-7 SIO-16 Connector Pin Assignments
SBA Connectors J0 and J1 (continued)

Connector J0 Port No.	*Connector J1* Port No.	Pin No.	Signal Name	Direction	Function
4	12	13	GND	--	Signal Ground
4	12	14	GND	--	Signal Ground
4	12	15	DTR	In	Data Terminal Ready
4	12	38	RXD	Out	Receive Data
4	12	39	TXD	In	Transmit Data
4	12	40	DCD	Out	Data Carrier Detect
5	13	16	GND	--	Signal Ground
5	13	17	GND	--	Signal Ground
5	13	18	DTR	In	Data Terminal Ready
5	13	41	RXD	Out	Receive Data
5	13	42	TXD	In	Transmit Data
5	13	43	DCD	Out	Data Carrier Detect
6	14	19	GND	--	Signal Ground
6	14	20	GND	--	Signal Ground
6	14	21	DTR	In	Data Terminal Ready
6	14	44	RXD	Out	Receive Data
6	14	45	TXD	In	Transmit Data
6	14	46	DCD	Out	Data Carrier Detect
7	15	22	GND	--	Signal Ground
7	15	23	GND	--	Signal Ground
7	15	24	DTR	In	Data Terminal Ready
7	15	47	RXD	Out	Receive Data
7	15	48	TXD	In	Transmit Data
7	15	49	DCD	Out	Data Carrier Detect

Table 3-8 SIO-ST Connector Pin Assignments
DCE Connectors J0C and J7C

Pin No.	*RS-232-C Name*	*Bridge Name*	*Direction*	*Function*
1	AA	--	--	Chassis Ground*
2	BA	TXD/	In	Transmit Data
3	BB	RXD/	Out	Receive Data
4	CA	RTS	In	Request to Send
5	CB	CTS	Out	Clear to Send
6	CC	DSR	Out	Data Set Ready
7	AB	GND	--	Signal Ground
8	CF	DCD	Out	Data Carrier Detect
9-14	--	--	--	Unused
15	DB	TXC	Out	Transmit Clock**
16	--	--	--	Unused
17	DD	RXC	Out	Receive Clock**
18-19	--	--	--	Unused
20	CD	DTR	In	Data Terminal Ready
21-25	--	--	--	Unused

* Cable shield should be connected to this pin.
** DB and DD are controlled by the same driver; in applications where better electrical transmission is needed, only one wire should be implemented for both lines and the connection should be established at the remote end.

Table 3-9 SIO-SM Connector Pin Assignments
DTE* Connectors J0T through J3T

Pin No.	*RS-232-C Name*	*Bridge Name*	*Direction*	*Function*
1	AA	--	--	Chassis Ground**
2	BA	TXD/	Out	Transmit Data
3	BB	RXD/	In	Receive Data
4	CA	RTS	Out	Request to Send
5	CB	CTS	In	Clear to Send
6	CC	DSR	In	Data Set Ready
7	AB	GND	--	Signal Ground
8	CF	DCD	In	Data Carrier Detect
9-14	--	--	--	Unused
15	DB	TXC	In	Transmit Clock***
16	--	--	--	Unused
17	DD	RXC	In	Receive Clock
18	--	--	Out	Spare
19	--	--	--	Unused
20	CD	DTR	Out	Data Terminal Ready
21	CG	--	In	Spare
22	--	--	--	Unused
23	CH	--	Out	Spare
24	DA	EXC	Out	External Clock***
25	--	--	--	Unused

* This table applies only when the port's INTerfaceType parameter is set to DTE. For the functions of the pins when the parameter is set to DCE, refer to Figure 4-5 in Section 4.1.1. For a description of the INTerfaceType parameter, see reference [3].

** Cable shield should be connected to this pin.

*** Either Transmit Clock or External Clock can be selected, but not both (see Section 5.2.5).

Table 3-10 SIO-422 Connector Pin Assignments
DTE Connectors J0T through J3T

Pin No.	*RS-449 Name*	*Direction*	*Function*
1	Shield	--	Chassis Ground*
2,3	--	--	Unused
4	SD-A	Out	Send Data - A
5	--	--	Unused
6	RD-A	In	Receive Data - A
7	--	--	Unused
8	RT-A	In	Receive Timing - A
9-11	--	--	Unused
12	TR-A	Out	Terminal Ready - A
13	RR-A	In	Receiver Ready - A
14-16	--	--	Unused
17	TT-A	Out	Terminal Timing - A**
18	--	--	Unused
19	SG	--	Signal Ground
20,21	--	--	Unused
22	SD-B	Out	Send Data - B
23	--	--	Unused
24	RD-B	In	Receive Data - B
25	--	--	Unused
26	RT-B	In	Receive Timing - B
27-29	--	--	Unused
30	TR-B	Out	Terminal Ready - B
31	RR-B	In	Receiver Ready - B
32-34	--	--	Unused
35	TT-B	Out	Terminal Timing - B**
36-37	--	--	Unused

* Cable shield should be connected to this pin.

** For applications requiring ST rather than TT, shorting plugs must be in place in configuration areas E69 and E70 on the SIO-422, and a modified cable must be used (see Section 5.2.5).

Table 3-11 SIO-H422 Connector Pin Assignments DTE Connectors J0T through J7TP

Pin No.	*X.20 Name*	*RS-449 Name*	*Direction*	*Function*
1	Shield	Shield	--	Chassis Ground*
2	T(A)	SD+	Out	Transmit Data +
3	--	--	--	Unused
4	R(A)	RD+	In	Receive Data +
5-7	--	--	--	Unused
8	G	SG	--	Signal Ground
9	T(B)	SD-	Out	Transmit Data -
10	--	--	--	Unused
11	R(B)	RD-	In	Receive Data -
12-15	--	--	--	Unused

* Cable shield should be connected to this pin.

Table 3-12 SIO-HS422 Connector Pin Assignments
DTE Connectors J0T through J3T

Pin No.	*X.21 Name*	*RS-449 Name*	*Direction*	*Function*
1	Shield	Shield	--	Chassis Ground*
2	T(A)	SD+	Out	Transmit Data +
3	C(A)	TR+	Out	Control +
4	R(A)	RD+	In	Receive Data +
5	I(A)	DM+	In	Indication +
6	S(A)	RT+	In	Signal Element Timing +
7	St(A)	TT+/ST+	Out/In	Terminal Timing +**
8	G	SG	--	Signal Ground
9	T(B)	SD-	Out	Transmit Data -
10	C(B)	TR-	Out	Control -
11	R(B)	RD-	In	Receive Data -
12	I(B)	DM-	In	Indication -
13	S(B)	RT-	In	Signal Element Timing -
14	St(B)	TT-/ST-	Out/In	Terminal Timing -**
15	G	SG	--	Signal Ground

* Cable shield should be connected to this pin.
** Line functions as Clock In (ST) or Clock Out (TT) depending on the settings of the clock source configuration areas on the SIO board (see Section 5.2.5).

Table 3-13 SIO-V.35 Connector Pin Assignments DTE Connector J0T and J1T

Pin No.	*V.35 Name*	*Direction*	*Function*
A	SHIELD	--	Chassis Ground*
B	S.GND	--	Signal Ground
C	RTS	Out	Ready To Send
D	CTS	In	Clear To Send
E	DSR**	--	Not Supported
F	DCD	In	Data Carrier Detect
G	--	--	Unused
H	DTR**	In	Data Terminal Ready
I-N	--	--	Unused
P	SD-A	Out	Send Data - A
Q	--	--	Unused
R	RD-A	In	Receive Data - A
S	SD-B	Out	Send Data - B
T	RD-B	In	Receive Data - B
U	--	--	Unused
V	SCR-A	In	Receive Clock - A
W	--	--	Unused
X	SCR-B	In	Receive Clock - B
Y	SCT-A	In***	Transmit Clock - A
Z	--	--	Unused
a	SCT-B	In***	Transmit Clock - B
b-n	--	--	Unused

* Cable shield should be connected to this pin.

** Nonstandard use of DSR and DTR lines; in V.35 specification, DSR is implemented on pin E and DTR is not implemented.

*** For applications requiring SCTE rather than SCT, shorting plugs must be in place in configuration areas E69 and E70 on the SIO-V.35, and a modified cable must be used (see Section 5.2.5).

3.1.8 HSM Connectors

The HSM board (in the CS/1-HSM) uses a special SBA assembly (SBA-HSM) with a single 9-pin, D-type subminiature female connector. Table 3-14 lists the pin assignments for the HSM connector.

Refer to Figure 4-13 in Section 4.1.1 for information on the cabling requirements for the connection between the CS/1-HSM and the Host Adapter Card.

The HSM-MDM board (in the GS/6) connects to the RF modem inside the unit (refer to Section 3.1.9); an "F" type connector is present on the SBA assembly (SBA-BBM).

Table 3-14 HSM Connector Pin Assignments

Pin No.	*Bridge Name*	*Direction*	*Function*
1	SHIELD	--	Chassis Ground*
2	XMIT+	In	Transmit Data +
3	--	--	Unused
4	REC+	Out	Receive Data +
5	ELFS	--	External Loopback Fixture Sense
6	XMIT-	In	Transmit Data -
7	--	--	Unused
8	REC-	Out	Receive Data -
9	SG	--	Signal Ground

* Cable shield should be connected to this pin.

3.1.9 Other Connectors

GS/4 Connectors

The GS/4 connects directly to two Ethernets; it supports connectors to Ethernet transceivers. The server has two standard Series/1 transceiver cable connectors, which are described in Section 3.1.5. Refer to Tables 3-2 and 3-3 for the connector pin assignments.

GS/6 Connector

The GS/6 connects to an Ethernet network and to a broadband network. On the Ethernet side, it connects with a standard Series/1 transceiver cable connector, which is described in Section 3.1.5. To connect to the broadband drop cable from the RF modem inside the unit, the GS/6 has one type "F" connector on its rear panel.

3.2 Environmental Planning

This section provides information for the preinstallation planning process, including space requirements, environmental recommendations, and power and grounding specifications.

3.2.1 Space Requirements

The Series/1 server is available for either tabletop or rack mount installation. Dimensions of the unit are 9.5 inches x 17.0 inches x 21.3 inches (24.1 cm x 43.2 cm x 54.1 cm). The rack mount version is designed to fit in a 19-inch ANSI-standard rack.

The air intake on the front of the unit and the air exhaust on the sides of the unit must not be blocked, and approximately 6 inches (15 cm) free space must be allowed at the rear of the unit for cable clearance. The clearance provided by standard rack construction normally allows adequate air flow and cable clearance for rack mount installations, provided that the rack contains an independent blower or fan.

3.2.2 Environmental Requirements

The Series/1 server is designed to operate safely and reliably in an office environment. The fan that cools the unit generates 28 decibels PSIL. The environmental conditions recommended for safe, reliable operation are listed in Table 3-15.

Table 3-15 Environmental Requirements

	Minimum	*Maximum*
Storage Temperature	-13 ° F (-25 ° C)	140 ° F (60 ° C)
Operating Temperature	41 ° F (5 ° C)	104 ° F (40 ° C)
Altitude	Sea level	12,000 ft (3657 m)
Humidity *	10%	90%

* Relative humidity with no condensation.

3.2.3 Power and Grounding Requirements

The Series/1 server power supply has overcurrent protection on all voltages and overvoltage protection on +5 VDC. The total power consumption is 300 watts.

The power supply unit can be ordered in a 120 VAC or a 230 VAC version, as listed in Table 3-16. Refer to the label on the back panel of the unit to verify that the voltage option is appropriate for the local power source. Conversion of the unit from one voltage range to the other can be performed only by trained personnel. The frequency range acceptable at either voltage is 47 Hz to 440 Hz, allowing the unit to be powered from high-frequency emergency power sources.

The unit must be connected to the AC power source with a grounded line cord in order to meet safety requirements.

Table 3-16 Voltage Options

Voltage	*Range*	*Current*
120 VAC	90 - 140 VAC	3.5 amps maximum
230 VAC	180 - 260 VAC	1.8 amps maximum

3.3 Coaxial Cable, Tap, and Transceiver Installation

Installation of coaxial cables, taps, and transceivers is the responsibility of the customer and should be performed by a qualified contractor in accordance with local regulations.

All coaxial cable must meet the Ethernet specifications (see reference [10]). Coaxial cable consists of four main layers, as shown in Figure 3-4. Starting with the innermost, these layers are:

Center conductor	Thick, tin-plated copper wire
Dielectric	Plastic foam material with a thin layer of foil bonded to its outer surface
Electrostatic shielding	Three layers: thin, fine braid; thin foil; and wide, thick braid; provides shielding and acts as a ground
Jacket	Outer jacket, usually marked at 2.5-meter intervals; commonly PVC or TFE

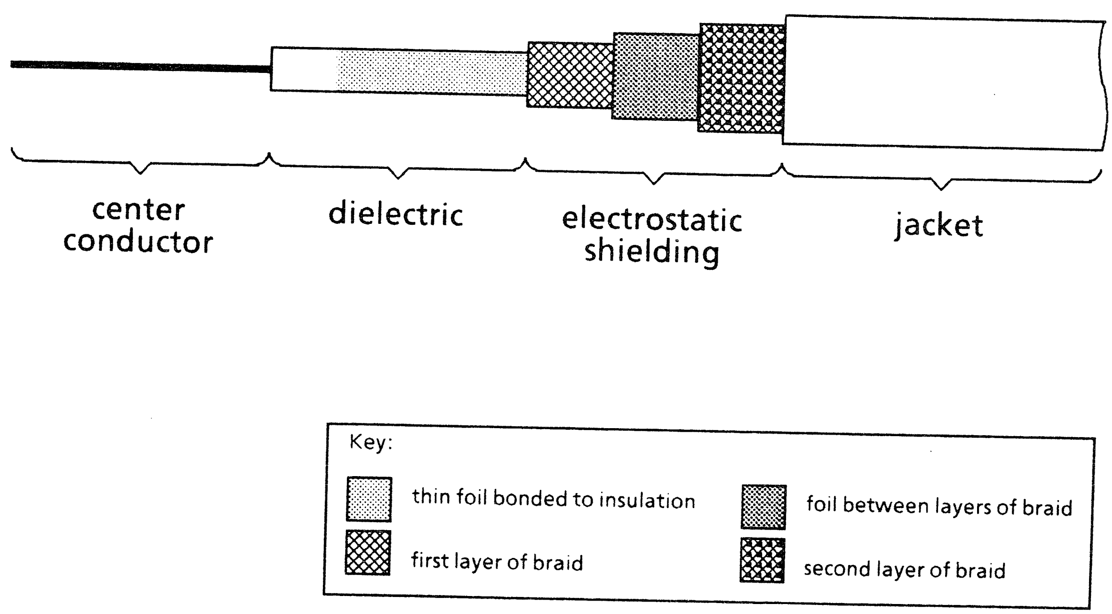


Figure 3-4 Coaxial Cable Layers

3.3.1 Cable Installation

The following guidelines should be observed when installing baseband coaxial cable. A cable installation tool kit (CBL-CITK) can be ordered from Bridge Communications, Inc.

1. Keep the cable ends tightly sealed during transportation, storage, and installation to prevent damage caused by moisture or foreign matter. After removing a portion of cable from a spool, reseal the cut end of the cable remaining on the spool.
2. Do not exceed the minimum bend radius of the cable as specified by the manufacturer.
3. Do not twist the cable or exceed the maximum recommended pulling force of the cable. When removing cable from a spool, unroll the cable; do not pull wire from the side of the roll.
4. Route cables to allow easy access when stations are added, moved, or serviced. Ensure that nothing strikes or dents the cable during installation and that the routing of the cable is such that it will not be physically degraded during service.
5. Install the cable in segments connected with inline extenders for flexibility and ease of fault isolation.
6. Most Ethernet coaxial cable is marked at 8.2-foot (2.5-meter) intervals. Place transceivers at these marks to minimize wave effects. If the cable is not marked, measure the distance between transceivers.
7. Attach all transceivers firmly to the building; transceivers must not rely on the cable for physical support. A side-mount transceiver may be used to facilitate attachment to the building. The transceiver box may be placed in a retainer if necessary. Do not allow the cable tapping clamp to be grounded.
8. Where cable does not run through supportive raceways or conduits, support it every 15 feet (4.5 meters). Ensure that supporting clamps do not pinch, dent, or deform the cable.
9. Terminate cable ends with a 50-ohm terminator, as described in Section 3.3.2. Terminators need not be placed at 2.5-meter markings; they are usually placed midway between two markings.
10. Install the cable as a logically continuous length, with no branches.
11. Connect the electrostatic shielding to a reliable earth ground at one of the terminators (preferably the highest one). All elements connected to the shielding (e.g., transceiver tap block, segment connection barrels, terminators) must be isolated to ensure that the cable is grounded at one point only.

In addition, Bridge recommends the following on-site cable testing procedures:

1. Visually inspect all cables for manufacturing faults or shipping damage.
2. Test each cable length for electrical continuity.
3. Remove the terminator from one end of the cable and check for a 50-ohm resistance between the electrostatic shielding and center conductor. Also, check the other end of the cable in this manner.

A large Ethernet system should be installed in stages. Repeat electrical continuity tests after each stage to detect problems caused by faulty connectors or damaged cable.

3.3.2 Terminator and Connector Installation

An N-series connector must be installed at each end of any length of coaxial cable. The cable must then be either terminated by attaching a terminator or extended with a barrel extender. The cable may be extended up to a length of 1,640 feet (500 meters).

Two types of N-series connectors are available: crimpable (e.g., K-Grip) and screw-on (e.g., Amphenol). Crimpable connectors require the use of a hand-crimp tool for installation. Screw-on connectors are more expensive and can be installed using an X-ACTO knife, a crescent wrench, and a soldering iron. The cable installation tool kit (designated CBL-CITK), available from Bridge Communications, Inc., facilitates installation of connectors, terminators, and extenders. The kit includes:

- N-series connector hand-crimp tool kit
- Ten N-series connectors (male)
- Four barrel extenders (female to female)
- Four 50-ohm cable terminators (female)
- Transceiver-tapping tool kit

The procedures for installing crimpable and screw-on connectors are outlined below.

Crimpable Connectors

Crimpable connector installation is facilitated by the use of jacket and dielectric trim-jigs. If the trim-jigs are not used, the cable must be measured by hand, as specified in the following steps.

1. Cut the cable end square and slip the connector sleeve over the jacket.
2. Make the first cut 13/32 in. from the square end and the second cut 19/32 in. from the square end. The jacket trim-jig may be used to score the jacket at these locations so that it can be removed easily.
3. Remove the jacket up to the first cut.
4. Remove the shielding from the square end up to the first cut, exposing the final layer of foil bonded to the dielectric.
5. Remove the jacket up to the second cut, exposing the shielding.
6. Remove 7/32 in. of the dielectric to expose the center conductor. To use a dielectric trim-jig, pass the dielectric through the hole in the end of the trim-jig, butting the outer jacket against the shoulder. Trim off the protruding dielectric flush with the end of the trim-jig.
7. Place the contact pin on the center conductor and use the hand-crimp tool to crimp it onto the center conductor.
8. Install the connector over the dielectric and under the shielding. The shielding may be split 1/4 in. axially in two places to facilitate entry of the connector. The end of the connector must be flush with the end of the contact pin.
9. Slide the sleeve to the end of the cable and up against the connector.

10. Use the hand-crimp tool to crimp the sleeve.
11. To terminate the cable, thread a 50-ohm N-series terminator into the connector and tighten it firmly. To extend the cable, thread an N-series barrel extender into the connector, tighten it firmly, and attach the extender to another section of cable.

Screw-on Connectors

1. Cut the cable end square and strip 2/10 in. of the jacket.
2. Install the collar on the cable, followed by the rubber gasket and boot. The boot should be the closest to the square end.
3. Fold all three layers of the shielding back against the boot.
4. Strip the dielectric back to the shielding (approximately 1/8 in.) to expose the center conductor.
5. Solder a contact pin to the center conductor, ensuring that the pin is pressed against the dielectric.
6. Thread the connector into the collar and tighten it.
7. To terminate the cable, thread a 50-ohm N-series terminator into the connector and tighten it firmly. To extend the cable, thread an N-series barrel extender into the connector, tighten it firmly, and attach the extender to another section of cable.

3.3.3 Tap and Transceiver Installation

To install taps and transceivers supplied by Bridge Communications, Inc., follow these steps:

1. Acquire the number of taps and transceivers necessary to install the system.
2. Acquire a transceiver tapping tool kit (designated CBL-TTK; also included in the cable installation tool kit). The kit consists of three tools:
   - Coring tool with cylindrical, serrated blade (A0003-D0-1)
   - Scraping tool with chisel blade (A0003-D1-0)
   - Punching tool with probe (A0003-D2-0)

**** NOTE ****

The tools are sharp and fragile. Do not drop or mishandle them.

3. Locate the 2.5-meter mark nearest the required drop and place the tap so that the threaded hole is centered over the mark.
4. With the tap centered, tighten it firmly using a 9/16 in. open-end wrench. Hold the body of the tap so that the cable is not twisted during tap installation.
5. Insert the coring tool (A0003-D0-1) into the threaded hole on the tap body and, using a back-and-forth motion, turn the coring tool until it makes contact with the center conductor (resistance increases).

**** CAUTION ****

Overtightening may damage the tap threads.

6. Orient the tap so that the coring tool is hanging downward; tap lightly on the threaded stud in the body of the clamp so that the material removed from the cable falls out through the center of the tool.
7. Remove the coring tool. The cable has been cut through the jacket and shielding to the foil bonded to the dielectric.
8. Insert the scraping tool (A0003-D1-0) into the threaded hole in the tap and rotate the tool clockwise several turns. The scraping tool removes the shielding that the coring tool loosened.
9. Remove the scraping tool. Using a small screwdriver or probe, carefully and thoroughly clean out any remaining bits of wire or foil, which may short the coaxial system.

**** CAUTION ****

To ensure proper operation of the tap, the shielding must be cut cleanly, and all metal debris must be completely removed. If necessary, repeat steps 8 and 9.

10. Insert the punching tool (A0003-D2-0) into the threaded hole in the tap. Tighten the tool gently until it resists further tightening, indicating that it has made contact with the center conductor of the coaxial cable. Do not overtighten.
11. Remove the punching tool.

**** NOTE ****

When the tool is removed, the center conductor of the coaxial cable may not be visible. For transceivers with non-spring-loaded probes, this should not cause transmission problems. However, for any transceiver with a spring-loaded probe, repeat steps 8 and 9 if necessary to ensure that the conductor is visible.

12. Insert the probe end of the transceiver gently into the threaded hole of the clamp. Turn the transceiver until the O-ring seal makes contact with the clamp, then turn a half-turn more to tighten. Do not overtighten. When several transceivers are installed, they may not be oriented in the same direction. Do not attempt to face them all the same way, because this may result in overtightening.
13. Secure the transceiver as required, ensuring that the coaxial cable clamp end is not grounded.

3.3.4 Transceiver Removal and Reinstallation

To remove a transceiver, follow these steps:

1. Unscrew the transceiver and carefully remove it from the tap. Ensure that the O-ring seal is in place. Protect the probe end of the transceiver.
2. Leave the tap in place and check that it is clean and free of particles. Screw a tap block plug into the tap.

If a transceiver must be reinstalled, use a new tap. Locate the new tap the minimum possible distance from the original one; the new tap may be located a maximum of 1 in. (2.5 cm) on either side of the original tap. Follow the tap installation procedure in Section 2.2.3 to reinstall the tap and transceiver.

3.4 Fiber Optic Cable Installation

All Series/1 products can operate with fiber optic Ethernet equipment. Cable installation arrangements are the responsibility of the customer unless otherwise specified by Bridge Communications, Inc. Fiber optic cable installation should be performed only by a qualified contractor in accordance with local regulations.

4.0 CABLE, MODEM, AND LINE INTERFACE REQUIREMENTS

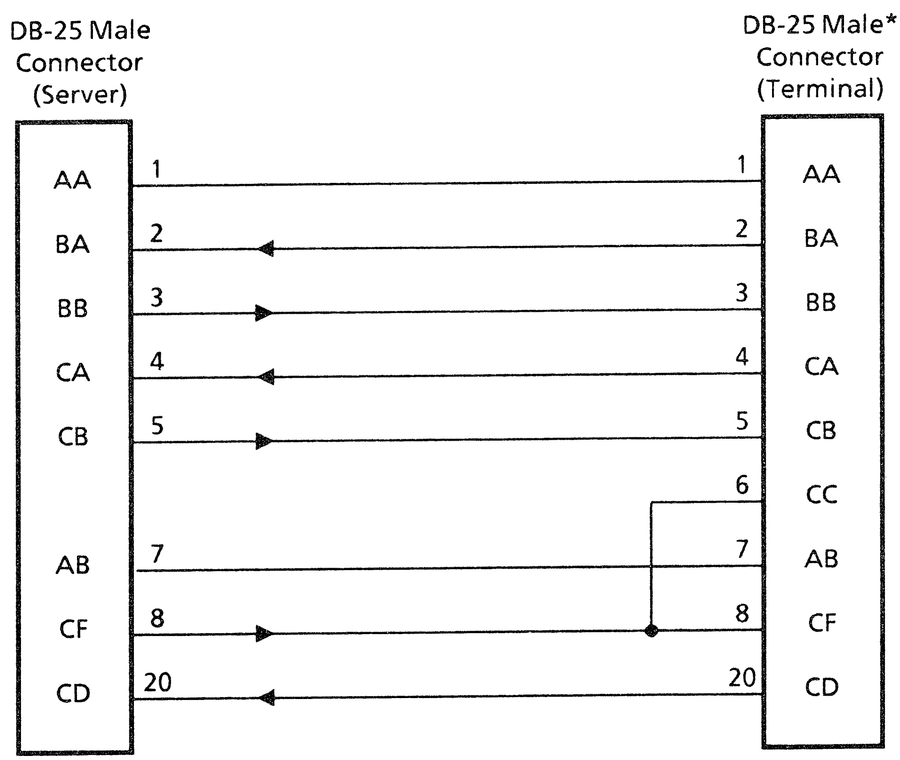
This section provides information about the cable, modem, and line interface requirements of the Series/1 servers. See reference [10] for more details on these requirements.

4.1 Device Cables

The following sections contain specifications for the cables commonly used to connect devices to Series/1 servers along with information about SIO control signals that may be affected by the cables. Section 4.1.1 describes the standard cable specifications for use with the CS/1 server; Section 4.1.2 describes the cabling options recommended for use with the SIO-16 module.

4.1.1 Standard Cable Specifications

Figures 4-1 through 4-13 illustrate the cable specifications for use with standard devices and various models of Series/1 server. The connector types needed on the device end of the cables may vary depending on the kind of connector on the device. To attach a terminal to the server's console port, use the cable shown in Figure 4-1.



* Deviation from EIA standards. Connector type may vary; check requirements of device.

Figure 4-1 Asynchronous Terminal Cable Specification
(CBL-AT-25, for use with SIO-A module)

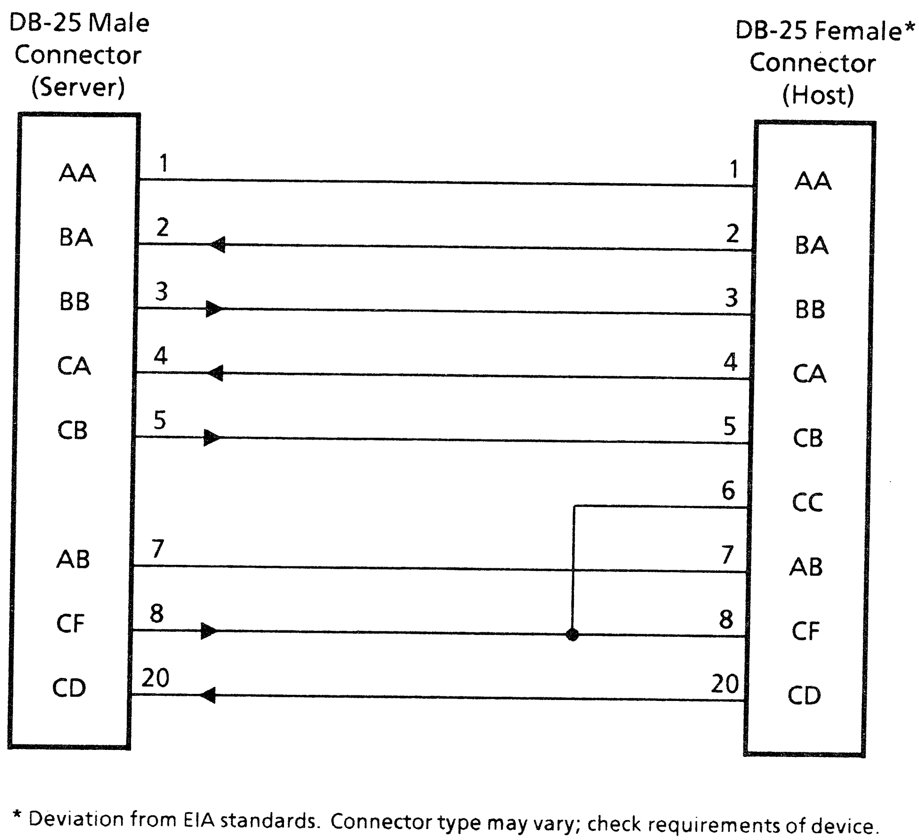
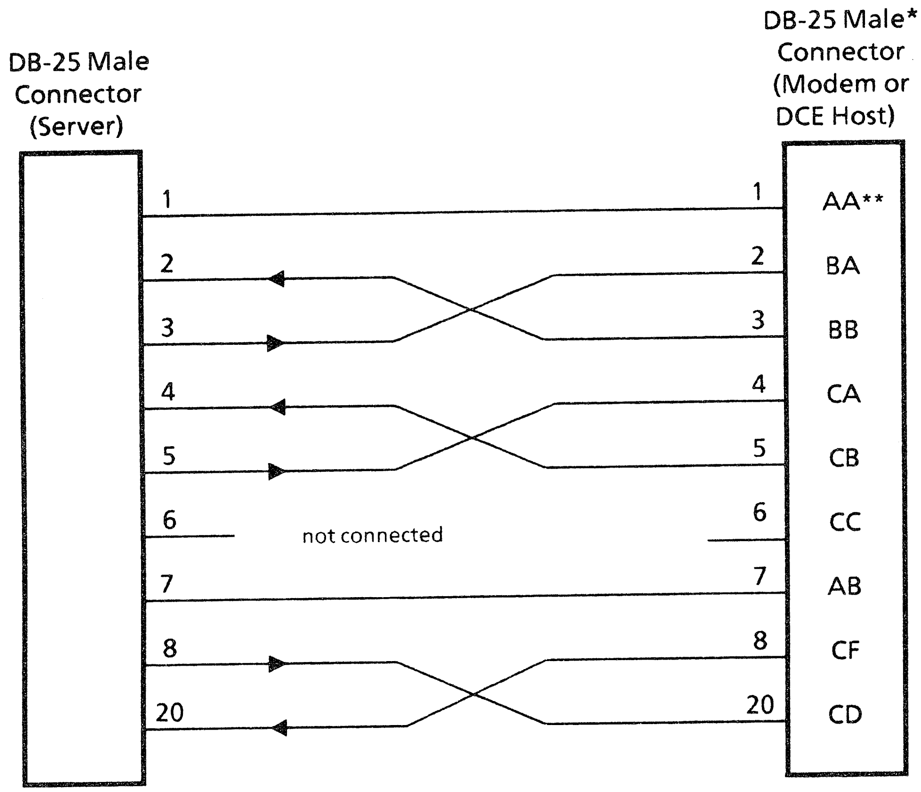
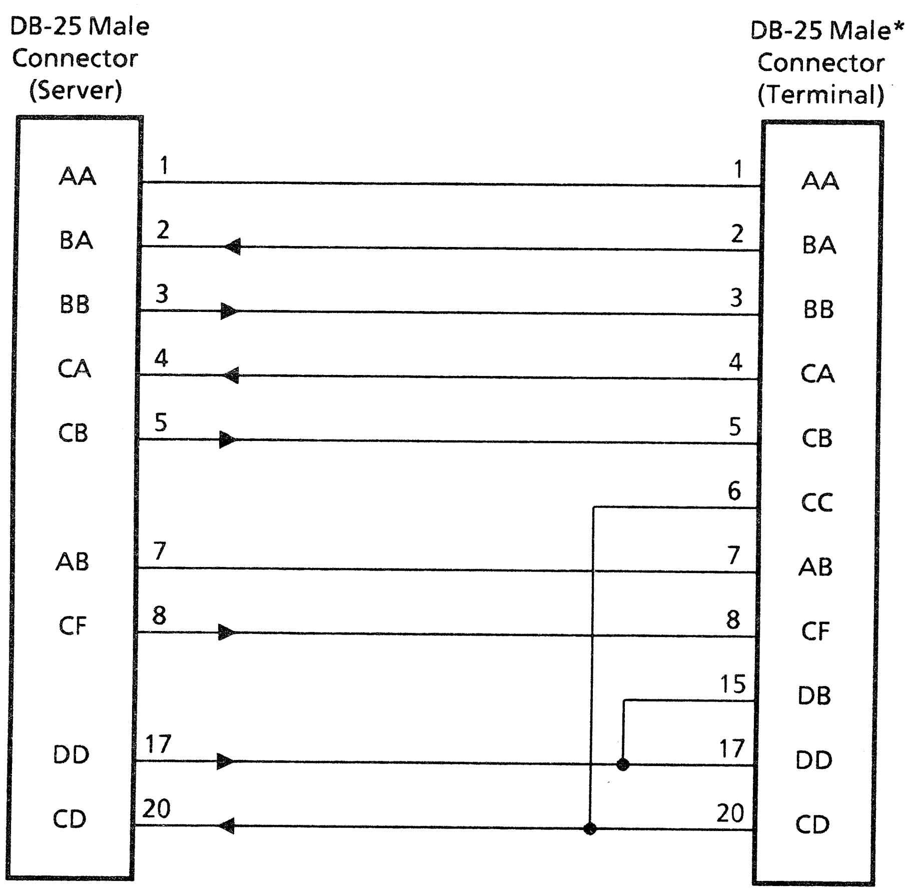


Figure 4-2 Asynchronous Host Cable Specification
(CBL-AH-25, for use with SIO-A module)



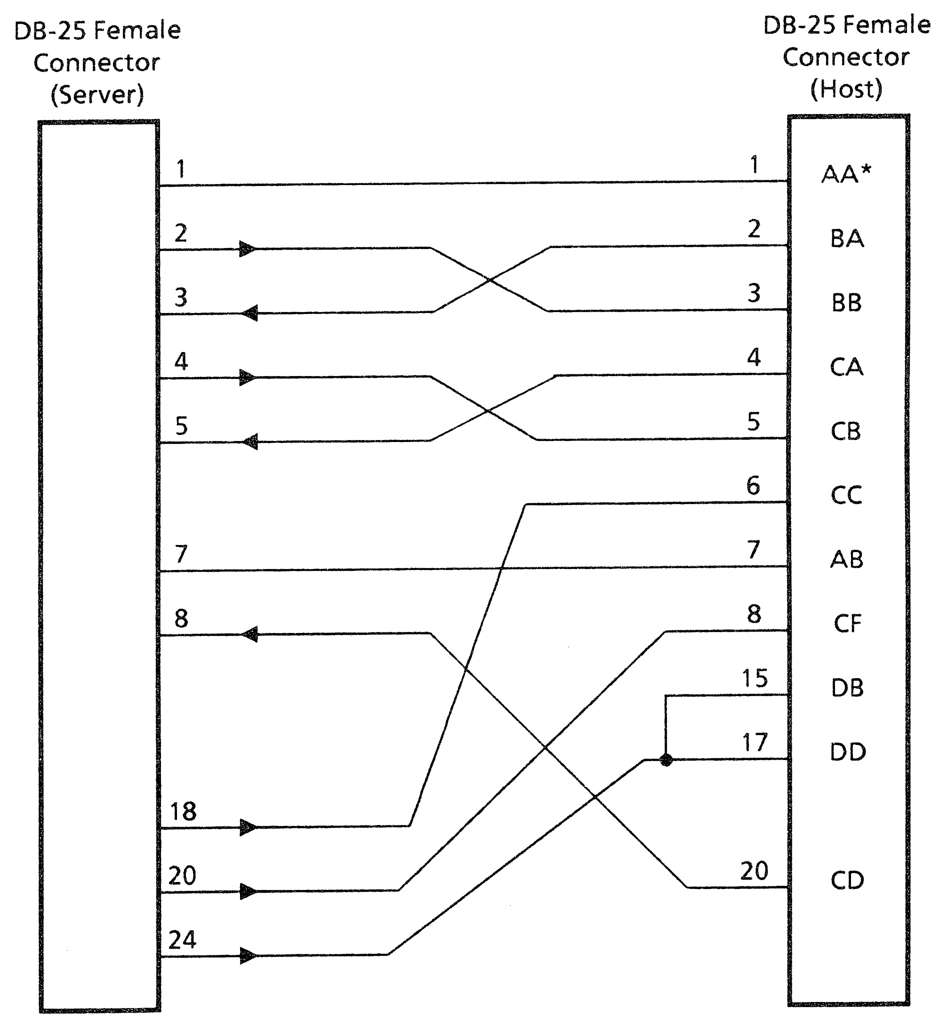
* Connector type may vary; check requirements of the device.
** Circuit names are based on the function at the device end of the circuit.

Figure 4-3 Asynchronous Modem Cable Specification
(CBL-AM-25, for use with SIO-A module)



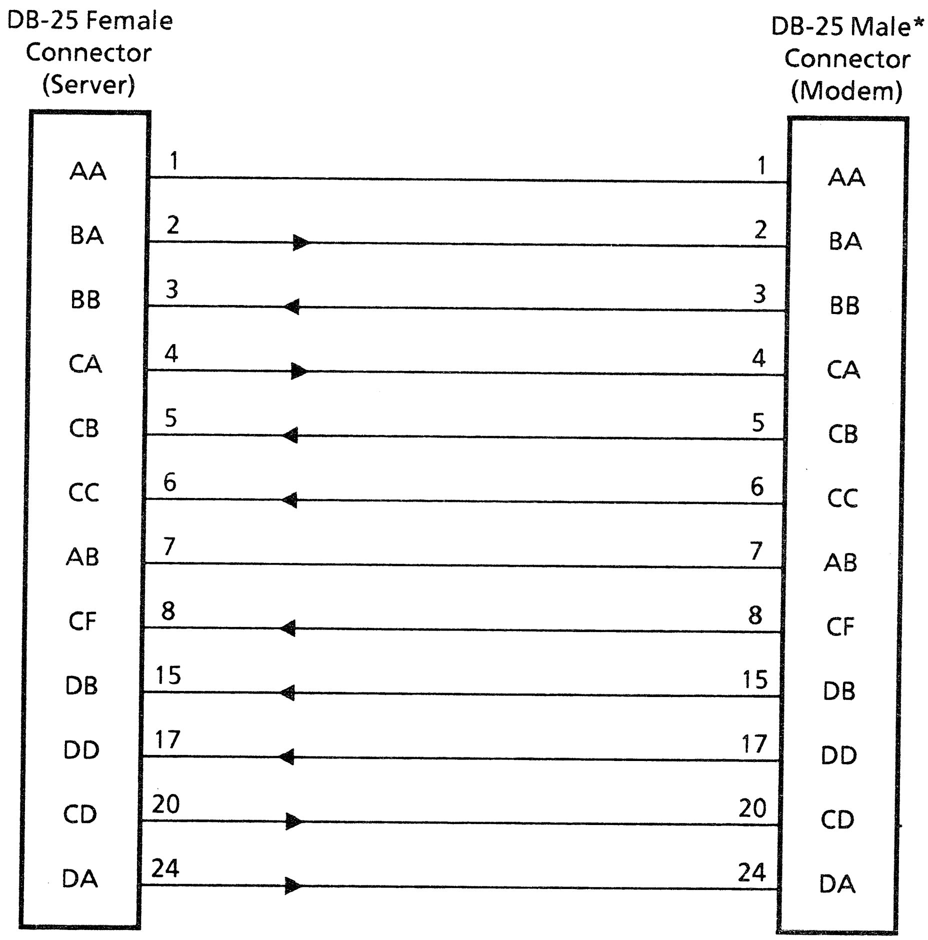
* Deviation from EIA standards. Connector type may vary; check requirements of device.

Figure 4-4 Synchronous Terminal Cable Specification
(CBL-ST-25, for use with SIO-ST module)



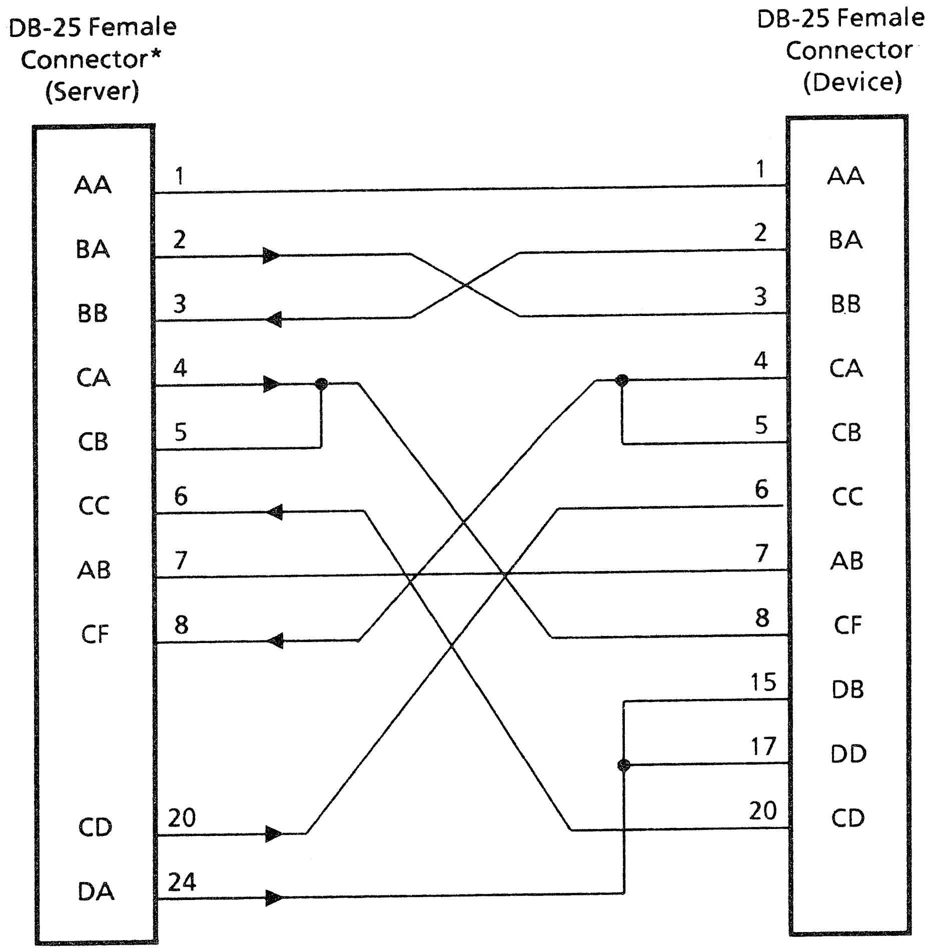
* Circuit names are based on the function at the device end of the circuit.

Figure 4-5 Synchronous Host Cable Specification
(CBL-SH-25, for use with SIO-SM module)



* Connector type may vary; check requirement of modem connector.

Figure 4-6 Synchronous Modem Cable Specification
(CBL-SM-25, for use with SIO-SM module)



* This end of cable must be connected to the server or device generating clock signals.

Figure 4-7 Synchronous Modem Eliminator Cable Specification (CBL-SME-25, for use with SIO-SM module)

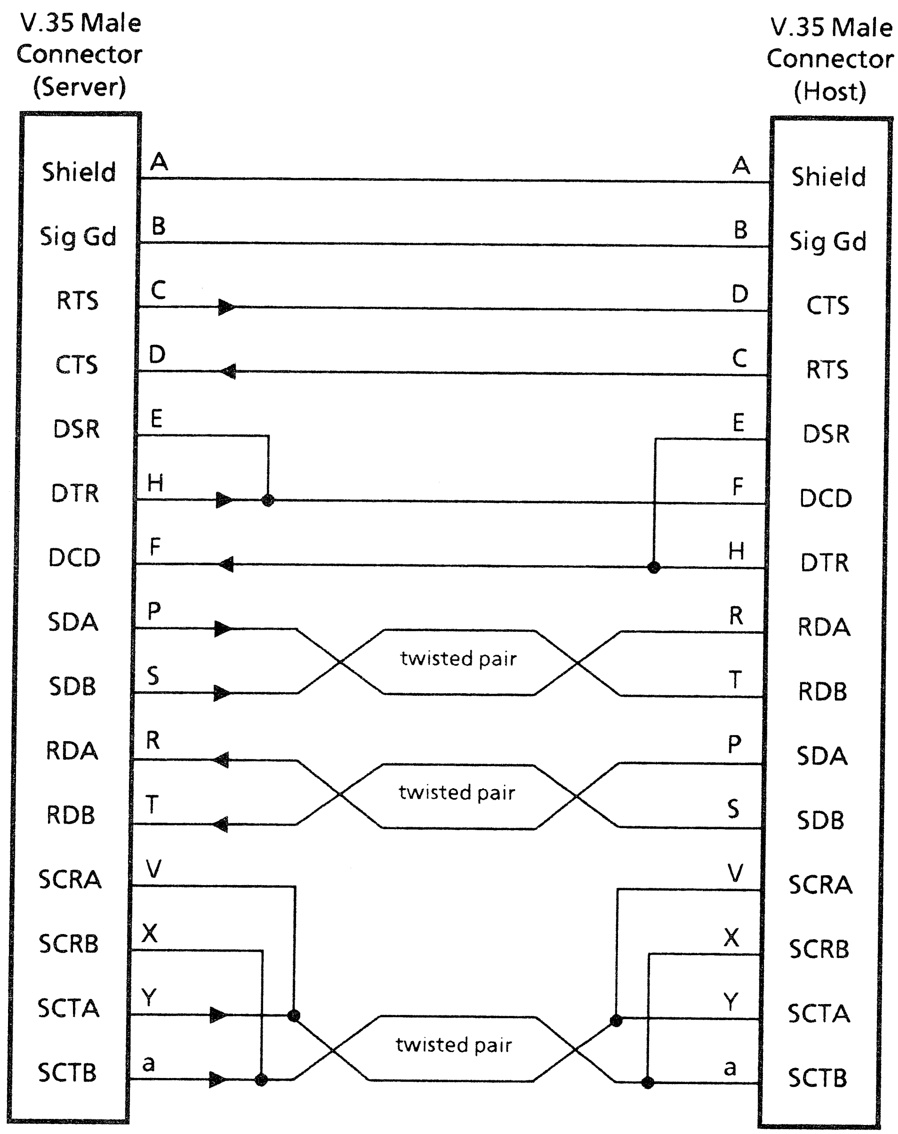


Figure 4-8 V.35 Host Cable Specification
(CBL-V35H-25, for use with SIO-V.35 module)

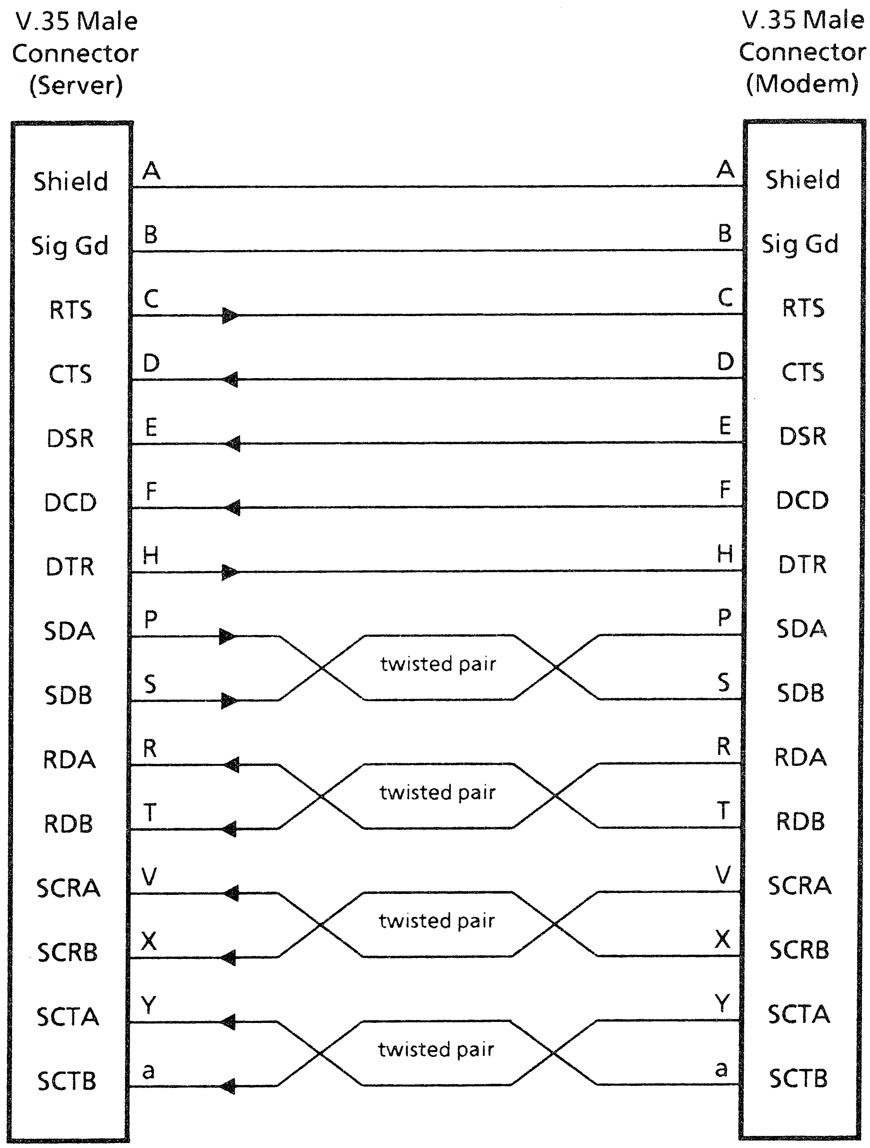


Figure 4-9 V.35 Modem Cable Specification
(CBL-V35M-25, for use with SIO-V.35 module)

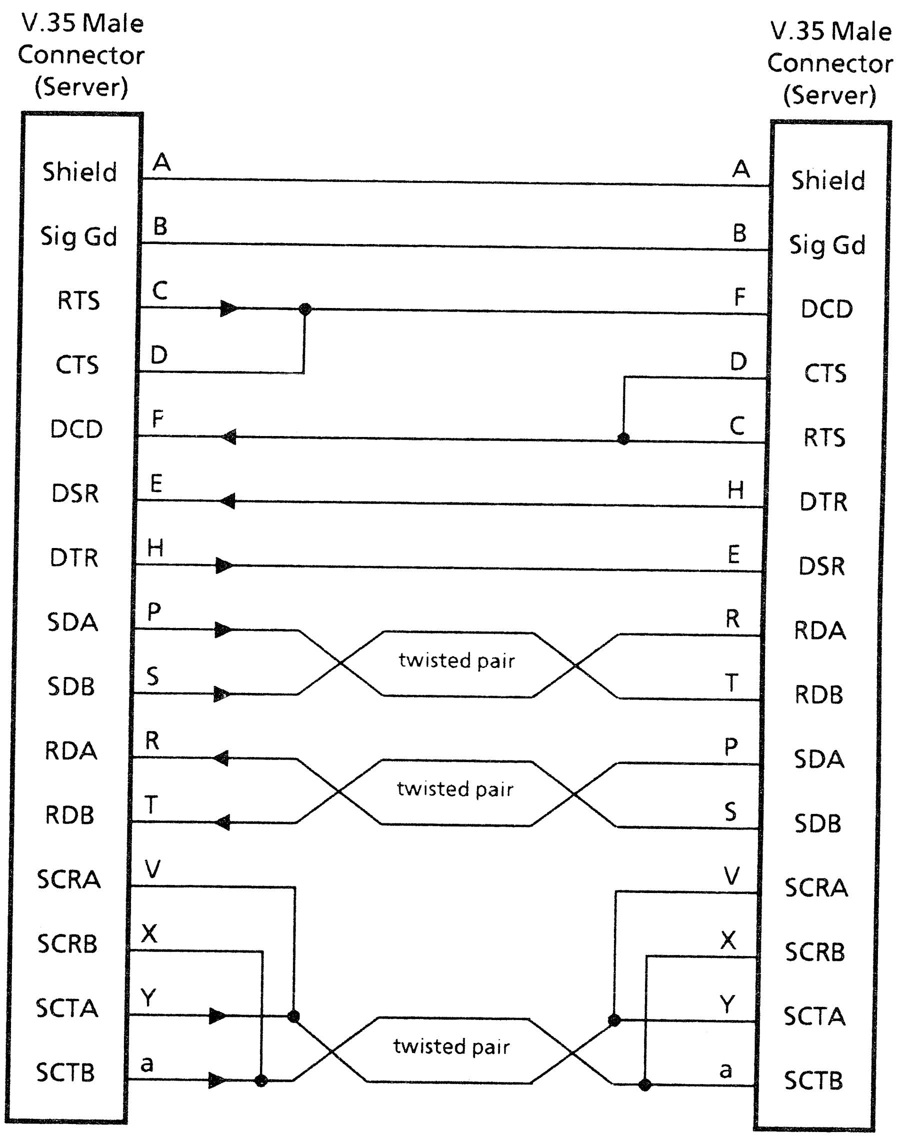


Figure 4-10 V.35 Modem Eliminator Cable Specification
(CBL-V35ME-25, for use with SIO-V.35 module)

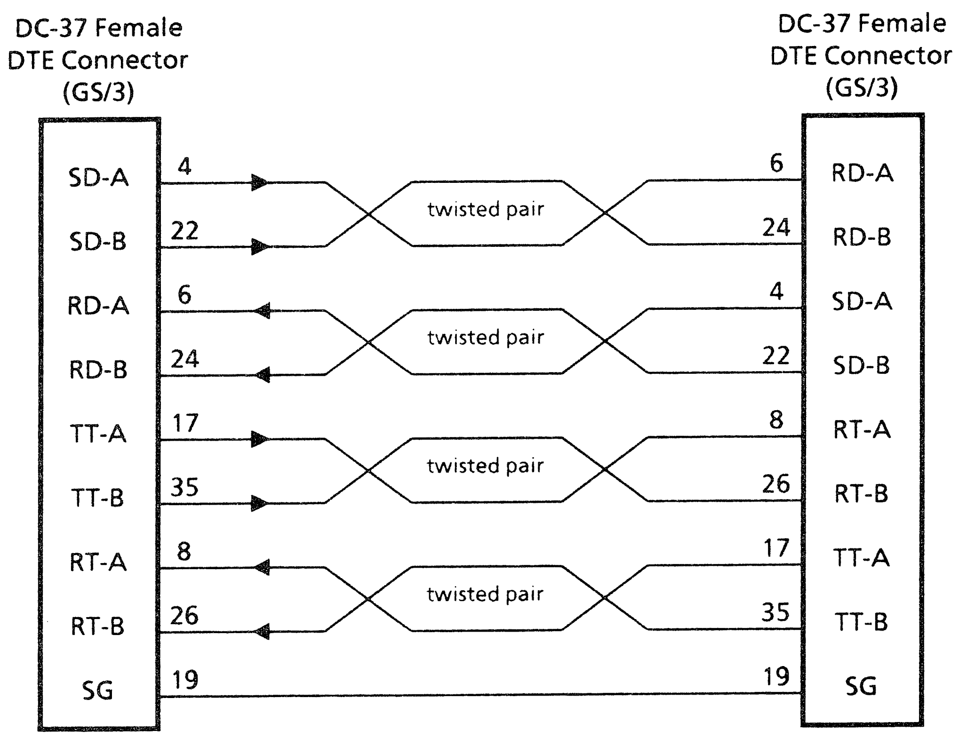


Figure 4-11 RS-449 Modem Eliminator Cable Specification
(CBL-449ME-25, for use with SIO-422H module)

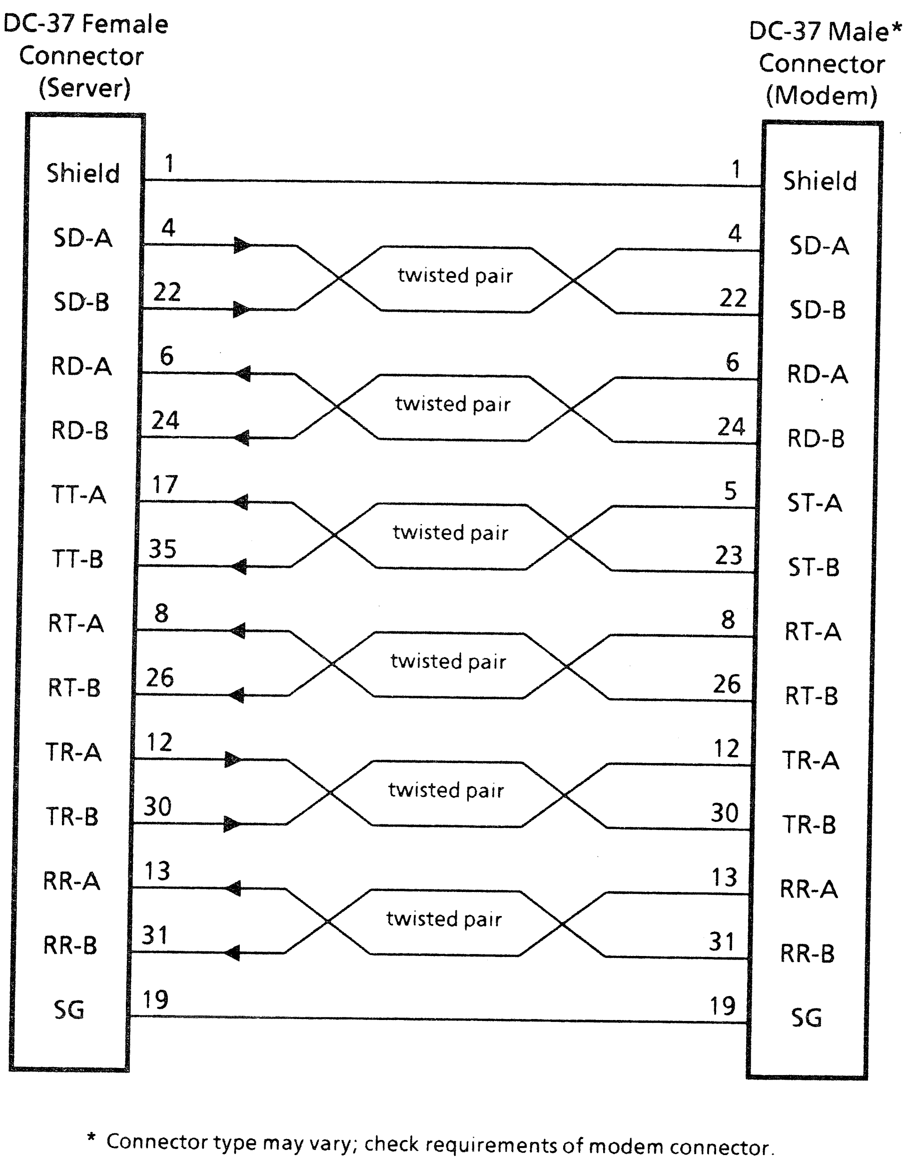


Figure 4-12 RS-449 Modem Cable Specification
(CBL-449M-25, for use with SIO-422H module)

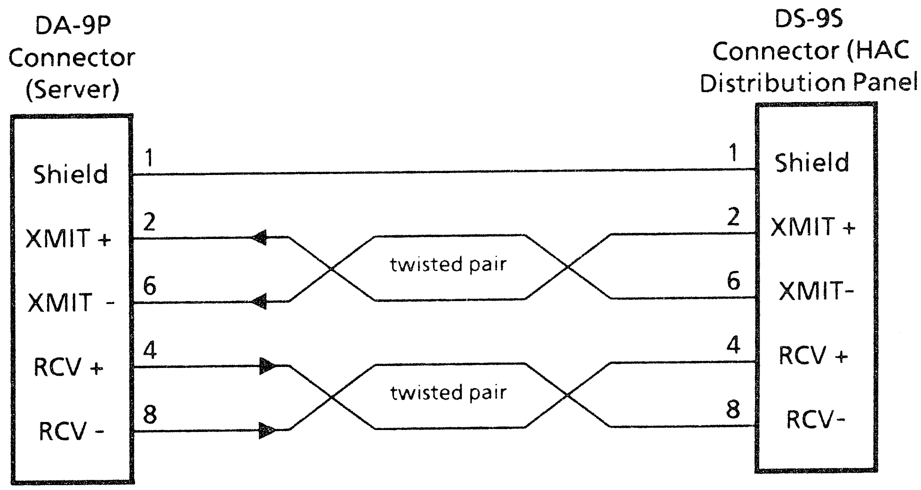


Figure 4-13 Host Adapter Card Cable Specification
(CBL-HSM-25, for use with HSM module)

4.1.2 Cabling Options for use with the SIO-16 Module

This section describes the cables and adapters recommended for use with the SIO-16 module. Figure 4-14 illustrates the cabling options offered by Bridge.

**** NOTE ****

Cables designed for use with other SIO boards cannot be intermixed with the cables designed for use with the SIO-16.

- **25-pair Extension Cable**
  - Double-ended female/female
  - Available in 25, 50, and 100-foot lengths
- **3-pair RJ-11 Modular Cable**
  - Double-ended male/male
  - Connects to any 6-wire RJ-11 receptacle
  - Available in 25-foot lengths
- **25-pair/RJ-11 Hydra Adapter Cable**
  - 25-pair connector breaks out into eight 6-wire RJ-11 male connectors
  - Attaches to modems or DB-25 adapters
  - Available in lengths to order
- **Harmonica Breakout Box**
  - 25-pair male connector breaks out into eight female RJ-11 receptacles
  - Accepts one 25-pair connector and eight 6-wire RJ-11 plugs
- **Modular DB-25 Adapter**
  - Converts modular 6-wire RJ-11 male connector to DB-25 RS-232 connector (either male or female)
  - Connects to 6-wire RJ-11 modular cable or RJ-11 Hydra Adapter cable
  - Available in 3 pre-wired configurations (illustrated in figures 4-15 and 4-16)

These cables and adapters may be purchased either from Bridge Communications, Inc., from Nevada Western, Inc., or from other cable vendors.

Table 4-1 lists the RS-232 DB-25 connector pin assignments; Table 4-2 lists the RJ-11 connector pin assignments. Figures 4-15 and 4-16 illustrate the pre-wired configurations of the Modular DB-25 Adapters.

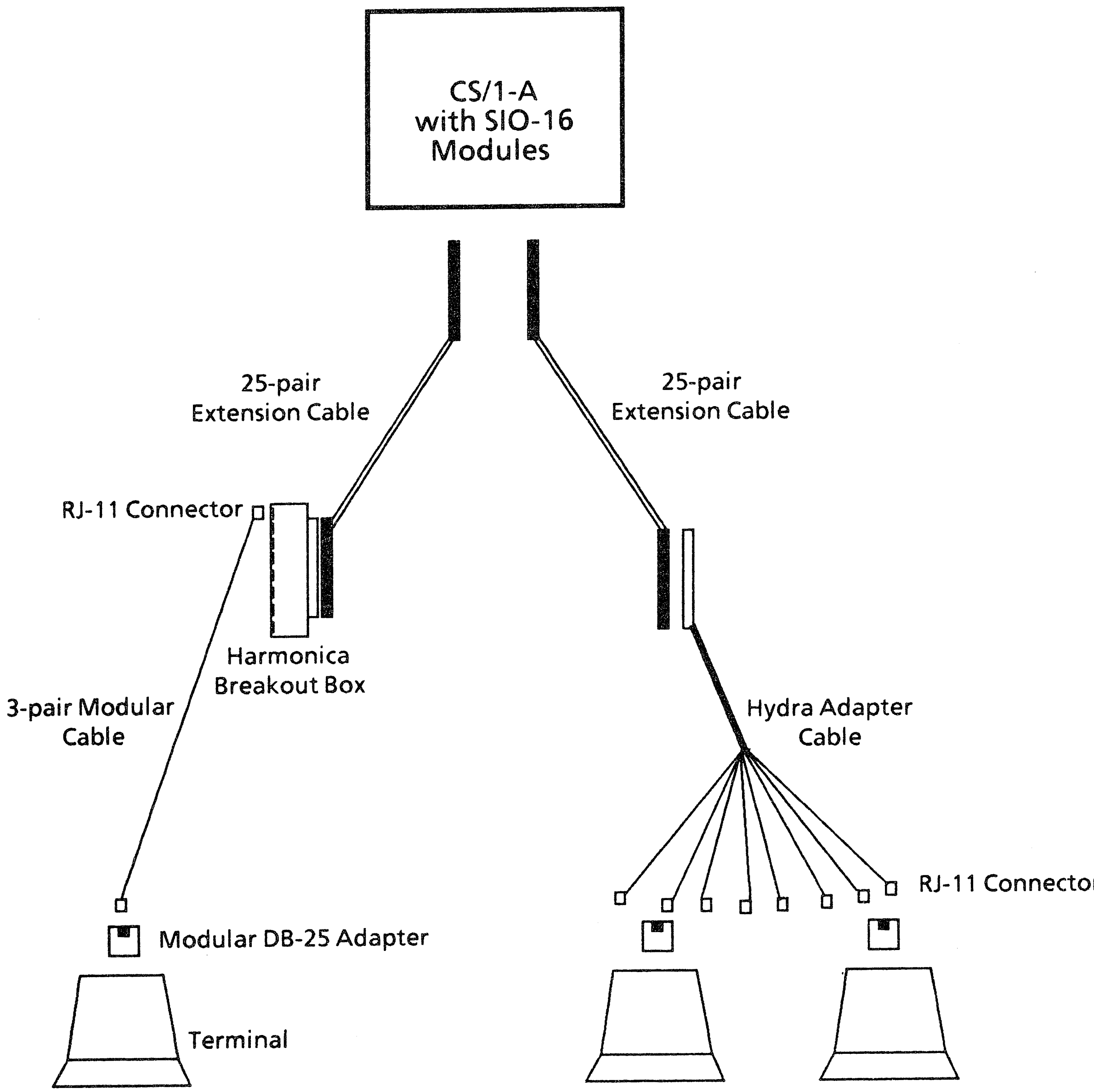


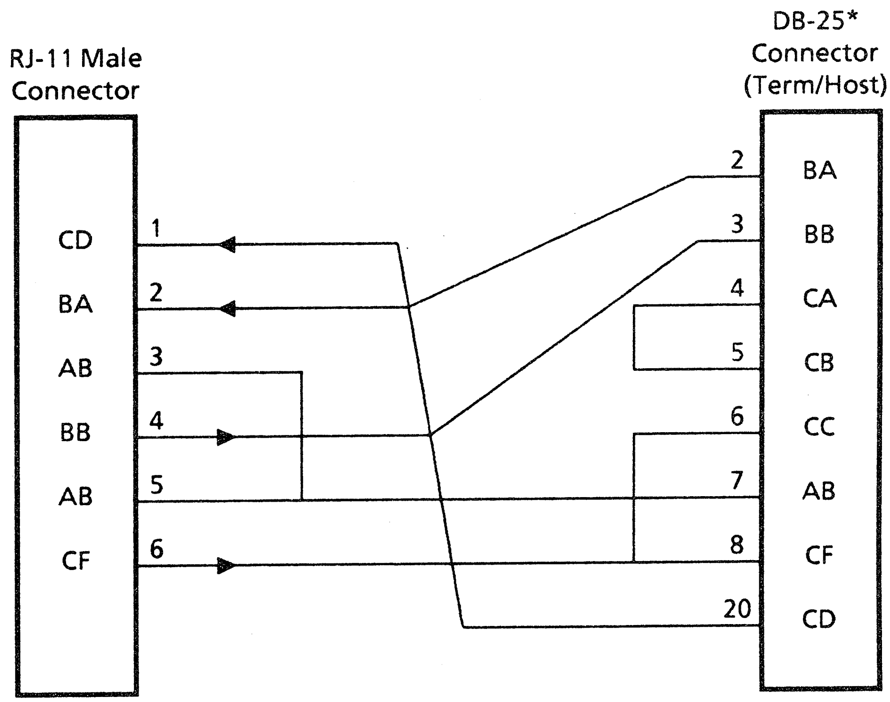
Figure 4-14 SIO-16 Cable and Adapter Options

Table 4-1 SIO-16 Connector Pin Assignments
DB-25 Connectors

Pin No.	*RS-232-C Name*	*Signal Name*	*Direction*	*Function*
2	BA	TXD	In	Transmit Data
3	BB	RXD	Out	Receive Data
7	AB	GND	--	Signal Ground
8	CF	DCD	Out	Data Carrier Detect
20	CD	DTR	In	Data Terminal Ready

Table 4-2 SIO-16 Connector Pin Assignments
RJ-11 Connectors

Pin No.	*Signal Name*	*Direction*	*Function*
1	DTR	In	Data Terminal Ready
2	TXD	In	Transmit Data
3	GND	--	Signal Ground
4	RXD	Out	Receive Data
5	GND	--	Signal Ground
6	DCD	Out	Data Carrier Detect



* Available either male or female.

Figure 4-15 Modular DB-25 Terminal/Host Adapter
(CBL-Term/Comp-Male or CBL-Term/Comp-Female)

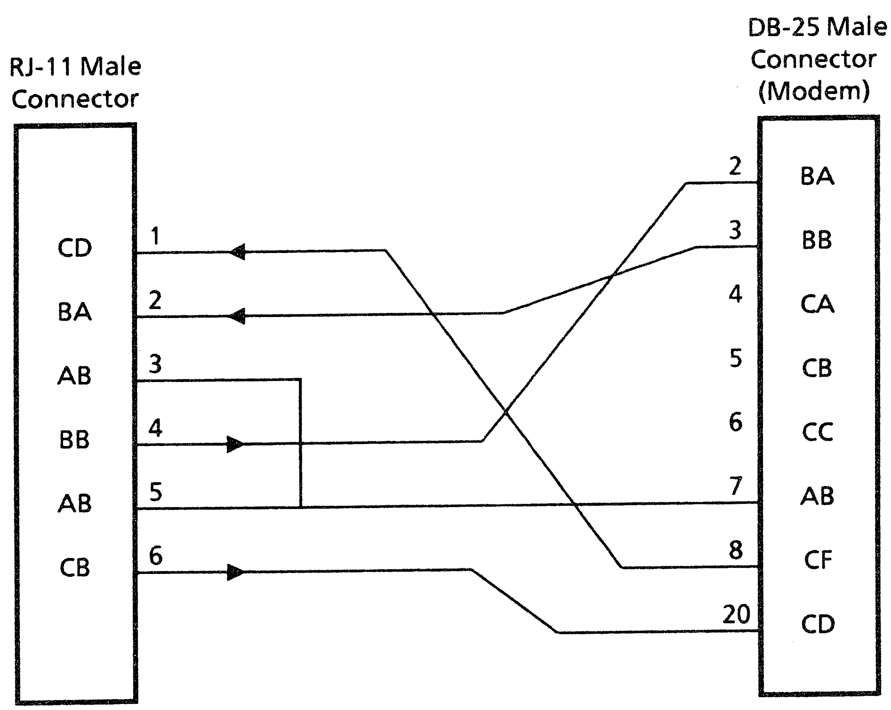


Figure 4-16 Modular DB-25 Modem Adapter
(CBL-Modem-Male)

4.1.3 Special Cable Considerations

The figures and tables in Sections 4.1.1 and 4.1.2 describe the cables needed for most CS/1 installations. This section contains additional guidelines and restrictions that apply to the cables connecting a server to the devices it supports.

General Restrictions

1. Never use ribbon cable to attach a device to the Series/1 server.
2. Never connect a device or server input to a line that is not driven by an active device on the other side. In particular, do not connect the RTS and CTS pins to a physical wire if those signals are not used.
3. In order to guarantee proper operation and compliance with FCC regulations, ensure that all cables are shielded and that the shield is connected either to pin 1 or to the connector boot.

Asynchronous Systems

1. A CS/1-A with an SIO-A module connects to an RS-232-C DTE device with the asynchronous terminal cable shown in Figure 4-1 (CBL-AT-25). For a DTE device with a male connector (e.g., most asynchronous host ports), the appropriate cable is the asynchronous host cable shown in Figure 4-2 (CBL-AH-25).
2. If a modem or DCE host is connected to a CS/1-A, use the asynchronous modem cable illustrated in Figure 4-3 in Section 4.1.1.
3. If the device supports and requires the DTR and DCD control lines, ensure that the device cable passes these control lines between the device and the server.
4. If the device supports and requires the DTR and DCD control lines, but the cable does not pass these lines from the server to the device, ensure that DTR is looped back to DCD at the device end.
5. The SIO-A module does not support the Ring Indicator or Incoming Call (RI) signal, usually on pin 22. If a device uses this line, connect RI to pin 8 instead of pin 22 at the device end.

Synchronous Systems

1. If a synchronous terminal or host is connected to a CS/1-BSC, CS/1-SNA, or CS/1-SDLC through an SIO-SMS module, use the synchronous host cable illustrated in Figure 4-5 in Section 4.1.1.
2. For half-duplex operation, always provide RTS, CTS, and DCD in the cable.
3. For maximum cable run length, minimize the number of receivers that depend on a single driver.

4.2 CS/1-A Modem and Line Interfaces

The CS/1-A can be attached to devices directly or through a full-duplex modem. The choice depends on the distance between the server and the attached device, the communication speed desired, and environmental requirements. The asynchronous modem cable (CBL-AM-25) connects an RS-232-C asynchronous DCE device, usually a modem, to a CS/1 equipped with an SIO-A module (see Figure 4-3).

4.3 CS/1-BSC, CS/1-SDLC, and CS/1-SNA Modem and Line Interfaces

The CS/1-BSC, CS/1-SDLC, and CS/1-SNA can be attached to devices directly or through a modem. The modem may be either full duplex or half duplex. The choice of a particular scheme depends on the distance between the server and the attached device, the communication speed desired, and environmental requirements.

Table 4-3 lists the possible lines and equipment and the configurations appropriate for each.

Table 4-3 Summary of CS/1-BSC, CS/1-SDLC, and CS/1-SNA Modem and Line Interface Requirements

Equipment	*Maximum Distance to Device*	*Line Speed*	*SIO Module*	*Devices Per SIO Module*
Direct cable connection	200 feet	19.2K bps	SIO-STS SIO-SMS	8 4
Direct cable connection	6,000 feet	64K bps*	SIO-422S	4
Switched-line modem	No limit	4.8K bps**	SIO-SMS	4
Leased-line modem	No limit	9.6K bps	SIO-SMS	4
DDS-line modem	No limit	64K bps*	SIO-V.35S	4
Limited-distance modem	4 miles	64K bps*	SIO-422S	4

* Aggregate speed for four ports without flow control is 124K bps.
** Some modems allow speeds up to 9.6K bps.

The typical half-duplex modem for use with the CS/1-BSC, CS/1-SDLC, and CS/1-SNA is the Bell 208A-type modem. Bridge Communications, Inc., has also tested the Racal-Vadic VA 4840 and other Bell 208A-compatible modems successfully with these servers.

On a switched line, the advantage of half-duplex communication over full-duplex is that higher speeds are available (4.8K or 9.6K bps, compared with 2.4K bps maximum). For a leased line, full-duplex communication at 9.6K bps eliminates the line turnaround delay. The duplex configuration parameter affects only the handshake of the modem control line; because the BSC and SNA protocols are inherently half duplex in terms of data flow, data typically flows in only one direction at a time.

For full-duplex operation, the typical connection methods employ either direct connections, limited-distance modems, or high-speed leased lines. Refer to Sections 4.5.1 through 4.5.3 for information.

Figure 4-4 in Section 4.1.1 provides the cabling information for connecting the server to a synchronous DTE device (usually a terminal) through an SIO-ST module. Figure 4-5 in Section 4.1.1 provides the cabling information for connecting the server to a synchronous DTE device (usually a host) through an SIO-SM module. Figure 4-6 in Section 4.1.1 provides the cabling information for connecting the server to a synchronous DCE device (usually a modem) through an SIO-SM module.

For the SIO-ST, the receive and transmit clocks must be set to Internal; the settings of the clocks for the SIO-SM depend on the cables used. The duplex configuration parameter must be set for either half-duplex lines or full-duplex lines. Reference [3] describes configuration parameters for all Bridge server models.

Devices may be connected to the CS/1-BSC, CS/1-SDLC, and CS/1-SNA using the following methods:

- A direct cable connection and an SIO-422S or SIO-SMS module
- A leased-line modem and an SIO-SMS module
- A DDS-line modem and an SIO-V.35S module
- A limited-distance modem and an SIO-422S module

Refer to Section 4.5 for information on these alternate connection methods.

4.4 GS/1 Modem Interfaces

The GS/1 is typically used with full-duplex, synchronous modem equipment supplied by the Public Data Network (PDN). The choice of SIO module to be used in the GS/1 is affected by the speed of the modem equipment to which the SIO module is to be connected.

The SIO-SMS module can interface to virtually any RS-232-C modem operating at speeds of 9600 baud or less.* The connection from the modem to the carrier's central office uses a four-wire leased line. The cable connecting the modem to the GS/1 is a standard RS-232-C cable (usually available with the modem). Refer to the specifications for the synchronous modem cable in Section 4.1.1. Refer to Section 3.1.7 for tables of the lines supported on different SIO connectors. Refer to Sections 5.2.5 and 5.2.9 for the options and default settings on the SIO board and SBA.

The SIO-422S module is used to interface to modems operating at speeds greater than 9600 baud. High-speed service typically uses an RS-449 or V.35 interface. For an RS-449 interface, order the SIO-422S module; for a V.35 interface, order the SIO-V.35S module. The cables used with the SIO-422S and SIO-V.35S modules are described in Section 4.1.1.

In the United States, service at speeds of 56K bps or higher (64K bps or higher elsewhere) requires the use of special high-speed Dataphone Digital Service (DDS) lines, which are available only in major metropolitan areas.

* RS-232-C can be used with terminal devices at speeds up to 19.2K bps; however, RS-422 is typically used for speeds over 9600 baud with modem equipment.

4.5 GS/3 and CS/1-X.25 Modem and Line Interfaces

The GS/3 and CS/1-X.25 can interface to a wide variety of lines and full-duplex modems. The choice of a particular scheme depends on the distance between the connected GS/3s or between the CS/1-X.25 and the X.25 host, the speed of the line connecting them, and environmental requirements. Table 4-4 lists the possible lines and equipment and the requirements of each.

Table 4-4 Summary of GS/3 and CS/1-X.25 Modem and Line Interface Requirements

Equipment	*Maximum Distance*	*Line Speed*	*SIO Module GS/3*	*SIO Module CS/1-X.25*
Direct cable connection	1 mile	64K bps	SIO-422H	SIO-422S
	200 feet	19.2K bps	SIO-SMH	SIO-SMS
Limited-distance modem	4 miles	64K bps	SIO-422H	SIO-422S
DDS-line modem	No limit	64K bps	SIO-V.35H	SIO-V.35S
Leased-line modem	No limit	1200 to 9600 baud	SIO-SMH	SIO-SMS
Switched-line modem	No limit 2400 baud	1200 or	SIO-SMH	SIO-SMS

4.5.1 Direct Cable Connection

The simplest method for connecting two GS/3 units or a CS/1-X.25 and an X.25 host is a direct cable connection. Two schemes are possible; the choice between the two depends on the distance between units and the speed of the link.

The first scheme can provide a virtually null error rate using common 24-gauge, twisted-pair telephone wire for distances up to 1 mile and speeds up to 64K bps. The connection should be implemented with the 9-wire cable illustrated in Figure 4-10. The GS/3 connection uses an SIO-422H module; the CS/1-X.25 connection uses an SIO-422S module. During system generation, the transmit clock parameter must be set to "internal" and the receive clock parameter must be set to "external". In addition, the clock source configuration areas on the boards must be set to internal transmit clock and external receive clock. See reference [3] for system generation information, and Section 5.2.5 of this guide for clock source jumper configuration information.

The second scheme provides service for distances up to 200 feet and speeds up to 19.2K bps. The connection should be implemented with the synchronous modem eliminator cable shown in Figure 4-7 and an SIO-SMH module for the GS/3 and SIO-422S module for the CS/1-X.25. This scheme is typically used to connect a CS/1-X.25 to a host; in this case, the clock source configuration areas on the SIO-SMS board must be set to internal transmit clock and internal receive clock. If this scheme is used to connect two GS/3 units, the configuration area must specify internal transmit and receive clocks on one GS/3 unit and external transmit and receive clocks on the other GS/3 unit.

Connecting GS/3s by means of a direct cable may present system grounding problems. If the GS/3s are connected to different AC power circuits, or if other electrical equipment is connected to the same AC power circuit as the GS/3s, chassis ground on each GS/3 may not be at the same electrical potential (ground differential). The difference in chassis ground potential may cause damaging cable-shield currents or unmanageable electrical noise. To prevent these problems, disconnect the cable shield (drain wire) from pin 1 on *one end* of the direct-connect cable.

4.5.2 Limited-Distance Modems

Limited-distance modems are designed to be used with private lines or with unloaded, 4-wire telephone lines over a limited distance. Typical range at 64K bps is approximately 4 miles.

Unloaded telephone lines are practical when the sum of the distances between the buildings to be connected and the telephone company's central office is within the applicable range. Unloaded lines are relatively inexpensive.

Limited-distance modems typically tolerate more ground shifts than direct cable connections.

Bridge Communications has successfully tested GS/3 units with the Avanti 2349M Local Area Data Distributor, with the following settings established on the modem:

- 64K bps data rate
- External send timing
- Constant carrier
- RS-449 interface option

For use in this configuration, the clock selection pins must be set to "external" for both transmit and receive.

The cable used to connect the GS/3 or CS/1-X.25 to the modem is illustrated in Figure 4-11 in Section 4.1.1.

4.5.3 DDS Leased-Line Modems

This service is compatible with a Bell 303-type, high-speed synchronous modem. Bridge Communications, Inc., has also successfully tested the Amdahl 983 DSU-B modems. There is no distance limitation, since line repeaters are integral to the DDS service. However, availability is typically limited to major metropolitan areas, and line costs are relatively high.

For operation with DDS leased-line modems, the server must be equipped with an SIO-V.35 module. The clock source pins must be configured as "external" for both transmit and receive.

The cable used to connect the GS/3 or CS/1-X.25 to a V.35 modem is a standard V.35 cable with male connectors on both ends. Figure 4-9 in Section 4.1.1 provides the cable specifications for use with the SIO-V.35 module.

4.5.4 Standard Leased-Line Modems

Standard leased-line modems are the most commonly used of all the connection schemes. Leased lines are available at speeds of 1200, 2400, 4800, and 9600 baud. These lines must be 4-wire lines.

Bridge Communications has successfully tested GS/3 units with the Micom M4096, M4048, and M4024 synchronous modems, operating at 9600 baud, 4800 baud, and 2400 baud, respectively.

Other modems that have been tested successfully with the GS/3 are the Racal Vadic VA 3455 (1200 baud) and VA 4403 (2400 baud).

The specification for the cable used to connect the GS/3 or CS/1-X.25 to any of these modems is described in Figure 4-3 in Section 4.1.1. The server should be equipped with the SIO-SMH module. The clock source pins should be configured as "external" for both transmit and receive.

Leased-line costs are moderate, based on the distance between the connected devices. In the past, operation at speeds above 1200 baud required special conditioning by the telephone company and was therefore more expensive. However, the newer modems (such as the modems listed in this section) can provide automatic compensation and do not require conditioning even at 9600 baud; thus, line cost becomes identical for the four available speeds.

4.5.5 Switched-Line Modems

This scheme is convenient for applications where constant connection between the GS/3s or the CS/1-X.25 and the host is not required. Speeds available are 1200 and 2400 baud (synchronous, full duplex). The server should be equipped with the SIO-SM module.

**** NOTE ****

The GS/3 does not support an automatic dial-out capability; the user must dial the connection manually.

The cable used to connect the server to the modem is standard RS-232-C cable, described in Figure 4-3 in Section 4.1.1. In general, leased-line service is preferable in any application where connection to the remote GS/3 or the X.25 host exceeds a few hours per day.

4.5.6 Other Connections

Additional connection schemes supported by the GS/3 and CS/1-X.25 include such techniques as fiber optic, broadband, or microwave transmission.

Fiber optic connection is a potential alternative to limited-distance modems in environments with high levels of electrical or RFI interference or where absolute data security is required. Standard low-cost fiber optic cable (with stand-alone driver units) can support speeds up to 64K bps for distances up to two miles; greater distances are possible with more sophisticated fiber cable and driver combinations.

Contact Bridge Communications, Inc., or an authorized representative for further information on other connection schemes.

4.6 GS/4 Interface

The GS/4 does not interface to a device or modem. The unit is connected to two transceivers and taps directly into two Ethernet cables.

4.7 GS/6 Interface

The GS/6 has one type "F" interface connector, from the RF modem inside the unit to a 75-ohm, RG 59/U broadband drop cable.

5.0 UNPACKING AND INSTALLATION

The following procedures are required to get the Series/1 server ready for operation:

- Unpacking the server
- Configuring the server's boards (if necessary)
- Installing the server
- Connecting the server to the transceiver and to the devices or lines
- Starting up and checking out the server

This section describes the steps necessary to perform these procedures and lists recommendations for preventive maintenance.

Section 5.6 describes additional installation procedures required for the CS/1-HSM.

Once the hardware is installed and connected, some software configuration may also be necessary. The *Connection Service User's Guide* describes the Bridge Connection Service and configuration procedures for asynchronous servers and the GS/1. The *Network Management Guide* describes system generation, and port configuration procedures for all Bridge server models.

5.1 Unpacking

Each Series/1 server unit is inspected before shipment and is packed in a carton with protective padding. However, the shipping carton and the unit itself should be inspected after receipt for damage sustained during shipment. The following steps are recommended:

1. Inspect the carton for damage.
2. Carefully open the top of the carton.
3. Remove the upper layer of protective padding, and then remove the unit from the carton.
4. Remove the plastic bag from the unit.
5. Inspect the unit for shipping damage. If damage is detected, contact the transport representative to file a report. If the unit must be returned to the factory, it should be shipped in its original carton. If the original carton was damaged in shipment, repack the unit in a carton that provides equivalent protection.

**** CAUTION ****

> The cover of the unit is held in place by ball studs and can be removed simply by sliding it upward. When lifting the entire unit, be sure to hold it by the bottom edge, not by the cover's rear overhang.

6. Verify that the carton contains all the items listed on the packing slip.
7. Verify that the serial number on the label on the back of the unit corresponds to the serial number listed on the packing slip.

**** NOTE ****

> The Ethernet address of the unit also appears on this label. On some units, the label may be affixed to the bottom.

8. Verify that the power specifications listed on the serial number label are appropriate for the available power source.
9. Ensure that all the boards inside the unit are securely seated. First, remove the unit's top cover by lifting each side of the back overhang with a brisk upward motion, thereby disengaging each ball stud separately. Remove each board by pulling up firmly on the extractor levers; reseat with a firm downward push.

After these steps have been accomplished, the unit is ready to be configured. Hardware configuration is described in Section 5.2.

5.2 Hardware Configuration

This section describes the configuration of the boards in a Series/1 server: the MCPU, EC/1, EC/2, SIO, SIO-16, SBB, HSM, and MBI boards, and the various Serial Backplane Attachment (SBA) assemblies. Table 5-1 contains a summary of the available options, listing the factory default for each option and indicating the section that describes the option in detail.

** NOTE **

Most configuration areas have a default that is set at the factory; if the default setting is appropriate, no reconfiguration is necessary.

All configuration areas on the Flexible Disk Controller (FDC) board and on the floppy disk drive itself are factory set and must not be changed for operation with the Series/1 server.

If it is necessary to alter the configuration of any of the boards, the unit's top cover must be removed first (refer to Section 5.1, step 10).

** CAUTION **

When handling any PC board or assembly, avoid touching the gold edge area. Careful handling prevents damage to the board or assembly.

Figure 5-1 illustrates the placement of the major hardware components within the enclosure.

Table 5-1 Series/1 Hardware Configuration Option Summary

Board	*Option*	*Factory Default*	*Section*
ETI	AC- or DC-coupled transceiver	AC-coupled	5.2.2
MCPU	Bootstrap option	Automatic bootstrap	5.2.4
MCPU	Console/download port baud rate	9600 baud (both ports)	5.2.4
MCPU	Automatic reboot option (internal disk drive)	Enabled	5.2.4
MCPU	Automatic reboot option (diskless)	Enabled	5.2.4
MCPU	Memory size	384K bytes	5.2.4
MCPU	Continuous self-test option	Disabled	5.2.4
SIO	Local loopback	Enabled	5.2.5
SIO	SIO board number	SIO 1*	5.2.5
SIO	Clock source	**	5.2.5
SIO-16	SIO board number	SIO 1*	5.2.6
SIO	Clock source	**	5.2.5
HSM	HSM board number	HSM 1*	5.2.8
SBA	EXT/TXC selection	TXC enabled	5.2.9

* Applies only to boards ordered separately
** Depends on board version. See Tables 5-5 through 5-9

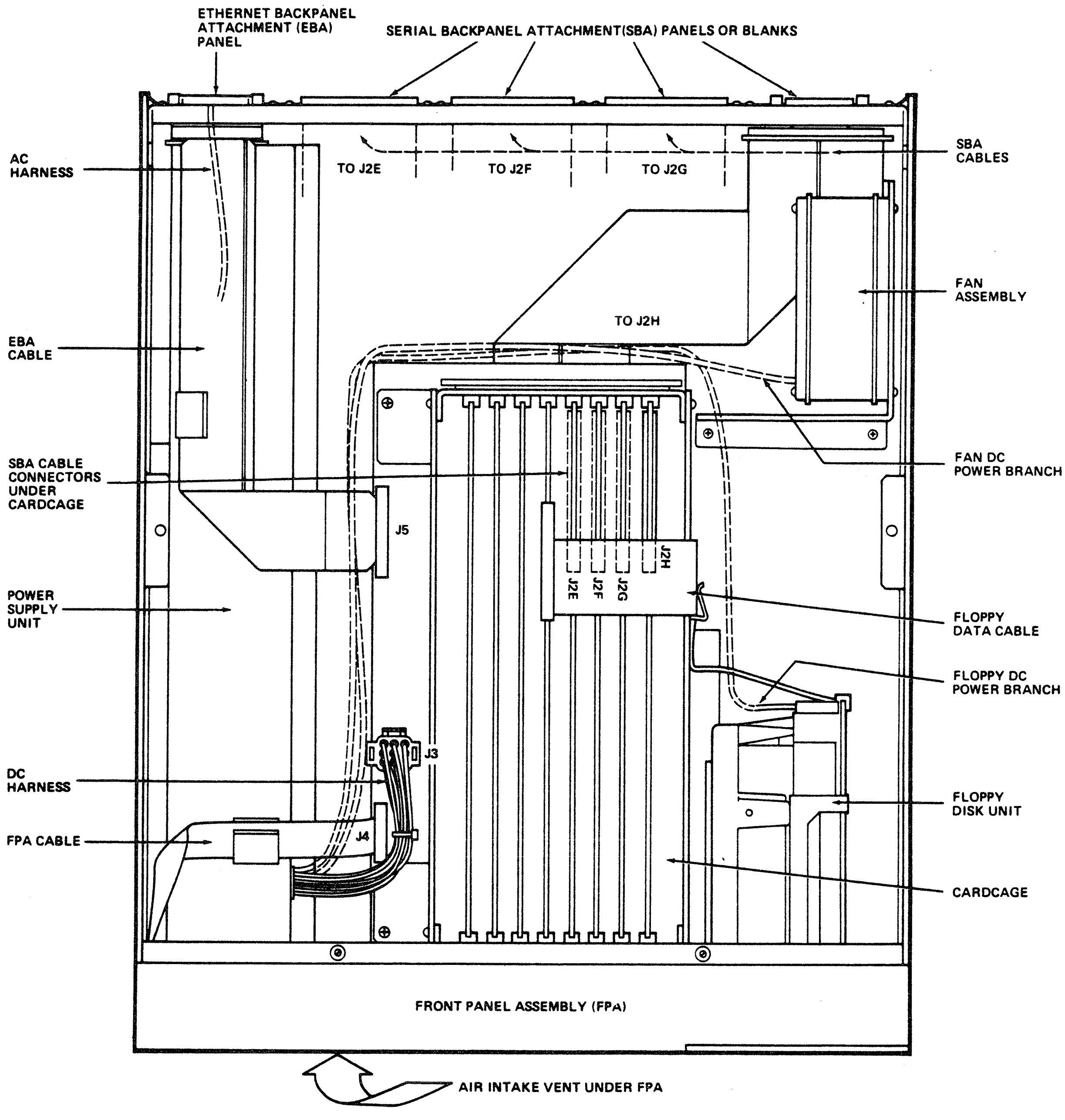


Figure 5-1 Placement of Hardware Components

5.2.1 ESB Board Configuration

The ESB board is located in either slot A or slot B of the cardcage. The board contains a self-test LED, labeled S.TEST, and a HALT LED. The self-test LED lights at power-on or reset to indicate that the self-test diagnostics are being performed. The LED turns off when the diagnostics complete successfully. The halt LED lights at power-on or reset or when the microprocessor is in a halt state. (See Appendix A for a discussion of the power-on diagnostics of the ESB board.)

The ESB board contains no configuration areas.

Figure 5-2 illustrates the positions of the diagnostic LEDs on the ESB board.

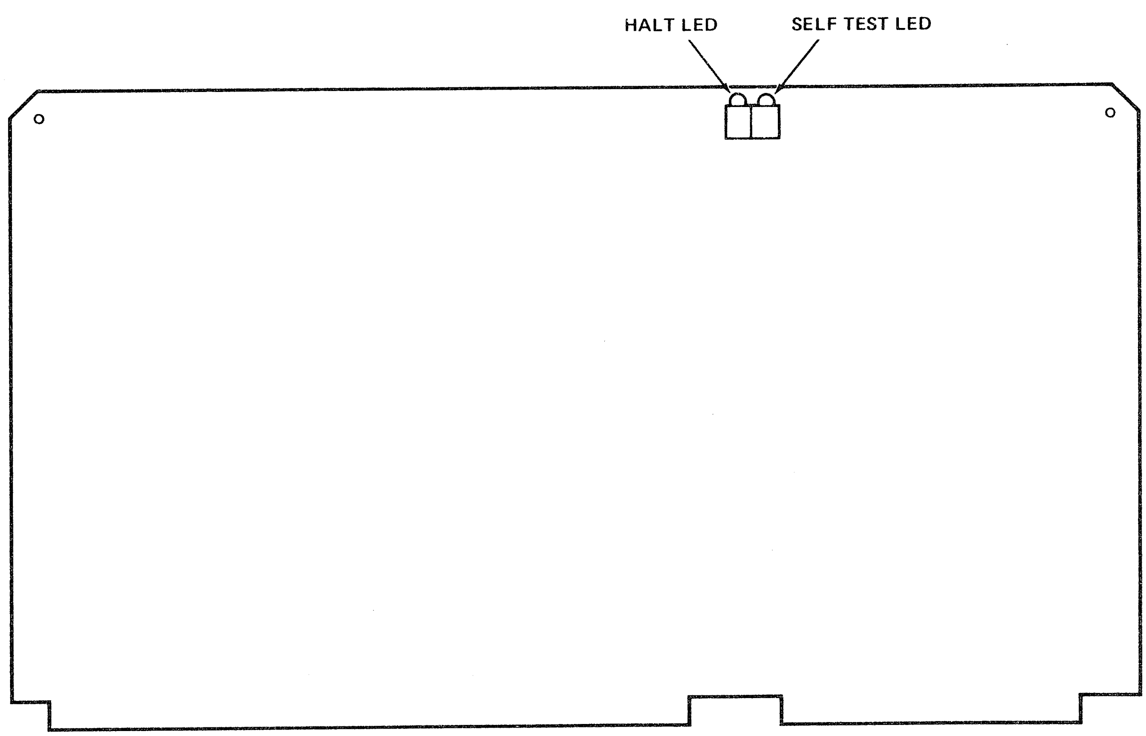


Figure 5-2 ESB Board

5.2.2 ETI Board Configuration

The ETI board is located in either slot A or slot B of the cardcage.

The board contains a self-test LED, labeled S.TEST, which lights at power-on and reset to indicate that the self-test diagnostics are being performed. The LED turns off when the diagnostics complete successfully. (See Appendix A for a discussion of the power-on diagnostics for the ETI board.)

The ETI board contains one configuration area, labeled E102E, which is located in the lower right corner of the board, below reference designator R26. A shorting plug must be in place if the unit is attached to an AC-coupled transceiver (e.g., TCL Inc. 2010E or Bridge transceiver) and must be removed if the unit is attached to a DC-coupled transceiver.

Figure 5-3 illustrates the ETI board and indicates the positions of the diagnostic LED and area E102E.

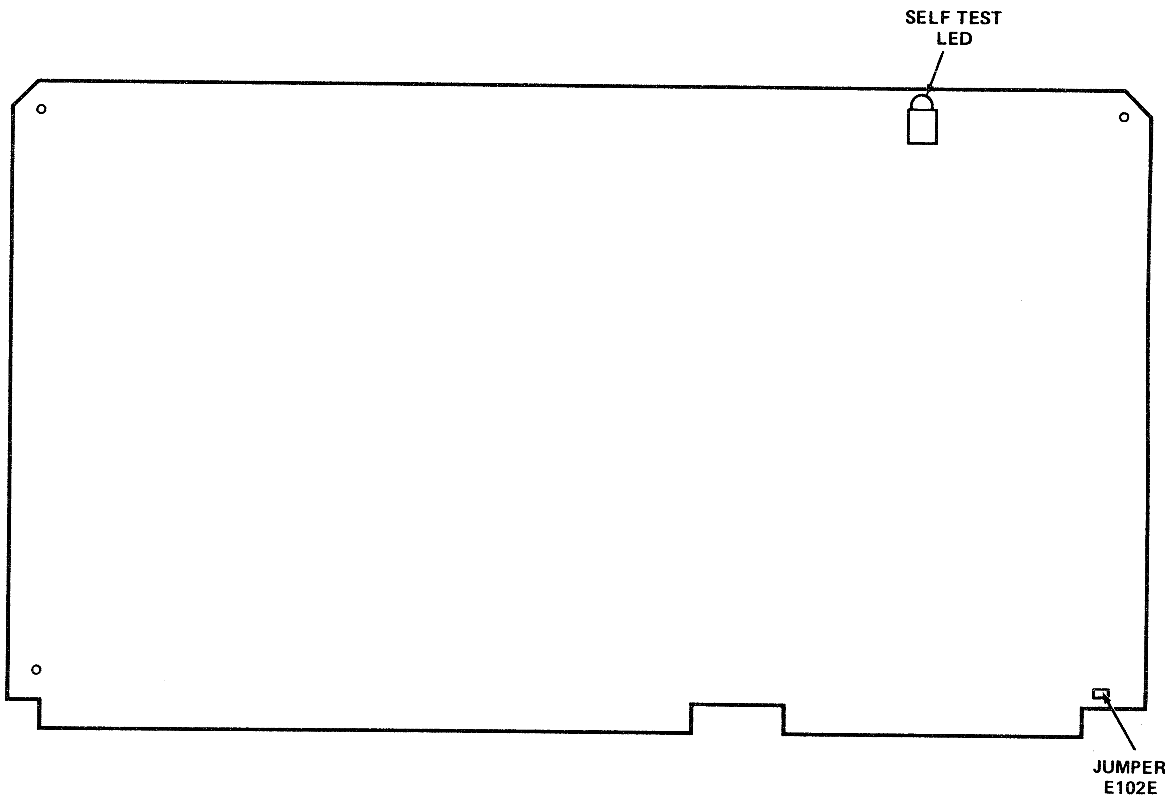


Figure 5-3 ETI Board

5.2.3 EC/2 Board Configuration

The EC/2 board is located in slot B of the cardcage. It is a direct replacement for the ESB and ETI boards. In a GS/4, which contains two EC/2 boards, the second EC/2 is located in slot H.

The board contains six LEDs--one HALT LED and five self-test LEDs (labeled A through E). At power-on, all the LEDs light to indicate that the board is running the self-test diagnostics. If all the tests complete successfully, the LEDs are turned off. The halt LED lights at power-on or reset or when the microprocessor is in a halt state. (Refer to Appendix A for a discussion of the power-on diagnostics for the EC/2.)

The EC/2 has two configuration areas, which are factory set and should not be changed. Area E82 has a shorting plug connecting the pins. The configuration of area E103 depends on the model of Manchester encoder/decoder used. If it is model 7992A, pins 2 and 3 are connected; if it is model 7992B, pins 1 and 2 are connected. The encoder/decoder chip is located between the two configuration areas and has the model number clearly printed on it (AM7992ADC or AM7992BDC). No reconfiguration is required to operate Ethernet (Version 1.0 or 2.0) transceivers, IEEE 802.3 transceivers, fiber optic transceivers, or DELNI equipment.

Figure 5-4 illustrates the position of the diagnostic LEDs and the configuration areas on the EC/2 board.

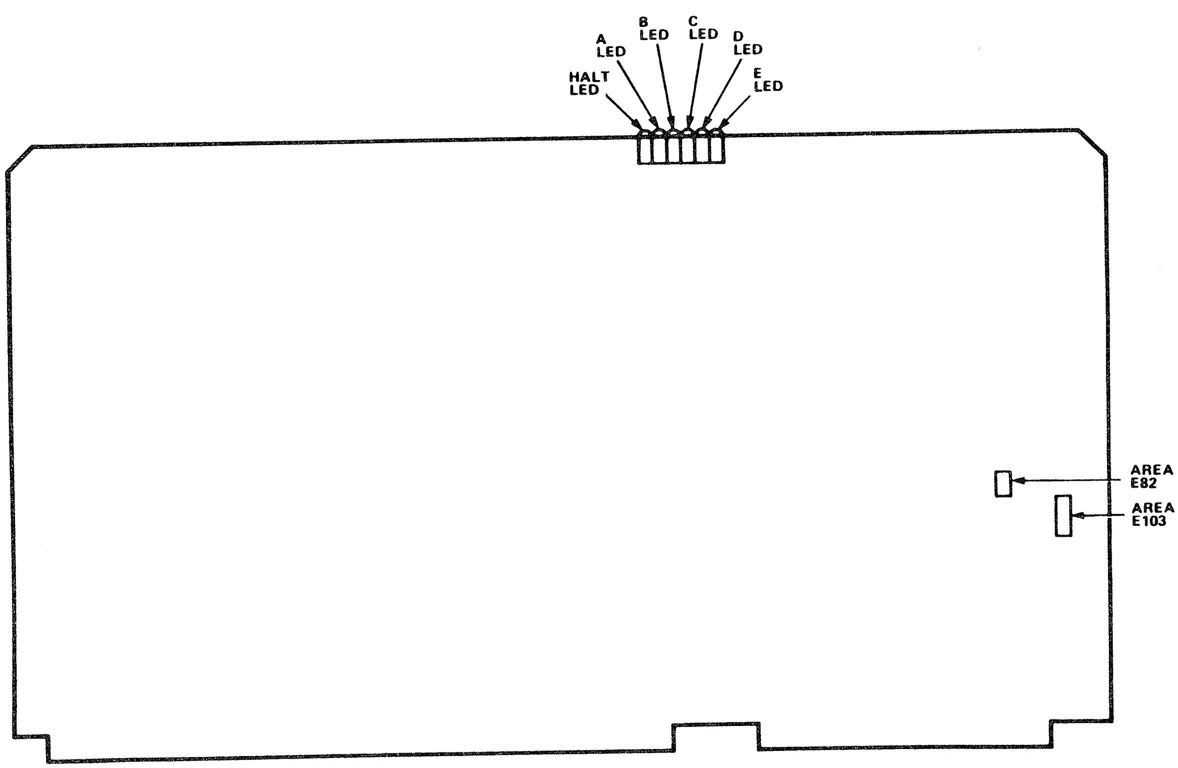


Figure 5-4 EC/2 Board

5.2.4 MCPU Board Configuration

The MCPU board contains power-on, self-test diagnostics, a monitor, and console terminal and download port interfaces. The console and download ports are accessed via connectors on the back panel (refer to Figure 3-3). Both ports support XON/XOFF flow control. Both ports are configured for 8 databits and no parity, and cannot be reconfigured; the attached devices must be set appropriately. The board is located in slot C of the cardcage.

The optional FDC board is piggybacked on the MCPU board via an iSBX interface and occupies slot D of the cardcage.

The MCPU board contains two diagnostic LEDs, labeled SELF TEST and HALT. The self-test LED lights at power-on and reset to indicate that the self-test diagnostics are running. The LED turns off when the diagnostics complete successfully. The halt LED lights at power-on and reset or when the microprocessor is in a halt state. (For a complete discussion of the self-test diagnostics for the MCPU board, refer to Appendix A.)

The MCPU board contains one configuration area designated E1, which is located on the upper edge of the board and is accessible without removing the board. Six sets of pins in E1 are implemented:

- **Pins A, B, and C** select the bootstrap mechanism. The shorting plug positions and the options they select are listed in Table 5-2 and described in detail in Appendix B. In the table, "out" indicates that the pins are not connected; "in" indicates that the pins are connected by a shorting plug.
- **Pins D and E** select the baud rate of the console port. **Pins I and J** select the baud rate of the download port. The shorting plug positions and the options they select are listed in Table 5-3. The speed of the download port must always be set equal to or less than the speed of the console port.
- **Pin F** disables or enables the automatic reboot option. Auto reboot is disabled when the shorting plug is removed (the factory default) and enabled when the plug is in place. When auto reboot is enabled, fatal error conditions and exception conditions cause the monitor to display an error message on the console and then reset and reboot the system. When auto reboot is disabled, the monitor displays error messages but retains control of the system; no reset or reboot occurs (allowing the user the option of saving dumps on diskette or performing debugging procedures).
- **Pin G** specifies the speed of the processor installed on the MCPU board. This shorting plug is factory set and must not be altered. The plug should be in place on a 12.3 MHz system and absent on a 10 MHz system.
- **Pin H** specifies the amount of memory installed on the MCPU board. The shorting plug must be absent on all 384K systems, and must be in place on 256K systems running MCPU firmware designated M1 MMON 01B or later. Early MCPU firmware ignores the setting of this shorting plug, so the plug is optional for 256K systems running MCPU firmware designated Release 9 or earlier.
- **Pin K** selects continuous test mode. Extended test mode causes the system to perform self-test diagnostics continuously as long as the unit is powered on. Continuous test mode is enabled when the shorting plug is in place and disabled when the plug is removed.

Figure 5-5 illustrates the positions of the LEDs and configuration area E1 on the MCPU board. Pin A of the configuration area is toward the server front panel.

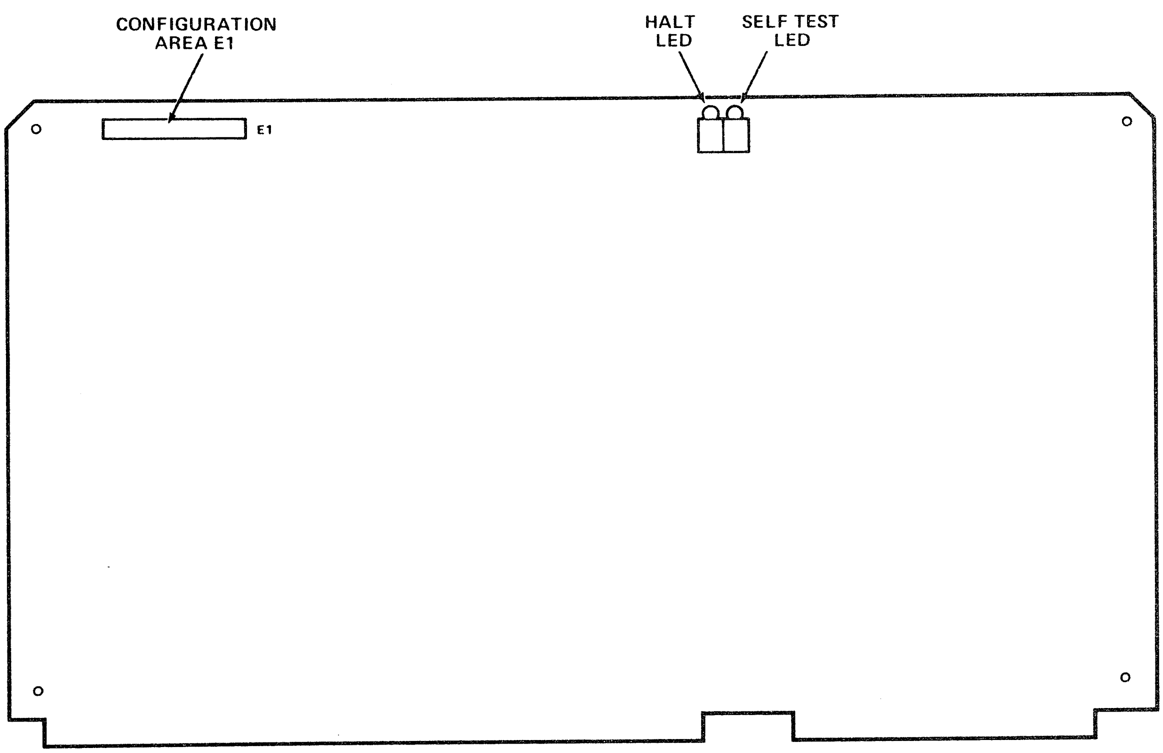


Figure 5-5 MCPU Board

Table 5-2 Bootstrap Option Shorting Plug Positions MCPU Configuration Area E1

Pin A	*Pin B*	*Pin C*	*Bootstrap Option*
Out	Out	Out	Automatic bootstrap*
Out	Out	In	Floppy bootstrap
Out	In	In	Network bootstrap

* Factory default

Table 5-3 Console/Download Port Baud Rate Shorting Plug Positions MCPU Configuration Area E1

Console Port		*Download Port*		
Pin D	*Pin E*	*Pin I*	*Pin J*	*Baud Rate*
Out	Out	Out	Out	9600 baud*
Out	In	Out	In	1200 baud
In	Out	In	Out	300 baud
In	In	In	In	110 baud

* Factory default

5.2.5 SIO Board Configuration

The CS/1-A, CS/1-BSC, and CS/1-SDLC each support up to four SIO modules, with a maximum of 48 serial ports, depending on the SIO version. The GS/1, CS/1-X.25, and GS/3 also support up to four SIO modules, with a maximum of eight serial ports. The CS/1-SNA supports one SIO module with a single serial port. The CS/1-HSM, GS/4, and GS/6 support no SIO modules.

A CS/1-A can support up to four SIO-16 modules to provide a maximum of 64 serial ports. The SIO-16 module is described in Section 5.2.6.

The SIO module is available in eight versions: SIO-A, SIO-16 (discussed in Section 5.2.6.), SIO-ST, SIO-SM, SIO-422, SIO-H422, SIO-HS422, and SIO-V.35. Section 3.1.7 describes the features of each version.

The first SIO board is always mounted in slot H. If subsequent SIO boards are added, they must be mounted in slots G, F, and E, in that order.

The SIO board contains two LEDs, labeled SELFTEST and HALT. The self-test LED lights at power-on and reset to indicate that the self-test diagnostics are being performed.

On each SIO module, The LED turns off when the diagnostics complete successfully. The halt LED lights during reset and when the microprocessor is in a halt state. For a complete discussion of board level diagnostics, refer to Appendix A.

Figure 5-6 illustrates the positions of the two diagnostic LEDs and all configuration areas on the SIO board. Most SIO board configuration options (e.g., baud rate and protocol selection) are software-selectable and are stored on the diskette. The following paragraphs describe the shorting plug settings controlling hardware elements that cannot be selected by the software.

- **Area E23** enables or disables local loopback, which is implemented by factory default on all SIO ports irrespective of version or configuration. For each port, Transmit Data is looped back to Receive Data. Other lines (when implemented) are not looped back. Local loopback causes a continuous BREAK to be transmitted on the Data Out line. If this is undesirable, local loopback can be disabled by removing the shorting plug.

- **Areas E22A, E22B, and E59** are used to assign the SIO board number (SIO 1 through SIO 4) and to set the Multibus interrupt. Board numbers must be assigned in sequence, in ascending numeric order. Table 5-4 lists the numbers assigned by each combination of shorting plug positions. The locations of these areas are indicated in Figure 5-6. Board number assignment is required only for boards ordered separately; boards shipped with a Series/1 server have preassigned board numbers.

- **Areas E49, E69, and E70** determine whether the clock sources are internal or external. Tables 5-5 through 5-8 list the shorting plug settings necessary for various clock sources. These settings apply only to the SIO-SM, SIO-ST, SIO-422, SIO-HS422, and SIO-V.35 boards. On the SIO-A and SIO-H422 boards, the shorting plug settings are factory set for internal receive and transmit and should not be altered by the user. Areas E49 and E69 do not appear on the SIO-ST board.

The recommended settings for the SIO-SM, SIO-ST, SIO-422, SIO-HS422, and SIO-V.35 boards vary according to the type of device being connected. In general, for use with modem equipment, both transmit and receive clock sources should be set to "external". For direct connection (GS/3 and CS/1-X.25), the transmit clock should be set to "internal" and receive clock to "external". For use with terminal devices, both clocks should be set to "internal".

The corresponding configuration areas on the SBA assembly must select the same option (see Section 5.2.9).

**** NOTES ****

For SIO-422 applications requiring ST rather than TT, a special cable must be constructed with ST-A jumpered to pin 17 and ST-B jumpered to pin 35 (standard RS-449 cables have ST-A on pin 5 and ST-B on pin 23).

For SIO-V.35 applications requiring SCTE rather than SCT, a special cable must be constructed with SCTE-A jumpered to pin Y and SCTE-B jumpered to pin a (V.35 standards specify SCTE-A on pin U and SCTE-B on pin W).

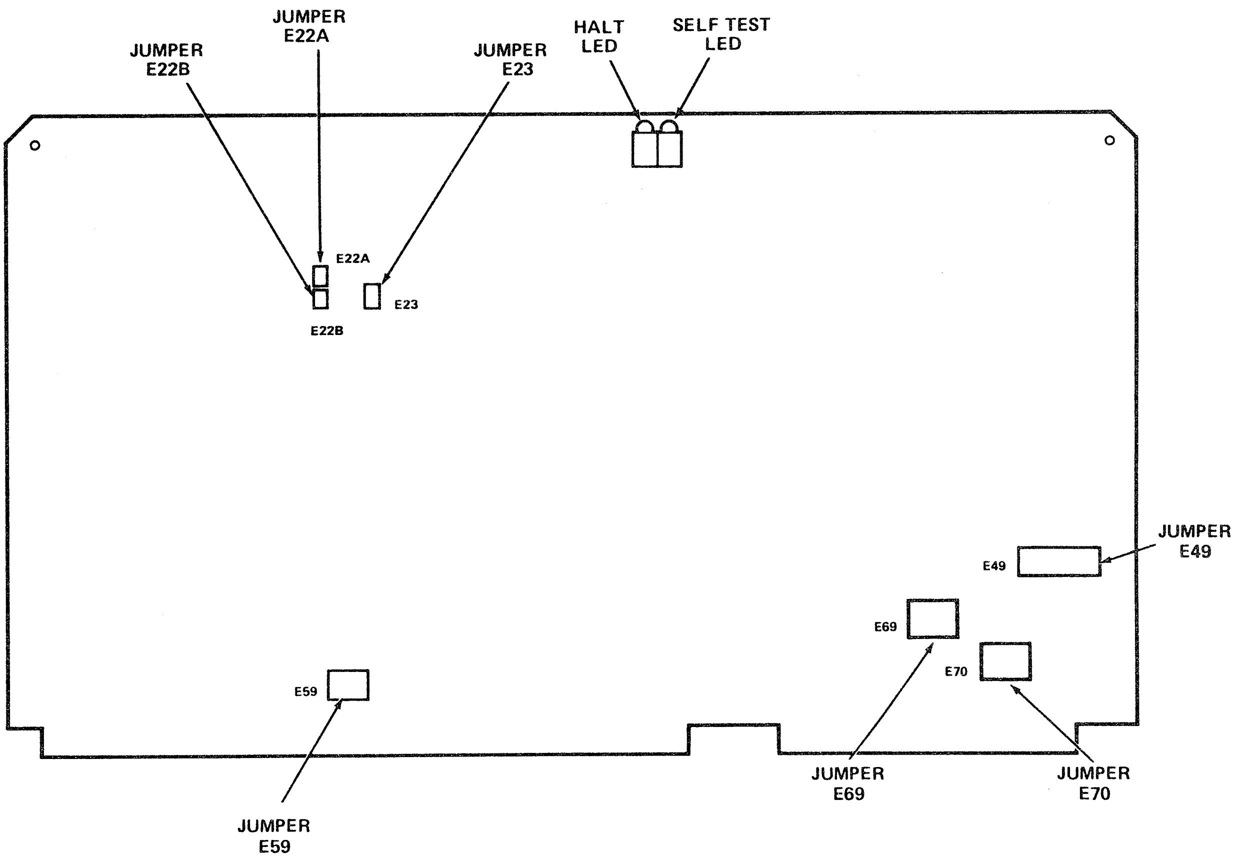


Figure 5-6 SIO Board

Table 5-4 SIO Board Number Assignment Shorting Plug Positions

Area E22A	*Area E22B*	*Area E59**	*Board No.*
Out	Out	10-11	SIO 1**
In	Out	7-8	SIO 2
Out	In	4-5	SIO 3
In	In	1-2	SIO 4**

* Numbers refer to the pins in area E59 that must be connected by a shorting plug.
** Factory default for boards shipped separately.

Table 5-5 SIO-SM Clock Source Shorting Plug Positions

Port No.	*Clock Source*	*Line Name*	*E49 Pins Connected*	*E69 Pins Connected*	*E70 Pins Connected*
0	TX External	TXC	1-2*	1-2**	2-3*
0	TX Internal	EXC	2-3	1-2**	1-2
0	RX External	RXC	4-5*	n/a	n/a
0	RX Internal	--	5-6	n/a	n/a
1	TX External	TXC	7-8*	4-5**	5-6*
1	TX Internal	EXC	8-9	4-5**	4-5
1	RX External	RXC	10-11*	n/a	n/a
1	RX Internal	--	11-12	n/a	n/a
2	TX External	TXC	13-14*	7-8**	8-9*
2	TX Internal	EXC	14-15	7-8**	7-8
2	RX External	RXC	16-17*	n/a	n/a
2	RX Internal	--	17-18	n/a	n/a
3	TX External	TXC	19-20*	10-11**	11-12*
3	TX Internal	EXC	20-21	10-11**	10-11
3	RX External	RXC	22-23*	n/a	n/a
3	RX Internal	--	23-24	n/a	n/a

* Factory default, user-alterable
** Factory default, not user-alterable

Table 5-6 SBA-SM Clock Source Shorting Plug Positions

Port No.	*Clock Source*	*Line Name*	*E<x>* Pins Connected*
0	TX External	TXC	1-2**
0	TX Internal	EXC	2-3
1	TX External	TXC	1-2**
1	TX Internal	EXC	2-3
2	TX External	TXC	1-2**
2	TX Internal	EXC	2-3
3	TX External	TXC	1-2**
3	TX Internal	EXC	2-3

* To obtain the complete SBA area designator, substitute the port number on the SBA for <x> (e.g., area E2 sets clocks for port 2)

** Factory default, user-alterable

Table 5-7 SIO-ST Clock Source Shorting Plug Positions

Port No.	*Clock Source*	*Line Name*	*E70 Pins Connected*
0	TX Internal	TXC	1-2*
1	TX Internal	TXC	4-5*
2	TX Internal	TXC	7-8*
3	TX Internal	TXC	10-11*

* Factory default, not user-alterable

Table 5-8 SIO-422 and SIO-HS422
Clock Source Shorting Plug Positions

Port No.	*Clock Source*	*Line Name*	*E49 Pins Connected*	*E69 Pins Connected*	*E70 Pins Connected*
0	TX External	ST	1-2	2-3	2-3
0	TX Internal	TT	2-3 *	1-2 *	1-2*
0	RX External	RT	4-5 *	n/a	n/a
0	RX Internal	--	5-6	n/a	n/a
1	TX External	ST	7-8	5-6	5-6
1	TX Internal	TT	8-9 *	4-5 *	4-5*
1	RX External	RT	10-11 *	n/a	n/a
1	RX Internal	--	11-12	n/a	n/a
2	TX External	ST	13-14	8-9	8-9
2	TX Internal	TT	14-15 *	7-8 *	7-8*
2	RX External	RT	16-17 *	n/a	n/a
2	RX Internal	--	17-18	n/a	n/a
3	TX External	ST	19-20	11-12	11-12
3	TX Internal	TT	20-21*	10-11*	10-11*
3	RX External	RT	22-23*	n/a	n/a

* Factory default, user-alterable

Table 5-9 SIO-V.35 Clock Source Shorting Plug Positions

Port No.	*Clock Source*	*Line Name*	*E49 Pins Connected*	*E69 Pins Connected*	*E70 Pins Connected*
0	TX External	SCT	1-2*	2-3*	2-3*
0	TX Internal	SCTE	2-3	1-2	1-2
0	RX External	SCR	4-5*	n/a	n/a
0	RX Internal	--	5-6	n/a	n/a
1	TX External	SCT	7-8*	5-6*	5-6*
1	TX Internal	SCTE	8-9	4-5	4-5
1	RX External	SCR	10-11*	n/a	n/a
1	RX Internal	--	11-12	n/a	n/a
2	TX External	SCT	13-14*	8-9*	8-9*
2	TX Internal	SCTE	14-15	7-8	7-8
2	RX External	SCR	16-17*	n/a	n/a
2	RX Internal	--	17-18	n/a	n/a
3	TX External	SCT	19-20*	11-12*	11-12*
3	TX Internal	SCTE	20-21	10-11	10-11
3	RX External	SCR	22-23*	n/a	n/a
3	RX Internal	--	23-24	n/a	n/a

* Factory default, user-alterable

5.2.6 SIO-16 Board Configuration

The CS/1-A can support up to four SIO-16 modules with a maximum of 64 serial ports. SIO-16 features are described in Section 3.1.7.

The SIO-16 board contains a halt LED, labeled CR1. While the self-test diagnostics or the microprocessor are running, the halt LED remains unlit. The LED lights to indicate that the microprocessor is in a halt state and ready to download code to the SIO-16 board's RAM area. The LED also lights when the server is initialized or reset. Refer to Appendix A for a description of the SIO-16 self-test diagnostics.

Figure 5-7 illustrates the position of the halt LED and configuration areas on the SIO-16 board. The following paragraph describes configuration areas on the SIO-16 module.

- **Areas E41 and E58** are used to assign the SIO-16 board number (SIO 1 through SIO 4) and to set the Multibus interrupt. Table 5-10 lists the SIO board number assigned by each combination of shorting plug positions. The location of these configuration areas is shown in Figure 5-7.

**** NOTE ****

Board number assignment is required only for boards ordered separately; factory installed boards have preassigned board numbers.

Table 5-10 SIO-16 Board Number Assignment Shorting Plug Positions

Board Number	*Configuration Area*	*Pins Connected*
1	E41	None
1	E58	7 and 8
2	E41	2 and 4
2	E58	5 and 6
3	E41	1 and 3
3	E58	3 and 4
4	E41	1 and 3, 2 and 4
4	E58	1 and 2

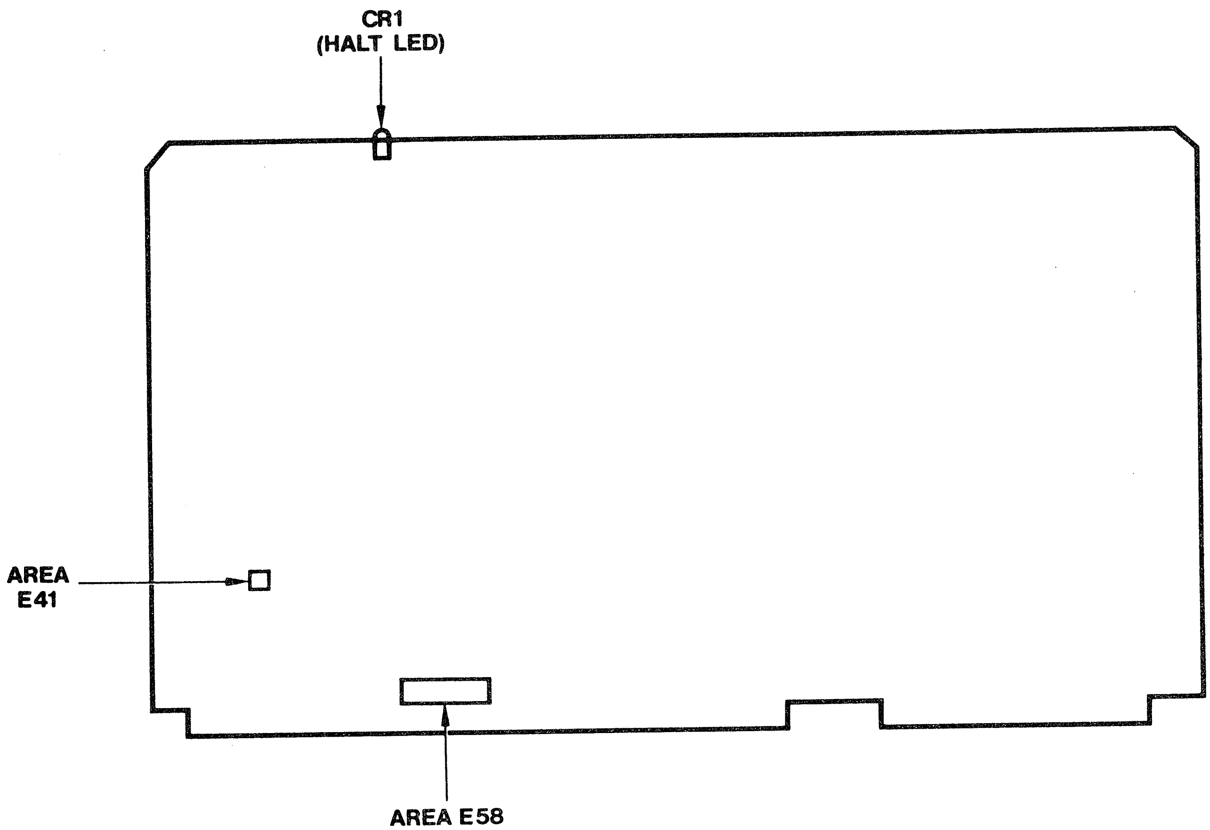


Figure 5-7 SIO-16 Board

5.2.7 SBB Board Configuration

The CS/1-SNA supports one SBB board, which provides 256K of extra RAM. The board can be placed in any slot between the MCPU (slot C) and the SIO module.

The board contains one LED, a parity error indicator. It does not light unless a parity error is detected.

The SBB board contains four switches, labeled SW1 through SW4, which are factory set and should not be changed. SW1 is the I/O address switch; SW2 is the start address switch; SW3 is the stop address switch; and SW4 is the 1M block select switch. Refer to Table 5-11 for default switch settings.

In addition, the SBB board contains 39 configuration areas. They are factory set and should not be changed. Their numbers and shorting plug settings are listed in Table 5-12.

Figure 5-8 illustrates the LED and configuration areas on the SBB board.

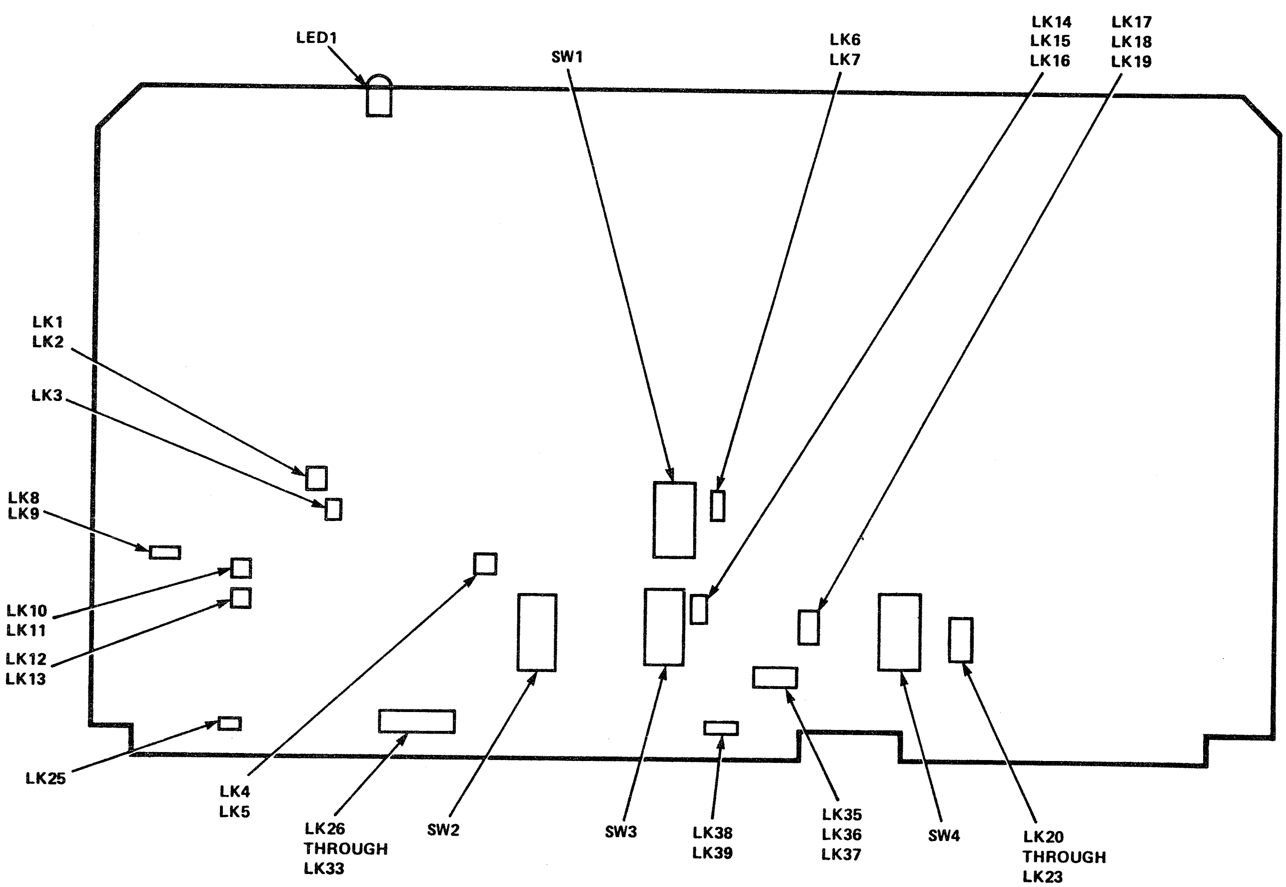


Figure 5-8 SBB Board

Table 5-11 SBB Board Default Switch Settings

Pole	*SW1*	*SW2*	*SW3*	*SW4*
1	On	On	On	Off
2	Off	On	Off	Off
3	Off	Off	Off	Off
4	Off	On	Off	Off
5	Off	On	Off	Off
6	Off	On	Off	Off
7	Off	On	Off	Off
8	Off	On	Off	Off

Table 5-12 SBB Board Configuration Areas

Area	*Setting*	*Area*	*Setting*	*Area*	*Setting*
LK1	Out	LK14	Out	LK27	Out
LK2	Out	LK15	In	LK28	Out
LK3	In	LK16	Out	LK29	Out
LK4	In	LK17	Out	LK30	Out
LK5	Out	LK18	In	LK31	Out
LK6	In	LK19	Out	LK32	Out
LK7	Out	LK20	Out	LK33	Out
LK8	Out	LK21	Out	LK34	Out
LK9	In	LK22	Out	LK35	In
LK1	Out	LK23	Out	LK36	Out
LK1	In	LK24	Out	LK37	Out
LK1	Out	LK25	Out	LK38	In
LK1	In	LK26	Out	LK39	Out

5.2.8 HSM Board Configuration

The HSM board is available in two versions: the version in the CS/1-HSM, referred to as the HSM board, and the version in the GS/6, referred to as the HSM-MDM board.

Both versions of the HSM board contain three diagnostic LEDs: RCV DATA, BUS ERROR, and SELF TEST. At power-on, the receive data and bus error indicators light. As soon as the system software is booted, these LEDs turn off, and the self-test LED lights to indicate that the internal self-test is in progress. If the board passes this test, the self-test LED turns off.

While the communications software is running, the receive data LED indicates the state of the Receive Data line. When the light is dim or flashing, data is being transferred between the HSM and the attached line. When no data is being transferred, the light is either on at full intensity or off.

The CS/1-HSM supports up to two HSM boards. The first HSM board in each unit must be mounted in slot H, the second (if present) in slot G.

The HSM board contains two configuration areas, E34 and E38, which are used to assign the board and slot number (e.g., board 1, in slot H). Board numbers must be assigned in sequence, in ascending numeric order. Table 5-13 lists the shorting plug positions appropriate for the possible slots. Board number reassignment is required only for boards ordered separately; board numbers are preassigned on boards shipped with a CS/1-HSM. Slots F and E are not normally available for an HSM board; the entries are included in Table 5-13 only for custom installations in which slots H and G contain SIO boards.

Figure 5-9 illustrates the positions of the diagnostic LEDs and the configuration areas on the HSM board.

Each HSM board must be used with an SBA-HSM installed in the appropriate slot. The SBA-HSM is not configurable.

Table 5-13 HSM Board Number Assignment Shorting Plug Positions

Board No.	*Slot*	*Area E34 Pins 1-2*	*Area E34 Pins 3-4*	*Area E38 Pins **
1**	H	Out	Out	10-11
2	G	In	Out	7-8
3***	F	Out	In	4-5
4***	E	In	In	1-2

* Numbers refer to the pins in area E38 that must be connected by a shorting plug
** Factory default for boards shipped separately
*** For custom installations only

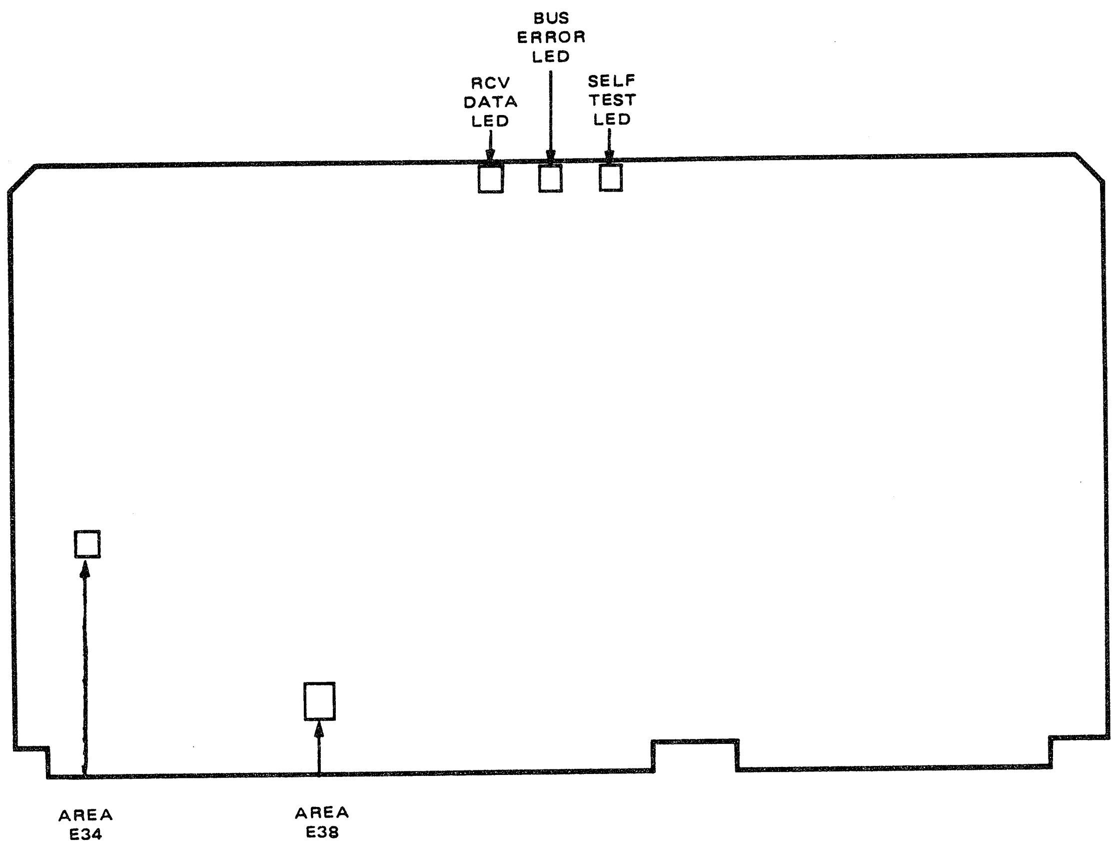


Figure 5-9 HSM Board

The GS/6 supports one modified HSM board (HSM-MDM), which must be mounted in slot H. The HSM-MDM board connects to the RF modem on the rear panel of the unit (SBA-BBM). The five configuration areas (E13, E29, E31, E34, E38) on the HSM-MDM are factory set and should not be changed:

- E13 (pins 1 and 2, 5 and 6, 8 and 9 connected)
- E29 (pins 5 and 6 connected)
- E31 (pins 2 and 3 connected)
- E34 (open, no pins connected)
- E38 (pins 10 and 11 connected)

Figure 5-10 illustrates the positions of the diagnostic LEDs and the configuration areas on the HSM-MDM board.

The HSM-MDM board must be mounted in slot H of the unit. It must be used with an SBA-BBM.

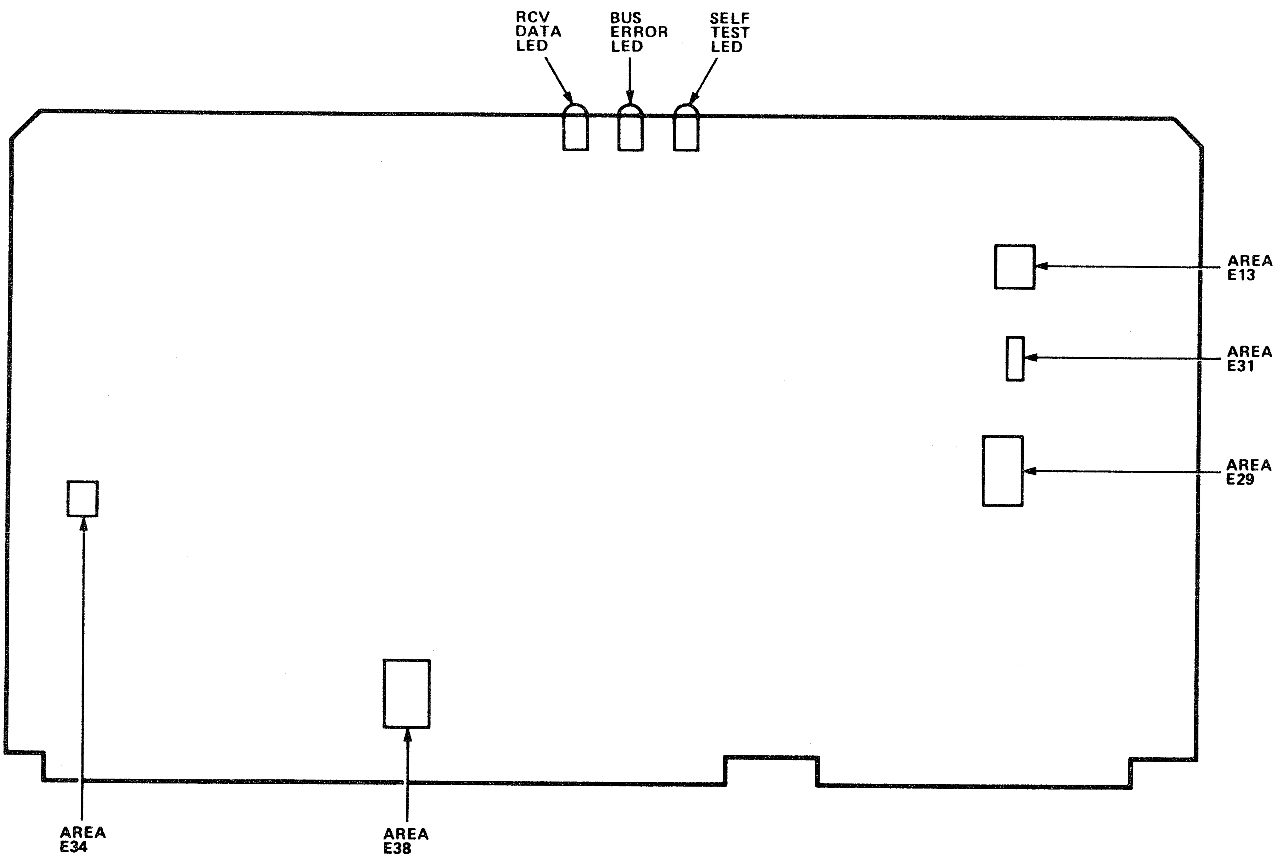


Figure 5-10 HSM-MDM Board

5.2.9 SBA Assembly Configuration

The Serial Backpanel Attachment (SBA) assembly provides the connectors for serial device cables. The SBA assembly is available in ten versions:

- SBA-A (used only with the SIO-A module)
- SBA-16 (used only with the SIO-16 module)
- SBA-SM (used only with the SIO-SM module)
- SBA-ST (used only with the SIO-ST module)
- SBA-422H (used only with the SIO-422 module)
- SBA-H422A (used only with the SIO-H422 module)
- SBA-HS422 (used only with the SIO-HS422 module)
- SBA-V.35 (used only with the SIO-V.35 module)
- SBA-HSM (used only with the HSM module)
- SBA-BBM (used only with the HSM-MDM module)

All SIO boards and their SBA assemblies are connected in one of two ways: by a 60-pin flat cable from the SIO board's P2 connector to a 60-pin header on the SBA's PC board, or by a cabling harness from the bottom of the P2 connector directly to the individual connectors on the SBA. The type of configuration is chosen for convenience and has no effect on the performance of the system.

The HSM board and the SBA assembly are connected by a cable harness from the P2 connector on the board to the individual connectors on the SBA.

The SBA-A, SBA-16, SBA-ST, SBA-422H, SBA-H422A, SBA-HS422, SBA-V.35, and SBA-HSM do not contain any configuration areas; the assemblies are factory configured and require no alteration.

The SBA-16 assembly contains two 50-pin, male telephony connectors which are illustrated in Figure 5-11.

Each SBA-SM assembly contains four configuration areas labeled E0 through E3. These areas determine whether the EXC line or the TXC line is enabled for the port whose number corresponds to the configuration area number, according to the specifications in Table 5-14. Placing a shorting plug on pins 1 and 2 of area E2, for example, selects line TXC for port 2; placing a plug on pins 2 and 3 selects line EXC for port 2. For accessibility, the areas are located on the back of the assembly rather than on the component side.

**** NOTE ****

> The configuration areas on the SBA-SM assembly for a particular port must always be set for the same option as that selected for the same port by areas E49, E69, and E70 on the SIO-SM board (refer to Section 5.2.5).

Figure 5-12 shows the positions on the SBA-SM assembly of configuration areas E0 through E3. Table 5-14 lists the settings of the shorting plugs.

The SBA-BBM has no areas that require configuration. However, the board includes the RF modem, which must be adjusted for each broadband installation (see Section 5.2.10).

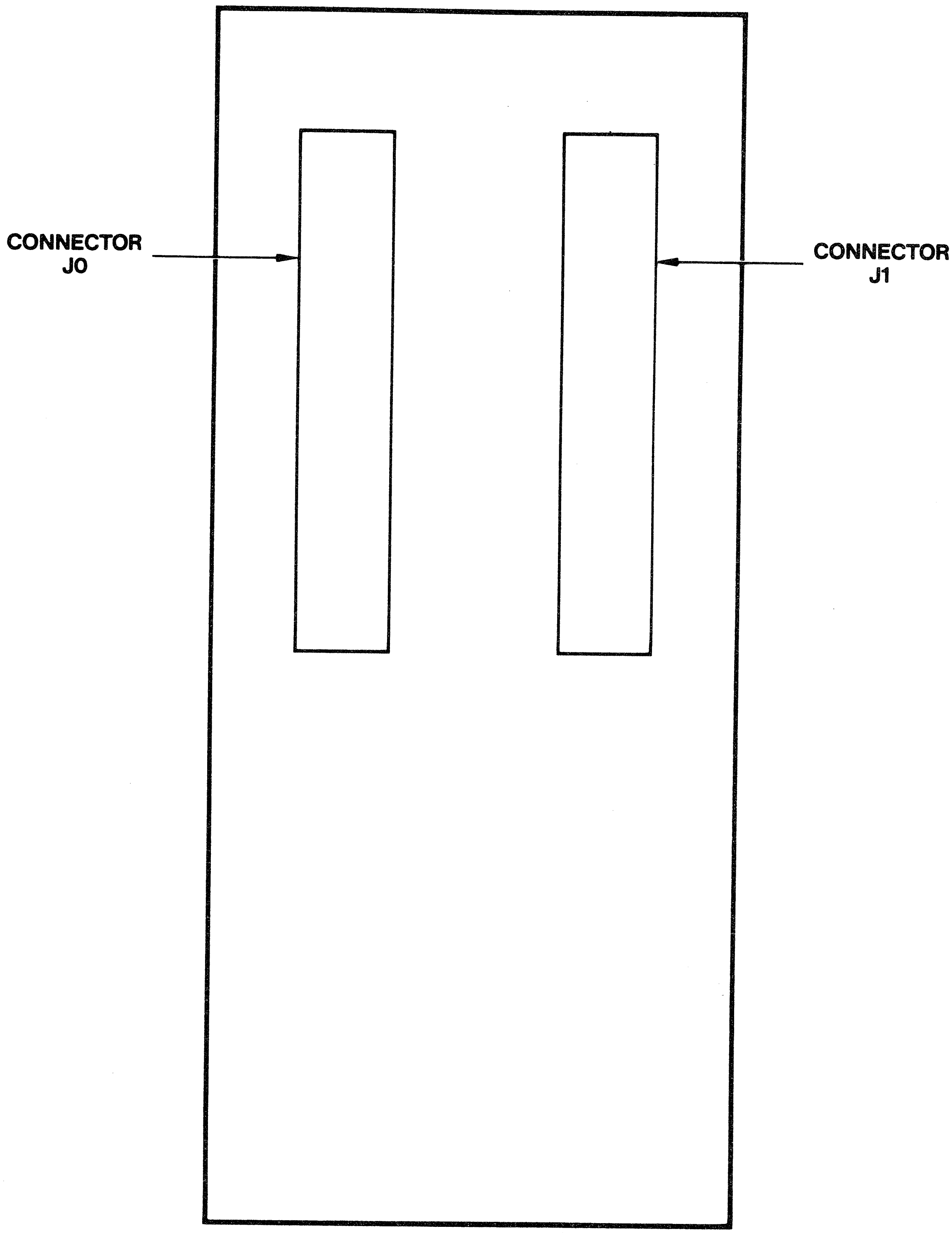


Figure 5-11 SBA-16 Assembly

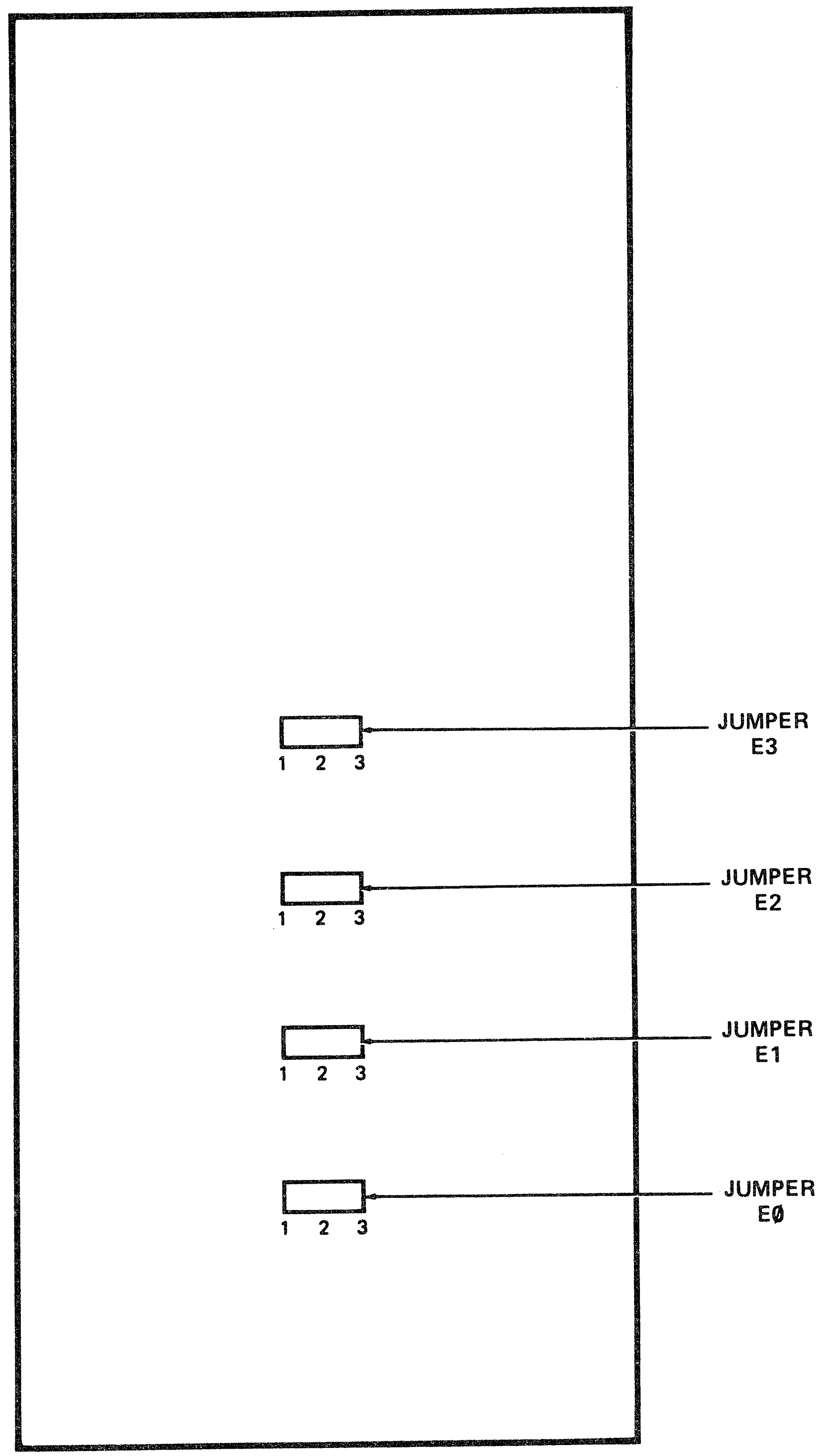


Figure 5-12 SBA-SM Assembly

Table 5-14 SBA-SM Clock Source Shorting Plug Positions

Port No.	*Line Selected*	*Jumpered Pins*
0	TXC	E0 1-2*
0	EXC	E0 2-3
1	TXC	E1 1-2*
1	EXC	E1 2-3
2	TXC	E2 1-2*
2	EXC	E2 2-3
3	TXC	E3 1-2*
3	EXC	E3 2-3

* Factory default

5.2.10 MBI Board Configuration

The Main Backplane Interconnect (MBI) board is designed to accommodate eight Multibus boards. The slot assignments are listed in Table 5-15.

Slot A is identified by the designations J1A and J2A on the component side of the MBI board. It is the slot closest to the power connector (J3). The J1 connectors are all bussed according to the Multibus specification outlined in reference [26]. The connections to connectors J2A, J2B, and J2C (slots A, B, and C) are PCed on the MBI; to avoid component damage, no boards except those specified in Table 5-15 should be mounted in these slots. Connectors J2D through J2H are left open and are designed to accommodate either standard Multibus P2 backplanes or 60-pin connectors with short wirewrap pins (allowing direct connection to flat cables). One such 60-pin connector must be present for each SIO or SIO-16 board.

Table 5-16 lists the silkscreen reference designators for the MBI's external cables. All of these cables are polarized to prevent improper insertion.

System chassis ground and signal ground are connected through a resistor/capacitor network (R5 and C5) located on the MBI. Connecting the grounds this way is essential for reliable system operation.

Figure 5-13 illustrates the MBI board and indicates the positions of all cable connectors and components R5 and C5.

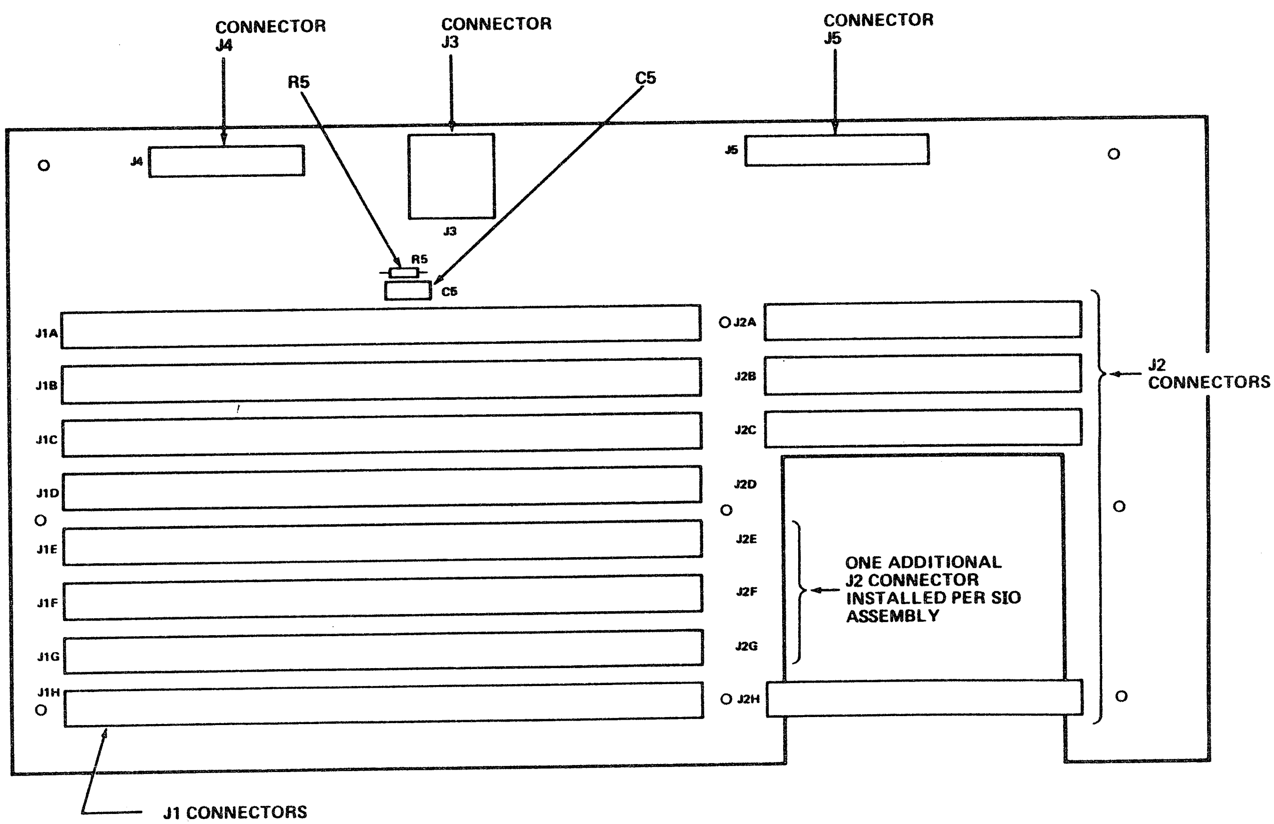


Figure 5-13 MBI Board

Table 5-15 MBI Slot Assignments

Slot No.	*Board*
A	ESB
B	ETI or EC/2
C	MCPU
D	FDC*
E	SIO 4
F	SIO 3
G	SIO 2 or HSM**
H	SIO 1, HSM, HSM-MDM, or EC/2***

* The Floppy Disk Controller is piggy-backed on the MCPU and occupies one backplane slot.

** Only the second HSM board in a CS/1-HSM can be placed in this slot; the first must be placed in slot H.

*** Only the second EC/2 board in a GS/4 can be placed in this slot; the first must be placed in slot B.

Table 5-16 MBI External Cable Locations

Connector	*Cable Name*
J3	Power supply harness
J4	FPA cable
J5	EBA cable
J6	Unused
J2E	SBA cable 4
J2F	SBA cable 3
J2G	SBA cable 2
J2H	SBA cable 1

5.2.11 RF Modem Configuration

The RF modem is located on the SBA-BBM, which is attached to backpanels 3 and 4 in a GS/6; backpanels 1 and 2 are blank.

The modem contains three LEDs (Figure 5-14), labeled PWR, RS, and RR. PWR is the power LED; it lights at power-on and remains lit until the unit is powered off. The RS (Request to Send) LED flashes on and off as the HSM-MDM board sends a request to send data to the modem. The RR (carrier detect) LED flashes on and off as it detects the presence of the carrier. Because the GS/6 sends short packets at high speed, it may be difficult to detect the flashing of the LEDs.

The two screws on the modem are used to adjust the squelch level and the transmit level of the modem. These adjustments should be done only by a factory-authorized technician.

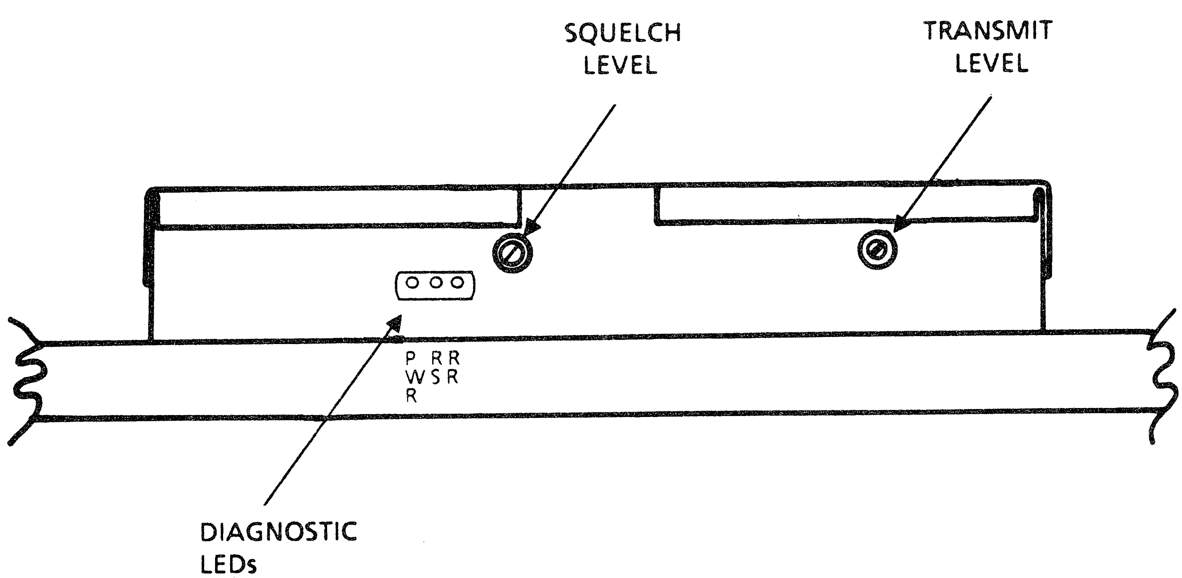


Figure 5-14 RF Modem

5.3 Tabletop Installation

After all hardware configuration areas have been checked, the unit is ready to be installed. Refer to Section 3.2 for space and environment requirements. Place the unit on a firm, level surface and connect the unit's external cables.

5.4 Optional Rack Mount Installation

For rack mount installation, an optional rack mount kit (designated RM) can be ordered from Bridge Communications, Inc. The kit consists of a set of rack mount slides. The following steps are required to install the slides on the unit:

1. Remove the chassis side covers by removing the four screws securing the plastic feet to the chassis bottom. The plastic feet may be discarded, since they are not needed on a rack-mounted unit.

2. Unpack the slide set from its shipping carton. Verify that the carton contains the following items:

Description	*Quantity*
Slides (3 sections each)	2
Slide rear extension brackets	2
Package of slide hardware	1
Slide manufacturer's installation instructions	1

   Report any discrepancy to Bridge Communications, Inc., or an authorized service representative.

3. Remove the inner slide section from each slide by fully extending the slide and depressing the inter-section latch.

4. Using the ten 10-32 x .375" screws provided, secure the slide inner sections to the chassis sides. The end of the slide that has a latch-leaf spring must be placed so it points toward the rear of the chassis.

5. Reattach the chassis side covers, using the four screws removed in step 1.

Refer to the slide manufacturer's installation instructions for the remaining steps in the slide installation procedure and for the steps required to rack mount the unit once the slides are installed.

5.5 HSM Host Adapter Card Installation

The CS/1-HSM includes a Host Adapter Card (HAC), which is installed in the host computer. This section outlines the procedure for installing and configuring the HAC. (Refer to Sections 6.3 and 6.4 for the procedure for adding or replacing an HSM board in a CS/1-HSM.)

After the CS/1-HSM has been configured, follow these steps to complete the installation:

1. Check the settings of the microswitches in locations S1 and S2 on the HAC card. In location S1, all settings except 4 should be "open" ("off"); 4 should be "closed" ("on"). In location S2, all settings except 8 should be "open"; 8 should be "closed". Figure 5-15 illustrates the positions of the two switches on the HAC.

2. Consult a DEC field representative for configuration of the host UNIBUS* backplane. The HAC may also require configuration. Refer to the documentation provided with the HAC (reference [28]).

3. Ascertain the base address of a free address space on the UNIBUS adequate for the needs of the HAC. The HAC needs hexadecimal 20 addresses for every 8 ports to be supported. This information is used in step 8, below.

4. With the power to the host off, install the distribution panel/harness and the HAC in the UNIBUS cardcage of the host.

**** NOTE ****

This step must be performed by a qualified DEC service representative.

5. Run the system generation program on the CS/1-HSM. Refer to the *Network Management Guide* for the system generation procedures. When Sysgen is finished, leave the CS/1-HSM in the MCPU monitor.

6. Install the HAC cable (Figure 4-13) between the CS/1-HSM back panel connector and the HAC distribution panel on the host. Refer to the cabling requirements listed in Section 4.1.

7. Turn on the power to the host, but do not boot the DEC system software (i.e., leave the host in the monitor).

8. Run the CS/1-HSM host installation program by following these steps:

   a. If any software other than the system generation program has been running on the CS/1-HSM, reset the server and enter the monitor. Refer to the *Network Management Guide* for the procedure for entering the monitor.

   b. In response to the monitor prompt, run the host installation program by entering this command:

```
> bt 1
```

* UNIBUS is a trademark of Digital Equipment Corporation.

c. The program prompts for the number of the HSM board attached to the HAC being configured. If a single CS/1-HSM is connected to two different hosts, the host installation program must be run once for each host. Enter the board number (either 1 or 2 for non-custom installations), followed by a carriage return. The program does not accept values outside the possible range.

d. At this point, the program initiates communication with the HAC connected to the specified HSM board. If no response is received from the HAC within 15 seconds, the program displays an error message and returns to the initial prompt screen.

   If communication is established with the HAC, the program displays the current UNIBUS base address of the HAC, in hexadecimal, and prompts for a new value.

e. Enter the hexadecimal base address acquired in step 2, above, followed by a carriage return. The program does not accept characters that are not valid hexadecimal digits.

f. The program updates the UNIBUS address stored in non-volatile RAM on the HAC, then displays the current unit count value and prompts for a new value. One unit represents eight ports (one DMF32 card). Enter an integer representing the number of eight-port cards that would be required for the desired number of ports, followed by a carriage return. To configure the HAC for 48 ports, for example, enter a unit count of 6.

g. The program updates the unit count stored on the HAC, then displays a message that host configuration is complete. If the CS/1-HSM contains more than one HSM board, return to step c, above, and repeat the procedure for the second board.

h. When all HACs have been configured, respond to the initial prompt with a carriage return in order to exit from the host installation program and return to the monitor.

9. Turn off power to the host computer.
10. Wait five seconds, then turn the power on and boot the host as usual.
11. After the host is booted, boot the CS/1-HSM communications software by disconnecting the console terminal and pressing the Reset switch.

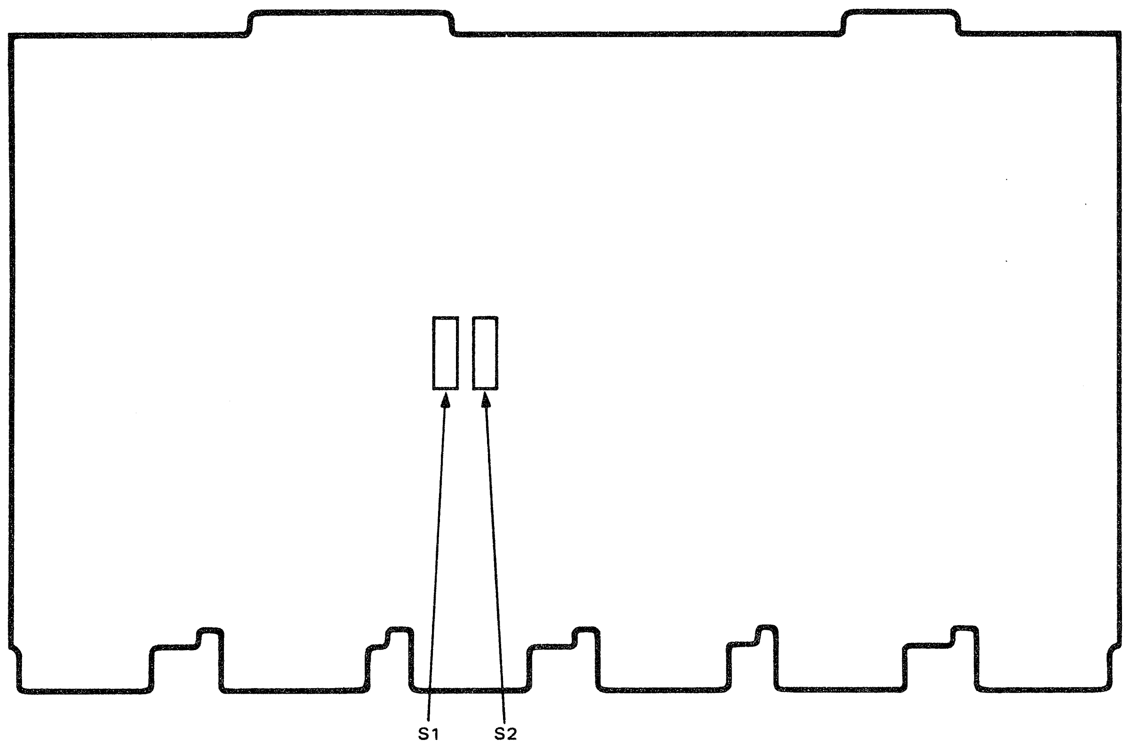


Figure 5-15 HAC Board

5.6 System Cabling

This section describes the Series/1 servers' external cabling. The cable connecting a device or line to the Series/1 server is usually supplied by the customer, although Bridge supplies device cables as an option. Cable options supplied by Bridge are described in Section 4.0; cable connectors are described in Section 3.1.

Section 5.6.1 describes the CS/1-A/BSC/SDLC, CS/1-SNA, and CS/1-HSM server-to-device cabling; Section 5.6.2 describes server-to-device cabling for servers with SIO-16 modules; Section 5.6.3 provides parallel information for the CS/1-X.25, GS/1, GS/3, GS/4, and GS/6.

5.6.1 CS/1-to-Device/Line Cabling

To attach a terminal device to port 0 of a CS/1, simply attach the device cable to the connector labeled J0C on the first SBA assembly; to attach a terminal device to port 1, attach the cable connector labeled J1C on the first SBA assembly. Figure 3-3 illustrates the position of each connector on the CS/1 backpanel.

For the CS/1-A/BSC/SDLC, a terminal attached to a port configured as a host port will not interact appropriately with the server. The default configuration shipped with the CS/1-A/BSC/SDLC specifies ports 0 through 3 of each SIO-A module as host ports and ports 4 through 7 of each SIO-A module as terminal ports. The default parameters for all terminal ports assume 9600 baud and 1 stopbit.

The terminal ports are shipped with different databits and parity settings so that at least one port will be compatible with almost any terminal.

The ports numbered 0 through 7 on each SIO module are considered ports 0 through 31 by the software, i.e., SIO module 1 supports ports 0 through 7, SIO module 2 supports ports 8 through 15, and so on. Use the SETDefault or the ReaD commands from another port as necessary to alter inappropriate configurations (see reference [2] for command descriptions). Table 5-17 lists the default terminal port settings that apply to the CS/1-A/BSC/SDLC.

Table 5-17 CS/1-A/BSC/SDLC Default Terminal Port Settings

Port Numbers	*Databits*	*Parity*
4, 12, 20, 28	8	None
5, 13, 21, 29	7	Odd
6, 14, 22, 30	7	Even

The **CS/1-SNA** supports one synchronous host port, port 0. The sysgen program, described in reference [3], sets the data flow for this port; it can not be reconfigured as a terminal port.

The **CS/1-HSM** provides 64 virtual ports to a DEC VAX host computer. These ports are configured as host ports only. The CS/1-HSM is attached to the host computer via a HAC cable, shown in Figure 4-13.

5.6.2 SIO-16 Module-to-Device/Line Cabling

The SIO-16 module can be connected to a device using any of the cabling schemes listed in Section 4.1.2. These schemes are described in detail below, and illustrated in Figure 4-14.

Each SIO-16 has two SBA-16 assemblies on its backpanel. Each assembly has two male telephony connectors for a total of eight connectors on a fully loaded CS/1-A. The connectors are labeled J0 and J1. Figure 5-11 illustrates the SBA-16 assembly.

Each of the telephony connectors on the server's backpanel provides eight ports, sixteen ports per SBA-16. Ports 0 through 7 are associated with connector J0 of the first SBA-16 assembly; ports 8 through 15 are associated with connector J1 of the first SBA-16 assembly; ports 16 through 23 are associated with connector J0 of the second SBA assembly, and so on.

The Hydra Adapter cable and the Harmonica breakout box, described below, are labeled sequentially from 1 through 8. Table 5-18 indicates the SIO-16 port numbers to which the labels correspond.

Table 5-18 SIO-16 Port Number Correspondence for 64-port CS/1-A

SIO-16 Board No.	*Connector*	*Port No.*	*Hydra/Harmonica Connector Number**
1	J0	0	1
1	J0	1	2
1	J0	2	3
1	J0	3	4
1	J0	4	5
1	J0	5	6
1	J0	6	7
1	J0	7	8
1	J1	8	1
1	J1	9	2
1	J1	10	3
1	J1	11	4
1	J1	12	5
1	J1	13	6
1	J1	14	7
1	J1	15	8
2	J0	16	1
2	J0	17	2
2	J0	18	3
2	J0	19	4
2	J0	20	5
2	J0	21	6
2	J0	22	7
2	J0	23	8
2	J1	24	1
2	J1	25	2
2	J1	26	3
2	J1	27	4
2	J1	28	5
2	J1	29	6
2	J1	30	7
2	J1	31	8

(continued)

* Each Hydra/Harmonica connector number represents a separate cable or connector

Table 5-18 SIO-16 Port Number Correspondence for 64-port CS/1-A (continued)

SIO-16 Board No.	*Connector*	*Port No.*	*Hydra/Harmonica Connector Number**
3	J0	32	1
3	J0	33	2
3	J0	34	3
3	J0	35	4
3	J0	36	5
3	J0	37	6
3	J0	38	7
3	J0	39	8
3	J1	40	1
3	J1	41	2
3	J1	42	3
3	J1	43	4
3	J1	44	5
3	J1	45	6
3	J1	46	7
3	J1	47	8
4	J0	48	1
4	J0	49	2
4	J0	50	3
4	J0	51	4
4	J0	52	5
4	J0	53	6
4	J0	54	7
4	J0	55	8
4	J1	56	1
4	J1	57	2
4	J1	58	3
4	J1	59	4
4	J1	60	5
4	J1	61	6
4	J1	62	7
4	J1	63	8

* Each Hydra/Harmonica connector number represents a separate cable or connector

The cabling schemes used with the SIO-16 module are described below. To attach cables to the SIO-16 using any of the schemes described, a 25-pair female connector is required. Variations of the cables and connectors described in this section are compatible with the SIO-16. Cables and connectors described in this section may be purchased from Bridge Communications, Inc. Contact Bridge for further information about SIO-16 cabling.

**** NOTE ****

Cables designed for use with other SIO boards cannot be intermixed with the cables designed for use with the SIO-16.

- **Hydra Adapter Cable to Terminal**

  To install the Hydra Adapter Cable, follow these steps:

  1. Acquire a 25-pair Hydra Adapter cable and Modular DB-25 Adapters as needed. To order the appropriate type of Hydra Adapter cable, specify Bridge order number CBL-Hydra-6w.

     To order the DB-25 adapters, specify Bridge order number CBL-Term/Comp-Male, or CBL-Term/Comp-Female, as needed.

  2. Attach the 25-pair end of the Hydra Adapter Cable to the SBA-16 assembly on the backpanel of the server.

     Ports 0 through 7 are associated with connector J0 of the first SBA-16 assembly; ports 8 through 15 are associated with connector J1 of the first SBA-16 assembly; ports 16 through 23 are associated with connector J0 of the second SBA-16 assembly, and so on.

  3. Each RJ-11 connector on the Hydra Adapter cable is labeled with a number in sequence from one to eight (Table 5-18 shows the correspondence to the server's port numbers).

     To attach a terminal device to port 0 of the CS/1-A with SI0-16 modules:

     a. Connect the RJ-11 connector labeled 1 to a male Modular DB-25 Adapter.

     b. Attach the Modular DB-25 Adapter to the DB-25 connector on the terminal.

- **25-pair Extension Cable to Harmonica Breakout Box to Terminal**

  To install the 25-pair extension cable to Harmonica breakout box to terminal, follow these steps:

  1. Acquire a 25-pair extension cable (in the length required by the application), a Harmonica breakout box, 3-pair modular cable, and a Modular DB-25 adapter.

     To order the appropriate 25-pair extension cable from Bridge, specify order numbers CBL-25pair-25, CBL-25pair-50, or CBL-25pair-100, as required by the installation.

     To order a Harmonica breakout box from Bridge, specify order number CBL-Harmonica-6W.

     To order 3-pair modular cable from Bridge, specify order number CBL-3pair-25.

     To order Modular DB-25 Adapters from Bridge, specify order number CBL-Term/Comp-Male, or CBL-Term/Comp-Female, as required by the installation.

2. Attach one end of the 25-pair extension cable to the first (left-most) SBA-16 assembly on the server's backpanel.
3. Attach the other end of the extension cable to the 25-pair connector on the Harmonica breakout box.
4. The RJ-11 receptacles on the Harmonica breakout box are labeled with a number between one and eight (Table 5-18 shows the correspondence to the server's SIO-16 ports).

   To attach a terminal device to port 0 of the CS/1-A with SIO-16 modules:

   a. Connect one end of the modular cable to the RJ-11 receptacle labeled 1 on the Harmonica breakout box.
   b. Connect the other end of the modular cable to a female Modular DB-25 Adapter.
   c. Attach the Modular DB-25 Adapter to the DB-25 connector on the terminal.

On the CS/1-A with four SIO-16 modules, a terminal attached to a port configured as a host port will not be able to interact appropriately with the server. The default configuration shipped with the server specifies ports 0 through 3 and ports 8 through 11 of each SIO-16 module as host ports and ports 4 through 7 and ports 12 through 15 as terminal ports. The default parameters for all terminal ports on the SIO-16 module assume 9600 baud and 1 stop-bit.

On the CS/1-A with four SIO-16 modules, the terminal ports are shipped with different parity and databit settings so that at least one port will be compatible with almost any terminal.

The ports on a CS/1-A with four SIO-16 modules are considered ports 0 through 63 by the software, i.e., SIO-16 module 1 supports ports 0 through 15; SIO-16 module 2 supports ports 16 through 32; and so on.

Use the SETDefault or the ReaD commands as necessary from another port to alter inappropriate configurations (see reference [2] for command descriptions). Table 5-19 lists the default settings that apply to the CS/1-A with four SIO-16 modules.

Table 5-19 Default Terminal Port Settings for 64-port CS/1-A

Port Numbers	*Databits*	*Parity*
4, 12, 20, 28, 36, 44, 52, 60	8	None
5, 13, 21, 29, 37, 45, 53, 61	7	Odd
6, 14, 22, 30, 38, 46, 54, 62	7	Even
7, 15, 23, 31, 39, 47. 55, 63	7	1

After the installation is defined for the site and the appropriate cabling equipment is obtained, Bridge recommends the following steps to simplify network management:

1. Label each 25-pair cable with a number in sequence from 1 to 8 (line 1 is attached to the first SBA-16 assembly, line 2 is attached to the second SBA-16 assembly, and so on).
2. On a map of the site, mark the locations of the 25-pair cable lines from end-point to end-point.
3. Mark the cable line leading from each server port to the attached terminal according to its line and port number (i.e., line 1, port 4 = L1 P4; line 2, port 17 = L2 P17, and so on).

5.6.3 CS/1-X.25 and Gateway Server Device/Line Cabling

For the **CS/1-X.25, the GS/1, and the GS/3,** if two physical lines connected to the same SIO board are of different speeds, the higher-speed line must be connected to port 0 and the lower-speed line must be connected to port 1.

The **CS/1-X.25 and the GS/1** each provide 48 virtual ports that are configured as terminal ports. These virtual ports are not mapped directly to the number of SIO boards, to the number of physical lines connected to the SIO boards, or to the number of physical lines connected to the X.25 network to which the server is attached. Instead, the ports incoming from the X.25 network are dynamically allocated on a round-robin basis over all of the physical lines connected to the server. The virtual ports are configured with 7 databits, no parity. They are considered ports 0 through 47.

The **GS/4 and the GS/6** support no SIO boards. The GS/4 connects to two Ethernet cables through transceiver cables (refer to Section 5.6.4).

The **GS/6** connects to the broadband line via a broadband drop cable connected to the RF modem.

5.6.4 Server-to-Transceiver Cabling

The transceiver cable can be supplied either by the customer or as an option from Bridge Communications, Inc.

Before installing the cable, be sure the server is powered off. Then connect the transceiver cable to the server's transceiver connector and to the transceiver itself. Refer to Section 3.1 for transceiver specifications and to Section 4.1 for cable specifications.

** CAUTION **

> Connecting or disconnecting the cable between the server and the transceiver while the server is powered on can damage the transceiver.

In order to facilitate the startup and checkout procedures for Communications Servers, do not attach the transceiver cable to the server until the server itself has been fully checked out. Refer to Sections 5.7 and 5.8 for startup and checkout procedures, respectively.

5.7 Server Startup

The following sections list the steps recommended for starting up a Series/1 server. The procedure differs for a server that has an internal disk drive and one that does not.

The procedures make the following assumptions:

- The bootstrap option areas on the MCPU board have been configured properly. To check the settings, refer to Section 5.2.4. The options are described in Appendix B.
- Servers with an internal disk drive have not been attached to the network.

The Series/1 server startup procedure consists of four steps:

1. Self-test diagnostics
2. Boot procedure
3. System generation
4. Boot procedure

Steps 1 and 2, self-test diagnostics and booting, are common to all servers. If the self-tests do not pass successfully, refer to Appendix A for an explanation of the failure.

Steps 3 and 4, system generation and rebooting, are necessary only on some servers, as shown in Table 5-20. System generation may be performed on servers with internal disk drives. System generation may be performed on the NCS/1 for client servers with or without internal disk drives. See references [3] and [8] for detailed information about system generation.

Table 5-20
System Generation Requirements

Server	*System Generation*
CS/1 that boots from an NCS/1	Not required *
CS/1 that boots from an NCS/150	Not available
CS/1-A running either XNS or TCP/IP protocols, standard CS/1-BSC, CS/1-SDLC	Not required *
CS/-A with 4 SIO-16 modules	Not required *
CS/1-BSC running SPMUX software, CS/1-HSM, CS/1-SNA, CS/1-X.25, GS/1, GS/3, GS/4, GS/6	Required

* System generation may be required for nonstandard software or installation.

5.7.1 Server with an Internal Disk Drive

Follow these steps to start up a Series/1 server that has an internal disk drive:

1. Power on the server by pressing the "I" side of the power switch (located on the server backpanel). If the Power and Self Test LEDs on the front panel fail to light, power off the server by pressing the "O" side of the power switch. Verify that the power cord is properly connected to a working outlet; then power on the server again.

2. Place the diskette in the drive with the label facing right (i.e., away from the LEDs) while the Self Test LED is still lit.

   If the Self Test LED turns off or begins flashing before the diskette is in place, insert the diskette and press the Reset switch to restart the server.

3. If the Self Test LED remains lit longer than 10 or 12 seconds, one or more boards have failed the self-test diagnostics. Remove the server's top cover and check the status of the self-test LEDs on the individual boards. A lit LED indicates a board failure. (Refer to Section 5.2 for an illustration of each board, and to Appendix A for a description of the power-on diagnostics.)

   **** CAUTION ****

   The unit is still powered on. Do not drop or place any object in the enclosure.

   If a console terminal is attached, check the console for confirmation of the failure. Depending on where the failure occurred, the system may not be able to report the failure on the console (e.g., MCPU failure). Report the board failure and console messages (if any) to Bridge Communications, Inc., or an authorized service representative.

4. If the Self Test LED flashes on and off after the self-test diagnostics have completed, verify that the floppy diskette is properly inserted in the drive. Press the Reset switch to try again.

5. If the Self Test LED turns off within 10 or 12 seconds after power is applied, the server enters bootstrap phase and the Boot State LED lights. (Refer to Appendix B for a description of the bootstrap procedure.) When the bootstrap process is complete, the Boot State LED turns off; bootstrap takes approximately 20 seconds. If the LED remains lit longer than 60 seconds, contact a service representative.

6. After the bootstrap process is complete, the server reads default parameter tables and the clearinghouse directory from the diskette (reference [2] describes the parameter tables and clearinghouse directory). This takes approximately 20 seconds, after which the system is ready to be checked out.

5.7.2 Server without an Internal Disk Drive

The procedure for starting up a diskless server is as follows:

1. The server being checked out must be attached to the network, and the network must include an operational NCS that has been configured to support that server. (References [7] and [8] discuss the operation of Network Control Servers in detail.)

2. With the server powered off, connect the transceiver cable between the server and a transceiver.

**** CAUTION ****

Connecting or disconnecting the cable between the server and the transceiver while the server is powered on can damage the transceiver.

3. Power on the server by pressing the "I" side of the power switch (located on the server backpanel). If the Power and Self Test LEDs on the front panel fail to light, power off the server by pressing the "O" side of the power switch. Verify that the power cord is properly connected to a working outlet; then power on the server again.

4. If the Self Test LED remains lit longer than 10 or 12 seconds, one or more boards have failed the self-test diagnostics. Remove the server's top cover and check the status of the self-test LEDs on the individual boards. A lit LED indicates a board failure. (Refer to Section 5.2 for an illustration of each board, and to Appendix A for a description of the power-on diagnostics.)

**** CAUTION ****

The unit is still powered on. Do not drop or place any object in the enclosure.

If a console terminal is attached, check the console for confirmation of the failure. Depending on where the failure occurred, the system may not be able to report the failure on the console (e.g., MCPU failure). Report the board failure and console messages (if any) to Bridge Communications, Inc., or an authorized service representative.

5. If the Self Test LED flashes on and off after the self-test diagnostics have completed, verify that the NCS is properly configured and attached to the network. Press the Reset switch to try again.

6. If the Self Test LED turns off within 10 or 12 seconds after power is applied, the server enters bootstrap phase and the Boot State LED comes on. Refer to Appendix B for a description of the bootstrap procedure. When the bootstrap process is complete, the Boot State LED turns off; bootstrap takes approximately 60 seconds. If the LED remains lit longer than 60 seconds, contact a service representative.

7. After the bootstrap process is complete, the server reads default parameter tables and the clearinghouse directory from the NCS files (reference [2] describes the parameter tables and clearinghouse directory). This takes approximately 20 seconds, after which the system is ready to be checked out. Refer to Section 5.8 for the server checkout procedure.

5.8 Server Checkout

A Series/1 server can be checked out in one of two ways, depending on its model:

- A server with an SIO-A or SIO-16 board and an asynchronous terminal attached can be checked out locally.
- All other Series/1 servers must be checked out by accessing them in remote mode from a terminal attached to an SIO-A or SIO-16 port on a server somewhere on the network. The server being checked out and the server to which the terminal is attached must be running the same set of high-level protocols.

Table 5-21 shows which servers can be checked out locally and which must be checked out remotely, and where the checkout procedure can be found.

Table 5-21 Checkout Procedures

Server	*Checkout Procedure*	*Section Number*
CS/1-A/BSC/SDLC with at least one SIO-A or SIO-16 board	Local	5.8.1
CS/1-BSC/SDLC with no SIO-A or SIO-16 board, CS/1-HSM, CS/1-SNA, CS/1-X.25, GS/1, GS/3, GS/4, GS/6	Remote	5.8.2

Before checking out a server, make sure:

- Sysgen has been run, if the server requires it. Refer to Table 5-20, in Section 5.7, for Sysgen requirements.
- Servers with an internal disk drive have not been attached to the network. These servers are attached to the network during the checkout procedure.

5.8.1 Servers that Are Checked Out Locally

After a Series/1 server has been started up successfully, follow these steps to check out the server:

1. Attach a terminal to an SIO-A or SIO-16 port that is configured for the same parity and databits as the terminal. Sections 5.6.1 and 5.6.2 list default terminal port settings and describe cabling instructions for the CS/1-A and for a server with SIO-16 modules, respectively.

2. Power on the terminal and press the return key. The server's welcome message and prompt should appear on the terminal. If they appear, skip to step 7.

3. If no welcome message and prompt appear on the terminal, verify that the Data Received LED on the server's front panel flashes when a key on the terminal is pressed.

4. If the LED flashes but no prompt appears, verify that the port parameters are set appropriately for the terminal. A port configured for interaction with a host will not interact appropriately with a terminal. Refer to Section 5.6.1 for default terminal port settings and for cabling information.

5. If the LED does not flash, verify that the I/O cable is properly attached to both the device and the Series/1 server. Once the cables are attached properly, repeat step 2.

6. If the server still does not respond, contact Bridge Communications, Inc., or an authorized service representative.

7. After the welcome message and prompt appear on the terminal, verify that the terminal can communicate successfully with the server by entering the command:

   ```
   show address
   ```

   Series/1 servers running XNS protocols respond with the server's entire network address: network number, station address, and port number. Make a note of the port number, which will be used later in this procedure (step 13). Servers running the TCP/IP protocols display only the port number.

8. If either the command or the resulting display appears as a string of random characters or does not appear at all, the terminal is not transmitting with the same baud rate, parity, or databits as the server. Check the baud rate, parity, and databits of both the terminal and the Series/1 server port. If these settings do not match, either adjust the terminal or attach it to a Series/1 server port whose parameters do match the terminal's requirements (Table 5-17 lists the default port parameters for the CS/1-A/BSC/SDLC; Table 5-18 lists the default port parameters for the CS/1-A with four SIO-16 modules).

9. After the Series/1 server and the terminal have successfully established two-way communication, set the privilege level of the terminal to Global Network Manager by entering the command:

   ```
   set priv=gnm
   ```

   A password is required; the default password supplied with the system software is the null string (""); simply press the return key.

10. Attach a second terminal to another SIO-A or SIO-16 port on the server. If necessary, use the SETDefault command from the first terminal port to adjust the baud rate, parity, and databits parameters of the second terminal port. The SETDefault command is described in reference [2].

11. Test the connection between the server and the second terminal by following the same steps as for the first terminal (steps 2 through 8).

12. Place the second terminal in Listening mode (so that it can be the destination of a connection) by entering the command:

    ```
    listen
    ```

13. Establish a connection from the second terminal to the first terminal. For servers running the XNS protocols, enter the following command using the port number obtained in step 7:

    ```
    connect !<destination port number>
    ```

    For servers running the TCP/IP protocols version 10110 (CS/1) or 10200 (CS/100) or earlier, enter the command:

    ```
    connect <internet address of port>
    ```

    **** NOTE ****

    The internet address must have been defined during system generation.

    For servers running the TCP/IP protocols version 1.1 and later, enter the commands:

    ```
    setd (!<port #>) ip=<internet address>

    connect <internet address of port>
    ```

    **** NOTE ****

    The address assigned to a port using the SETDefault command must have the same network number portion as the server address assigned during system generation.

14. Once the connection is established, all characters typed on the first terminal appear on the second, and vice versa, but the data is not echoed on the terminal sending the data. Test the connection by typing a few characters on both terminals.

15. From the first terminal, terminate the connection by typing the Enter-Command-Mode character (typically "<CTRL-^>" or "<CTRL-~>") and the command:

    ```
    disconnect
    ```

    When all the servers in the network are checked out and are operating properly, connect the transceivers to the Ethernet and check out the connections across the network.

16. Power off the server.

17. Attach the transceiver from each server to the Ethernet cable (refer to Section 3.3).

18. Power on and reboot the servers (refer to Section 5.7 for the startup procedure).
19. Form a connection from a terminal on one server to a terminal on another. For servers running the XNS protocols, enter the command:

    ```
    connect %<Ethernet address>!<destination port number>
    ```

    For servers running the TCP/IP protocols, enter the command:

    ```
    connect <internet address of port>
    ```

20. Terminate the connection by entering the command:

    ```
    disconnect
    ```

5.8.2 Servers that Are Checked Out Remotely

This section details the procedure for checking out a server by accessing it in remote mode. The procedure assumes that any local connections between devices on the network that are needed to check remote devices (e.g., a terminal connected to an SIO-A or SIO-16 port on a CS/1) have been checked and are functioning properly (refer to Sections 5.7 and 5.8.1).

Remote access cannot be made from an XNS server to a TCP/IP server or vice versa.

1. Run the startup procedure (Section 5.7) on the server being checked out.
2. Power off the server.
3. Attach the transceiver for each server to the Ethernet cable (refer to Section 3.3).
4. Power on and reboot the servers (refer to Section 5.7 for the startup procedure).
5. From a terminal attached to an asynchronous server whose protocols match those run on the server being checked out, obtain Global Network Manager privilege by entering:

    ```
    set priv=gnm
    ```

    A password is required; the default password shipped with the system software is the null string (""); simply press the return key.

6. Access the server being checked. For servers running the XNS protocols, enter the command:

    ```
    remote %<Ethernet address>
    ```

For servers running the TCP/IP protocols, enter the REMote command and the internet address, as follows:

```
remote <internet address of port>
```

The internet address must have been set during system generation.

7. Check that the remote server is functioning properly. At the "Remote:" prompt, enter the command:

```
show version
```

The server should respond by displaying the current version of software running in the unit and the current PROM firmware revisions. If the server does not respond or responds with the "Timeout failure" message, a problem may exist with the remote server's physical connection. Check the remote server's transceiver connection.

8. Press the break key to exit remote mode.

9. Form a connection to the server that was checked out in steps 1 through 5.

If the server being checked out is a *Communications Server* the following assumptions are made:

- The connection between the terminal and the server with the SIO-A or SIO-16 port has been checked out.
- The connection has been successful between the server being checked out and the devices attached to it; if the device is a host, the host has been properly configured.

  At the terminal attached to the SIO-A or SIO-16 port, enter the following command for servers running XNS protocols:

```
connect %<address>!<destination port number>
```

For servers running TCP/IP protocols, enter the command:

```
connect <internet address of port>
```

The internet address must have been established previously.

If the server being checked out is a *Gateway Server,* the following assumptions are made:

- The Gateway Server (if any) on the remote network has been checked out.
- A destination whose network number and network or internet address is known has been checked out locally on the remote network and is functioning properly.

At the terminal attached to the SIO-A or SIO-16 port, enter the following command for servers running XNS protocols:

```
connect &<rem net#>%<rem Ethernet addr>!<dest port #>
```

To make a connection across a Gateway Server running the IP protocol, enter the command:

```
connect <internet address of port>
```

- After the connection has been made successfully, terminate the connection at the terminal attached to the SIO-A or SIO-16 port by entering the Enter-Command-Mode character <CTRL-^> and the command:

```
disconnect
```

5.9 System Shutdown Procedure

To shut down a Series/1 server, follow these steps:

1. Notify all users that the server is being shut down. This may be done from an SIO-A or SIO-16 port on a Communications Server via the Broadcast command (see reference [2]).
2. Disconnect all active sessions. See reference [2] for the Connection Service commands needed to display a list of sessions and to disconnect sessions.
3. Remove the diskette from the disk drive before powering off the server.
4. Turn off the power to the server.

5.10 Preventive Maintenance

Bridge Communications, Inc., recommends the following general procedures for preventive maintenance:

1. Observe the environmental requirements listed in Section 3.2. Temperatures outside the recommended range degrade system reliability and cause diskette access errors.
2. Keep the unit's top cover closed (except when actually adding or replacing boards) to ensure proper cooling of the unit.
3. When adding or replacing boards, handle the boards carefully. Avoid touching the gold board edge area, since body oils can affect the conductivity of the surface.
4. Clean the air intake filter periodically by scrubbing it with a stiff brush to remove accumulated dust and lint. The filter is located inside the enclosure, between the front panel and the cardcage.
5. Before powering on, powering off, or resetting the unit, be sure the disk activity LED on the unit front panel is not lit. Remove the diskette from the disk drive before powering the unit on or off.
6. Handle the diskette carefully. Always hold the diskette by its protective cover or by the label area; never touch the exposed areas of the diskette itself.
7. In case of a system crash, an immediate memory dump may aid in diagnosing the problem. The network manager should keep two formatted diskettes available for this purpose. The procedure for obtaining a memory dump is described in reference [3].
8. To avoid excessive diskette wear, change the system diskette every three months. Reference [3] describes the procedure for copying diskettes.
9. When the system diskette is changed, clean the disk head by using a head cleaning diskette (e.g., Inmac 7157). A head cleaning diskette is available as an option from Bridge Communications, Inc., as part of the Installation Support Tool Kit (CS/1-INTK).

6.0 SYSTEM MODIFICATION

This section describes the modifications that can be made to the Series/1 server and outlines the procedures for making these modifications.

6.1 Standard System Features

The equipment and services that are standard features of the Series/1 server are as follows:

- Multibus boards:
  - One Ethernet Controller module (except GS/4)
  - Two Ethernet Controller modules (GS/4 only)
  - MCPU board
  - One I/O module (except GS/4, GS/6)
  - HSM module (CS/1-HSM and GS/6 only)
  - SBB board (CS/1-SNA only)
- Firmware in PROM (data link; I/O driver, device driver, or framing driver; monitor; debugger; and diagnostics). Not applicable to SIO-16
- Software (Bridge operating system and communications protocols on a 5¼", double-sided, double-density diskette):
  - SW/1-A/BSC/SDLC for CS/1-A running XNS protocols, CS/1-BSC, and CS/1-SDLC
  - SW/1-TCP for CS/1-A running TCP/IP protocols
  - SW/1-SPMUX for CS/1-BSC with SPMUX software
  - SW/1-SNA3270 for CS/1-SNA running XNS protocols
  - SW/1-SNA/TCP for CS/1-SNA running TCP/IP protocols
  - SW/1-X.25 for CS/1-X.25
  - SW/1-HSM for CS/1-HSM
  - SW/2-CS/ICS for GS/1 Connection Service and Interconnection Service
  - SW/3 for GS/3 running XNS protocols
  - SW/3-IP for GS/3 running IP protocols
  - SW/4 for GS/4
  - SW/6 for GS/6 running XNS protocols
  - SW/6-IP for GS/6 running the IP protocol
- *Series/1 Planning and Installation Guide*
- *Connection Service User's Guide*
- *Network Management Guide*

6.2 Optional System Components

The equipment and services that are optional features of the Series/1 server are as follows:

- 5¼" floppy disk subsystem
- Up to three additional I/O modules (depending on server model)
- Ethernet coaxial cable
- Ethernet tap and transceiver
- Transceiver cable
- Serial device cables
- 25-pair extension cable (SIO-16 only)
- 3-pair modular cable (SIO-16 only)
- Hydra adapter cable (SIO-16 only)
- Harmonica breakout box (SIO-16 only)
- Modular DB-25 Adapter (SIO-16 only)
- *Software Technical Reference Manual*
- Frequency translator and drop cable (GS/6 only)

6.3 Adding I/O Modules

This section describes the steps required for adding and replacing I/O modules. Refer to Section 2.4 for descriptions of the I/O versions.

6.3.1 Adding an SIO or SIO-16 Module

The SIO module consists of one SIO board, one SBA assembly, one SBA cable, one 60-pin card edge connector, and two #4-40 x 0.50 in., cross-head, recessed screws with washers.

In addition to these items, the SIO-16 module includes a power cable for connecting the SBA-16 board with the MCPU.

The SIO board version and the SBA assembly version must be compatible (e.g., an SIO-16 board must be used with an SBA-16 assembly). Steps for adding or replacing an SBA assembly are included in the instructions.

SIO slot assignments are as follows:

Board # 1	Slot H
Board # 2	Slot G
Board # 3	Slot F
Board # 4	Slot E

SIO or SIO-16 board numbers must be assigned in sequence and in ascending numeric order. When adding a new SIO or SIO-16 board, always assign the next unused number.

**** CAUTION ****

When handling any PC board or assembly, avoid touching the gold edge area. Careful handling prevents damage to the board or assembly.

The steps required to add an SIO or SIO-16 module are as follows:

1. Verify that the unit is powered off.
2. Remove the top cover. Disengage each ball stud separately by lifting each side of the back overhang with a brisk upward motion.
3. If the new assembly is an SBA-422H, SBA-422A, SBA-H422A, SBA-HS422, or SBA-V.35, go to step 5.

   If the assembly is an SBA-A, SBA-16, SBA-SM, or SBA-ST, place the 60-pin card edge connector in the appropriate slot of the cardcage and bolt it in place with the two screws and washers provided. Pin 1 of the connector must be adjacent to the 86-pin connector.
4. Remove all cables going to the cardcage and the MBI assembly.
5. Remove the three cross-head screws attaching the cardcage to the chassis and carefully lift out the cardcage.

   If the assembly is an SBA-A, SBA-16, SBA-SM, or SBA-ST, elevate the cardcage and insert the end of the SBA cable into the 60-pin card edge connector installed in step 3. The colored stripe on the cable must point toward the outside of the cardcage. Be careful not to bend the pins when inserting the cable connector in the card edge connector.

If the assembly is an SBA-422H, SBA-422A, SBA-H422A, SBA-HS422, or SBA-V.35, place the 60-pin card edge connector in the appropriate slot of the cardcage and bolt it with the two screws and washers provided. Pin 1 of the connector must be adjacent to the 86-pin connector. Be careful not to bend the pins when inserting the cable connector in the card edge connector.

6. Verify that the filter foam is placed correctly before replacing the cardcage.
7. Replace the cardcage and reinstall the three cross-head screws, attaching the cardcage to the chassis.
8. Reconnect all cables to the cardcage.
9. Remove the six #4-40 x 0.25" screws holding the appropriate blank backpanel cover to the chassis back panel. The leftmost backpanel cover (as seen from the back of the unit) is assigned to board number 1. The backpanel cover to its right is assigned to board 2; the next, to board 3; and the rightmost, to board 4.
10. If the SBA cable was not shipped from the factory already connected to the SBA assembly, connect the free end of the SBA cable to the bottom header (J10). The red mark on the cable must point toward the fan (i.e., toward the pin-60 side of the connector).
11. Attach the new SBA assembly to the backpanel using the six screws and washers removed in step 9.
12. If the SBA assembly is an SBA-16, connect the power cable to the SBA-16 and to the MCPU board.
13. Assign an SIO board number to the new board (refer to Section 5.2.5).
14. Install the new SIO board in the cardcage slot in which the new 60-pin connector was installed in step 3 or 5. Seat the new board with a firm downward push.
15. To replace the top cover, align the gridded area on the cover with the fan and push the cover down gently until it snaps into place.

6.3.2 Adding an HSM Module

This section describes the procedure for adding a second HSM module to a CS/1-HSM.

The HSM module consists of one HSM board, one SBA-HSM cable assembly, and two #4-40 x 0.50 in., cross-head, recessed screws with washers.

A CS/1-HSM can support up to two HSM boards. Their slot assignments are as follows:

Board #1	Slot H
Board #2	Slot G

Board numbers must be assigned in sequence and in ascending numeric order.

**** CAUTION ****

When handling any PC board or assembly, avoid touching the gold edge area. Careful handling prevents damage to the board or assembly.

The steps required to install a new HSM board are as follows:

1. Verify that the unit is powered off.
2. Remove the top cover. Disengage each ball stud separately by lifting each side of the back overhang with a brisk upward motion.
3. Remove all cables to the cardcage and the MBI assembly.
4. Remove the three cross-head screws attaching the cardcage to the chassis and carefully lift out the cardcage. With the cardcage elevated, place the 60-pin card edge connector of the SBA-HSM assembly in the appropriate slot of the cardcage and bolt it in place with the two screws and washers provided. Pin 1 of the connector must be adjacent to the 86-pin connector. Be careful not to bend the pins when inserting the cable connector in the card edge connector.
5. Verify that the filter foam is placed correctly before replacing the cardcage.
6. Replace the cardcage and reinstall the three cross-head screws, attaching the cardcage to the chassis.
7. Reconnect all cables to the cardcage.
8. Remove the six #4-40 x 0.25" screws holding the appropriate blank backpanel cover to the chassis back panel. The leftmost backpanel cover (as seen from the back off the unit) is assigned to board number 1. The backpanel cover to its right is assigned to board 2. The other two backpanels remain blank.
9. Attach the new SBA-HSM assembly to the backpanel using the six screws and washers removed in step 8.
10. Assign a board number to the new board (refer to Section 5.2.9).
11. Install the new board in the cardcage slot in which the new 60-pin connector of the SBA-HSM was installed in step 4. Seat the new board with a firm downward push.
12. To replace the top cover, align the gridded area on the cover with the fan and push the cover down gently until it snaps into place.

6.4 Replacing an SIO, HSM, or HSM-MDM Board

This section describes the procedure for replacing an installed SIO, HSM, or HSM-MDM board. The SBA assembly for the GS/6 (SBA-BBM), which includes the RF modem, should be replaced only by a factory-authorized technician.

1. Verify that the unit is powered off.
2. Remove the top cover by lifting each side of the back overhang.
3. Remove the board by pulling up firmly on the extractor levers. Place the board in the protective bag in which the replacement board was shipped.
4. Assign a board number to the replacement SIO, SIO-16, or HSM board (refer to Sections 5.2.5, 5.2.6, and 5.2.7, respectively). This step does not apply to the HSM-MDM board; skip to step 5.
5. Install the replacement board in the slot from which the original board was removed in step 3.*
6. Replace the top cover.

* If an SIO-16 module is replacing an SIO-A module, some software configuration may be necessary. See the descriptions of the ReaD and SetDefault commands in reference [2].

6.5 Replacing Firmware

To replace firmware, follow these steps:

1. Power off the server and unplug the power cord from the power source.
2. Remove the top cover by lifting each side of the back overhang.
3. Remove the board that contains the PROM to be replaced by pulling up firmly on the extractor levers.
4. Identify the PROM to be replaced by comparing the entire eight-digit part number of the new PROM with that of the old PROM. Do not interchange a low-order PROM with a high-order PROM.
5. Take note of the orientation of the notch or prong 1 identifier in the old PROM. The new PROM must be oriented in the same direction. Do not use the printed label to determine the orientation of the PROM.

**** CAUTION ****

Failure to orient the PROM correctly destroys the PROM.

6. Using a small screwdriver or PROM-pulling tool and making sure not to bend the prongs, carefully pry the old PROM out of its socket.
7. Remove the new PROM from the antistatic foam shipping pad.
8. If the rows of prongs have been misshapen, push the side of the PROM against a flat surface so that the prongs are at right angles to the PROM body and fit easily into the socket.
9. Being careful to line the prongs up with the socket, gently push the new PROM into its socket.

**** CAUTION ****

Be certain that no prongs are bent under the body of the PROM. Each prong must be properly inserted into the socket.

10. Place the old PROM in the antistatic foam pad.
11. The unit may now be powered on to run the self-test diagnostics, described in Appendix A. Retain the old PROM until the system has been powered up and tested with the new firmware.
12. If the new PROM fails the self-test diagnostics, verify that the PROM prongs are correctly inserted into the socket, and that no prong is bent under the PROM. Check the orientation of the PROM.
13. Follow the instructions in the release memo for return of the firmware.
14. Replace the top cover by aligning the gridded area on the cover with the fan and pushing the cover down gently until it snaps into place.

6.6 Adding Custom Interfaces

The custom interfaces that can be added to the Series/1 server are:

- Additional Multibus board(s) in the cardcage
- Additional iSBX bus device(s) on the MCPU or SIO boards (unavailable on the SIO-16 module).

APPENDIX A

POWER-ON DIAGNOSTICS

The self-test diagnostics, which determine whether the boards in the system are functioning correctly, are performed automatically whenever the Series/1 server is powered on or reset. The tests are grouped into primary and secondary tests.

The primary test runs on the MCPU board. If the primary test fails, there is a fault on the MCPU board, and further testing is aborted. The self-test LEDs on the front panel and on the MCPU board itself remain lit.

If the primary test is successful, the secondary tests are performed on the Ethernet Controller. On servers with an EC/1, the ESB board is tested first. Any failure in the ESB board's RAM area causes further testing to abort, since the RAM is used to store status information; if any failure other than RAM failure is detected, testing continues. Both types of failure cause the self-test LEDs on the ESB board and on the front panel to remain lit.

When all tests on the ESB board are completed, the ETI board is tested. If any failure is detected, the self-test LEDs on the ETI board and on the front panel remain lit. Testing continues on all SIO boards present in the system; as with the other boards, failure causes the self-test LEDs on the SIO board and on the front panel to remain lit.

On servers with an EC/2, a failure in the checksum PROM and RAM tests aborts further testing.

If a console terminal is present during the power-on diagnostic tests, error messages and test results print on the terminal, if possible. When a secondary test fails, the monitor retains control of the system and waits for further commands. If this occurs, contact Bridge Communications, Inc., or an authorized service representative.

When all the tests are completed, the system is ready to be booted. Refer to Appendix B for a description of the bootstrap procedure.

The self-test diagnostics check most of the server hardware functionality. A more complete diagnostic package, called the Installation Support Tool Kit (CS/1-INTK), is available as an option from Bridge Communications, Inc.

The following sections describe the diagnostics for the individual boards. Section A.6 lists the status and error messages associated with each board.

A.1 MCPU Board Diagnostics

The MCPU contains two diagnostic LEDs, labeled SELF TEST and HALT. (Figure 5-5 in Section 5.2 illustrates the positions of the LEDs on the board.) The self-test LED lights at power-on and reset to indicate that the self-test diagnostics are running. The LED turns off when the diagnostics complete successfully (10 to 12 seconds, depending on the amount of memory on and the speed of the board). If the LED fails to light at all, or if it remains lit longer than 12 seconds, the board should be replaced.

The halt LED lights at power-on and reset or when the microprocessor is in a halt state. If the failure that caused the halt LED to light is in the software, pressing the Reset switch on the front panel may clear the problem. If the halt LED remains lit after a system reset, or if it lights frequently during normal operation, a malfunction is indicated; contact Bridge Communications, Inc., or an authorized service representative.

Table A-1 lists the MCPU self-tests. If an error is encountered in tests 1 through f, further testing is aborted; an error message is sent to the console terminal, if possible. Refer to Section A.6 for a list of the status and error messages associated with the MCPU self-tests.

Table A-1 MCPU Self-tests

Test Number	*Test Name*
1	Prom low byte checksum
2	Prom high byte checksum
3-7	9513 5-channel counter
8	Onboard data bus ripple
9	Onboard address bus ripple
a-c	Onboard RAM march
d-f	Onboard RAM refresh
10-11	9513 interrupts
12	Multibus timeout
13-14	Offboard data bus ripple
17-18	Offboard address bus ripple

A.2 EC/1 Diagnostics

The EC/1 is made up of the ESB and ETI boards. Both boards are tested but all testing information is stored on the ESB. The ESB runs its own tests first. The failure of an ESB RAM test halts further testing. Once the ESB tests complete successfully, the ESB starts the ETI tests.

Table A-2 lists the EC/1 self-tests. The ESB runs all of the tests; the ETI runs tests 13 through 1c only. Refer to Section A.6 for a list of the status and error messages associated with the EC/1 self-tests.

Table A-2 EC/1 Self-tests

Test Number	*Test Name*
1	Prom low byte checksum
2	Prom high byte checksum
3-7	9513 5-channel counter
8	Onboard data bus ripple
9	Onboard address bus ripple
a	Onboard RAM march
b	Onboard RAM refresh
c	Level 0 input check
d	Level 1 interrupt check
e-11	9513 interrupts
12	Channel attention interrupt
13	Loopback short packet good CRC
14	Loopback short packet bad CRC
15	Address recognition good CRC
16	Address recognition bad CRC
17	Address mismatch
18	Broadcast recognition
19	Transmit timeout
1a	Transmit 6 fragments good CRC
1b	Transmit reload pointer interrupt
1c	Transmit odd length packet

A.2.1 ESB Board

The ESB board contains a self-test LED, labeled S.TEST, which lights at power-on or reset to indicate that the self-test diagnostics are being performed. The LED turns off when the diagnostics complete successfully (this takes approximately three seconds). If the LED fails to light at all during power-on, or if it remains lit for longer than three seconds, the board should be replaced.

The ESB board contains another LED, labeled HALT, which lights at power-on and reset or when the microprocessor is in a halt state. If the failure that caused the halt LED to light is in the software, pressing the Reset switch on the front panel may clear the problem. If the halt LED remains on after a system reset, or if it lights frequently during normal operation, a malfunction is indicated; contact Bridge Communications, Inc., or an authorized service representative.

Refer to Figure 5-2 in Section 5.2 for the positions of the diagnostic LEDs on the ESB board.

A.2.2 ETI Board

The ETI board contains a self-test LED, labeled S.TEST, which lights at power-on and reset to indicate that the self-test diagnostics are being performed. The LED turns off when the diagnostics complete successfully (this takes approximately three seconds). If the LED fails to light at all during power-on, or if it remains lit longer than three seconds, the board may be faulty.

A faulty transceiver connection can cause the ETI board to fail the self-test diagnostics. To determine the cause of the failure, power off the server, disconnect the transceiver cable, then power on the server. If the ETI board still fails, the board itself is at fault.

Refer to Figure 5-3 in Section 5.2 for the position of the LED on the ETI board.

A.3 EC/2 Diagnostics

The EC/2 contains six LEDs: one HALT LED and five self-test LEDs (labeled A through E). At power-on, all the LEDs are turned on. Then, as the EC/2 runs its 18 self-tests, the LEDs corresponding to the number of the test being run light. If no errors are encountered, the LEDs are turned off.

The halt LED lights at power-on and reset or when the microprocessor is in a halt state. If the failure that caused the halt LED to light is in the software, pressing the Reset switch on the front panel may clear the problem. If the halt LED remains on after a system reset, or if it lights frequently during normal operation, a malfunction is indicated; contact Bridge Communications, Inc., or an authorized service representative.

Refer to Figure 5-4 in Section 5.2 for the positions of the LEDs on the EC/2 board.

Table A-3 lists the EC/2 self-tests. Refer to Section A.6 for a list of status and error messages associated with the EC/2 self-tests.

Table A-3 EC/2 Self-Tests

Test Number	*Test Name*
1	PROM Low Byte Checksum
2	PROM High Byte Checksum
3-5	8253 Three-Channel Timer Test
6	On-board Data Bus Ripple Test
7	On-board Address Bus Ripple Test
8	On-board RAM March Test
9	On-board RAM Refresh Test
a	8253 Timer Generated Interrupt
b	Channel Attention Generated Interrupt Test
c	Test and Set Check of Lock
d	Lance Initialization Test
e	Lance Single Fragment Transmission Test
f	Lance Transmission and Reception of a Single Fragment Test
10	Lance Transmission and Reception with Odd Length Test
11	Lance Transmission and Reception without CRC Error Test
12	Lance Transmission and Reception with CRC Error Test

A.4 SIO Board Diagnostics

This section describes the SIO board diagnostics. A discussion of the SIO-16 board diagnostics is provided in Section A.5.

Each eight-port SIO board contains two diagnostic LEDs, labeled SELFTEST and HALT. Figure 5-6 in Section 5.2 illustrates the positions of the LEDs. The self-test LED lights at power-on and reset to indicate that the self-test diagnostics are being performed. The LED turns off when the diagnostics complete successfully (approximately 10 seconds). If the LED fails to light at all during power-on, or if it remains lit longer than 10 seconds, the board should be replaced.

The halt LED lights during reset and when the microprocessor is in a halt state. If the failure that caused the halt LED to light is in the software, pressing the Reset switch on the front panel may clear the problem. If the halt LED remains on after a system reset, or if it lights frequently during normal operation, a malfunction is indicated; contact Bridge Communications, Inc., or an authorized service representative.

Table A-4 lists the SIO self-tests. Refer to Section A.6 for a list of status and error messages associated with the SIO self-tests.

Table A-4 SIO Self-tests for SIO*

Test Number	*Test Name*
1	Prom low byte checksum
2	Prom high byte checksum
3	Onboard data bus ripple
4	Onboard address bus ripple
5	Onboard RAM march
6	Onboard RAM address pattern
7-b	9513 5-channel counter
c-10	9513 5-channel counter
11-12	9513 timer interrupts
13	Channel attention interrupt
14-15	Serial controller
16-17	Serial controller
18-19	Serial controller
1a-1b	Serial controller
1c-1d	Serial controller
1e-1f	Serial controller
20-21	Serial controller
22-23	Serial controller
24-25	Serial controller
26-27	Serial controller
28-29	Serial controller
2a-2b	Serial controller
2c	Multibus timeout test
2d-2e	Offboard data bus ripple
31-32	Offboard address bus ripple

* Except SIO-16; SIO-16 self-tests are listed in Table A-5

Figure A-1 in Section A.6 shows a sample screen of messages following the power-on diagnostics for the Series/1 server. The diagnostics displayed in the figure were run on a server with an EC/2, one SIO board, one SIO-16 board, and no internal disk drive.

A.5 SIO-16 Board Diagnostics

The SIO-16 board contains one LED, labeled CR1. This LED lights to indicate that the microprocessor is in a halt state and ready to download code to the SIO-16 board's RAM area. The LED also lights when the server is initialized or reset. The LED is unlit when the microprocessor is running. Figure 5-7 in Section 5.2 illustrates the position of this LED.

The SIO-16 board self-test diagnostics download and run automatically at power on, with no external LEDs or other indicators. If a console terminal is present during the power-on diagnostic tests, error messages and test results print on the terminal, if possible.

Table A-5 lists the SIO-16 self-tests; Section A.6 describes the status and error messages associated with each test.

Table A-5 SIO-16 Self-tests

Test Number	*Test Name*
1	Onboard data bus ripple
2	Onboard address bus ripple
3	Onboard RAM march
4	8253 timer interrupts, counter 1
5	8253 timer interrupts, counter 0
6-7	Serial controller
8-9	Serial controller
a-b	Serial controller
c-d	Serial controller
e-f	Serial controller
10-11	Serial controller
12-13	Serial controller
14-15	Serial controller
16-17	Serial controller
18-19	Serial controller
1a-1b	Serial controller
1c-1d	Serial controller
1e-1f	Serial controller
20-21	Serial controller
22-23	Serial controller
24-25	Serial controller
26	Offboard data bus ripple
27	Offboard address bus ripple
28	Channel Attention interrupt

Figure A-1 in Section A.6 shows a sample screen of messages following the power-on diagnostics for the Series/1 server. The diagnostics displayed in the figure were run on a server with an EC/2, one SIO board, one SIO-16 board, and no internal disk drive.

A.6 Messages

If a console terminal is attached to a Series/1 server, status and error messages generated by the power-on self-tests are sent to the terminal, if possible.

```
Bridge Communications MCPU Monitor
>
```

This message and prompt appear when the self-tests have completed. Control returns to the MCPU monitor.

```
EC - Failed Test # x
```

This message is displayed if an error is encountered in test x.

In servers with an EC/2, the test number is encoded in binary on the five self-test LEDs. For example, if test 10 fails, LED A lights, corresponding to binary number 10000.

```
EC - not present
```

This message appears if the Ethernet Controller does not respond to a Multibus memory access. Control returns to the MCPU monitor.

```
EC - Passed Station Address -.br
        xxxxxxxxxxxx M0 EDL1 rev. xxy (EC/1)
EC - Passed Station Address -.br
        xxxxxxxxxxxx M0 EDL2 rev. xxy (EC/2)
```

This message appears if no errors are encountered in the Ethernet Controller tests.

```
EC - timed out
```

This message appears if the Ethernet Controller is present but does not respond to a status request. Control returns to the MCPU monitor.

```
Floppy Controller not present
```

This message appears if the system has no internal disk drive.

```
MCPU - Failed Test # x
```

This message is displayed if an error is encountered in test x.

```
MCPU - Passed M1 MMON rev. xxy
```

This message appears if no errors are encountered in the MCPU self-tests.

```
Series/1 Power-up
```

This message appears when the MCPU board enters the test sequence, and stays on the screen whether the tests terminate or fail.

```
SIO <n> - Passed Mx aaaa rev. xxy
```

This message appears if no errors are encountered in the SIO self-tests.

```
SIO <n> - Failed Test # x
```

This message appears if an error is encountered in test x.

```
SIO <n> - not present
```

This message appears if any of the possible SIO boards fails to respond to a Multibus request. Control returns to the MCPU monitor. This message indicates an error only if an SIO board is actually in place in the slot indicated in the message.

```
SIO <n> - timed out
```

This message appears if SIO boards are present, but do not respond to a status request. Control returns to the MCPU monitor.

Figure A-1 shows a sample screen of messages following the power-on diagnostics. The diagnostics were run on a server with an EC/1, one SIO board, and no internal disk drive.

```
Series 1 Power-up
MCPU - Passed M1 MMON rev. 01D
EC2 - Passed Station Address - 080002003113 M0 EDL2 rev. 00A
SIO # 1 - Passed M0 ASYN rev.17B
SIO # 2 - Present MR ASYN
SIO # 3 - Not Present
SIO # 4 - Not Present

Floppy Controller not present

Bridge Communications MCPU Monitor
>
```

Figure A-1 Sample Power-on Diagnostics Messages

APPENDIX B

BOOTSTRAP PROCEDURE

The Series/1 servers running XNS protocols offer three bootstrap options: automatic bootstrap, floppy bootstrap, and network bootstrap. Series/1 servers running TCP/IP protocols support network bootstrap from an NCS/150, but do not support the option from an NCS/1.

The option is selected by the Bootstrap Option shorting plug positions on the MCPU board (refer to Section 5.2.4). The procedure is affected by the presence or absence of a console terminal and by the version of the MCPU firmware. Firmware designated Release 9 or earlier does not support network bootstrap.

1. Automatic Bootstrap

   The server first checks for the presence of a terminal attached to the console port.

   - If no console terminal is attached, the server checks for the presence of a diskette in the disk drive. If a diskette is present, the server performs a floppy bootstrap (option 2). If no drive or diskette is present and if the MCPU firmware is designated M1 MMON 01B or later, the server performs a network bootstrap (option 3). If the network bootstrap request fails, the Self Test LED on the front panel begins flashing.

   - If a console terminal is attached, the server branches into the MCPU monitor and prints an angle-bracket prompt (>) on the console.

     To specify floppy bootstrap, enter the command:

     ```
     bt [<filename>]
     ```

     where "filename" is an optional file specification. The filename must be a single numeric character (i.e., 0 through 9). If a filename is specified, the server attempts to boot from the specified file. If no filename is entered, the server boots from the default bootfile (file 0). If no drive or diskette is present, or if the file is not found, an error message appears on the console and the monitor retains control of the server.

     To specify network bootstrap, enter the command:

     ```
     bt <filename>
     ```

     where "filename" is a bootfile on the NCS's disk. If no filename is specified, the server attempts to boot from file 0 on an internal disk drive. If no drive or diskette is present or file 0 is not found, an error message appears on the console and the monitor retains control of the server. A valid NCS bootfile name can contain up to 14 characters, the first of which cannot be a number. If the specified NCS disk file is not found, or if no NCS in the network is operational, an error message appears on the console and the monitor retains control of the server.

2. Floppy Bootstrap

   If the configurations specify floppy bootstrap, the server does not check for the presence or absence of the console terminal, but boots directly from the default bootfile on the local diskette. If a console terminal is attached and either no diskette is present or no bootfile is found, an error message appears on the terminal and the monitor retains control of the server. If no terminal is attached and either no diskette is present or no bootfile is found, the Self Test LED on the front panel begins blinking.

3. Network Bootstrap

   Network bootstrap is supported by MCPU firmware M1 MMON 01B or later.

   When a server is powered on or reset with network bootstrap selected, it broadcasts a primary boot request over the network, asking for bootstrap from its primary NCS. (Primary and secondary NCSs are discussed in detail in references [7] and [8].) Each primary NCS on the network responds to this request by comparing the network address of the server issuing the request with the network addresses of its client servers.

   If the server is listed as a client of the primary NCS, that NCS sends the server the Connection Service software and the configuration tables established for the server's ports.

   If the client server receives no answer to its first request within ten seconds, it repeats the primary boot request up to six times.

   If the client server receives no answer to any of its primary boot requests, it broadcasts a secondary boot request to ask for bootstrap from its secondary NCS. If the client server's files have been backed up to the secondary NCS, the secondary NCS sends the server the Connection Service software and the configuration tables established for the server's ports.

   If the server does not get a response to the boot requests and no console terminal is attached, the Self Test LED on the front panel begins flashing. If the server does not get a response to its boot requests and a console terminal is attached, an error message appears on the console and the monitor retains control of the server. If a console terminal is attached and the bootstrap software is received from the network, the server displays a series of periods on the terminal screen during bootstrap.

All of these options may also be affected by the setting of the Automatic Reboot option configuration areas on the MCPU board (see Section 5.2.4). If this setting enables the auto reboot feature, and any boot attempt fails, the server displays an error message on the console (if present) and then automatically restarts, performs the self-test diagnostics, and tries to perform the bootstrap operation again. This cycle continues indefinitely until the server boots successfully or is powered off.

If the bootstrap procedure is successful, the Series/1 server is operational and ready to be used to configure user device ports or to establish network connections.

If the bootstrap procedure is performed without a console terminal, and a terminal is subsequently attached, the system immediately branches into the monitor. During normal operation, no console terminal should be attached; this port is used only for system generation and for custom software development.

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