Publication No. 048R138-000
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OPERATING AND INSTALLATION INSTRUCTIONS
FOR

DataComm 551 INTELLIGENT CHANNEL SERVICE UNIT

General DataComm, Inc.
MIDDLEBURY, CONNECTICUT
06762-1299

ATTENTION!
STATIC SENSITIVE DEVICES

PROPER HANDLING AND GROUNDING PRECAUTIONS REQUIRED

This equipment contains electrostatic sensitive devices. Use ESD pre-cautionary procedures when removing or inserting parts or printed circuit (pc) cards. Keep parts and pc cards in their antistatic packaging material until ready to install.

The use of an antistatic wrist strap, connected to the grounded equipment frame or chassis, is recommended when handling pc cards during installation, removal, or setting of on-board option switches. Do not use a conductive tool, such as a screwdriver or paper clip, to set the position of the option switches.

INSTALLATION SAFETY INSTRUCTIONS

a. Never install telephone wiring during a lightning storm.

b. Never install telephone jacks in a wet location unless the jack is specifically

c. designed for wet locations.

d. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.

e. Use caution when installing or modifying telephone lines.

CAUTION

Potentially hazardous voltages exist within this unit.

DataComm 551 INTELLIGENT CHANNEL SERVICE UNIT

(GDC PART NOS. 048A018-001 and 048P037-001)

APPLICABILITY

This manual applies only to assembly-level Revision (P) and LATER DataComm 551 pc cards. (The information regarding the Transcoding and Unframed Mode options applies only to assembly-level Revision (Y) and LATER DataComm 551 pc cards.)

Use Publication No. 048R137-800 only for Revision (N) and EARLIER pc cards.

This product was designed and manufactured by

General DataComm, Inc. (GDC)
Middlebury, Connecticut 06762-1299

WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction 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 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.

CAUTION

To Reduce the Risk of Electrical Shock, Do Not Remove the Cover.
Refer Servicing to Qualified Service Personnel.

ACHTUNG

Um einen elektrischen Schlag zu vermeiden, nicht das Gehäuse öffnen! Änderungen und Reparaturen dürfen nur von qualifizierten Personen auageführt werden.

CRC-REQUIRED NOTIFICATION

This equipment is a Class A digital apparatus which complies with the Radio Interference Regulations, CRC c.1374.

PUBLICATION NOTICE

This manual has been carefully compiled and checked for accuracy. The info-mation in this manual does not constitute a warranty of performance. Furthermore, GDC reserves the right to revise this publication and make changes from time to time in the content thereof. GDC assumes no liability for losses incurred as a result of out-of-date or incorrect information contained in this manual.

READER'S COMMENTS

Comments regarding this manual should be addressed to:

Publications Department
General DataComm, Inc.
1579 Straits Turnpike
P.O Box 1299
Middlebury, CT 06762-1299

PROPRIETARY NOTICE

Country code configurations/default group selectable data equip. U.S. Patent No. 4841561.

FCC-REQUIRED NOTIFICATION

FOR USERS OF FCC-REGISTERED EQUIPMENT

Read before using this technical manual or installing subject equipment.

This equipment complies with Part 68 of the Federal Communications Commission (FCC) Rules and Regulations. Connection of data communication equipment to the public telephone network is regulated by the FCC Rules and Regulations. These regulations require:

A. To connect the DC 551 to the Public Telephone Network you are required to give the Telephone Company the following information.

   1. The FCC Registration Number which is AG6 97J-60491-DE-N.

   2. The FIC (Facility Interface Code) which is 04DU9-B and or 04DU9-C.

   3. The SOC (Service Order Code) which is 6.0F.

   4. The Telephone Company jack type which is RJ48C.

B. If you experience trouble, disconnect the equipment from the telephone line to determine if the equipment is malfunctioning. If it is, remain disconnected until the problem is corrected. Should this equipment cause harm to the telephone network, the telephone company may discontinue your service temporarily. If possible they will notify you in advance. But if advance notice is not practical, you will be notified as soon as possible. You will be informed of your right to file a complaint with the FCC.

C. The telephone company may change its communication facilities, equipment, operations, and procedures where reasonably required for operation. If this occurs, the telephone company will notify you in writing.

D. It is the user's obligation to notify the telephone company prior to disconnecting equipment from 1.544 Mbps digital service.

E. According to Part 68 of the FCC Rules and Regulations, customers are not authorized to repair or modify this equipment. Any repair or modification will null and void the FCC registration and the warranty of this equipment.

Rev. 3, January 1992

CANADIAN DEPARTMENT OF COMMUNICATIONS (DOC) REQUIRED NOTIFICATION

FOR USERS OF DOC-CERTIFIED EQUIPMENT

Read before using this technical manual or installing subject equipment.

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

CANADIAN EMISSIONS REQUIREMENTS

"This digital apparatus does not exceed the (ClassA) limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications."

AFFIDAVIT FOR THE CONNECTION OF CUSTOMER PREMISES EQUIPMENT TO 1.544 Mbps AND/OR SUBRATE DIGITAL SERVICES

For work to be performed in the certified territory of

(Telco's Name)

State of:

County of:

I, ,
(Name) Business Address

representing ,
(Name of Customer)

being duly sworn, state:
(Telephone Number)

I have the responsibility for the operation and maintenance of the terminal equipment to be connected to 1.544 Mbps and/or subrate digital services. The terminal equipment to be connected complies with Part 68 of the Commission's rules except for the encoded analog content and billing protection specifications. With respect to encoded analog content and billing protection:

- ❑ I attest that all operations associated with the establishment, maintenance and adjustment of the digital CPE with respect to encoded analog content and encoded billing information continuously complies with Part 68 of FCC's Rules and Regulations.

- ❑ The digital CPE does not transmit digital signals containing encoded analog content or billing information which is intended to be decoded within the telecommunications network.

- ❑ The encoded analog and billing protection is factory set and is not under the control of the customer.

I attest that the operator(s)/maintainer(s) of the digital CPE responsible for the establishment, maintenance and adjustment of the encoded analog content and billing information has (have) been trained to perform these functions by successfully completing one of the following: (Check appropriate one(s)).

a. A training course provided by the manufacturer/grantee of the equipment used to encode analog signals

b. A training course provided by the customer or authorized representative, using training materials and instructions provided by the manufacturer/ grantee of the equipment used to encode analog signals

c. An independent training course (e.g., trade school or technical institution) recognized by the manufacturer/grantee of the equipment used to encode analog signals

d. In lieu of the preceeding training requirements, the operator(s)/maintainer(s) is (are) under the control of a supervisor trained in accordance with above.
(Circle One)

I agree to provide with proper documentation
(Telco's Name)
to demonstrate compliance with the information as provided in the preceding para-graph, if so requested.

(Signature)

(Title)

(Date)

Subscribed and Sworn to before me

this day of 19 .

Notary Public

My Commission expires:

READER SURVEY

Help us to produce a better manual by returning this page with your comments.

Name of Manual _____ Publication No. _____ Issue No. ___

Overall rating of this manual	☐ Excellent	☐ Good	☐ Adequate	☐ Poor
Readability of text	☐ Very clear	☐ Good	☐ Adequate	☐ Poor
Installation Instructions	☐ Very clear	☐ Good	☐ Adequate	☐ Poor
Usefulness of graphics	☐ Useful	☐ Good	☐ Adequate	☐ Poor
Is this manual User Friendly?	☐ Yes	☐ Partly	☐ No	
Did you find any errors?	☐ Yes	☐ No		

If so, describe (List page No.) _____
_____
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Do you recommend additions/changes? ☐ Yes ☐ No

If so, describe _____
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Any additional comments? _____
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Name _____Title _____ Date_____

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Middlebury, Ct 06762-1299

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SECTION 1

INTRODUCTION

DataComm 551 FEATURES

- Auto Framing adapts the DataComm 551 automatically to Extended Superframe Format (ESF) or D4 Superframe Format on both the customer equipment and the network sides
- Supports both Alternate Mark Inversion (AMI) and Bipolar with 8 Zero Substitution (B8ZS) line codes, and allows a variety of options for ones density in the data stream
- Supports both AT&T PUB 54016 and Bellcore TR-TSY-000194 (ANSI) procedures for the collection and monitoring (via the Supervisory terminal) of the network TABS Maintenance Messages and Performance Report Messages provided by the Central Office
- Provides two independent register sets for TABS performance data so that the user set is unaffected when the Central Office clears the network set
- Link-level (DS1) and channel-level (DS0) diagnostics provide extensive diagnostic capabilities
- Supervisory terminal provides software-control of configuration, diagnostics, and maintenance
- Supports GDC's PMC-100 Performance Monitor Card for enhanced, centralized network control

DESCRIPTION

The DataComm 551 Intelligent Channel Service Unit (CSU) provides the interface between the customer's 1.544 Mbps T1 equipment (e.g., one of GDC's MEGASWITCH®, MEGAMUX®, or MEGAMUX PLUS multiplexers) and the T1 digital carrier facility provided by the Telco or other carrier. The DataComm 551 provides the normal CSU functions of network interfacing and protection, as well as a host of other flexible and powerful features, including:

- The DataComm 551 can be pre-equalized for line lengths of up to 655 feet (199.6 m) on the customer equipment side.
- The DataComm 551 can perform automatic Line Build-Out (signal attenuation) of 0, 7.5 , or 15 dB at 772KHz on the network side.

- The DataComm 551 detects both network- and customer equipment-generated errors and alarms, stores the number of occurrences of each, and transmits the appropriate alarms to both ends.
- The DataComm 551 transmits a keep alive signal to the network when it detects a loss of signal from the customer equipment side.
- The DataComm 551 can perform a variety of loopbacks and other tests.
- The DataComm 551 can provide power to the T1 span (in DataComm FourPak, GDC TriPak, and Universal System Shelf installations, using a Telco-provided current source)
- The DataComm 551 can can be configured as a slave CSU, limiting the configuration changes and diagnostics available via the Supervisory terminal. This prevents actions which could disrupt service.

The DataComm 551 can be mounted in the following housings:

- Standalone single-slot DataComm Enclosure (model DE-7)
- Standalone four-slot DataComm FourPak Enclosure (model DFP-11)
- Rack-mountable sixteen-slot DataComm Modem Shelf (models DS-1, DS-5R, and DS-5NR)
- Rack-mountable three-slot GDC TriPak Shelf (models TPS-1 and TPS-2)
- Rack-mountable four-slot Universal System Shelf backplane (models USS-1D, USS-1-DC/R, and USS-1-DC/NR)

  (All rack-mountable housings fit into 19- and 23-inch wide equipment racks.)

Table 1-1 shows which related products can be installed with the DataComm 551 in these housings.

DIAGNOSTICS

The DataComm 551 offers the following link-level (DS1) diagnostics:

- Alarm counts display
- ANSI Payload Loopback (PLB)
- AT&T DTE Loopback (DLB)
- AT&T TABS Maintenance Message Protocol support
- Bellcore Performance Report Messages support
- DS1 End-to-End Self-Test
- DS1 Line Loop

TABLE 1-1. HOUSINGS FOR DataComm 551 AND RELATED PRODUCTS

Product	Housing				
	DE-7	DFP-11	DS-1 DS-5R DS-5NR	TPS-1 TPS-2	USS-1D USS-1-DC/R USS-1 DC/NR
DataComm 551 CSU	√	√	√	√	√
DataComm 552 DSU	√	√	√	√	√
PMC-100 Performance Monitor Card		√			√
DataComm 596 Modem		√	√	√	√

- DS1 Local Test (LT)
- DS1 Local Test with Self-Test
- DS1 Network Interface Loopback
- DS1 Network Interface Loopback with Self-Test
- DS1 Remote Test (RT)
- DS1 Remote Test with Self-Test
- DS1 Test Loop

It also offers the following channel-level (DS0) diagnostics:

- DS0 Circuit Delay Measurement Test
- DS0 End-to-End Self-Test
- DS0 Remote Test
- DS0 Remote Test with Self-Test

The DataComm 551 also allows the user to set the time and date, display the firmware revision level, and reset the CSU.

Note that some of these functions require the use of the Supervisory terminal. Refer to Supervisory Terminal Operating Procedures in Section 3 for further discussion.

Part numbers for the DataComm 551 are listed in Table 1-2.

APPLICATIONS

The DataComm 551 is used in pairs in a point-to-point data network over a T1 link, with one CSU on each end providing the interface between the T1-compatible customer equipment and the T1 link.

TABLE 1-2. EQUIPMENT LIST

Description	GDC Part No.
GDC DataComm 551 Intelligent CSU, standalone single-slot enclosure model DE-7, 117 V ac	048A018-001
GDC DataComm 551 Intelligent CSU, rackmount pc card	048P037-001
Mounting Enclosures and Shelves	
DataComm FourPak Enclosure model DFP-11, standalone, 117 V ac	010B115-001
DataComm Modem Shelf, rackmount	
Model DS-1, 117 V ac	010B015-001
Model DS-5R, dc-powered with redundant power supplies	010M011-001
Model DS-5NR, dc-powered with non-redundant power supply	010M011-002
GDC TriPak Shelf, rackmount	
Model TPS-1, 117 V ac	010B124-001
Model TPS-2, 48 V dc	010B125-001
Universal System Shelf, rackmount	
Model USS-1D, 117 V ac	010B080-001
Model USS-1-DC/R, dc-powered with redundant power supplies	010M040-002
Model USS-1-DC/NR, dc-powered with non-redundant power supply	010M040-001
CSU-551 Backplane (for Universal System Shelf installation)	048B015-001
Cables	
Customer Equipment Cables	
Adapter cable, DB25P male (with screws) to DB15S female (with slidelock posts) (CSU to customer equipment; use when replacing GDC 551A/S1 CSU) (1 foot)	027H230-005
Adapter cable, DB25P male to DB15S female (CSU to customer equipment with DB15P male connector) (3 feet)	027H324-002
Interface cable, DB25P male to DB25P male (CSU to customer equipment with DB25S female connector) (3- to 100-ft lengths)	027H227-XXX
Front Panel Cables	
Bantam-to-WECO 310 Adapter Plug	209-026-S001
Front panel access test jack patch cable (male-to-male) (24- and 60-inch lengths)	830-005-XXX
Front panel access test jack patch cable Bantam-to-WECO 310 (4 feet)	830-021-S001
Network Cables	
Adapter cable, RJ48C plug to DB15P male (with slidelock posts) (CSU to local exchange carrier; use when replacing GDC 551A/S1 CSU) (1 foot)	022H022-010
Interface cable, RJ48 to RJ48 (CSU to local exchange carrier) (10- to 50-ft lengths)	022H024-XXX
Interface cable, RJ48 to terminal lugs (CSU to local exchange carrier) (10- to 50-ft lengths)	022H021-XXX
Network Cables (DataComm Modem Shelf only)	
Adapter cable, RJ48C plug-to-plug (CSU to local exchange carrier for a DataComm Modem Shelf housing only; use with coupler 209-038-002)	027H242-X04
Coupler, RJ48C jack-to-jack (use with adapter cable 027H242-X04)	209-038-002
Interface cable, RJ48C plug-to-terminal lugs (CSU to local exchange carrier for a DataComm Modem Shelf housing only) (10- to 50-foot lengths)	022H025-XXX
Supervisory Terminal Cables	
Interface cable (PMC-100 to Supervisory terminal or DataComm 551) (2- to 100-ft lengths)	028H511-XXX
Interface cable (Supervisory terminal to DataComm 551) (1- to 25-ft lengths)	028H507-XXX

TABLE 1-2. EQUIPMENT LIST (Cont.)

Description	GDC Part No.
Optional Equipment	
Supervisory terminal (customer-provided)	n/a
Modem (customer-provided)	n/a
PMC-100 Performance Monitor Card	048P038-001
60 mA dc constant current source for providing span power (Telco-provided)	n/a
Applicable Instruction Manuals	
Instruction Manual for GDC TriPak Shelf	010R355-000
Instruction Manual for 10 1/2-Inch DataComm Modem Shelf Model DS-1	010R310-000
Instruction Manual for 10 1/2-Inch DataComm Modem Shelf Model DS-5	010R340-000
Instruction Manual for Universal System Shelf Models USS-1D, -1E, -1J, -1U, -1H	010R380-000
Instruction Manual for Universal System Shelf DC-to-DC Models USS-1-DC/NR, -DC/R	010R385-000
Operating and Installation Instructions for PMC-100 Performance Monitor Card	048R139-000

One Supervisory terminal is typically co-located with each CSU and used only with that CSU, as shown in Figure 1-1. However, a single Supervisory terminal in a remote service center, for example, can be used to access both CSUs by utilizing modems, as shown in Figure 1-2.

To centralize and enhance network control, install PMC-100 Performance Monitor Cards. The PMC-100s provide Supervisory terminal access to any DataComm 551 in the network, using a single multiplexer channel on each T1 link for primary intercommunication. And to allow terminal access in the event of a T1 link failure, install modems such as GDC's DataComm 596 Modem for dial backup, as shown in Figure 1-3. Figure 1-4 illustrates a small network and a terminal utilizing modems for remote access, while Figure 1-5 illustrates a larger network. The PMC-100 also, on request, polls each DataComm 551 in the network for its alarm status and displays this on the Supervisory terminal.

For other PMC-100 applications in a DataComm 551 network, and additional PMC-100 information, refer to Publication No. 048R139-000.

BACKWARD COMPATIBILITY

This manual applies only to assembly-level Revision (P) and LATER DataComm 551 pc cards. You must use Publication No. 048R137-800 for Revision (N) and EARLIER pc cards. However, the newer DataComm 551 is backward-compatible with the older version, so you can install it in your existing system.

The major improvement is PMC-100 support, eliminating the need for using MAU-1As and fallback switches for Supervisory terminal communications. When replacing an older DataComm 551 with a newer one, refer to this manual for options settings, but refer to Publication No. 048R137-800 for detailed discussion of these devices.

Other improvements include the addition of DS0 diagnostics and the DS1 Network Interface Loopback, but these do not affect an existing installation.

The information regarding the Transcoding and Unframed Mode options applies only to assembly-level Revision (Y) and LATER DataComm 551 pc cards.

SERVICE AND TRAINING

Refer to Section 4 for information on service and training available from GDC.

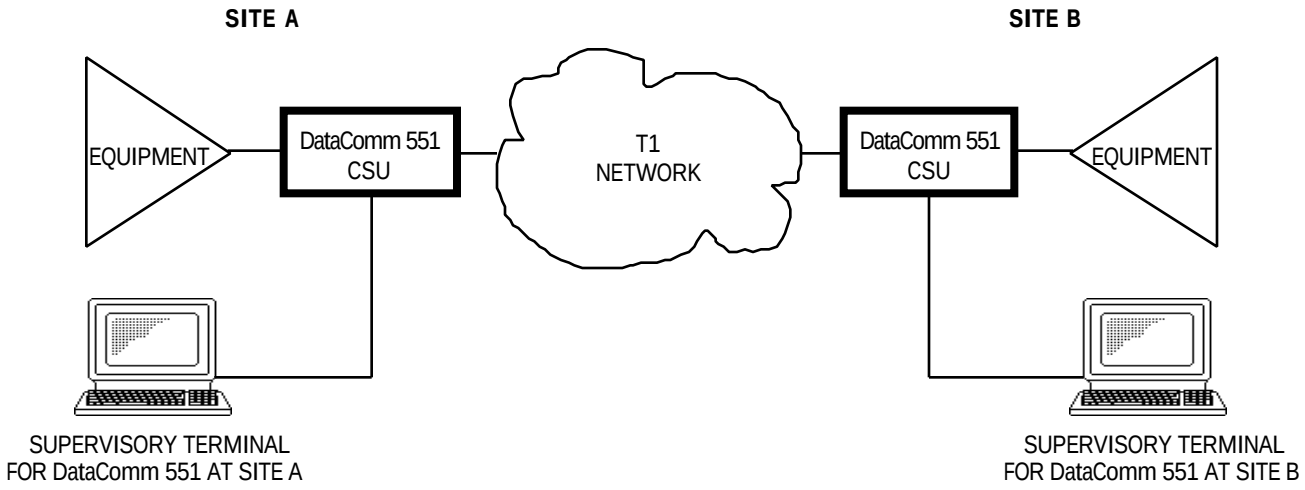


FIGURE 1-1. TYPICAL NETWORK, LOCAL TERMINAL CONTROL

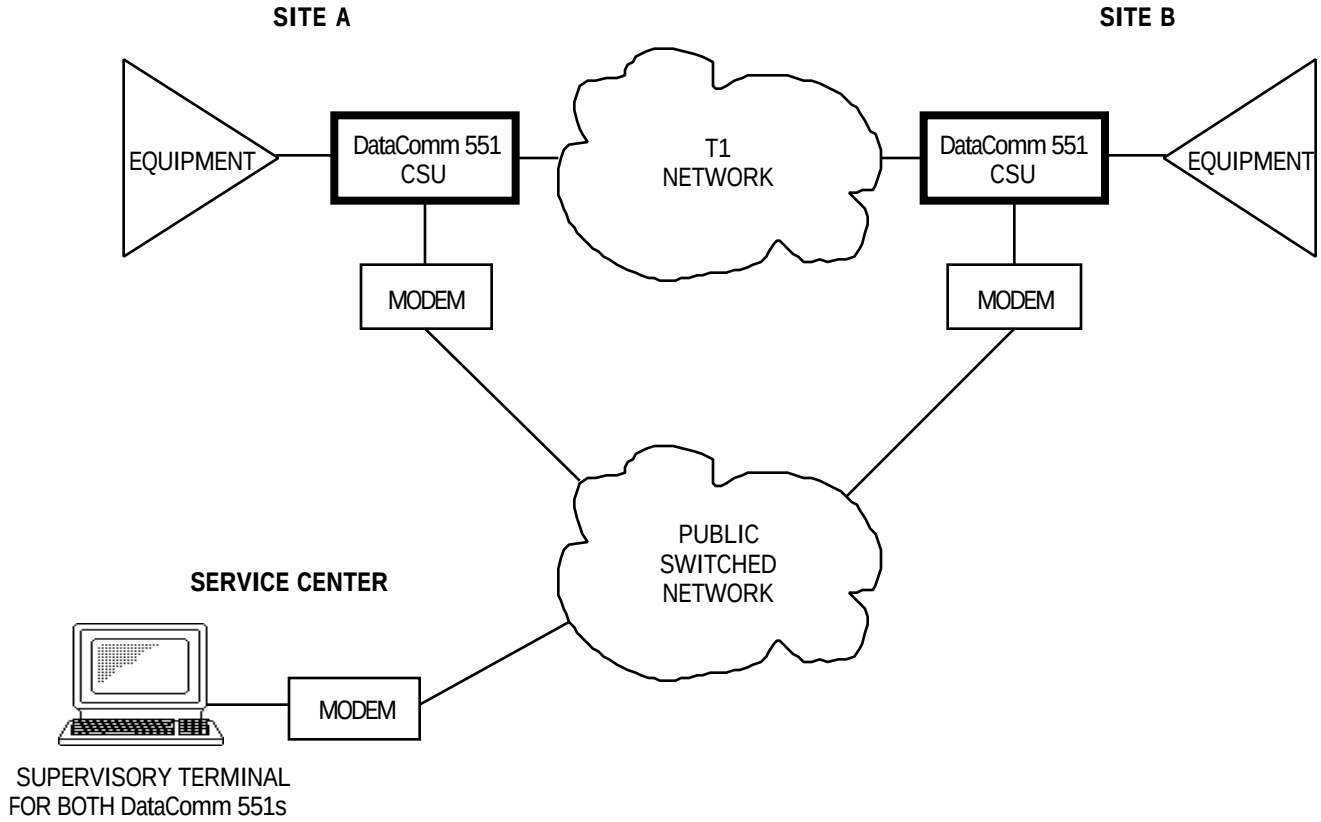


FIGURE 1-2. TYPICAL NETWORK, REMOTE TERMINAL CONTROL USING MODEMS

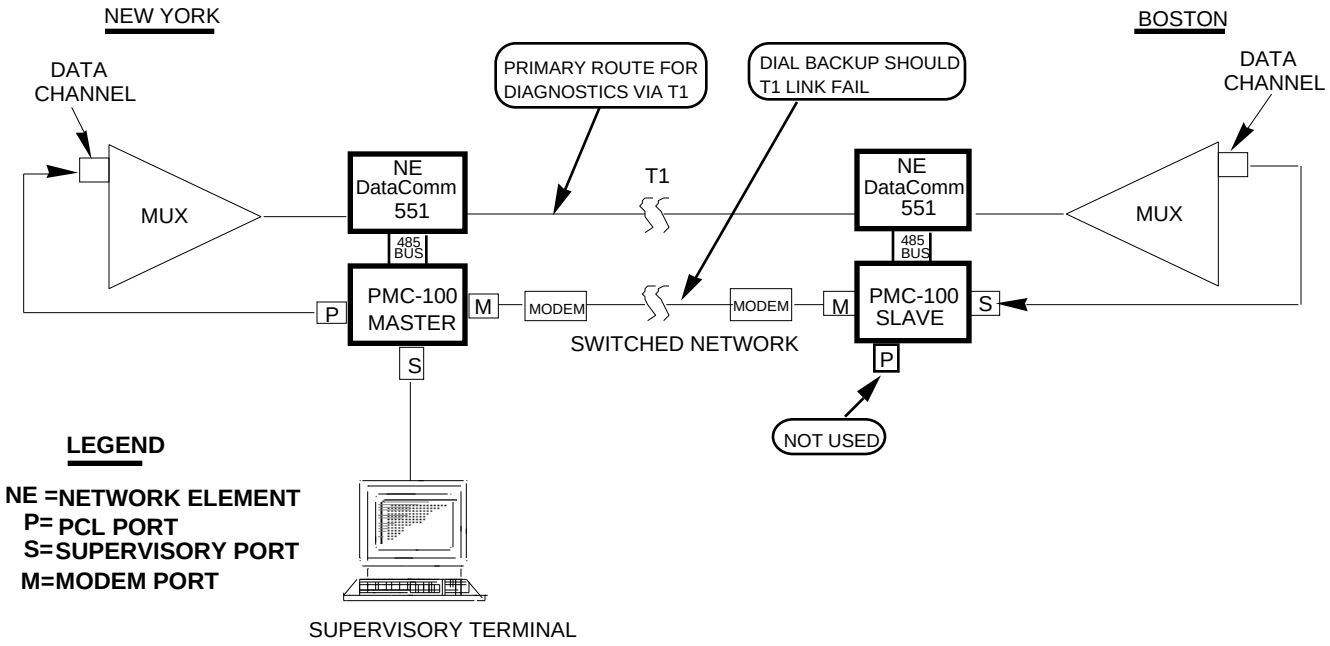


FIGURE 1-3. TYPICAL NETWORK, LOCAL TERMINAL CONTROL USING PMC-100s WITH DIAL BACKUP

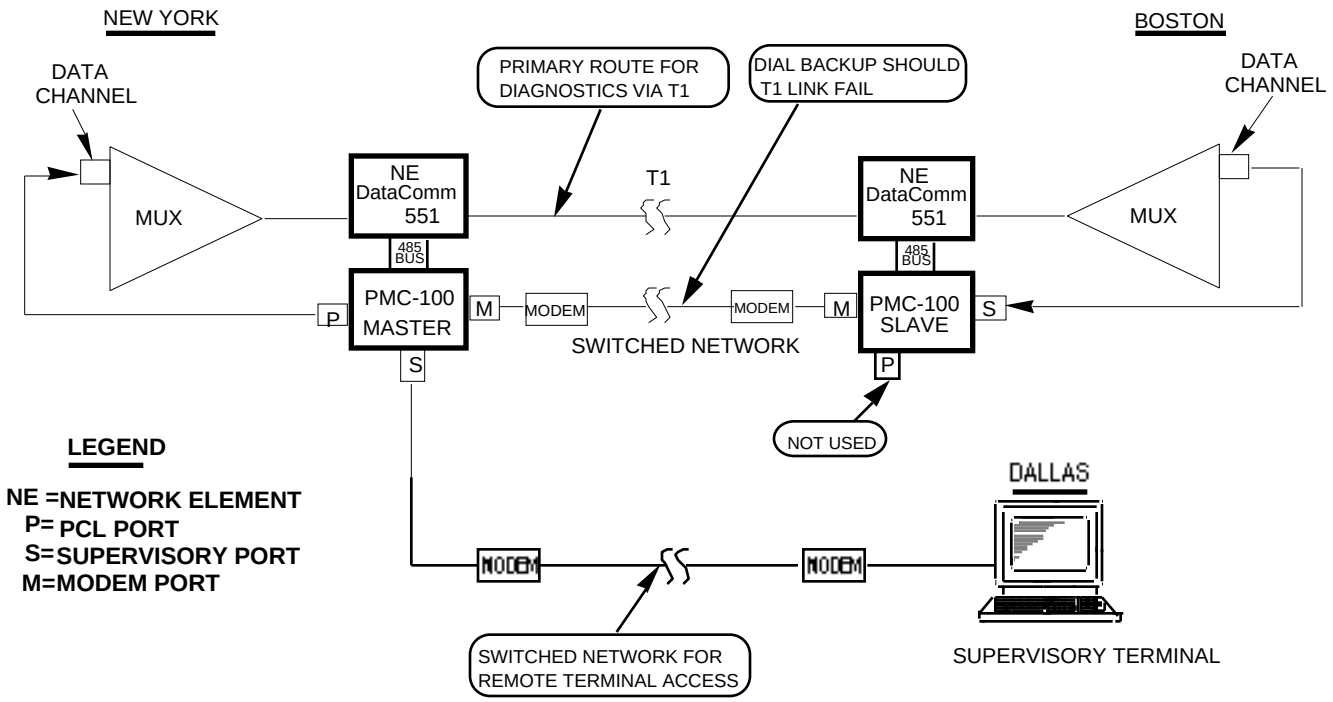


FIGURE 1-4. TYPICAL NETWORK, REMOTE TERMINAL CONTROL USING PMC-100s WITH DIAL BACKUP

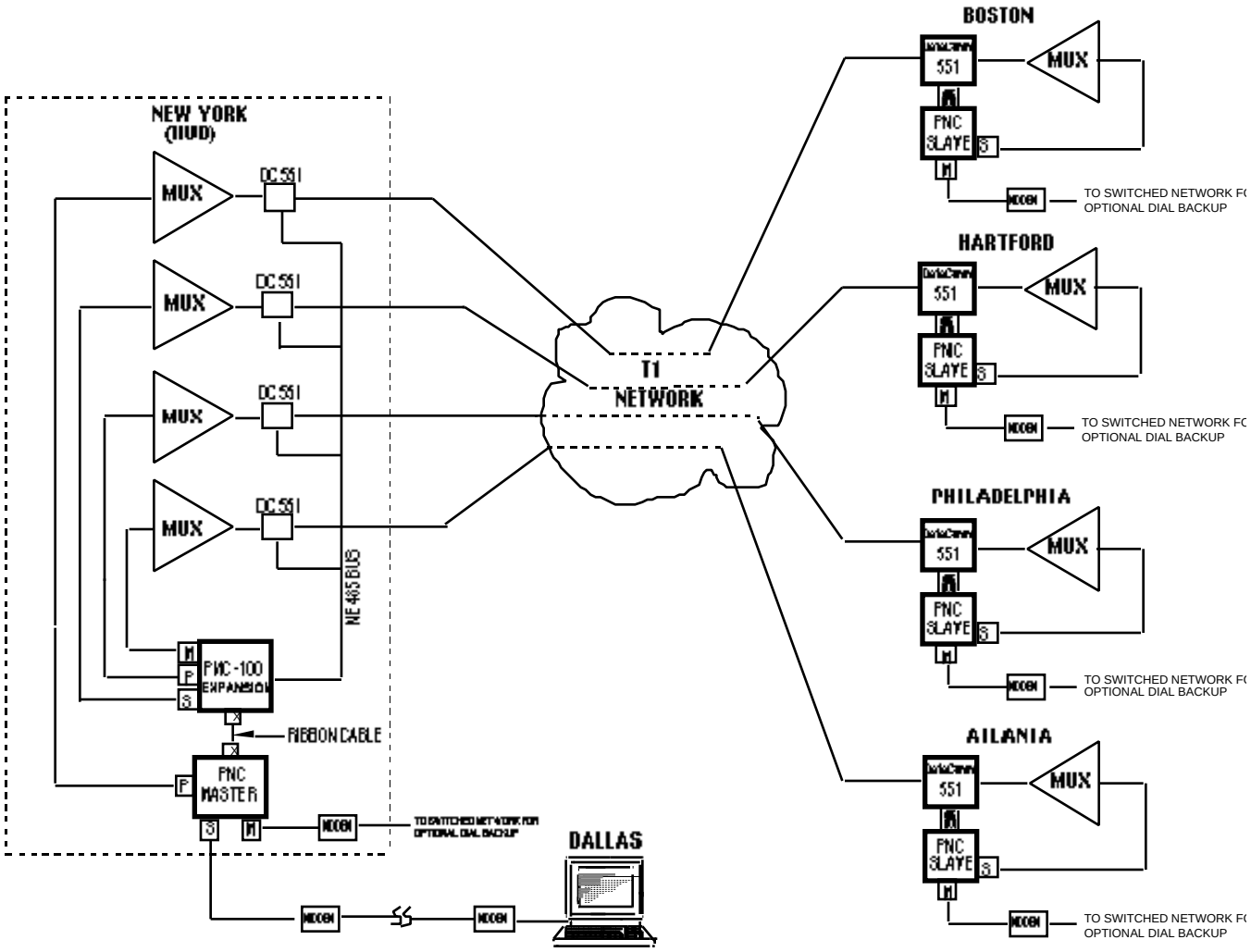


FIGURE 1-5. TYPICAL NETWORK, REMOTE TERMINAL CONTROL USING PMC-100s WITH EXPANSION AND DIAL BACKUP

SECTION 2

INSTALLATION

OVERVIEW

This section describes the installation of the DataComm 551, including option selection.

UNPACKING AND HANDLING

The DataComm 551 is shipped in packing material that is enclosed in a corrugated box. Inspect the DataComm 551 for damage; if any is observed, notify the shipper immediately. Do not discard the box and packing material; their use will facilitate reshipping the DataComm 551, if necessary.

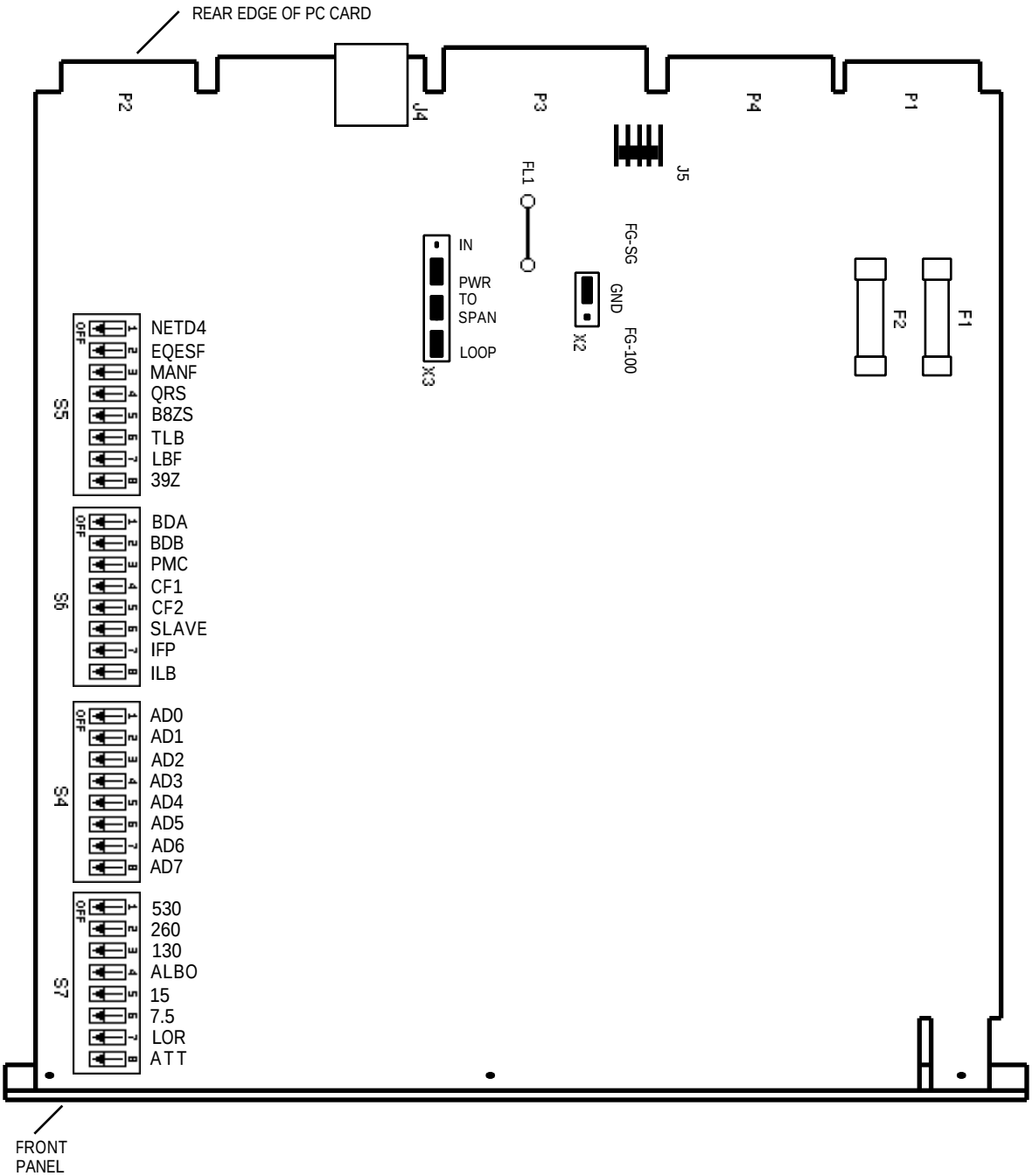
PREOPERATIONAL CHECK

Before it is connected to the network or the customer equipment, and *before any factory-set options are changed,* the DataComm 551 should be given a preoperational check by performing a DS1 Local Test with Self-Test to verify normal operation. Refer to Section 4 for instructions on performing this test. First verify that the options are set as shown in Figure 2-1, and perform the test on the DataComm 551 before it is connected to anything except ac power.

If the DataComm 551 passes the test, but subsequently fails to perform in data communications operation, it may not be at fault; some error may have been made in the installation or option selection, or there are other faulty devices or connections. Recheck the connections and option selections, and if necessary perform the Fault Isolation Procedures in Section 4 to isolate the fault. Also verify that the customer equipment and remote CSU are compatible. In the event that the DataComm 551 does not check out properly, replace it with a spare, if available, and repeat the test. Do not attempt to repair the DataComm 551. For assistance, contact DataComm Service Corporation (refer to the Technical Assistance Procedure in Section 4).

INSTALLATION PROCEDURES

The DataComm 551 should be installed in a ventilated area where the ambient temperature does not exceed 122°F (50°C). Do not install the DataComm 551 above other equipment that generates large amounts of heat (e.g., power supplies).



NOTE: OPTIONS ARE SELECTED AS SHIPPED FROM THE FACTORY.

FIGURE 2-1. OPTION LOCATION

The DataComm 551 can be mounted in the following housings:

DataComm Enclosure (model DE-7)

One DataComm 551 can be mounted in a standalone DataComm Enclosure.

If it is necessary to remove the pc card from the enclosure:

1. Disconnect ac power by pulling the plug from the wall receptacle.

2. Disconnect phone connections.

NOTE

Disconnect power supply and telco connections prior to removal of the cover.

3. Remove the cover, as shown in Figure 2-2.

4. Disconnect the power supply connector from J5, which is mounted at the rear center of the card (see Figure 2-1).

When reinstalling the pc card, reinstall the power supply connector at J5 before replacing the plug in the wall receptacle.

DataComm FourPak Enclosure (model DFP-11)

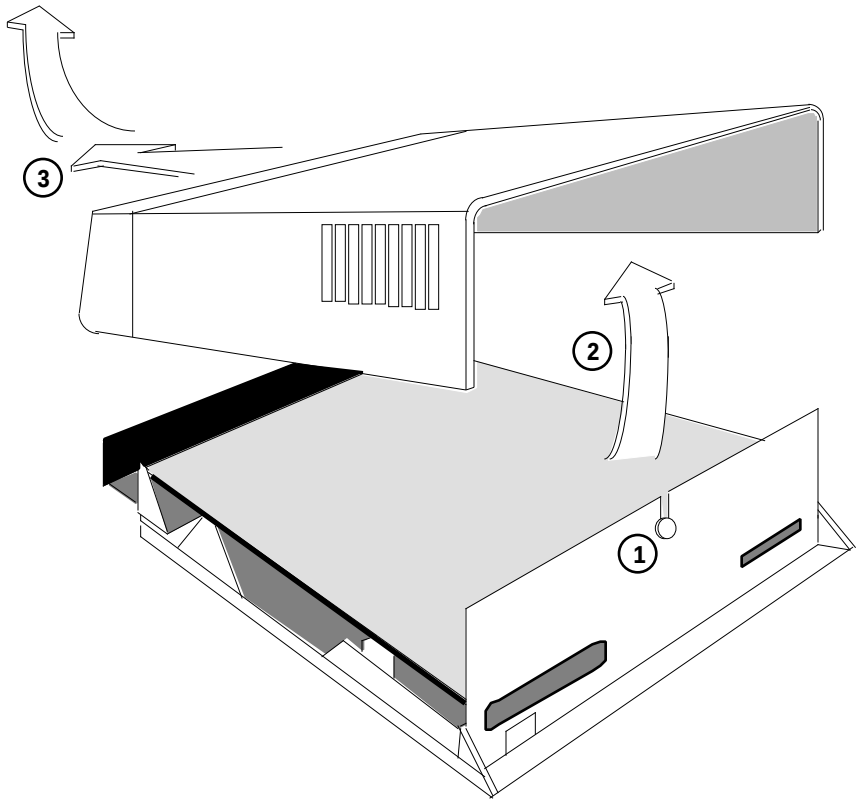
Four DataComm 551s or a combination of DataComm 551s and other plug-ins (PMC-100 Performance Monitor Cards, DataComm 552 DSUs, and DataComm 596 Modems only) can be mounted in a standalone DataComm FourPak Enclosure. If it is necessary to remove the pc card from the enclosure, use the procedure for the DataComm Enclosure.

DataComm Modem Shelf (models DS-1, DS-5R, and DC-5NR)

Up to 16 DataComm 551s or a combination of DataComm 551s and other plug-ins (including DataComm 552 DSUs and DataComm 596 Modems) can be installed in a rack-mountable DataComm Modem Shelf. A DataComm 551 can be installed in any slot; however, for each DataComm 551, one adapter cable and coupler (P/Ns 027H242-X04 and 209-038-002), or cable P/N 022H024-XXX, are required to connect the T1 line.

GDC TriPak Shelf (models TPS-1 and TPS-2)

Up to three DataComm 551s or a combination of DataComm 551s and other plug-ins (including DataComm 552 DSUs and DataComm 596 Modems) can be installed in a rack-mountable GDC TriPak Shelf.



CAUTION: DISCONNECT POWER CABLE AND PHONE CONNECTIONS BEFORE REMOVING COVER.

1. WITH FRONT OF UNIT FACING LEFT, TURN SCREW TO RELEASE COVER.
2. LIFT RIGHT END OF COVER UPWARD. (FOR DUAL-CARD PRODUCTS, SPREAD OUT THE SIDES OF THE COVER TO CLEAR THE UPPER CARD.)
3. SLIDE COVER TO LEFT WITH AN UPWARD MOTION.

WHEN REINSTALLING COVER, TOP EDGE OF REAR PANEL MUST SIT BETWEEN THE TWO RIDGES ON UNDERSIDE OF COVER.

FIGURE 2-2. DataComm ENCLOSURE COVER REMOVAL PROCEDURE

Universal System Shelf (models USS-1D, USS-1-DC/R, and USS-1-DC/NR)

Up to 16 DataComm 551s or a combination of DataComm 551s and other plug-ins (including PMC-100 Performance Monitor Cards, DataComm 552 DSUs, and DataComm 596 Modems) can be installed in a rack-mountable Universal System Shelf. For each group of four DataComm 551s, one CSU-551 Backplane (P/N 048B015-001) must be installed, occupying four slots (one quadrant) in the shelf.

All rack-mountable housings fit into 19- and 23-inch wide equipment racks.

Instructions specific to installing the DataComm 551 in the above housings follow. Refer to the appropriate Instruction Manual for general installation instructions.

OPTION SELECTION

The field-selectable options adapt the DataComm 551 to a variety of configurations, as well as enable or disable certain features and tests. These options are selected by the positioning of switches and jumper straps on the pc card. Some of these options may also be selected via the Supervisory terminal, and stored in non-volatile memory, overriding the switch settings (refer to Supervisory Terminal Operating Procedures in Section 3). Before selecting any options, consult Tables 2-1 and 2-2 to determine which options should be selected for your application.

NOTE

Do not enable Auto Framing for both CSUs on a link.

After determining which options should be selected, see Figure 2-3 (which describes the method of implementing each option) and Figure 2-1 (which illustrates the location of each switch and jumper, and its default setting). Also refer to Section 3, which describes configuring the DataComm 551 via the Supervisory terminal.

Master/Slave CSU Option

The master/slave CSU option provides control over using the Supervisory terminal to configure the CSU. A master CSU allows configuration via the Supervisory terminal, while a slave CSU prevents it (changes can be made only via option switches). Any number of CSUs in the network can be masters or slaves. There are two means of communication between the Supervisory terminal and a CSU's Supervisory terminal interface (port):

- *In-band communication* — the primary means of communicating with the CSU, utilizing PMC-100s and a dedicated multiplexer channel (i.e., a permanent virtual circuit, or PVC). In-band communication is intended for monitoring the CSU's performance reports and performing other *non-disruptive* diagnostics and maintenance functions. A typical in-band communication path is illustrated in Figure 2-4.

TABLE 2-1. OPTION APPLICATION NOTES

Option	Selection	Switch (S) or Jumper (X)	Position	Description
CSU Address Number	256 addresses, from 000 to 255	S4-1 through S4-8	Various (see Fig. 2-3 and Table 2-2)	Selects address number for CSU when using PMC-100s (S6-3 must be ON). Each CSU must have a unique address number. Factory default is address number 000 (all switches OFF). Note: For an installation with MAU-1As, addresses range from 00 to 31, using switches S4-1 through S4-5.
Unframed Mode	Disabled	S4-7	OFF *	Disables Unframed Mode when not using PMC-100s (S6-3 must be OFF).
	Enabled	S4-7	ON	Enables Unframed Mode (no framing on either the equipment side or the network side) when not using PMC-100s (S6-3 must be OFF). (NOTE: This overrides the settings for switches S5-1, S5-2, and S5-3.)
Transcoding	Disabled	S4-8	OFF *	Disables Transcoding when not using PMC-100s (S6-3 must be OFF).
	Enabled	S4-8	ON	Enables Transcoding (AMI coding on the equipment side and B8ZS on the network side) when not using PMC-100s (S6-3 must be OFF). (NOTE: This overrides the settings for switches S5-5 and S5-7.)
Network Frame Format	ESF framing	S5-1	OFF *	Selects Extended Superframe Format (ESF) framing for the network side (when S5-3 is ON).
	D4 framing	S5-1	ON	Selects D4 Superframe Format (D4) framing for the network side (when S5-3 is ON).
Equipment Frame Format	D4 framing	S5-2	OFF *	Selects D4 framing for the equipment side (when S5-3 is ON).
	ESF framing	S5-2	ON	Selects ESF framing for the equipment side (when S5-3 is ON).
Auto Framing	Enabled	S5-3	OFF *	Enables Auto Framing for both the network and equipment sides: the DataComm 551 adapts to the received framing for each side. **Do not enable Auto Framing for both CSUs on a link.**
	Disabled	S5-3	ON	Disables Auto Framing. Use S5-1 and S5-2 to manually select framing.
DS1 Self-Test Pattern	511-bit	S5-4	OFF *	Selects 511-bit pattern for DS1 Self-Test.
	QRS	S5-4	ON	Selects Quasi-Random Signal (QRS) pattern for DS1 Self-Test (per AT&T PUB 62411).
Line Code	AMI code	S5-5	OFF *	Selects Alternate Mark Inversion (AMI) line code.
	B8ZS code	S5-5	ON	Selects Bipolar with 8 Zero Substitution (B8ZS) line code.
Inband Loop-back Code Test Type	DS1 Line Loop	S5-6	OFF *	DataComm 551 starts or stops a DS1 Line Loop test when the appropriate inband loopback code is detected (when S6-8 is OFF, and only with ESF framing on the network side).
	DS1 Test Loop	S5-6	ON	DataComm 551 starts or stops a DS1 Test Loop test when the appropriate inband loopback code is detected (when S6-8 is OFF, and only with ESF framing on the network side).

TABLE 2-1. OPTION APPLICATION NOTES (Cont.)

Option	Selection	Switch (S) or Jumper (X)	Position	Description
Inband Loop-back Code	Unframed	S5-7	OFF *	DataComm 551 sends unframed inband loopback codes.
Framing	Framed	S5-7	ON	DataComm 551 sends framed inband loopback codes.
Ones Density	15 zeros	S5-8	OFF *	Allows a maximum of 15 consecutive zeros to be sent toward the network.
	39 zeros	S5-8	ON	Allows a maximum of 39 consecutive zeros to be sent toward the network.
Supervisory Port Baud Rate	4 rates, from 2400 bps to 19.2 kbps	S6-1 S6-2	Various (see Fig. 2-3)	Selects the baud rate for the Supervisory port. Factory default is 9600 bps (both switches OFF).
PMC-100 (or MAU-1A) Operation	Disabled	S6-3	OFF *	Disables use of PMC-100s or MAU-1As (disables the internal RS-485 bus and enables the Supervisory port).
	Enabled	S6-3	ON	Enables use of PMC-100s or MAU-1As (enables the internal RS-485 bus and disables the Supervisory port).
Supervisory Port Character Format	Various (see Fig. 2-3)	S6-4 S6-5	Various (see Fig. 2-3)	Selects the character format for the Supervisory port. Factory default is 8-bit data word, no parity, and one stop bit (both switches OFF).
Master/slave CSU operation	Master CSU	S6-6	OFF *	Defines the CSU as a master CSU (allows configuration via the Supervisory terminal).
	Slave CSU	S6-6	ON	Defines the CSU as a slave CSU (prevents configuration via the Supervisory terminal).
Inhibit Front	Disabled	S6-7	OFF *	Allows use of the front panel test switches.
Panel Test Switches	Enabled	S6-7	ON	Inhibits use of the front panel test switches.
Inband Loop-back Code	Enabled	S6-8	OFF *	Enables detection of inband loopback codes (framed or unframed). Select test type with S5-6.
Detection	Disabled	S6-8	ON	Disables detection of inband loopback codes.
Pre-equaliza-tion	0 to 655 feet, in 5 ranges	S7-1 S7-2 S7-3	Various (see Fig. 2-3)	Matches the equipment-side line length, providing transmitter pre-equalization. Factory default is for 0-130 feet (all switches OFF).
Line Build-Out	Manual	S7-4	OFF *	Selects manual Line Build-Out (attenuation of signal transmitted to the network). Use S7-5 and S7-6 to manually select amount of attenuation.
	Automatic	S7-4	ON	Selects automatic Line Build-Out. **Do not enable automatic Line Build-Out for both CSUs when they are connected back-to-back.**
Manual Line Build-Out	0 dB, 7.5 dB, and 15 dB	S7-5 S7-6	Various (see Fig. 2-3)	Matches transmitter to network gain characteristics (when S7-4 is ON). Factory default is 0 dB (both switches OFF).
Local Option Override	Disabled	S7-7	OFF *	Supervisory terminal selections override option switch selections.
	Enabled	S7-7	ON	Option switch selections override Supervisory terminal selections.

TABLE 2-1. OPTION APPLICATION NOTES (Cont.)

Option	Selection	Switch (S) or Jumper (X)	Position	Description
Central Office Compatibility	ANSI mode	S7-8	OFF *	Selects compliance with ANSI network performance report messages (per Bellcore TR-TSY-000194), available only with ESF framing on the network side.
	AT&T mode	S7-8	ON	Selects compliance with AT&T TABS network maintenance messages (per AT&T PUB 54016), available only with ESF framing on the network side.
Ground	Common	X2	FG-SG *	Selects common frame (chassis) and signal (reference) grounds. Grounds are connected through fusible link FL1.
	Isolated	X2	FG-100	Selects frame and signal grounds isolated by 100Ω.
Power to span	Disabled	X3	LOOP *	DataComm 551 loops power to the span.
	Enabled	X3	IN	DataComm 551 provides power to the span (requires Telco-provided external 60 mA dc constant current source). Available only in DataComm FourPak, GDC TriPak, and Universal System Shelf installations.

* Factory default position.

- *Out-of-band communication* — the alternate means of communicating with the CSU, that does not depend on the T1 link to the CSU. Out-of-band communication with the CSU is typically made via modems or a Supervisory terminal co-located with the CSU. It is intended for performing diagnostics that would disrupt in-band communication (such as a loopback) and for accessing the CSU when a T1 link failure prevents in-band communication. A typical out-of-band communication path is illustrated in Figure 2-5.

Configuring a CSU as a slave CSU assures that a Supervisory terminal user cannot make configuration changes, regardless of the communication path, that could disrupt in-band communication. A slave CSU displays a warning message when the user attempts to configure it or perform a self-test or loopback, although it does not prevent these tests. Refer to Electrical Connections for additional installation information.

Option Selection in an Installation with a MAU-1A

This manual applies only to assembly-level Revision (P) and LATER DataComm 551 pc cards. You must use Publication No. 048R137-800 for Revision (N) and EARLIER pc cards. However, the newer DataComm 551 is backward-compatible with the older version, so you can install it in your existing system.

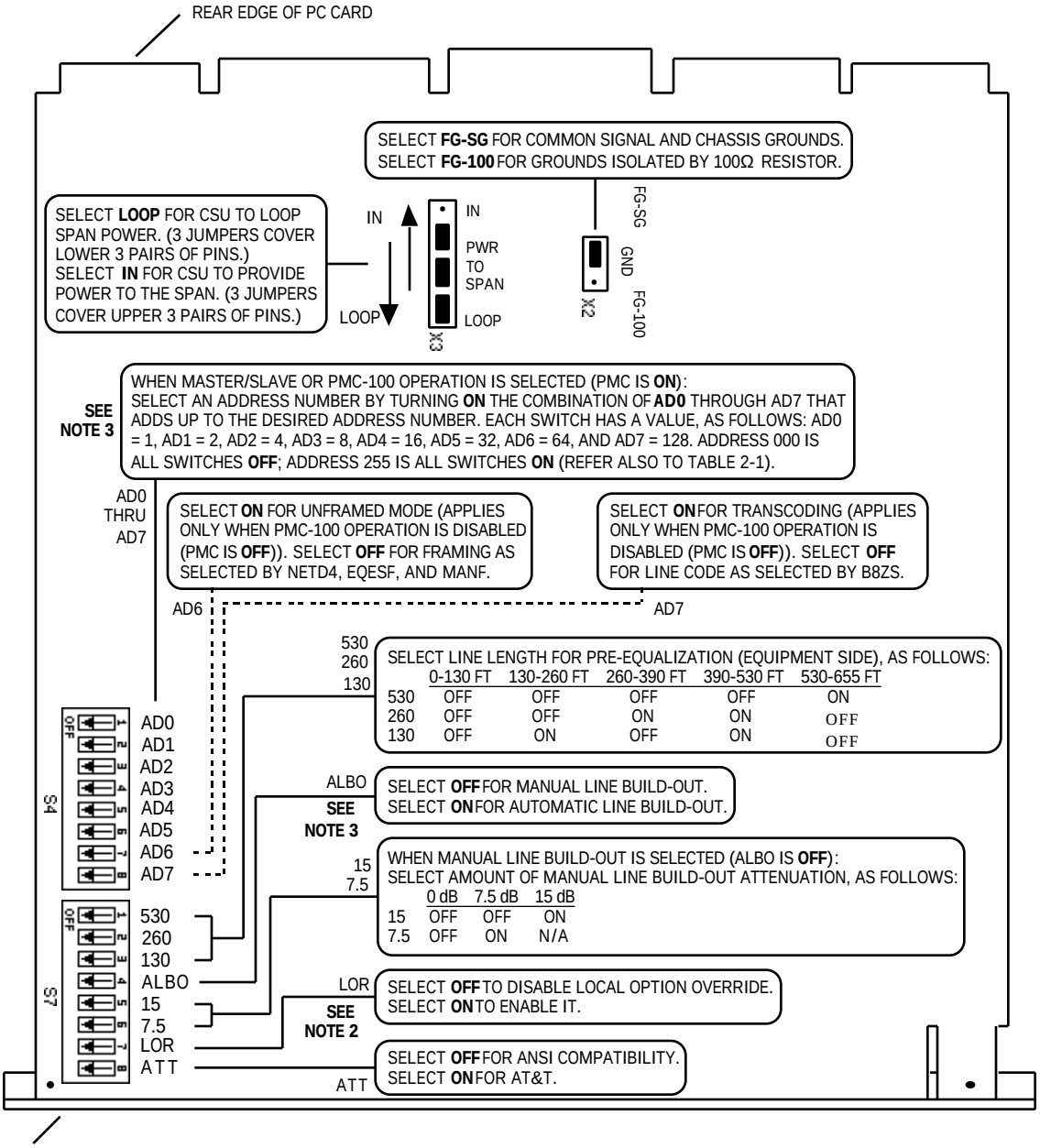
The major improvement is PMC-100 support, eliminating the need for using MAU-1As and fallback switches for Supervisory terminal communications. When replacing an older DataComm 551 with a newer one, note the following option switch changes:

Switch	Old Label	New Label
S6-1	BDA	BDA
S6-2	BDB	BDB
S6-3	BDC	PMC
S6-6	CF3	SLAVE
S4-6	AD5	AD5
S4-7	AD6	AD6
S4-8	SLAVE	AD7
S7-4	MLBO	ALBO

TABLE 2-2. CSU ADDRESS SELECTION

CSU Address = AD7/AD6/AD5/AD4/AD3/AD2/AD1/AD0 (Option Switches S4-8 to S4-1) 0 = Switch OFF; 1 = Switch ON				
0=00000000	51=00110011	102=01100110	153=10011001	204=11001100
1=00000001	52=00110100	103=01100111	154=10011010	205=11001101
2=00000010	53=00110101	104=01101000	155=10011011	206=11001110
3=00000011	54=00110110	105=01101001	156=10011100	207=11001111
4=00000100	55=00110111	106=01101010	157=10011101	208=11010000
5=00000101	56=00111000	107=01101011	158=10011110	209=11010001
6=00000110	57=00111001	108=01101100	159=10011111	210=11010010
7=00000111	58=00111010	109=01101101	160=10100000	211=11010011
8=00001000	59=00111011	110=01101110	161=10100001	212=11010100
9=00001001	60=00111100	111=01101111	162=10100010	213=11010101
10=00001010	61=00111101	112=01110000	163=10100011	214=11010110
11=00001011	62=00111110	113=01110001	164=10100100	215=11010111
12=00001100	63=00111111	114=01110010	165=10100101	216=11011000
13=00001101	64=01000000	115=01110011	166=10100110	217=11011001
14=00001110	65=01000001	116=01110100	167=10100111	218=11011010
15=00001111	66=01000010	117=01110101	168=10101000	219=11011011
16=00010000	67=01000011	118=01110110	169=10101001	220=11011100
17=00010001	68=01000100	119=01110111	170=10101010	221=11011101
18=00010010	69=01000101	120=01111000	171=10101011	222=11011110
19=00010011	70=01000110	121=01111001	172=10101100	223=11011111
20=00010100	71=01000111	122=01111010	173=10101101	224=11100000
21=00010101	72=01001000	123=01111011	174=10101110	225=11100001
22=00010110	73=01001001	124=01111100	175=10101111	226=11100010
23=00010111	74=01001010	125=01111101	176=10110000	227=11100011
24=00011000	75=01001011	126=01111110	177=10110001	228=11100100
25=00011001	76=01001100	127=01111111	178=10110010	229=11100101
26=00011010	77=01001101	128=10000000	179=10110011	230=11100110
27=00011011	78=01001110	129=10000001	180=10110100	231=11100111
28=00011100	79=01001111	130=10000010	181=10110101	232=11101000
29=00011101	80=01010000	131=10000011	182=10110110	233=11101001
30=00011110	81=01010001	132=10000100	183=10110111	234=11101010
31=00011111	82=01010010	133=10000101	184=10111000	235=11101011
32=00100000	83=01010011	134=10000110	185=10111001	236=11101100
33=00100001	84=01010100	135=10000111	186=10111010	237=11101101
34=00100010	85=01010101	136=10001000	187=10111011	238=11101110
35=00100011	86=01010110	137=10001001	188=10111100	239=11101111
36=00100100	87=01010111	138=10001010	189=10111101	240=11110000
37=00100101	88=01011000	139=10001011	190=10111110	241=11110001
38=00100110	89=01011001	140=10001100	191=10111111	242=11110010
39=00100111	90=01011010	141=10001101	192=11000000	243=11110011
40=00101000	91=01011011	142=10001110	193=11000001	244=11110100
41=00101001	92=01011100	143=10001111	194=11000010	245=11110101
42=00101010	93=01011101	144=10010000	195=11000011	246=11110110
43=00101011	94=01011110	145=10010001	196=11000100	247=11110111
44=00101100	95=01011111	146=10010010	197=11000101	248=11111000
45=00101101	96=01100000	147=10010011	198=11000110	249=11111001
46=00101110	97=01100001	148=10010100	199=11000111	250=11111010
47=00101111	98=01100010	149=10010101	200=11001000	251=11111011
48=00110000	99=01100011	150=10010110	201=11001001	252=11111100
49=00110001	100=01100100	151=10010111	202=11001010	253=11111101
50=00110010	101=01100101	152=10011000	203=11001011	254=11111110
				255=11111111

Note: For an installation with MAU-1As, use switches S4-5 to S4-1 (addresses 00 to 31). For an installation with PMC-100s, use all switches.

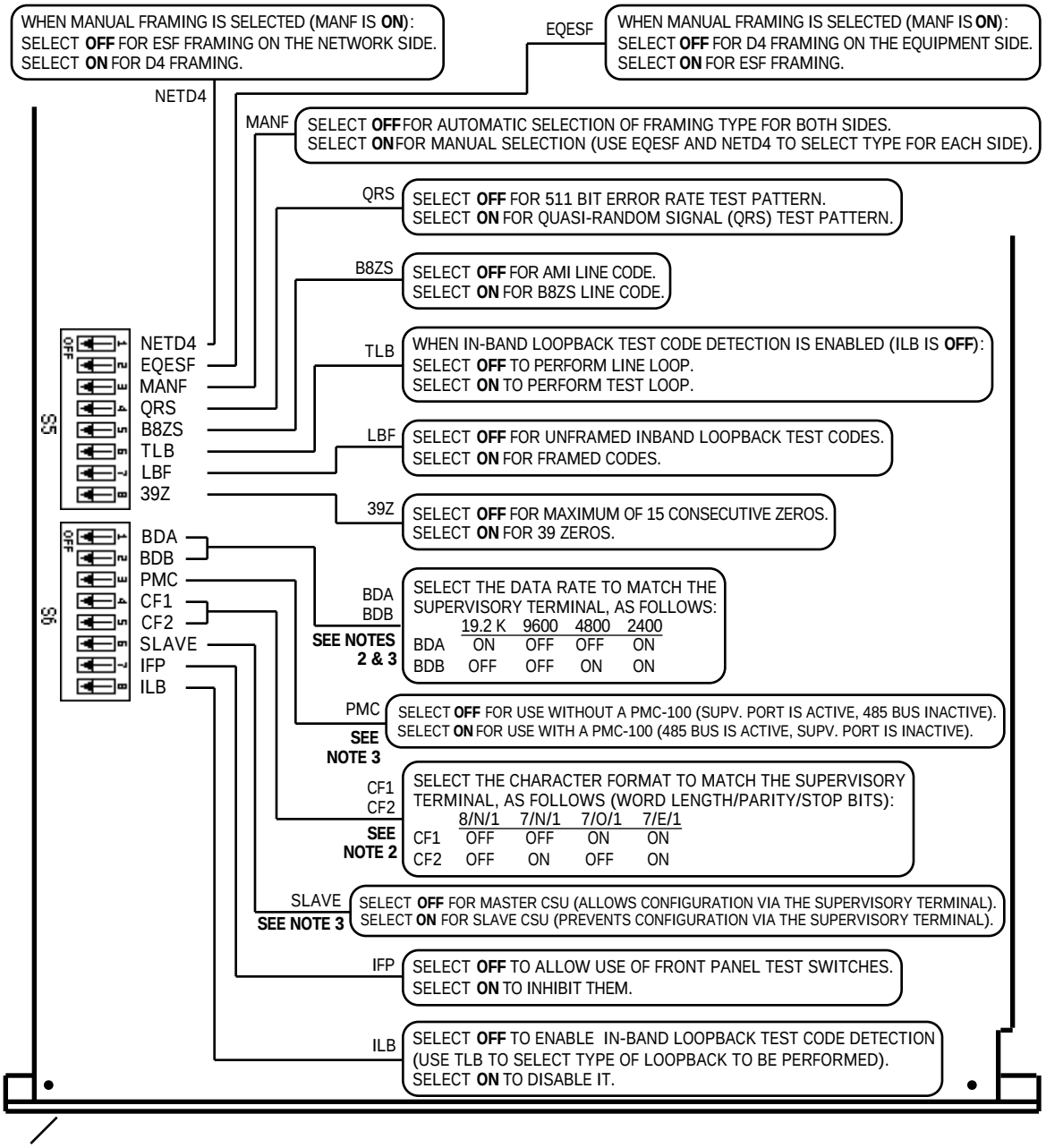


NOTE 1: OPTIONS ARE SELECTED AS SHIPPED FROM THE FACTORY.

NOTE 2: THIS OPTION IS NOT AFFECTED BY CONFIGURATION FROM THE SUPERVISORY TERMINAL.

NOTE 3: REFER TO OPTION SELECTION FOR USE OF THIS SWITCH WHEN REPLACING AN OLDER DataComm 551 WITH A NEWER ONE.

FIGURE 2-3. OPTION SWITCH AND JUMPER SELECTIONS (Sheet 1 of 2)



NOTE 1: OPTIONS ARE SELECTED AS SHIPPED FROM THE FACTORY.

NOTE 2: THIS OPTION IS NOT AFFECTED BY CONFIGURATION FROM THE SUPERVISORY TERMINAL.

NOTE 3: REFER TO OPTION SELECTION FOR USE OF THIS SWITCH WHEN REPLACING AN OLDER DataComm 551 WITH A NEWER ONE.

FIGURE 2-3. OPTION SWITCH AND JUMPER SELECTIONS (Sheet 2 of 2)

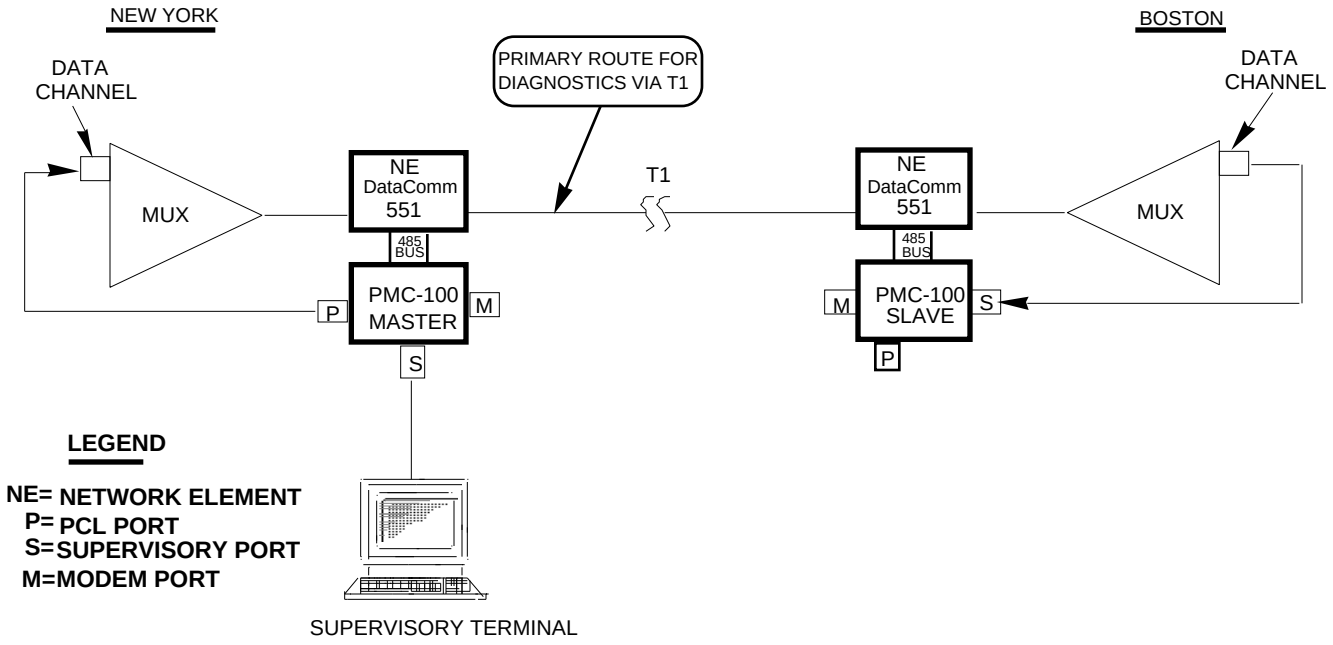


FIGURE 2-4. IN-BAND COMMUNICATION PATH

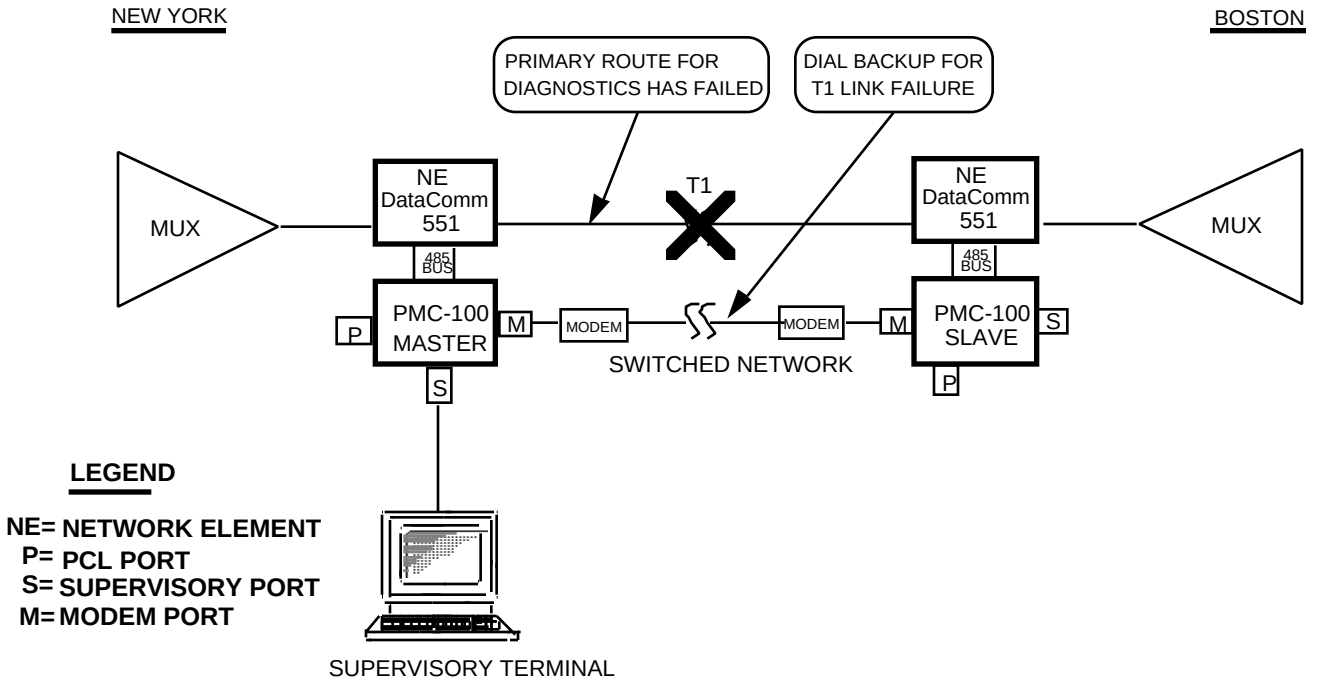


FIGURE 2-5. OUT-OF-BAND COMMUNICATION PATH

Switches S6-1, S6-2, and S6-3 were used for Supervisory port data rate, but now only switches S6-1 and S6-2 are used for this, and their settings are different:

	19.2 K	9600	4800	2400
BDA	ON	OFF	OFF	ON
BDB	OFF	OFF	ON	ON

Switch S6-3 and switch S4-6 now control the use of PMC-100s and MAU-1As. To enable the use of PMC-100s, turn ON switch S6-3 (switch S4-6 becomes a CSU address switch). To enable the use of MAU-1As, turn OFF switch S6-3 and turn ON switch S4-6. To disable the use of PMC-100s and MAU-1As, turn OFF both switches.

Switch S6-6 was used for Supervisory port character format, but now controls master/slave operation. The Supervisory port character format selections are now limited to the following:

	8/N/1	7/N/1	7/O/1	7/E/1
CF1	OFF	OFF	ON	ON
CF2	OFF	ON	OFF	ON

Switch S4-6 controls the use of MAU-1As (as before) when switch S6-3 is OFF. It is a CSU address switch when switch S6-3 is ON.

Switch S4-7 was not used, but now is a CSU address switch when switch S6-3 is ON.

Switch S4-8 controlled master/slave operation, but now is a CSU address switch when switch S6-3 is ON. Master/slave operation is now controlled by switch S6-6.

Switch S7-4 still controls Line Build-Out, but option selection is reversed (the OFF position now selects manual Line Build-Out and the ON position selects automatic Line Build-Out).

Refer to Publication No. 048R137-800 for detailed discussion of MAU-1A applications.

ELECTRICAL CONNECTIONS

The following paragraphs describe the customer equipment, network interface, Supervisory terminal, and primary power connections to the DataComm 551.

Equipment Connection

Connect the customer equipment (T1 multiplexer) to the DataComm 551 as described below.

Unless otherwise noted, the customer equipment interface is a 25-pin female subminiature-D connector located on the rear panel, and you should use GDC cable P/N 024H520-XXX (use GDC cable P/N 027H324-002 when

the existing customer equipment T1 cable is terminated in a DB15P male connector). The DataComm 551 requires that the signals be connected to the pins as shown in the appropriate figure.

DataComm Enclosure Installation

Connect the customer equipment T1 aggregate to the DataComm 551 by means of the connector labeled **Business Equipment**, as shown in Figure 2-6.

DataComm FourPak Enclosure

Connect the customer equipment T1 aggregate to the DataComm 551 by means of the connectors labeled **BUSINESS EQUIP 1** through **BUSINESS EQUIP 4**, as shown in Figure 2-7.

DataComm Modem Shelf Installation

Connect the customer equipment T1 aggregate to the DataComm 551 as shown in Figure 2-8.

GDC TriPak Shelf Installation

Connect the customer equipment T1 aggregate to the DataComm 551 by means of the connectors labeled **BUSINESS EQUIP A** through **BUSINESS EQUIP C**, as shown in Figure 2-9.

Universal System Shelf Installation

Connect the customer equipment T1 aggregate to the DataComm 551 by means of the connectors labeled **BUSINESS EQUIP 1** through **BUSINESS EQUIP 4**, as shown in Figure 2-10.

Network Interface Connection

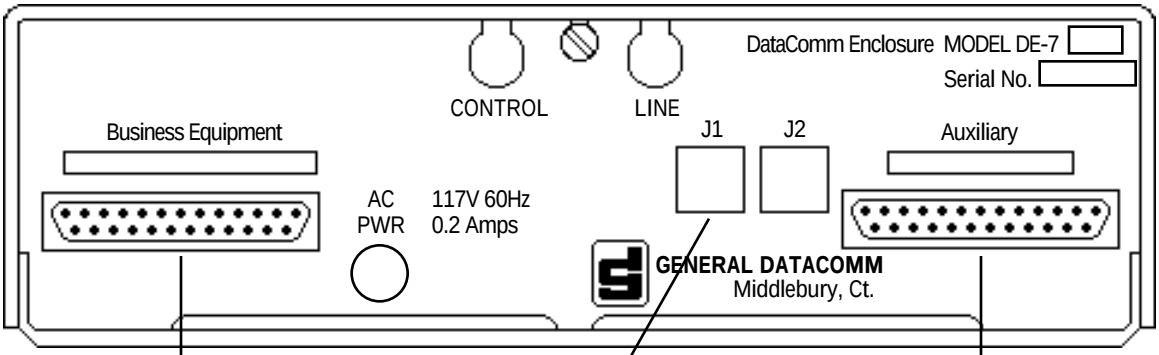
Connect the network (T1 line) to the DataComm 551 as described below.

Unless otherwise noted, the network interface is an RJ48C jack located on the rear panel.

For other than a DataComm Modem Shelf installation, you must use either GDC cable P/N 022H024-XXX (RJ48C plug-to-plug) or 022H021-XXX (RJ48C plug-to-terminal lugs) to connect the network to the CSU. For a DataComm Modem Shelf installation, you must use either 027H242-X04 (and coupler 209-038-002) or 022H025-XXX (RJ48C plug-to-terminal lugs). Using any other cable may cause damage to the CSU or the network. Cables 022H024-XXX and 027H242-X04 are labeled **NETWORK** and **CSU** to indicate where each end is used. The pinouts for the network end of these cables are listed in the appropriate figure.

NOTE

If you connect two CSUs back-to-back (a direct cable connection with no T1 line), do not enable automatic Line Build-Out for both of them.



EQUIPMENT CONNECTOR (25-PIN FEMALE) CONNECTS THE MULTIPLEXER TO THE CSU.

PIN NO.	FUNCTION	DIRECTION
1	FRAME GROUND	N/A
2	SEND DATA (TIP)	TO CSU
3	RECEIVE DATA (TIP)	FROM CSU
14	SEND DATA (RING)	TO CSU
16	RECEIVE DATA (RING)	FROM CSU

SUPERVISORY PORT CONNECTOR (25-PIN MALE) CONNECTS THE SUPERVISORY TERMINAL TO THE CSU.

PIN NO.	FUNCTION	DIRECTION
2	SEND DATA	TO CSU
3	RECEIVE DATA	FROM CSU
4	REQUEST TO SEND	TO CSU
7	SIGNAL GROUND	N/A
8	CARRIER DETECT	FROM CSU

THIS PORT IS ENABLED ONLY WHEN PMC-100 OPERATION IS DISABLED.

NETWORK INTERFACE CONNECTOR (RJ48C) CONNECTS THE NETWORK TO THE CSU.

CABLE 022H024-XXX PIN NO.	CABLE 022H021-XXX WIRE COLOR	FUNCTION	DIRECTION
1	ORN/WHT	RECEIVE DATA (RING)	TO CSU
2	WHT/ORN	RECEIVE DATA (TIP)	TO CSU
4	BLU/WHT	SEND DATA (RING)	FROM CSU
5	WHT/BLU	SEND DATA (TIP)	FROM CSU
7	DRAIN	SHIELD (FRAME GND.)	N/A

NOTE: THE REMAINING LEADS ARE NOT USED.

FIGURE 2-6. DataComm ENCLOSURE INSTALLATION

TERMINALS 1 AND 2 ON 4-POSITION TERMINAL BLOCK (LABELED **TB1** - **TB4**) CONNECT THE TELCO-PROVIDED 60 MA DC CONSTANT CURRENT SOURCE TO PROVIDE POWER TO THE T1 SPAN.

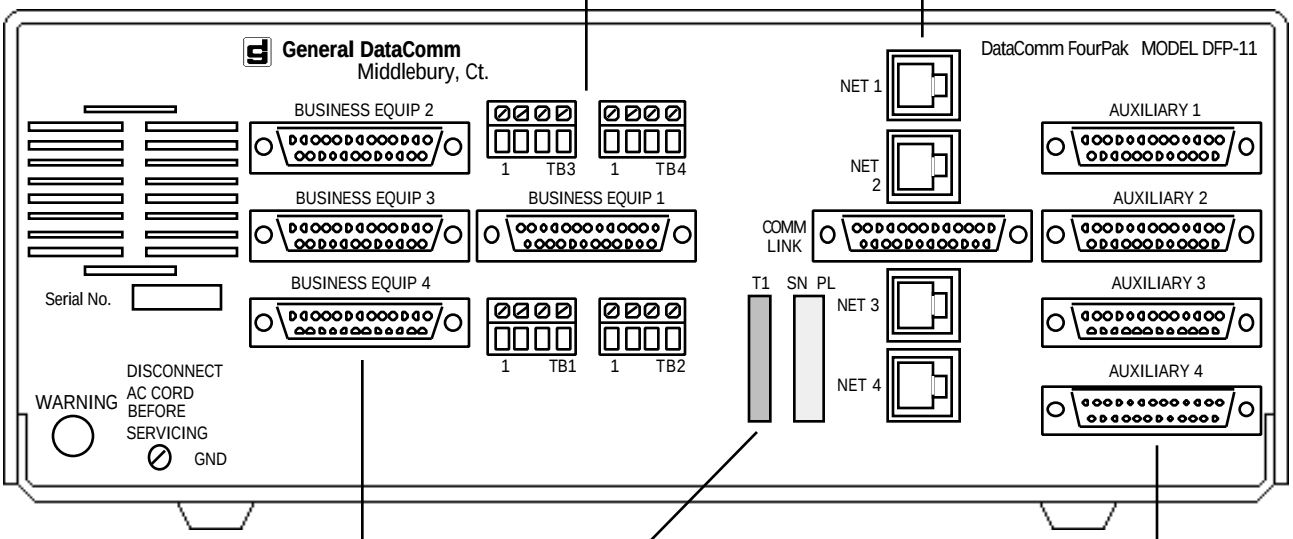
TERMINAL NO.	FUNCTION
1	MA OUT
2	MA IN
3	FLF
4	FLF

FLF: FAULT LOCATION FILTER (FUTURE USE)

NETWORK INTERFACE CONNECTOR (RJ48C, LABELED **NET 1** - **NET 4**) CONNECTS THE NETWORK TO THE CSU.

CABLE 022H024-XXX PIN NO.	CABLE 022H021-XXX WIRE COLOR	FUNCTION	DIRECTION
1	ORN/WHT	RECEIVE DATA (RING)	TO CSU
2	WHT/ORN	RECEIVE DATA (TIP)	TO CSU
4	BLU/WHT	SEND DATA (RING)	FROM CSU
5	WHT/BLU	SEND DATA (TIP)	FROM CSU
7	DRAIN	SHIELD (FRAME GND.)	N/A

NOTE: THE REMAINING LEADS ARE NOT USED.



EQUIPMENT CONNECTOR (25-PIN FEMALE, LABELED **BUSINESS EQUIP 1** - **BUSINESS EQUIP 4**) CONNECTS THE MULTIPLEXER TO THE CSU.

PIN NO.	FUNCTION	DIRECTION
1	FRAME GROUND	N/A
2	SEND DATA (TIP)	TO CSU
3	RECEIVE DATA (TIP)	FROM CSU
14	SEND DATA (RING)	TO CSU
16	RECEIVE DATA (RING)	FROM CSU

WHEN INSTALLING A DataComm 551 IN SLOT FOUR, PLACE JUMPER OVER COLUMN OF PINS LABELED **T1**.

SUPERVISORY PORT CONNECTOR (25-PIN MALE, LABELED **AUXILIARY 1** - **AUXILIARY 4**) CONNECTS THE SUPERVISORY TERMINAL TO THE CSU.

PIN NO.	FUNCTION	DIRECTION
2	SEND DATA	TO CSU
3	RECEIVE DATA	FROM CSU
4	REQUEST TO SEND	TO CSU
7	SIGNAL GROUND	N/A
8	CARRIER DETECT	FROM CSU

THIS PORT IS ENABLED ONLY WHEN PMC-100 OPERATION IS DISABLED.

FIGURE 2-7. DataComm FOURPAK ENCLOSURE INSTALLATION

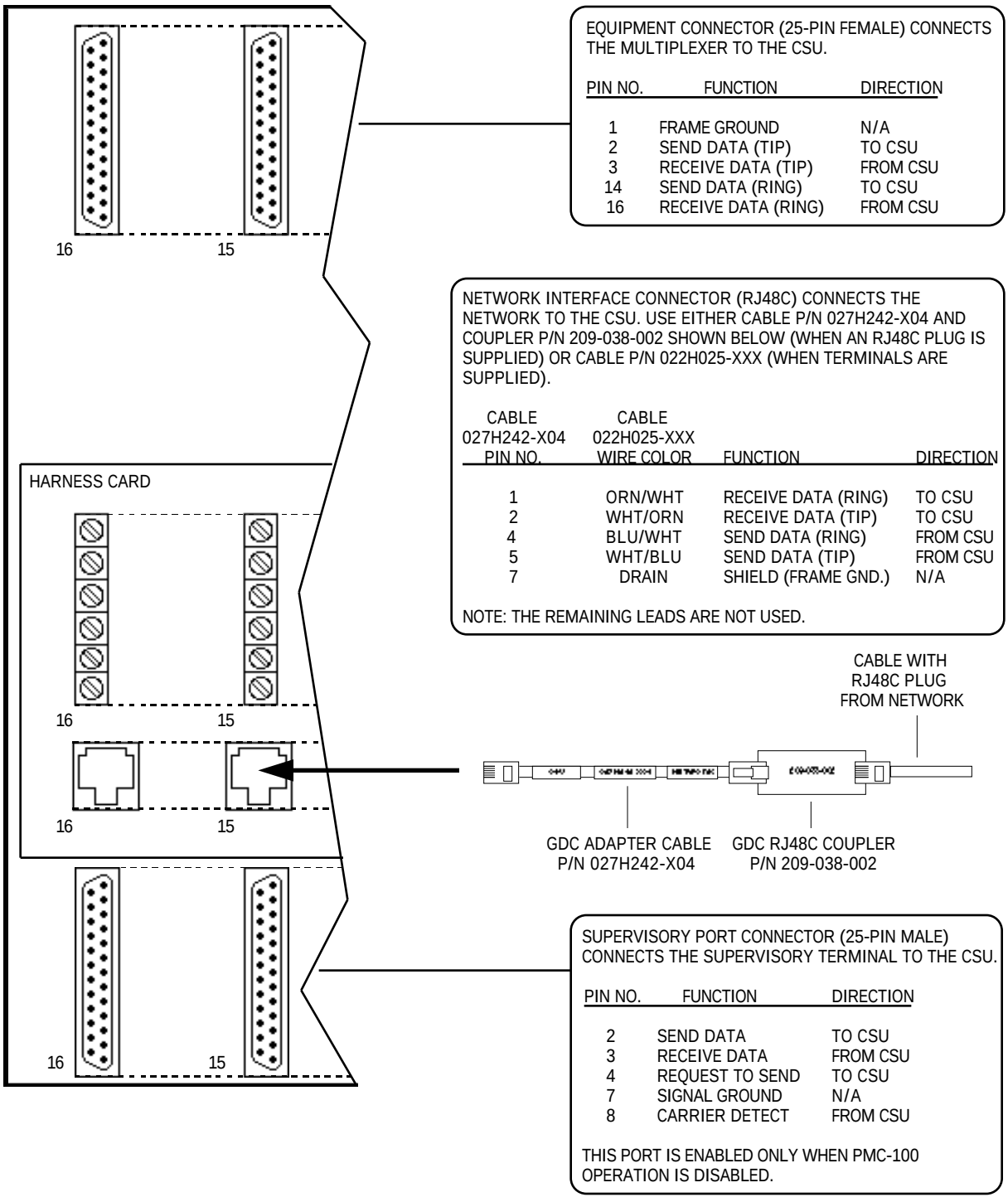


FIGURE 2-8. DataComm MODEM SHELF INSTALLATION

TERMINALS 1 AND 2 ON 4-POSITION TERMINAL BLOCK (LABELED **TB1 - TB3**) CONNECT THE TELCO-PROVIDED 60 MA DC CONSTANT CURRENT SOURCE TO PROVIDE POWER TO THE T1 SPAN.

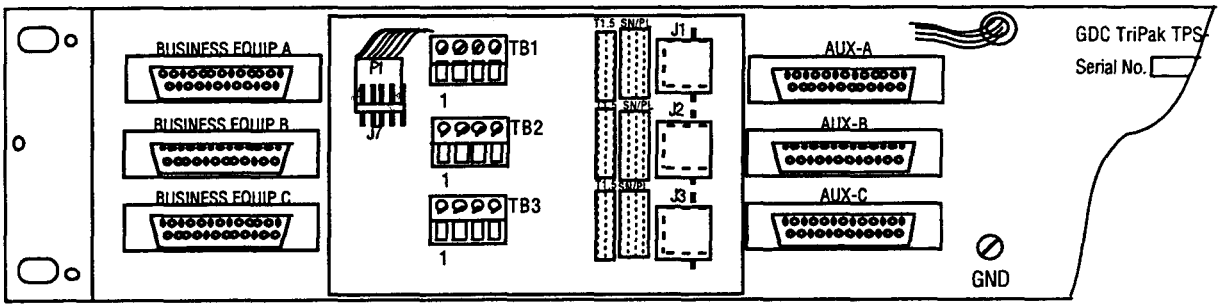
TERMINAL NO.	FUNCTION
1	MA OUT
2	MA IN
3	FLF
4	FLF

FLF: FAULT LOCATION FILTER (FUTURE USE)

NETWORK INTERFACE CONNECTOR (RJ48C, LABELED **J1 -J3**) CONNECTS THE NETWORK TO THE CSU.

CABLE 022H024-XXX PIN NO.	CABLE 022H021-XXX WIRE COLOR	FUNCTION	DIRECTION
1	ORN/WHT	RECEIVE DATA (RING)	TO CSU
2	WHT/ORN	RECEIVE DATA (TIP)	TO CSU
4	BLU/WHT	SEND DATA (RING)	FROM CSU
5	WHT/BLU	SEND DATA (TIP)	FROM CSU
7	DRAIN	SHIELD (FRAME GND.)	N/A

NOTE: THE REMAINING LEADS ARE NOT USED.



NOTE: HARNESS CARD COVER NOT SHOWN FOR CLARITY.

EQUIPMENT CONNECTOR (25-PIN FEMALE, LABELED **BUSINESS EQUIP A - BUSINESS EQUIP C**) CONNECTS THE MULTIPLEXER TO THE CSU.

PIN NO.	FUNCTION	DIRECTION
1	FRAME GROUND	N/A
2	SEND DATA (TIP)	TO CSU
3	RECEIVE DATA (TIP)	FROM CSU
14	SEND DATA (RING)	TO CSU
16	RECEIVE DATA (RING)	FROM CSU

SUPERVISORY PORT CONNECTOR (25-PIN MALE, LABELED **AUX-A - AUX-C**) CONNECTS THE SUPERVISORY TERMINAL TO THE CSU.

PIN NO.	FUNCTION	DIRECTION
2	SEND DATA	TO CSU
3	RECEIVE DATA	FROM CSU
4	REQUEST TO SEND	TO CSU
7	SIGNAL GROUND	N/A
8	CARRIER DETECT	FROM CSU

THIS PORT IS ENABLED ONLY WHEN PMC-100 OPERATION IS DISABLED.

FIGURE 2-9. GDC TRIPAK SHELF INSTALLATION

EQUIPMENT CONNECTOR (25-PIN FEMALE, LABELED **BUSINESS EQUIP 1** - **BUSINESS EQUIP 4**) CONNECTS THE MULTIPLEXER TO THE CSU.

PIN NO.	FUNCTION	DIRECTION
1	FRAME GROUND	N/A
2	SEND DATA (TIP)	TO CSU
3	RECEIVE DATA (TIP)	FROM CSU
9	SEND DATA (RING)	TO CSU
11	RECEIVE DATA (RING)	FROM CSU

X BUS CONNECTORS FOR COMMUNICATION BETWEEN PMC-100s. REFER TO PMC-100 MANUAL FOR DETAILS.

TERMINALS 1 AND 2 ON 4-POSITION TERMINAL BLOCK (LOCATED UNDER WHITE PLASTIC COVER, AND LABELED **TB1** -**TB4**) CONNECT THE TELCO-PROVIDED 60 MA DC CONSTANT CURRENT SOURCE TO PROVIDE POWER TO THE T1 SPAN.

TERMINAL NO.	FUNCTION
1	MA OUT
2	MA IN
3	FLF
4	FLF

FLF: FAULT LOCATION FILTER (FUTURE USE)

NETWORK INTERFACE CONNECTOR (RJ48C, LABELED **NET 1**- **NET 4**) CONNECTS THE NETWORK TO THE CSU.

CABLE 022H024-XXX PIN NO.	CABLE 022H021-XXX WIRE COLOR	FUNCTION	DIRECTION
1	ORN/WHT	RECEIVE DATA (RING)	TO CSU
2	WHT/ORN	RECEIVE DATA (TIP)	TO CSU
4	BLU/WHT	SEND DATA (RING)	FROM CSU
5	WHT/BLU	SEND DATA (TIP)	FROM CSU
7	DRAIN	SHIELD (FRAME GND.)	N/A

NOTE: THE REMAINING LEADS ARE NOT USED.

SUPERVISORY PORT CONNECTOR (25-PIN MALE, LABELED **AUXILIARY 1** - **AUXILIARY 4**) CONNECTS THE SUPERVISORY TERMINAL TO THE CSU.

PIN NO.	FUNCTION	DIRECTION
2	SEND DATA	TO CSU
3	RECEIVE DATA	FROM CSU
4	REQUEST TO SEND	TO CSU
7	SIGNAL GROUND	N/A
8	CARRIER DETECT	FROM CSU

THIS PORT IS ENABLED ONLY WHEN PMC-100 OPERATION IS DISABLED.

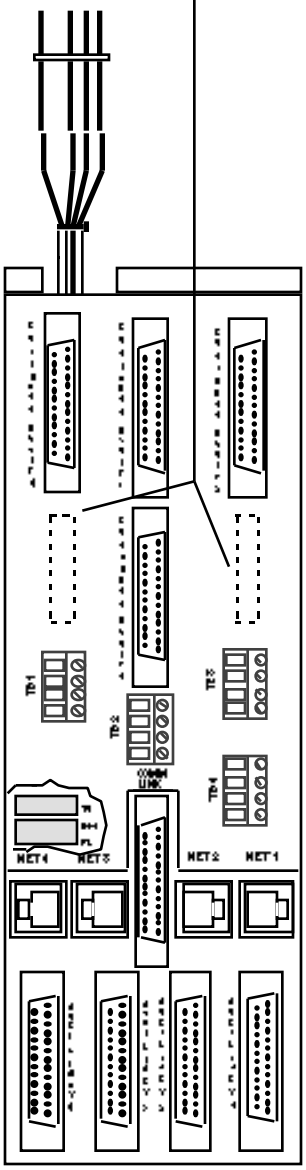


FIGURE 2-10. UNIVERSAL SYSTEM SHELF INSTALLATION

DataComm Enclosure Installation

Connect the network to the DataComm 551 by means of the jack labeled **J1**, as shown in Figure 2-6.

DataComm FourPak Enclosure

Connect the network to the DataComm 551 by means of the jacks labeled **NET1** through **NET4**, as shown in Figure 2-7. When you install a DataComm 551 in slot four (the lower slot), you must install the rear panel option jumper in the **T1** position.

DataComm Modem Shelf Installation

Connect the network to the DataComm 551 as shown in Figure 2-8. Plug the adapter cable and coupler into the network jack on the rear panel, then plug the Telco cable into the coupler.

CAUTION

You must use the adapter cable and coupler to connect the T1 line to the CSU. Plugging the Telco-provided cable directly into the shelf connector may cause damage to the CSU or the network.

GDC TriPak Shelf

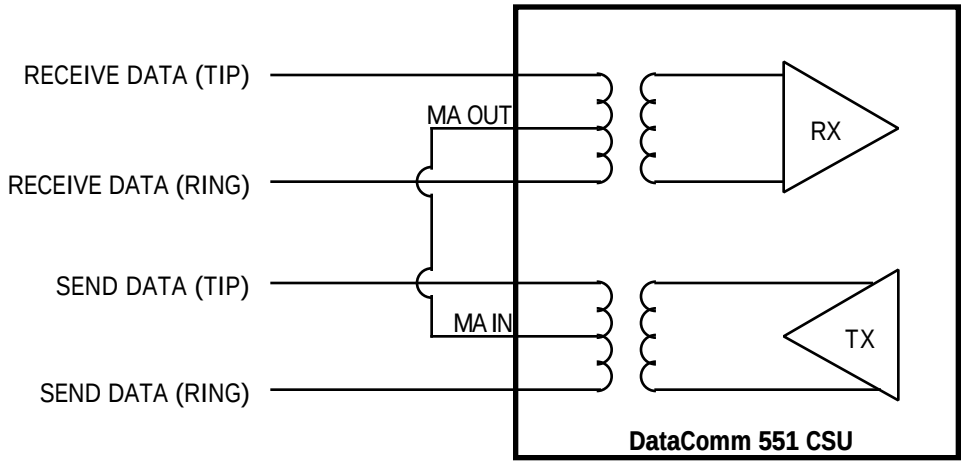
Connect the network to the DataComm 551 by means of the jacks labeled **J1** through **J3**, as shown in Figure 2-9. For each DataComm 551 you install, you must install the appropriate rear panel option jumper in the **T1.5** position.

Universal System Shelf Installation

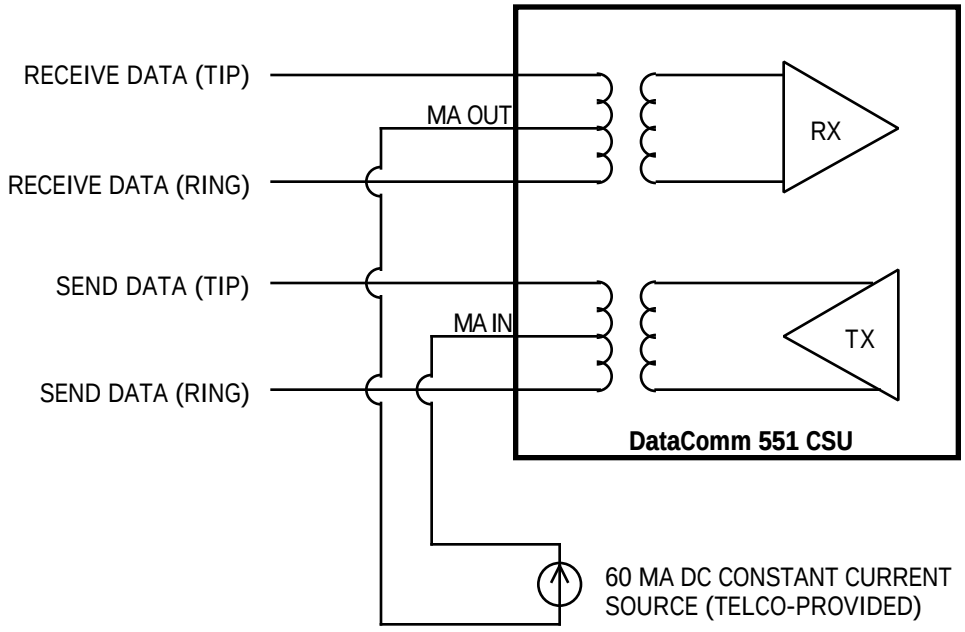
Connect the network to the DataComm 551 by means of the jacks labeled **NET1** through **NET4**, as shown in Figure 2-10. When you install a DataComm 551 in slot four (the rightmost slot) of a quadrant, you must install the rear panel option jumper in the **T1** position.

Span Power Source Connection

In DataComm FourPak, GDC TriPak and Universal System Shelf installations where the T1 span does not provide its own power, a Telco-provided source must be connected. The constant current source must be capable of providing 60 mA dc for simplexing power onto the network data pairs. (Additionally, you must select the IN position for option jumper X3 on the pc card.) Connect the source's positive lead to terminal 2 (MA IN) of the 4-position terminal block (labeled **TB1** through **TB4** on the DataComm FourPak and Universal System Shelf, **TB1** through **TB3** on the GDC TriPak) on the rear panel, as shown in the appropriate figure. Connect the source's negative lead to terminal 1 (MA OUT). Figure 2-11 is a simplified functional diagram of the CSU configured to (a) loop span-provided power, or to (b) provide power to the span.



A. CSU CONFIGURED TO LOOP SPAN POWER (LOOP SELECTED FOR JUMPER X3)



B. CSU CONFIGURED TO PROVIDE POWER TO THE SPAN (IN SELECTED FOR JUMPER X3)

FIGURE 2-11. SPAN POWER OPTIONS

Supervisory Terminal Connection

To allow software-control of configuration, diagnostics, and maintenance, connect the Supervisory terminal as described below. It can be connected directly to the CSU, or indirectly using modems or PMC-100 Performance Monitor Cards. Modems allow the Supervisory terminal to be located away from the CSU, while PMC-100s provide enhanced network control and allow one Supervisory terminal to be easily shared among all CSUs in the network. The Supervisory terminal can be any ANSI X3.64-compatible ASCII terminal that supports asynchronous EIA/TIA-232-E communications. The DataComm 551 Supervisory port supports:

- data rates from from 2400 to 19,200 bps
- one start bit
- a word length of 7 or 8 data bits
- even, odd, or no parity
- one or two stop bits (depending on the data rate).

See Figure 2-3 for the switch selections required to match the DataComm 551 to the Supervisory terminal's parameters.

NOTE

Be sure to configure each CSU in the network to match the Supervisory terminal's data rate and character format.

The Supervisory port pin functions for all installations are as follows:

Pin No.	Function	Direction
2	Send Data	From terminal
3	Receive Data	To terminal
4	Request To Send	From terminal
7	Signal Ground	n/a
8	Carrier Detect	To terminal

Refer to Supervisory Terminal Operating Procedures in Section 3 for further discussion.

DIRECT CONNECTION APPLICATION

The following paragraphs describe directly connecting an on-site Supervisory terminal to the CSU's Supervisory port. However, this basic information applies also to connecting the Supervisory terminal via other devices (such as modems and PMC-100s) described later for other applications.

Unless otherwise noted, the Supervisory port is a 25-pin EIA/TIA-232-E male connector located on the rear panel, and the terminal interface cable must be terminated on the DataComm 551 end in a DB25S connector and on the other end in a connector compatible with the Supervisory terminal. The DataComm 551 requires that the signals be connected to the pins as shown in the appropriate figure.

DataComm Enclosure Installation

Connect the Supervisory terminal to the DataComm 551 by means of the connector labeled **Auxiliary**, as shown in Figure 2-6.

DataComm FourPak Enclosure

Connect the Supervisory terminal to the DataComm 551 by means of the connectors labeled **AUXILIARY 1** through **AUXILIARY 4**, as shown in Figure 2-7.

DataComm Modem Shelf Installation

Connect the Supervisory terminal to the DataComm 551 as shown in Figure 2-8.

GDC TriPak Shelf

Connect the Supervisory terminal to the DataComm 551 by means of the connectors labeled **AUX-A** through **AUX-C**, as shown in Figure 2-9.

Universal System Shelf Installation

Connect the Supervisory terminal to the DataComm 551 by means of the connectors labeled **AUXILIARY 1** through **AUXILIARY 4**, as shown in Figure 2-10.

MODEM APPLICATION

In an application using modems for access to the Supervisory port from a remotely-located Supervisory terminal, such as illustrated in Figure 2-12, one modem is required for the terminal and one for each CSU.

At the service center:

- Connect the modem to the Supervisory terminal as shown. The interface cable must be terminated on the modem end in a DB25P connector and on the other end in a connector compatible with the Supervisory terminal. The Supervisory port requires that the signals described above be supported. For the modem, select XOFF/XON flow control (if applicable, to prevent losing data when the modem is operating at a slower speed than the terminal).

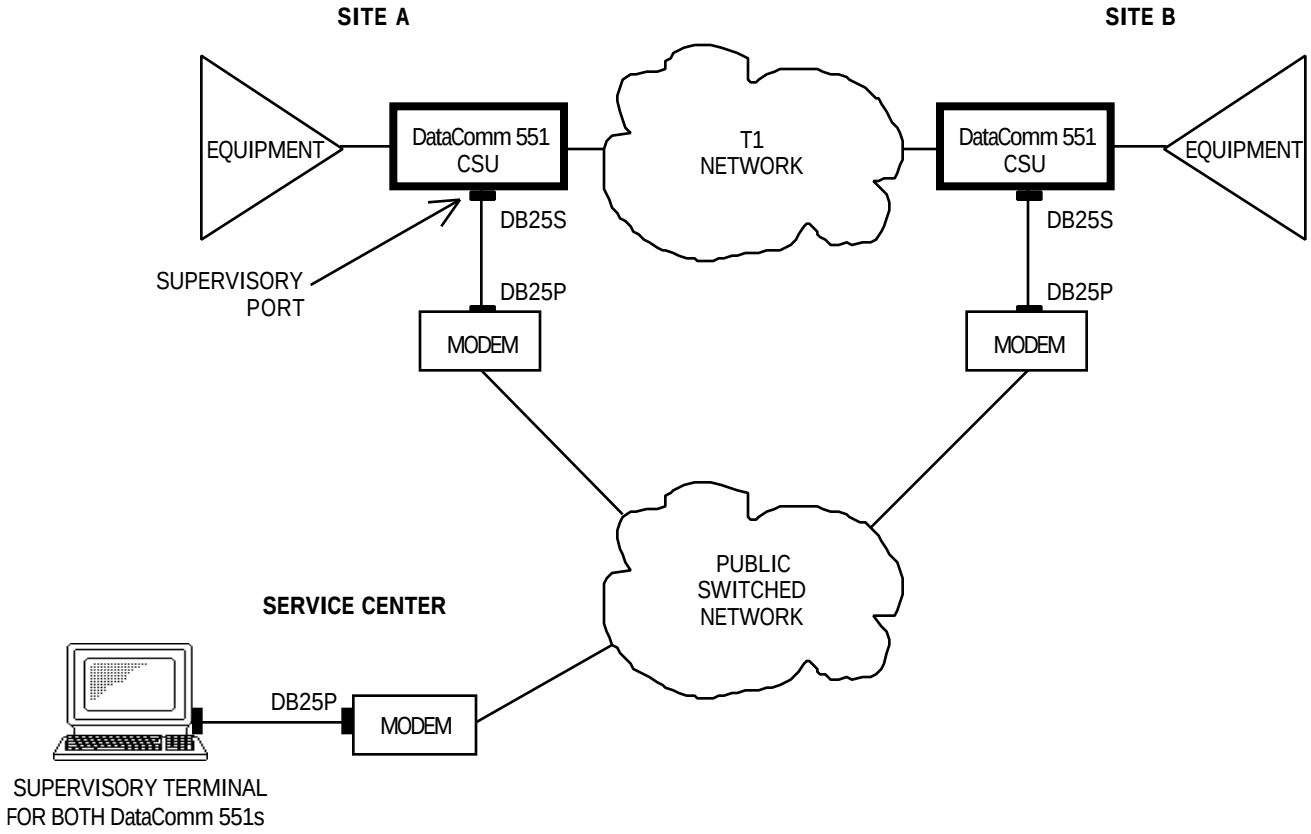


FIGURE 2-12. SUPERVISORY TERMINAL MODEM APPLICATION

At each CSU site:

- Connect the modem to the DataComm 551 by means of the 25-pin EIA/TIA-232-E male Supervisory port connector on the DataComm 551 rear panel, as shown in the appropriate figure. The interface cable must be terminated on the modem end in a DB25P connector and on the DataComm 551 end in a DB25S connector. The DataComm 551 requires that the signals be connected to the pins as shown. For the modem, enable Auto Answer (for unattended operation), disable terminal commands (to prevent the modem from responding to commands intended for the CSU), and select XOFF/XON flow control (if applicable, to prevent losing data when the modem is operating at a slower speed than the CSU).

PMC-100 APPLICATION

In a PMC-100 application, such as illustrated in Figures 1-3 through 1-5, the Supervisory terminal can be used to access all CSUs in the network. The PMC-100s at the hub site allow direct access to their CSUs, as well as access to the other sites' CSUs via in-band communication. The modem at each the other sites allows access to its CSU via out-of-band communication.

NOTES

a. Be sure to select a unique address number and enable PMC-100 operation for each CSU in the network.

b. When PMC-100 Operation is selected for a DataComm 551, its Supervisory port is disabled. Supervisory terminal communications are handled on the RS-485 bus interconnecting the units.

Refer to the PMC-100 manual for additional PMC-100 installation instructions.

Primary Power Connection

After the above connections have been made, the options selected, and the DataComm 551s installed, refer to the following instructions on connecting primary power to the system. The outlet used to provide ac power, where applicable, should not be under switch control. The DataComm 551 should be powered by the same ac source as the customer equipment interfaced with it to prevent large circulating currents caused by differences in ground potential. If it is not possible to determine whether the customer equipment is powered by the same ac source, it should be verified that a potential difference of less than 0.25 V rms exists between the grounding circuits of the respective outlets.

CAUTION

This unit incorporates an internal fusible link, FL1 (illustrated in Figure 2-1), which may be opened if the ground potential between the unit and peripheral equipment exceeds 0.25 V rms. Do not apply power to the unit until all connections to the peripheral equipment have been made. If the fusible link is opened, return the unit for repair.

NOTE

The Telco continuously monitors the T1 link and the equipment connected to it. Before connecting the DataComm 551 to the network, or disconnecting it, the Telco should be notified.

DataComm Enclosure Installation

The DataComm Enclosure is equipped with a captive ac power cord terminated in a molded three-prong plug. Plug the cord into a polarized outlet providing the required ac power.

DataComm FourPak Enclosure Installation

The DataComm FourPak Enclosure is equipped with a captive ac power cord terminated in a molded three-prong plug. Plug the cord into a polarized outlet providing the required ac power.

DataComm Modem Shelf Installation

Refer to the appropriate Instruction Manual for details.

GDC TriPak Shelf Installation

Refer to the Instruction Manual for details.

Universal System Shelf Installation

Refer to the appropriate Instruction Manual for details.

SECTION 3

OPERATION

OVERVIEW

This section describes the front panel indicators, test jacks, and switches of the DataComm 551, and the operation of the Supervisory terminal.

FRONT PANEL INDICATORS, TEST JACKS, AND SWITCHES

Figures 3-1, 3-2, and 3-3 illustrate the DataComm 551 front panel indicators, test jacks, and switches, and explain the function of each. Use of the test jacks and switches is further detailed in Section 4.

SUPERVISORY TERMINAL OPERATING PROCEDURES

The Supervisory terminal is used to configure, test, and maintain the DataComm 551 to which it is connected. It is also used to monitor the network Performance Reports provided by the Central Office. The functions of the Supervisory terminal are menu-oriented: there is a MAIN MENU which provides access to the DS1 and DS0 DIAGNOSTICS menus and their screens, and the CSU CONFIGURATION and MAINTENANCE screens (see Figure 3-4). Each screen displays current data and allows changes to be made to the data. Thus, the user steps through the menus until the desired screen is displayed, and reviews or changes the data for individual fields.

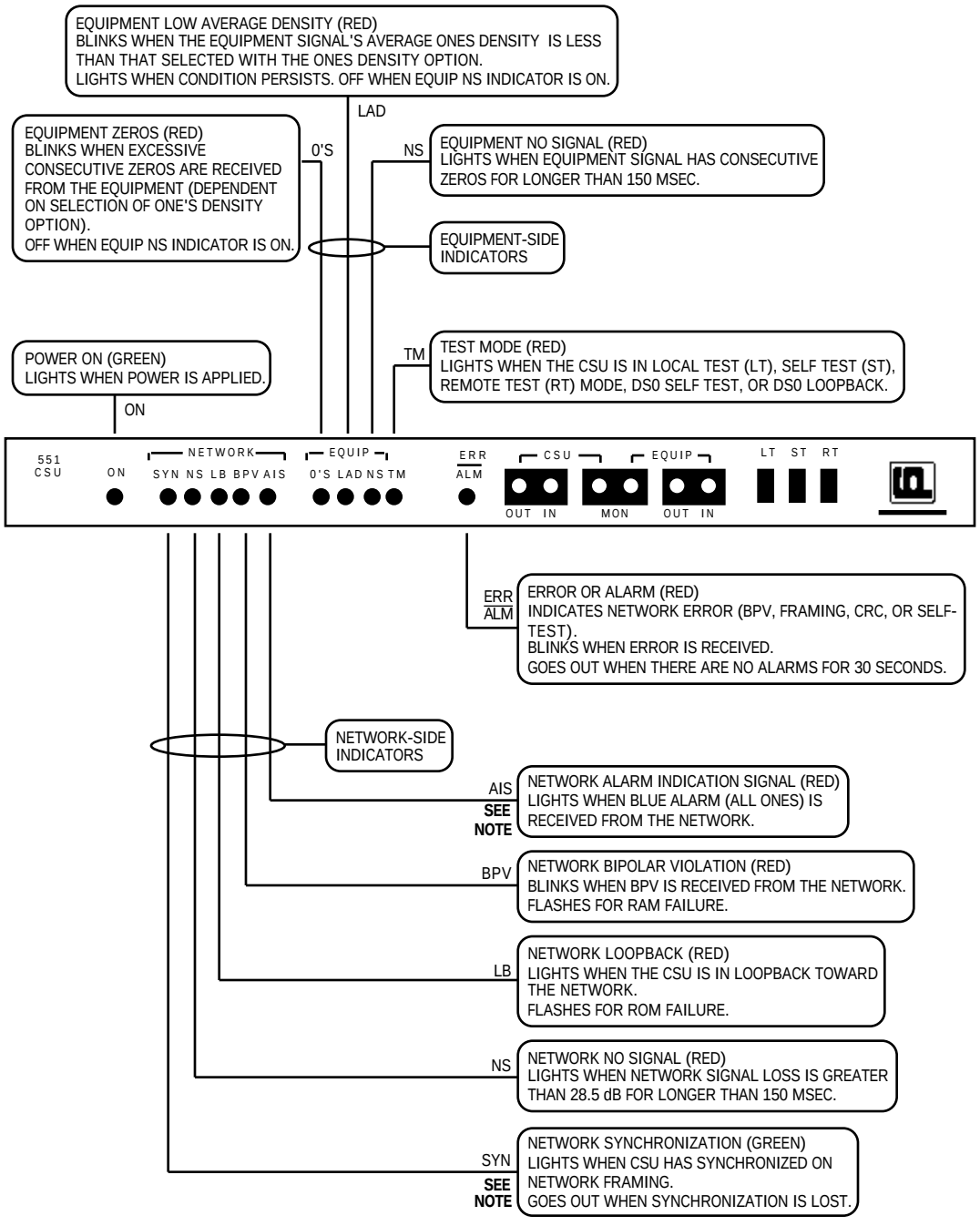
NOTE

a. *If the Supervisory terminal locks up (ceases to respond), cycle terminal power (turn it off and then on). This will not disrupt customer or network data.*

b. *In Unframed Mode, some Supervisory terminal status line indicators are not shown and some front panel LEDs are not used, and several screens and menus are altered or removed. These differences are noted with the affected items.*

Accessing a CSU

The Supervisory terminal is typically co-located and used with a single CSU, as shown in Figure 1-1. However, it can be located and used remotely, and it can be used to access more than one CSU. These applications utilize modems or PMC-100 Performance Monitor Cards, or both, to



NOTE: NOT USED IN UNFRAMED MODE.

FIGURE 3-1. FRONT PANEL INDICATORS

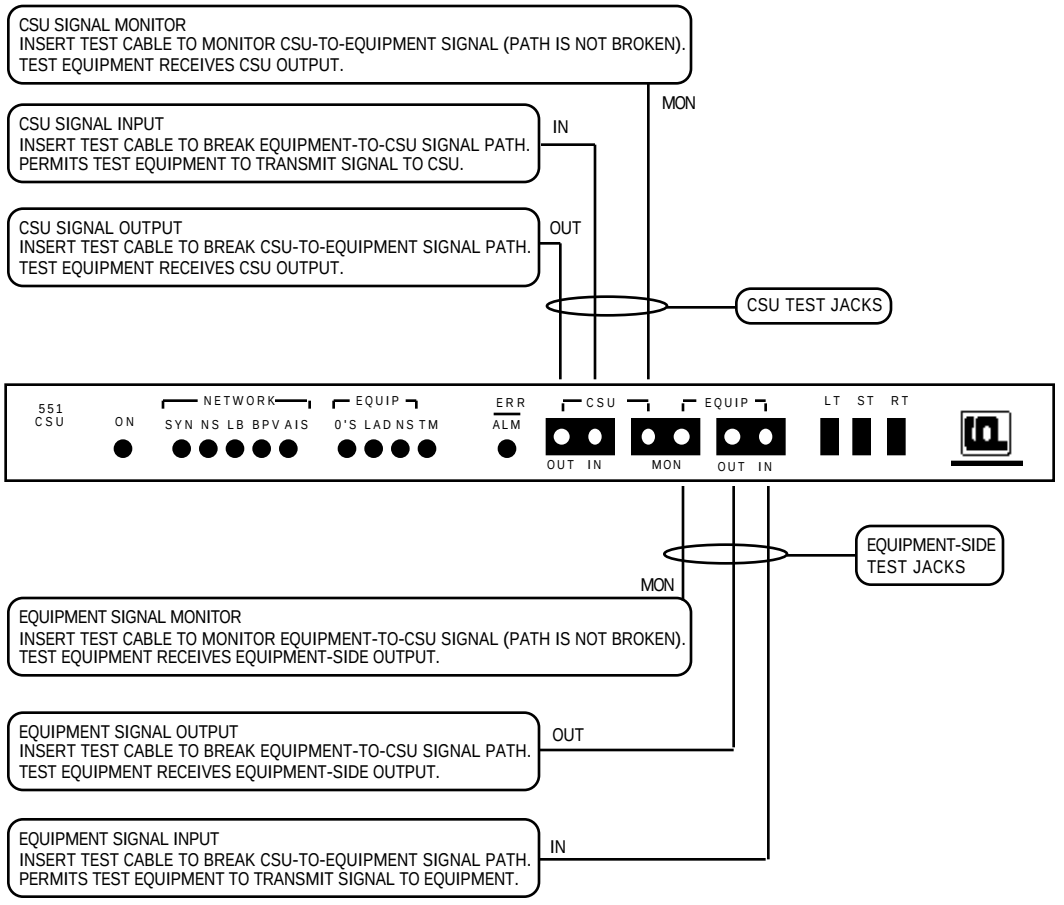
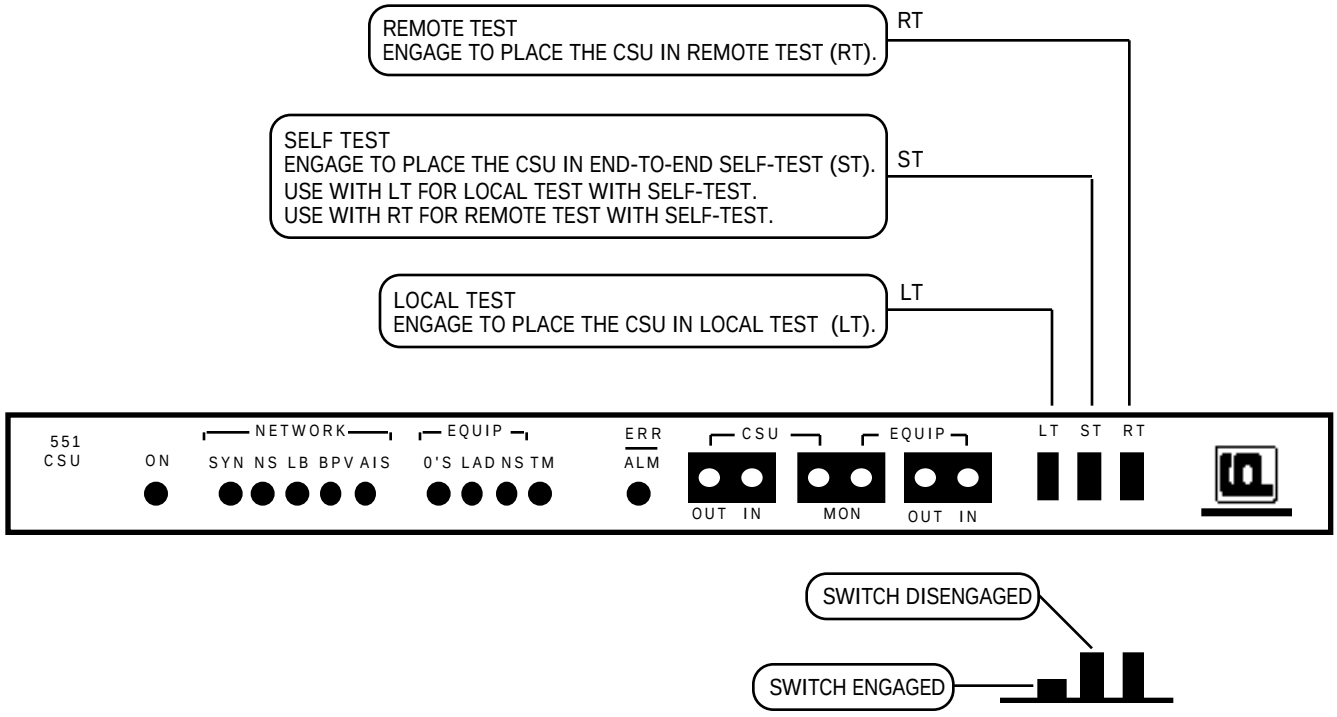


FIGURE 3-2. FRONT PANEL ACCESS TEST JACKS



NOTE: USE OF THESE SWITCHES MAY BE INHIBITED, DEPENDING ON SELECTION OF THE INHIBIT FRONT PANEL OPTION.

FIGURE 3-3. FRONT PANEL SWITCHES

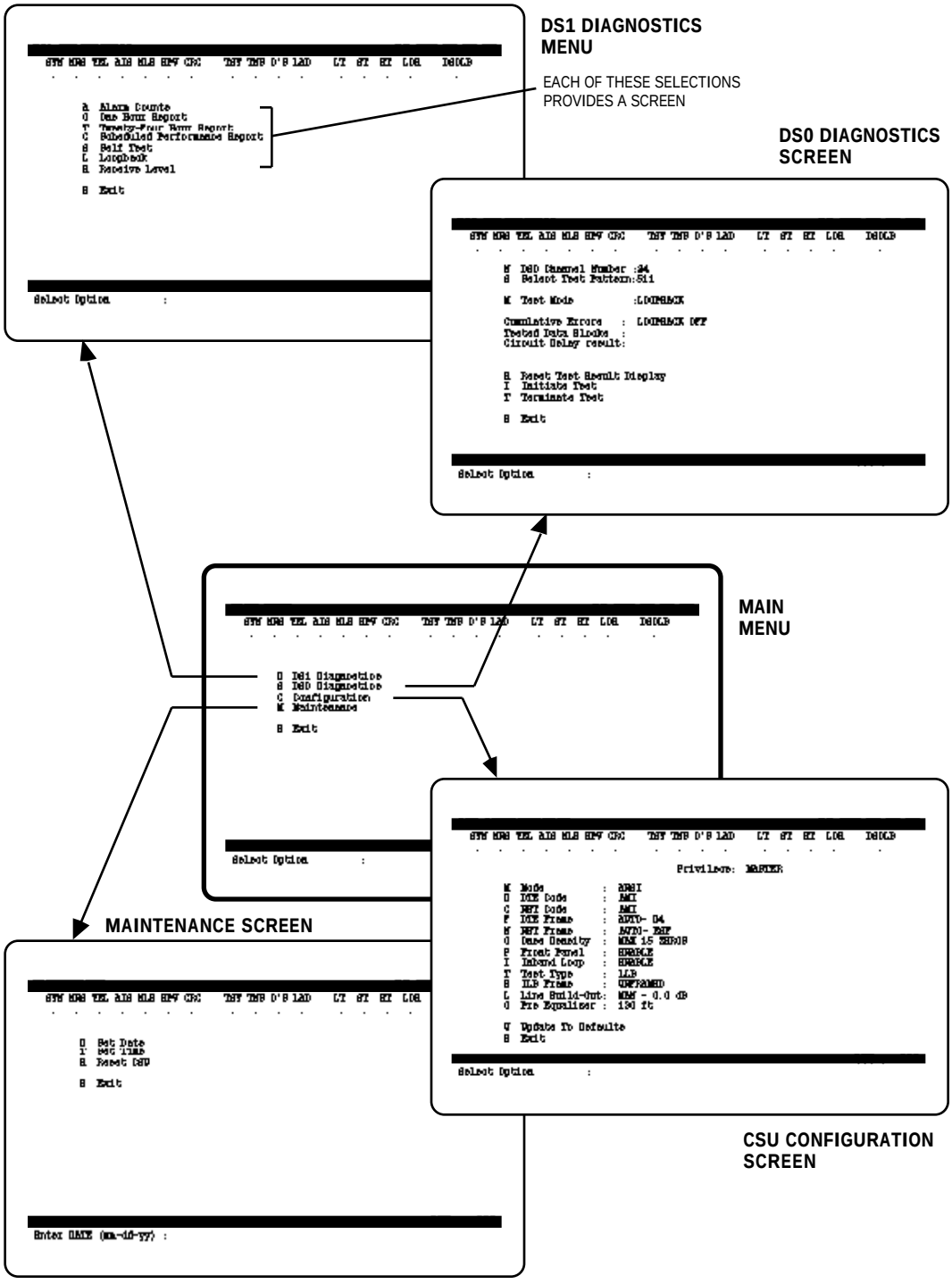


FIGURE 3-4. MENU ORGANIZATION

provide this access. Once the Supervisory terminal is communicating with the CSU, its operation is the same regardless of the means used to connect to it. That is, the Supervisory terminal appears to be connected directly to the CSU. The following paragraphs describe the procedures used to access the CSU.

MODEM APPLICATION

A typical application providing remote access is illustrated in Figure 1-2. To access a CSU, place a normal data call from the terminal location to the desired CSU location. After the data connection is made, use the terminal as you would when it is connected directly (described below). If you placed the call using the terminal, be sure to place the modem in data mode.

PMC-100 APPLICATION

PMC-100s provide enhanced network control and allow one Supervisory terminal to be easily shared among all CSUs in the network, as shown in Figures 1-3 through 1-5. Each CSU has a unique identification, or address, that is assigned during CSU configuration. (One PMC-100 is configured as the master and it is the one through which you access any CSU in the network.) To access a CSU once the Supervisory terminal is connected to the master PMC-100 (either directly or via modems) and the PERFORMANCE MONITOR menu is displayed:

1. Press N to select the NETWORK ELEMENT ACCESS screen.

2. Enter the three-digit address (000 to 255) of the desired CSU, then press the **RETURN** ( ) key. This address is sent to all CSUs, but only the one assigned this address responds. If the CSU does not respond, the terminal displays the message **No Response** at the bottom of the screen. If you entered an incorrect address, the terminal displays the message **Invalid Address** at the bottom of the screen. Enter the correct address.

3. The Supervisory terminal is communicating with the CSU, and the CSU displays the log-on screen and its address (at the bottom of the screen). Use the terminal as you would when it is connected directly (described below).

To access the master PMC-100 from a CSU, at any time, press the control key and the P key (for PMC-100) simultaneously. This is abbreviated as <Ctl>P.

You can also use the following at any time as an alternative method to access a CSU:

1. Press the control key and the A key (for address) simultaneously. This is abbreviated as <Ctl>A.

2. The terminal displays the message **Enter Address** at the bottom of the screen. Enter the address of the desired CSU, then press **RETURN**.

3. The Supervisory terminal is communicating with the CSU.

CAUTION

Do not attempt to access another CSU or the master PMC-100 while a CSU is waiting for confirmation of your last entry (indicated by the prompt **Are You Sure? (Y/N)** *displayed at the bottom of the screen). If you do, you must repeat the process of accessing it.*

Refer to the PMC-100 manual for additional PMC-100 operating instructions.

Master/Slave CSU Option

The master/slave CSU option provides control over using the Supervisory terminal to configure the CSU. A master CSU allows configuration via the Supervisory terminal, while a slave CSU prevents it (changes can be made only via option switches). Any number of CSUs in the network can be masters or slaves. There are two means of communication between the Supervisory terminal and a CSU's Supervisory port:

- In-band communication — the primary means of communicating with the CSU, utilizing PMC-100s and a dedicated multiplexer channel (i.e., a permanent virtual circuit, or PVC). In-band communication is intended for monitoring the CSU's performance reports and performing other *non-disruptive* diagnostics and maintenance functions. A typical in-band communication path is illustrated in Figure 2-4.

- Out-of-band communication — the alternate means of communicating with the CSU, that does not depend on the T1 link to the CSU. Out-of-band communication with the CSU is typically made via modems or a Supervisory terminal co-located with the CSU. It is intended for performing diagnostics that would disrupt in-band communication (such as a loopback) and for accessing the CSU when a T1 link failure prevents in-band communication. A typical out-of-band communication path is illustrated in Figure 2-5.

You cannot make configuration changes to a slave CSU, regardless of the communication path, that could disrupt in-band communication. A slave CSU displays a warning message when the user attempts to configure it or perform a self-test or loopback, although it does not prevent these tests.

CAUTION

Use only out-of-band communication for performing diagnostics that disrupt in-band communication. These include self-tests and all loopbacks. A slave CSU displays the warning message **WARNING: Interfering To Inband Communication** *when you attempt to perform a self-test or loopback: Proceeding with the diagnostic can result in inaccurate data on the terminal or complete loss of communication.*

The Log-On Screen

When you access the CSU, or on CSU power-up or reset, the DataComm 551 log-on screen is displayed (see Figure 3-5). It displays the following information:

- system date (**DD-MMM-YY**)
- system time (**HH:MM**)
- firmware revision level (**REV:** revision)
- status of the CSU non-volatile memory (**NVRAM:** status)
- status of the CSU random access memory (**RAM:** status)
- status of the CSU read-only memory (**ROM:** status)
- CSU address number (**CSU:** 3-digit address)

Until it is set (using the Set Date function of the MAINTENANCE screen), the date displayed is the firmware release date. After being set, it is the true system date.

Until it is set (using the Set Time function of the MAINTENANCE screen), the time displayed is the time elapsed since the CSU was powered up or reset. After being set, it is the true system time.

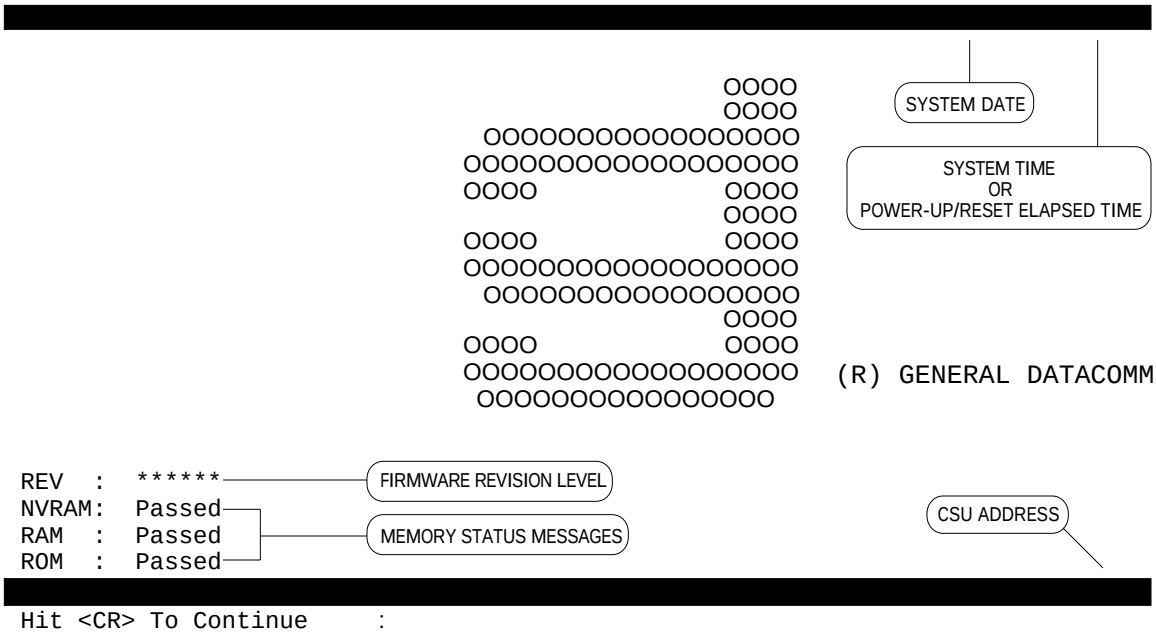


FIGURE 3-5. LOG-ON SCREEN

The firmware revision level identifies the firmware version (the system software contained in EPROMs).

A memory status message is **Passed** (message is on steady) or **Failed** (message is flashing), and indicates whether the memory passed certain tests. A RAM failure is also indicated by flashing front panel indicator **BPV**, and a ROM failure is also indicated by flashing front panel indicator **LB**. Any failed memory should be considered a potentially serious problem and the pc card should be replaced. Use of the Supervisory terminal is prohibited during a failed memory condition. Supervisory terminal operation may be restored and the memory problem may be temporarily corrected by powering off the CSU and then powering it on. If the problem cleared, the CSU and Supervisory terminal should be operational.

The CSU address number (000 to 255) identifies the CSU to which you are connected. This address is defined by option switches S4-1 to S4-8.

Press **RETURN** to display the MAIN MENU.

Display Information

Each menu and screen (except the log-on screen) displays the following information (see Figure 3-6):

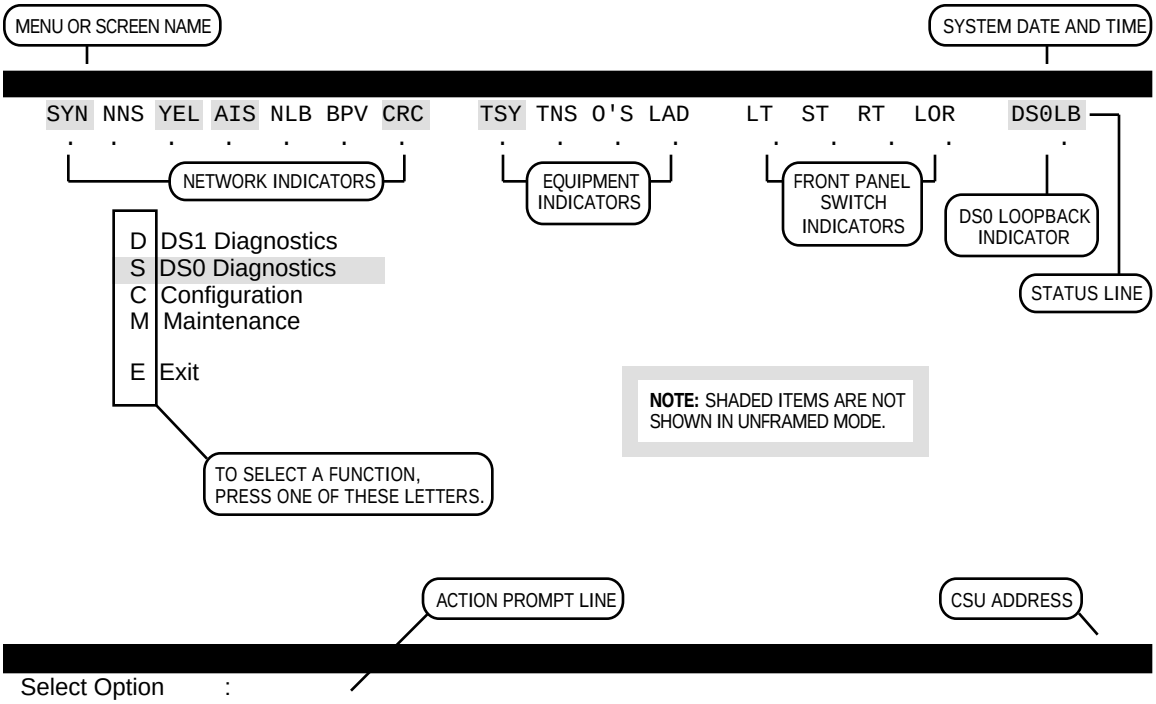


FIGURE 3-6. MAIN MENU

- current menu or screen name
- system date and time
- status line
- CSU address number

The status line reflects the status of the front panel indicators and switches, and provides additional information. For front panel switches, a period (**.**) indicates that the switch is disengaged, and an **X** indicates that it is engaged. For front panel indicators, a period indicates normal status, and an **X** indicates abnormal status. The meanings of the status line indicators are described in Table 3-1.

Using the Keyboard

To select any menu, screen or function displayed on the current screen, simply press the letter shown to left of its name. To select the DS1 DIAGNOSTICS menu from the MAIN MENU, for example, press **D**. The CSU requests confirmation of the entry by displaying the message **Are You Sure? (Y/N)** at the bottom of the screen. Press **Y** to confirm the entry and continue, or press **N** to stop. In all menus and screens, keyboard entries are not case-sensitive: it does not matter whether the Supervisory terminal is in lower-case or upper-case mode (all entries are converted to upper-case). If you press an invalid key (one that is not used in the current screen) or enter a value that is out of range, the terminal beeps and an error message is displayed at the bottom of the screen. Try a valid entry.

To return to the previous menu, press **E** (exit) or **<ESC>** (escape).

The Main Menu

The MAIN MENU (see Figure 3-6) provides access to the DS1 and DS0 DIAGNOSTICS menus and the CSU CONFIGURATION and MAINTENANCE screens.

NOTE

In Unframed Mode, the DS0 Diagnostics selection is removed from the MAIN MENU (the entire bandwidth is used for customer payload, so the signal is not channelized, DS0s do not exist, and DS0-level diagnostics do not apply).

TABLE 3-1. STATUS LINE INDICATORS

Status Line Indicator Name	Equivalent Front Panel Name	Description
		Network Indicators
SYN *	SYN *	*Network Synchronization* — indicates whether the CSU is (.) or is not (X) synchronized with network framing. (In Unframed Mode, there are no network framing bits, so synchronization with the network cannot be assured and it is not monitored.)
NNS	NS	*Network No Signal* — indicates whether the CSU is (.) or is not (X) receiving a network signal (a signal with loss greater than 28.5 dB for longer than 150 milliseconds is considered no signal).
YEL *	n/a	*Yellow Alarm* — indicates whether the CSU is (X) or is not (.) receiving a Yellow alarm signal. In response to receiving a Yellow alarm from one side, the CSU transmits a Yellow alarm to the other side, in the proper format (D4 or ESF). (In Unframed Mode, the entire bandwidth is used for customer payload, so none is available to carry this alarm information.)
AIS *	AIS *	*Alarm Indication Signal* — indicates whether the CSU is (X) or is not (.) receiving an AIS (a keep alive signal of all 1s). In response to receiving an AIS from one side, the CSU returns a Yellow alarm, and transmits an AIS to the other side. (In Unframed Mode, there are no network framing bits, so a keep alive signal is not indicated as an alarm.)
NLB	LB	*Network Loopback* — indicates whether the CSU is (X) or is not (.) in a loopback test toward the network.
BPV	BPV	*Network Bipolar Violation* — indicates whether the CSU has (X) or has not (.) received a BPV.
CRC *	n/a	*Cyclic Redundancy Check* — indicates whether the CSU has (X) or has not (.) received a CRC error. (In Unframed Mode, the entire bandwidth is used for customer payload, so this alarm information does not apply.)
		Equipment Indicators
TSY *	n/a	*Equipment Synchronization* — indicates whether the CSU is (.) or is not (X) synchronized with equipment framing. (In Unframed Mode, there are no equipment framing bits, so synchronization with the equipment is not required.)
TNS	NS	*Equipment No Signal* — indicates whether the CSU is (.) or is not (X) receiving an equipment signal (a signal with consecutive zeros for longer than 150 milliseconds is considered no signal).
0'S	0'S	*Equipment Zeros* — indicates whether the CSU is (X) or is not (.) receiving an excessive number of consecutive zeros. The threshold is dependent on the selection of the Ones Density option (maximum of 15 or 39 consecutive zeros).
LAD	LAD	Low Average Density — indicates whether the CSU is (X) or is not (.) receiving an average pulse density less than that selected with the Ones Density option (minimum of N "ones" per 8(N+1) bits).

* In Unframed Mode, this status line indicator is not shown (it is removed from the status line) or this front panel LED is not used (it remains OFF).

Note: The normal status is indicated by a period (.), while an abnormal condition is indicated by an X.

TABLE 3-1. STATUS LINE INDICATORS (Cont.)

Status Line Indicator Name	Equivalent Front Panel Name	Description
		Pushbutton Switches
LT	TM	*Local Test* — indicates whether the LT pushbutton is engaged (X) or disengaged (.).
ST	TM	*Self-Test* — indicates whether the ST pushbutton is engaged (X) or disengaged (.). Also indicates whether DS0 Self Test or DS0 Loopback (at the local CSU) is (X) or is not (.) active.
RT	TM	*Remote Test* — indicates whether the RT pushbutton is engaged (X) or disengaged (.).
		Other Indicators
LOR	n/a	*Local Option Override* — indicates whether Local Option Override is disabled (.) or enabled (X).
DS0LB *	n/a	*DS0 Loopback* — indicates whether DS0 Loopback (at the local CSU) is (X) or is not (.) active. (In Unframed Mode, the entire bandwidth is used for customer payload, so the signal is not channelized, DS0s do not exist, and channel-level (DS0) diagnostics do not apply.)

* In Unframed Mode, this status line indicator is not shown (it is removed from the status line) or this front panel LED is not used (it remains OFF).

Note: The normal status is indicated by a period (.), while an abnormal condition is indicated by an X.

The DS1 Diagnostics Menu

The Supervisory terminal can be used to monitor T1 link Performance Reports provided by the Central Office, display alarm counts, and perform diagnostics such as loopback tests. Figure 3-7 illustrates the screens and functions available through the DS1 DIAGNOSTICS menu.

To keep track of and analyze network performance, the network needs error information based on intervals of 15 minutes, one hour and 24 hours, with a resolution generally of one second. For the purposes of generating reports for the network, time begins when the CSU is powered up or reset, so the times you see displayed have little or nothing to do with the actual time of day. Most errors are logged over 15-minute intervals (there are four 15-minute intervals per hour and 96 15-minute intervals per 24 hour period). As time progresses, the errors for one interval become the errors for the next interval and are no longer updated: only the current interval is ever updated.

The CSU stores error information in two independent register (memory) sets: the network register set and the user register set. The network register set is provided for the Central Office to retrieve and clear. The user register set is what you see displayed in the various diagnostics screens, but it is not affected when the Central Office clears the network register set. Therefore, the two register sets will not contain the same error information after the Central Office clears the network register set.

NOTE

In Unframed Mode, the One Hour Report, Twenty-Four Hour Report and Scheduled Performance Report

NOTE

In Unframed Mode, the One Hour Report, Twenty-Four Hour Report and Scheduled Performance Report selections are removed from the DS1 DIAGNOSTICS menu (the entire bandwidth is used for customer pay-load, so network performance is not measured and these screens do not apply).

The errors reported by the CSU are:

- ESF error events — An Extended Superframe Format (ESF) error event is an ESF frame that contains a CRC-6 error event or an OOF state, or both. ESF error events are processed to derive ESs and severely ESs.
- Errored seconds (ESs) — An ES is a second with one or more ESF error events.
- Severely errored seconds — A severely ES is a second with 320 or more ESF error events. Severely ESs are also processed to derive failed sig-nal states.
- Failed signal states — A failed signal state occurs when 10 consecutive severely ESs occur. While in a failed signal state, no ESs are counted. For every second a failed signal state exists, an FS results.
- Failed seconds (FSs) — An FS is counted for every second a failed signal state exists.

How these errors are related and derived is shown in Figure 3-8.

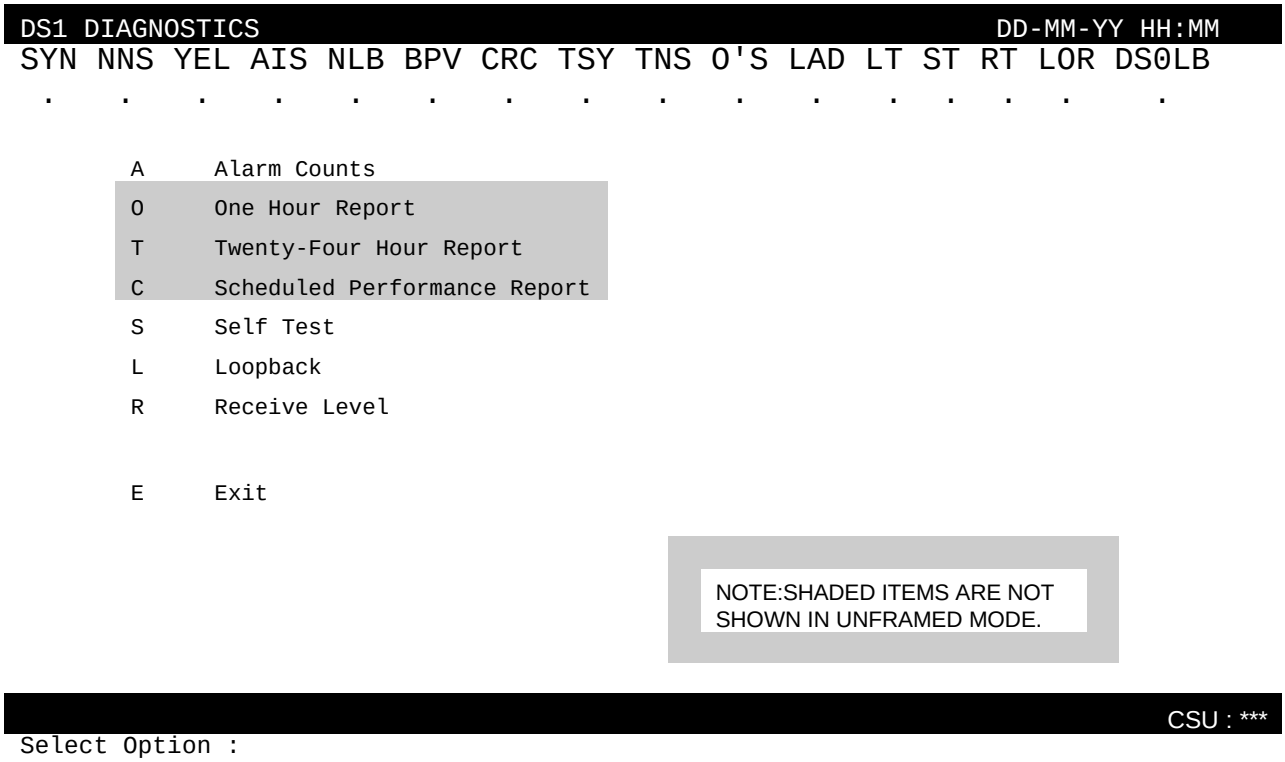


FIGURE 3-7. DS1 DIAGNOSTICS MENU

ALARM COUNTS SCREEN

This function displays the count (number of recorded events) of each of the listed errors that have been reported in the displayed time interval. The maximum count for any alarm is 65535, unless otherwise stated. The information is updated when you begin this function and when you press RETURN while this screen is displayed. The alarm counts are divided into two groups: network and DTE (equipment) alarm counts, and are described below. To use this function, press A. Figure 3-9 illustrates the ALARM COUNTS screen.

NOTE

In Unframed Mode, the Network Out Of Frame, Received Yellow, Alarm Indication, Failed Signal State, Controlled Slips and CRC Error counters, as well as the DTE Loss Of Sync counter, are removed from the ALARM COUNTS screen (the entire bandwidth is used for customer payload, so these framing alarms do not apply).

When you use the PMC-100 to perform the Scan Network Elements func-tion, a 551 with alarm conditions reports to the PMC-100 the number of Major and Minor Alarms but does not report specific alarms. You must review the ALARM COUNTS screen to determine which alarms exist. The following lists alarm conditions by type:

Minor Alarms	Major Alarms
Network Received Yellow	Network Alarm Indication
DTE Excessive Zeros	Network Failed Signal State
DTE Low Average Density	Network Loss Of Signal
	Network Red Alarm (* network OOF)
	DTE Loss Of Signal

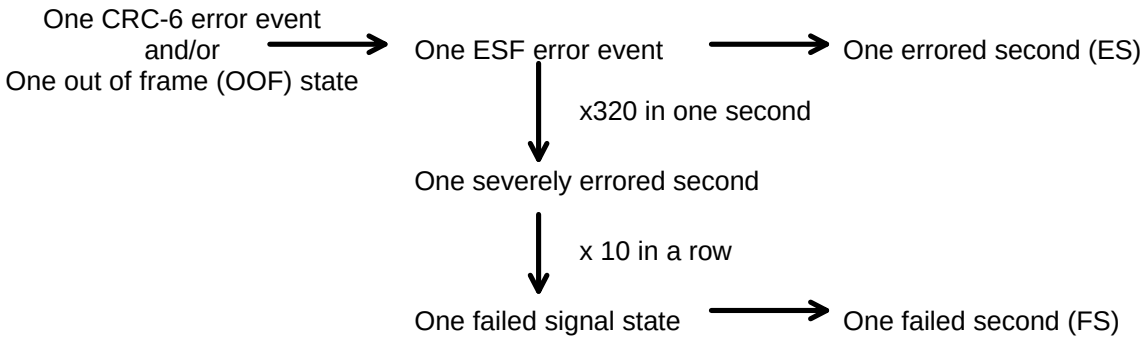


FIGURE 3-8. ERROR DESCRIPTION

* These alarms appear on the status line. Because they indicate current status, they may have cleared by the time you go from the PMC-100's Scan Network Elements screen to the 551 reporting the alarm.

Interval

The displayed time interval indicates the number of hours (**nn Hrs**) and minutes (**nn Mins**) since the CSU has been powered up or reset, or since the alarms have been cleared.

Network Loss Of Signal

A Loss of Signal (LOS) event occurs when the CSU senses an absence of network signal. A signal with loss greater than 28.5 dB for longer than 150 milliseconds is considered no signal. The status line **NNS** indicator and front panel **NS** indicator reflect the current status of the network signal condition.

Network Out Of Frame

An Out Of Frame (OOF) event occurs when the CSU misses two out of five network framing bits.

Network Received Yellow

This is a count of the number of times the CSU receives a Yellow alarm from the network (the counter increments only when the alarm is removed). The status line **YEL** indicator reflects whether the CSU is receiving a Yellow alarm.

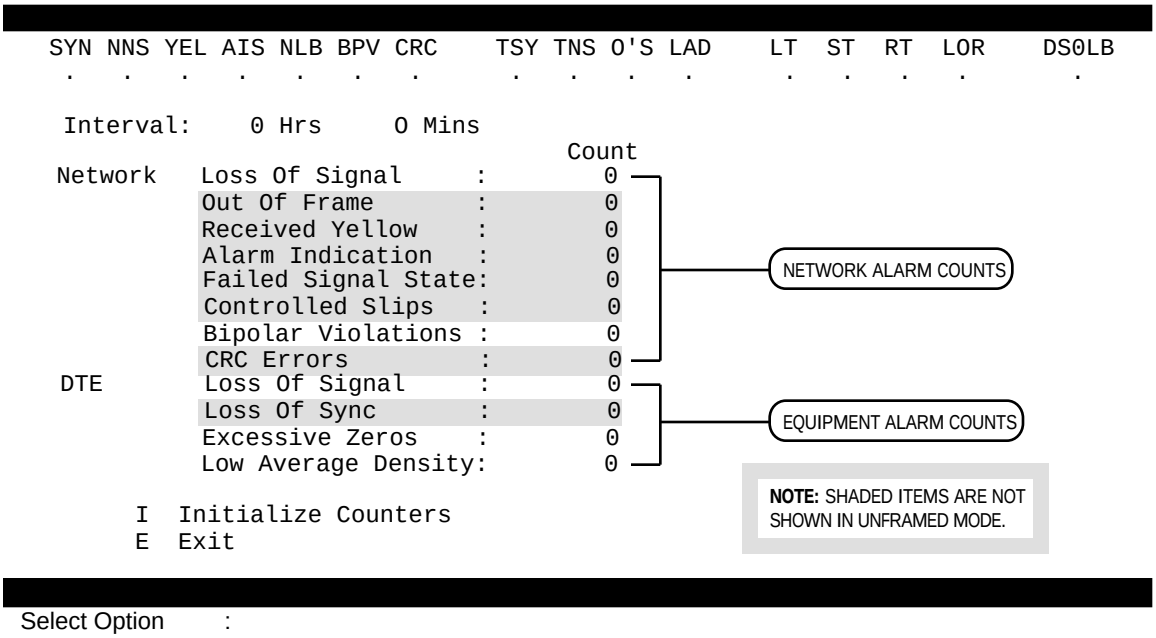


FIGURE 3-9. ALARM COUNTS SCREEN

Network Alarm Indication

This is a count of the number of times the CSU receives an AIS from the network (the counter increments only when the alarm is removed). The status line and front panel **AIS** indicators reflect whether the CSU is receiving an AIS.

Network Failed Signal State

A failed signal state event occurs when 10 consecutive severely ESs occur. A failed signal state ends when 10 consecutive seconds of data are processed and no severely ESs occur. For every second a failed signal state exists, an FS results.

Network Controlled Slips

A controlled slip event is the occurrence of a replication or deletion of one DS1 frame by the receiving equipment. A controlled slip event occurs when the difference in the timing between the synchronous receiving equipment and the received signal is of such magnitude that it exhausts the buffer capability of the equipment.

Network Bipolar Violations

A bipolar violation (BPV) event occurs when the CSU receives from the network two or more consecutive bits that do not alternate between signal levels as required by the network for the Alternate Mark Inversion (AMI) line code. The status line and front panel **BPV** indicators reflect the current status of BPV error events.

Network CRC Errors

A CRC error event occurs when the CRC-6 code calculated at the receiving end does not match the CRC-6 code calculated by the transmitting end. The CRC is a method of detecting errors in the DS1 signal, and is performed on each ESF superframe. The status line **CRC** indicator reflects the current status of CRC error events.

DTE Loss Of Signal

An LOS event occurs when the CSU senses an absence of equipment signal. A signal with consecutive zeros for longer than 150 milliseconds is considered no signal. The status line **TNS** indicator and front panel **NS** indicator reflect the current status of the equipment signal condition.

DTE Loss Of Sync

This is a count of the number of times the CSU loses synchronization with equipment framing. The front panel **TSY** indicator reflects the current status of CSU-to-equipment synchronization.

DTE Excessive Zeros

This is a count of the number of times the equipment transmits too many consecutive zeros. The threshold for this counter is dependent on the selec-

tion of the Ones Density option (maximum of 15 or 39 zeros), defining the maximum number of consecutive zeros transmitted before a "one" is inserted. The status line and front panel **0'S** indicators reflect the current status of excessive zeros.

DTE Low Average Density

This is a count of the number of times the CSU receives an equipment signal with an average pulse density less than that selected with the Ones Density option (minimum of N "ones" per 8(N+1) bits, where N = 1 to 24). The status line and front panel indicators **LAD** reflect the current status of the ones density.

Initialize Counters

This function clears from memory (initializes) the count for each of the above errors. It also initializes the time interval, setting it to 0 hours and 0 minutes. The alarm counters should be initialized daily, because once they reach their maximum value they no longer provide accurate information. To use this function, press **I**. The CSU prompts **Are You Sure? (Y/N)**. Press **N** to abort this function, or **Y** to continue (the CSU displays the message Cleared All Alarms as confirmation of this action).

ONE HOUR REPORT SCREEN

This function displays error information that the CSU stores in the user register set. It is similar to what the CSU stores in the network register set and makes available to the Central Office upon its request for a 1-Hour Performance Report. Although the 1-Hour Performance Report is required only for the AT&T mode, the user register set (but not the network register set) is also available for the ANSI mode. On power up, all registers are cleared (reset to 0). The information is updated once every second. To use this function, press **O**. Figure 3-10 illustrates the ONE HOUR REPORT screen.

NOTE

In Unframed Mode, the ONE HOUR REPORT screen is removed from the DS1 DIAGNOSTICS menu (the entire bandwidth is used for customer payload, so network performance is not measured and this screen does not apply).

Valid Intervals

This is a count of the number of valid 15-minute intervals during which the CSU has been collecting data. The maximum count is 96.

Current Interval ES/FS

This is a count of the ESs and FSs for the current 15-minute interval. When 15 minutes passes, this data is shifted down into the *1st 15-Minutes* counter and is replaced by new data. The maximum count for each is 900 (15 minutes = 900 seconds).

Current Interval Time

This is the number of seconds into the current 15-minute interval. The maximum count is 900.

Last 24 Hours ES/FS

This is an averaged summary of the ES and FS counts for the last 24 hours. The maximum count is 65535. If this number is exceeded, the counter freezes at this number until cleared using the Initialize CSU Registers command described below.

1st 15-Minutes ES/FS

This is a count of the ESs and FSs for the most recent 15-minute interval. When 15 minutes passes, this data is shifted down into the *2nd 15-Minutes* counter and is replaced by the data from the *Current Interval* counter. The maximum count for this and the other 15-minute counters is 900.

2nd 15-Minutes ES/FS

This is a count of the ESs and FSs for the second most recent 15-minute interval. When 15 minutes passes, this data is shifted down into the *3rd 15-Minutes* counter and is replaced by the data from the *1st 15-Minute* counter.

3rd 15-Minutes ES/FS

This is a count of the ESs and FSs for the third most recent 15-minute in-

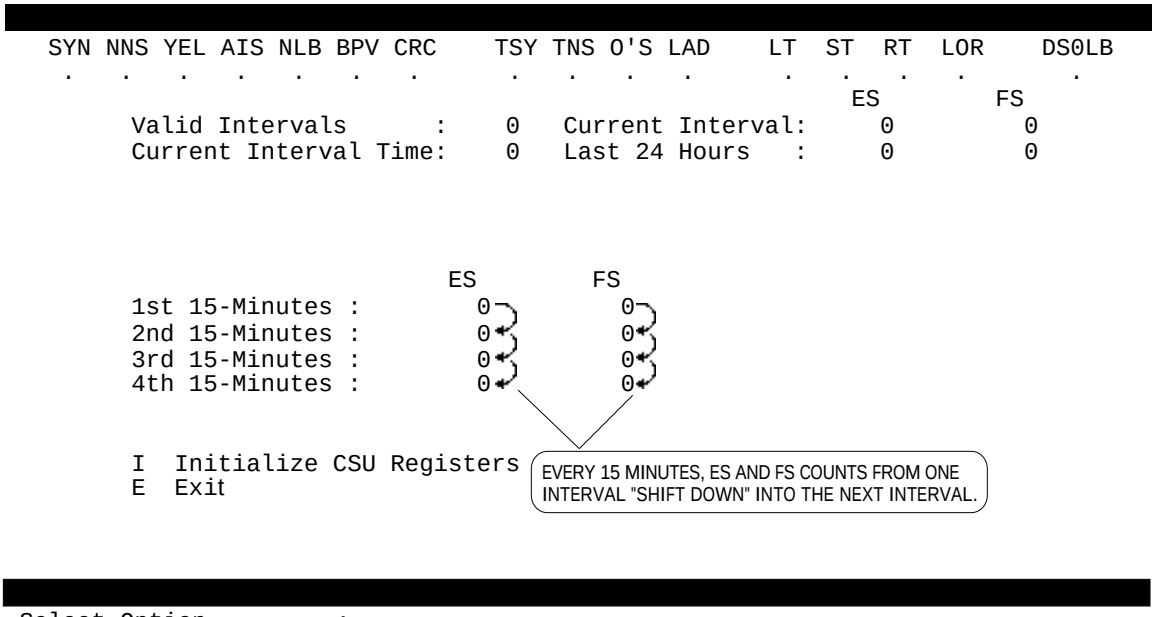


FIGURE 3-10. ONE HOUR REPORT SCREEN

terval. When 15 minutes passes, this data is shifted down into the *4th 15-Minutes* counter and is replaced by the data from the *2nd 15-Minute* counter.

4th 15-Minutes ES/FS

This is a count of the ESs and FSs for the fourth most recent 15-minute interval. When 15 minutes passes, this data is discarded and is replaced by the data from the *3rd 15-Minute* counter.

The counts for the *1st, 2nd, 3rd,* and *4th 15-Minutes* counters are added together and shifted into the *1st Hour* counter of the Twenty-Four Hour Report.

Initialize CSU Registers

This function clears (resets to 0) the displayed counters described above, but it does not clear similar counters maintained for reports to be transmitted to the network. It also clears the Twenty-Four Hour Report counters. To use this function, press **I**.

TWENTY-FOUR HOUR REPORT SCREEN

This function displays error information that the CSU stores in the user register set. It is similar to what the CSU stores in the network register set and makes available to the Central Office upon its request for a 24-Hour Performance Report. Although the 24-Hour Performance Report is required only for the AT&T mode, the user register set (but not the network register set) is also available for the ANSI mode. On power up, all registers are cleared (reset to 0). The information is updated once every second. To use this function, press **T**. Figure 3-11 illustrates the TWENTY-FOUR HOUR REPORT screen.

NOTE

In Unframed Mode, the TWENTY-FOUR HOUR REPORT screen is removed from the DS1 DIAGNOSTICS menu (the entire bandwidth is used for customer payload, so network performance is not measured and this screen does not apply).

Valid Intervals, Current Interval ES/FS, Current Interval Time, and Last 24 Hours ES/FS

These counters contain the same information as in the One-Hour Report.

The counts for the *1st, 2nd, 3rd,* and *4th 15-Minutes* counters from the One Hour Report are added together and shifted into the *1st Hour*.

1st Hour ES/FS

This is a count of the ESs and FSs for the most recent hour. When one hour passes, this data is shifted down into the *2nd Hour* counter and is replaced by the data from the *Current Interval* counter. The maximum count for this and the other one hour counters is 3600 (60 minutes = 3600 seconds).

2nd through 23rd Hour ES/FS

These are a count of the ESs and FSs for the second through 23rd most recent hours. When one hour passes, the data from one counter is shifted down into the next counter and is replaced by the data from the previous counter.

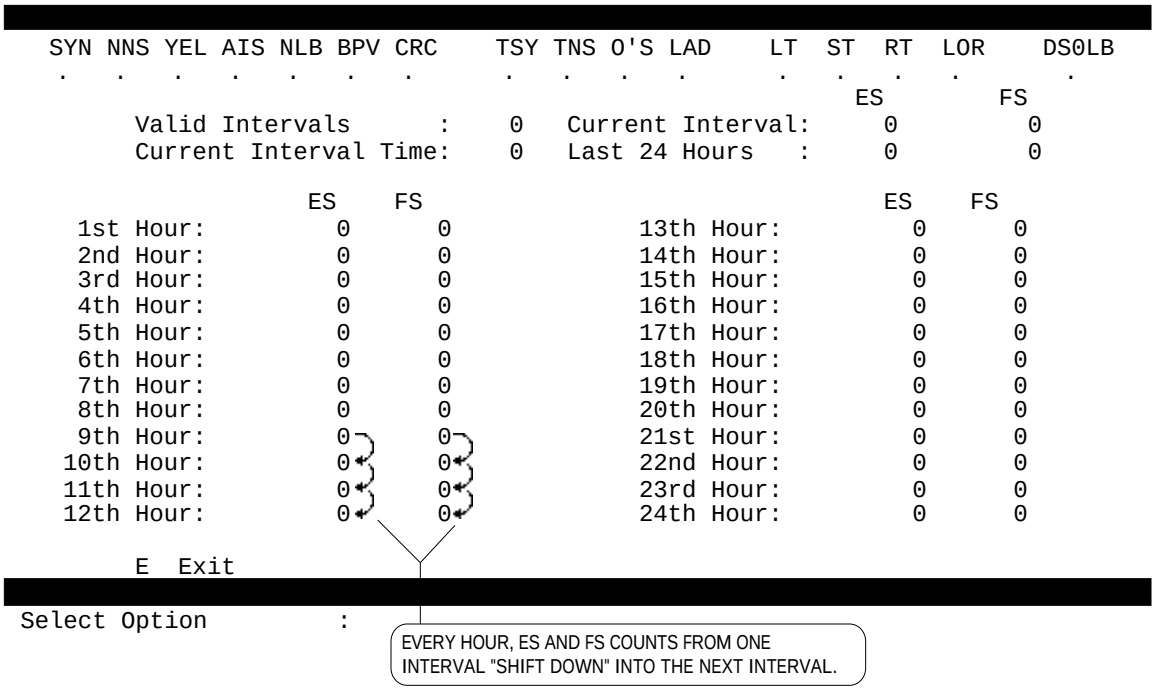


FIGURE 3-11. TWENTY-FOUR HOUR REPORT SCREEN

24th Hour ES/FS

This is a count of the ESs and FSs for the 24th most recent hour. When one hour passes, this data is discarded and is replaced by the data from the *23rd Hour* counter.

SCHEDULED PERFORMANCE REPORT SCREEN

This function displays the information that the CSU makes available to the network upon its request for a Scheduled Performance Report. This information is available only for the ANSI mode and ESF on the network side. The information is displayed for the last four one-second periods and is updated once every second. The data in the *1st Sec* column shifts to the right into the *2nd Sec* column, and so on. A period (.) indicates that no error event occurred (a null event). To use this function, press **C**. Figure 3-12 illustrates the SCHEDULED PERFORMANCE REPORT screen.

NOTE

In Unframed Mode, the SCHEDULED PERFORMANCE REPORT screen is removed from the DS1 DIAGNOSTICS menu (the entire bandwidth is used for customer payload, so network performance is not measured and this screen does not apply).

CRC Error Event

This is a count of CRC-6 error events, displayed in ranges, as follows:

0	no errors
1	1 error
<5	from 2 to 4 errors
<10	from 5 to 9 errors
<100	from 10 to 99 errors
<320	from 100 to 319 errors
>320	320 or more errors

Severe Error Event

An asterisk (*****) indicates that during this one-second interval one or more severely errored framing events occurred.

Frame Error Event

An asterisk (*****) indicates that during this one-second interval one or more frame synchronization bit error events occurred. A frame synchronization bit error event is not indicated (.) when a severely errored framing event also occurs.

Code Violation Event

An asterisk (*****) indicates that during this one-second interval one or more line code violation events occurred.

Controlled Slip Event

An asterisk (*****) indicates that during this one-second interval one or more controlled slip events occurred.

Active Payload Loop

An asterisk (*****) indicates that during this one-second interval the CSU was in a payload loopback condition (looping back toward the network frames consisting of the received 192 information bits [the payload] plus its own framing, CRC-6, and Data Link bits [the F-bits]). A period (.) indicates that the CSU was not in a payload loopback condition.

Select PRM

This function causes the display to toggle between the Performance Report Message (PRM) transmitted toward the network (**OUTBOUND**) and received from the network (**INBOUND**). To use this function, press **S**.

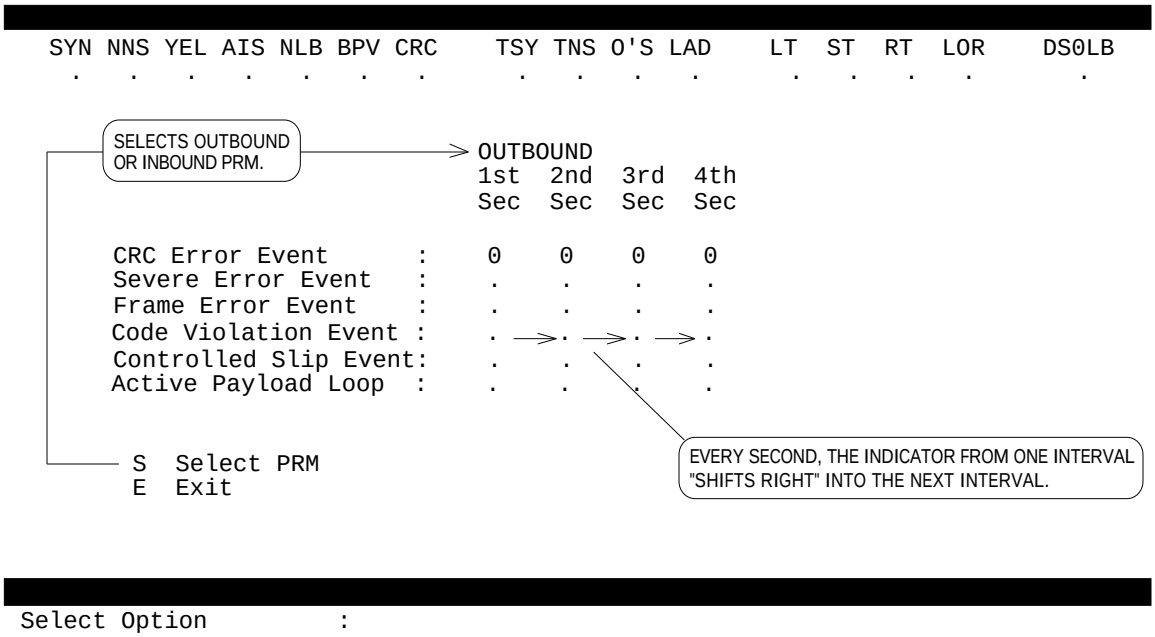


FIGURE 3-12. SCHEDULED PERFORMANCE REPORT SCREEN

DS1 SELF TEST SCREEN

This function causes the CSU to generate and verify a test pattern, similar to the DS1 Self-Test performed by using front panel switches **LT** and **ST** (described in Section 4). However, this test provides additional control and more test result information. Once started, this test must be stopped via the Supervisory terminal: it cannot be stopped via the front panel. The status line **ST** and front panel **TM** indicators reflect the status of this test. To use this function, press **S**. Figure 3-13 illustrates the DS1 SELF TEST screen. DS1 Self Test can also be used with DS1 Local Test and DS1 Remote Test from the LOOPBACKS screen. Refer to DS1 Remote Test with Self-Test and DS1 Local Test with Self-Test in Section 4 for test procedures.

NOTE

In Unframed Mode, the framing type is always UNFRAMED and the Framing selection is removed from the DS1 SELF-TEST screen.

Test Pattern

This displays one of the following test patterns selected with the Select Test Pattern (S) function:

511	511-bit test pattern
2047	2047-bit test pattern
PROG	user-programmable test pattern
QRS	Quasi-Random Signal (QRS) test pattern

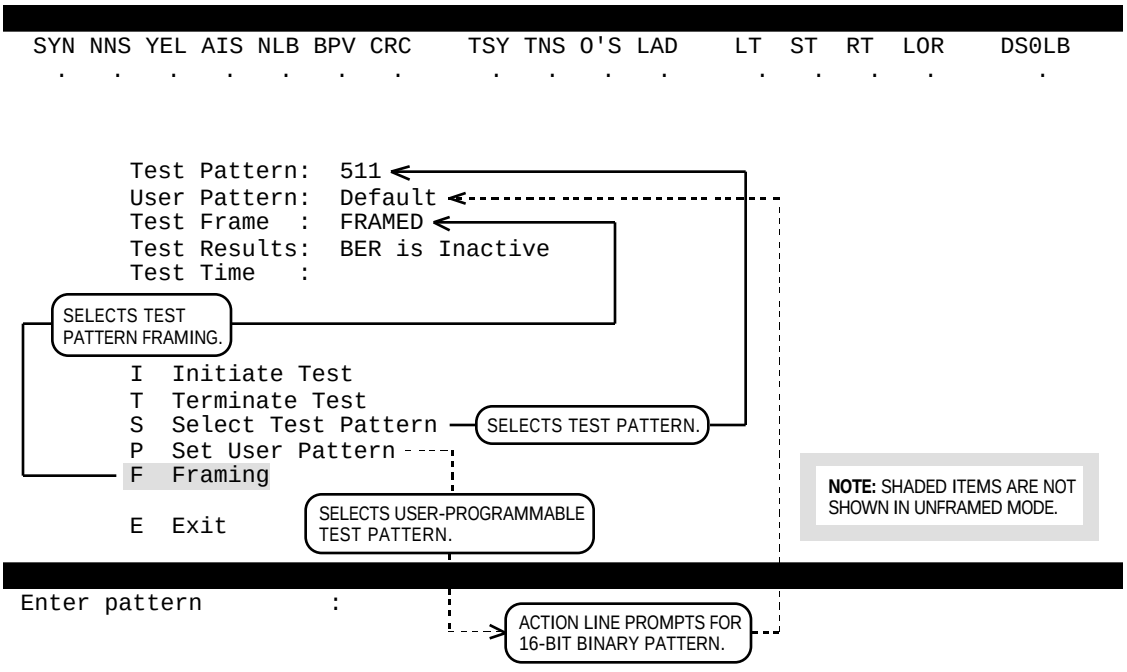


FIGURE 3-13. DS1 SELF TEST SCREEN

User Pattern

This displays the test pattern selected with the Set User Pattern (P) function. If no pattern has been selected, the pattern is **Default**.

Test Frame

This displays the framing type selected with the Framing (F) function. It is **FRAMED** or **UNFRAMED**. (In Unframed Mode, the framing type is always **UNFRAMED**.)

Test Results

This displays the averaged BER, updated once every second. The maximum BER is **5.59E-3** (5.59×10^{-3}, or 5.59 bit errors per 1,000 bits). The minimum BER is **1.00E-7** (1.00×10^{-7}, or 1 bit error per 10,000,000 bits). While no test is running, **BER is Inactive** is displayed.

Test Time

This displays the duration (in seconds) of the current test. While no test is running, this is blank. During the first seven seconds after the test is started, the CSU is collecting and averaging initial results and displays **Please Wait...**.

Initiate Test

This function starts the test. You cannot make any changes while the test is running, nor can you exit this screen. To use this function, press **I**.

CAUTIONS

a. *A slave CSU displays the warning message* **WARNING: Interfering To Inband Communication** *when the user attempts to perform DS1 Self-Test. Use only out-of-band communication for performing DS1 Self-Test.*

b. *If you initiate a DS1 diagnostic while a DS0 diagnostic is in progress, the DS0 diagnostic is terminated.*

Terminate Test

This function stops the test. To use this function, press **T**.

Select Test Pattern

This function selects the test pattern. To use this function, press **S** to step through the four test patterns available (displayed in *Test Pattern*).

Set User Pattern

This function allows you to select your own test pattern. It is a 16-bit, binary pattern (ones and zeros). To use this function, press **P**. Enter 16 bits,

and then press **RETURN**. The pattern is displayed in *User Pattern*. This pattern is retained when you exit this screen, but lost if the CSU is reset or powered down.

Framing

This function selects a framed or unframed test pattern. Press **F** to choose one (displayed in *Test Frame*).

LOOPBACKS SCREEN

This function allows you to control one of five standard loopback tests: Test Loop, Line Loop, Local Test, Remote Test, and NI Loop. Once started, these tests must be stopped via the Supervisory terminal: they cannot be stopped via the front panel. To use this function, press **L**. Figure 3-14 illustrates the LOOPBACKS screen.

Loop Type

This displays the test that is running: **Test Loop**, **Line Loop**, **Local Loop**, **Remote Loop**, or **NI Loop**. When no test is running, this displays **NONE**.

Loop Status

This displays the test status, **ON** (running the selected test) or **OFF** (not running a test).

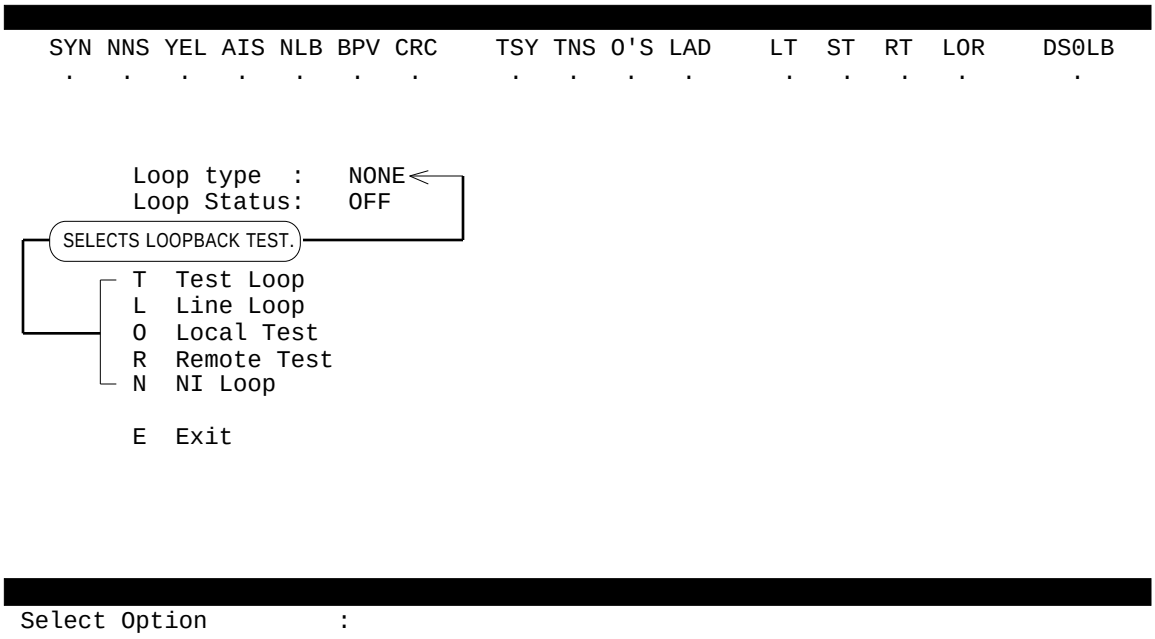


FIGURE 3-14. LOOPBACKS SCREEN

CAUTION

a. *A slave CSU displays the warning message* **WARNING: Interfering To Inband Communication** *when the user attempts to perform any loopback: Proceeding with the diagnostic can result in inaccurate data on the terminal or complete loss of communication. Use only out-of-band communication for performing loopbacks.*

b. *If you initiate a DS1 diagnostic while a DS0 diagnostic is in progress, the DS0 diagnostic is terminated.*

Test Loop

This function controls the DS1 Test Loop described in Section 4. The front panel **TM** indicator reflects the status of this test. To start or stop this test, press **T**.

Line Loop

This function controls the DS1 Line Loop described in Section 4. The front panel **TM** indicator reflects the status of this test. To start or stop this test, press **L**.

Local Test

This function controls the DS1 Local Test described in Section 4. The front panel **TM** indicator reflects the status of this test. This test can also be used in conjunction with DS1 Self-Test to control the DS1 Local Test with Self-Test described in Section 4. To start or stop this test, press **O**.

Remote Test

This function controls the DS1 Remote Test described in Section 4. There is a five second delay after you start or stop this test. During these five-second intervals before and after the actual test, the CSU is required to send inband loopback codes to the remote CSU. This test can also be used in conjunction with DS1 Self-Test to control the DS1 Remote Test with Self-Test described in Section 4. The status line **NLB** and **RT** indicators, and front panel **LB** and **TM** indicators reflect the status of this test. To start or stop this test, press **R**.

NI Loop

This function controls the DS1 Network Interface Loopback function described in Section 4. A Telco-provided DS1 Interface Connector must be installed at the remote CSU. There is a five second delay after you start or stop this test. During these five-second intervals before and after the actual test, the CSU is required to send inband loopback codes to the remote CSU. This test can also be used in conjunction with DS1 Self-Test to control the DS1 Network Interface Loopback with Self-Test described in Section 4. The front panel **TM** indicator reflects the status of this test. To start or stop this test, press **N**.

RECEIVE LEVEL SCREEN

This function displays information about the Line Build-Out option and the network signal. To use this function, press **R**. Figure 3-15 illustrates the RECEIVE LEVEL screen.

Line Build-out

This displays the amount of manual Line Build-Out (LBO) selected, **0.0 dB** or **15.0 dB**. The amount of manual Line Build-Out is selected with the LINE BUILD-OUT (L) Configuration command or option switches S7-4, S7-5, and S7-6.

Receive Level

This displays the actual signal level received from the network. If the displayed signal level and manually-set Line Build-Out do not agree, adjust the option setting to match the displayed signal level. The ranges displayed and appropriate option settings are:

Display	Nominal Cable Loss *	Manual LBO Option Setting
0 to -7	0 dB to 7.5 dB (± 2.5 dB)	15 dB
-7 to -15	7.5 (± 2.5 dB) dB to 15 dB (± 2.5 dB)	7.5 dB
< -15	15 dB (± 2.5 dB) to 30 dB (± 6 dB)	0 dB
NO SIGNAL	greater than 30 dB (± 6 dB)	0 dB

* The variation in cable loss is pattern dependent.

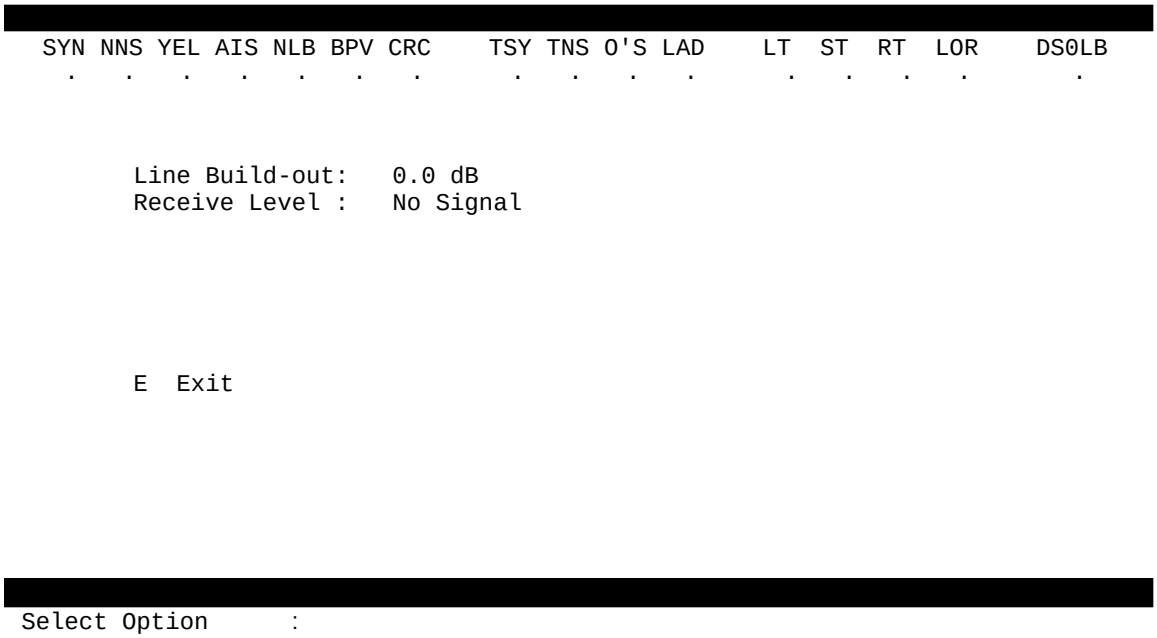


FIGURE 3-15. RECEIVE LEVEL SCREEN

The DS0 Diagnostics Screen

The Supervisory terminal can be used to control several channel-level (DS0) diagnostic tests. Figure 3-16 illustrates the functions available through this screen. Only one test, on one of the 24 channels, can be performed at a time. A DS0 diagnostic affects only the selected channel.

CAUTION

All DS0 diagnostic functions can be selected only via the Supervisory terminal, and those selected for the remote CSU must use out-of-band communications.

NOTE

In Unframed Mode, the DS0 DIAGNOSTICS screen is removed from the MAIN MENU (the entire bandwidth is used for customer payload, so the signal is not channelized, DS0s do not exist, and DS0-level diagnostics do not apply).

DS0 Channel Number

This function selects and displays the channel (**1** to **24**) on which the test is to be performed. The channel number selection is retained when you exit this screen, and when the CSU is reset or powered down. To use this function, press **N** and then enter the channel number.

CAUTION

Always select the same channel number at both CSUs.

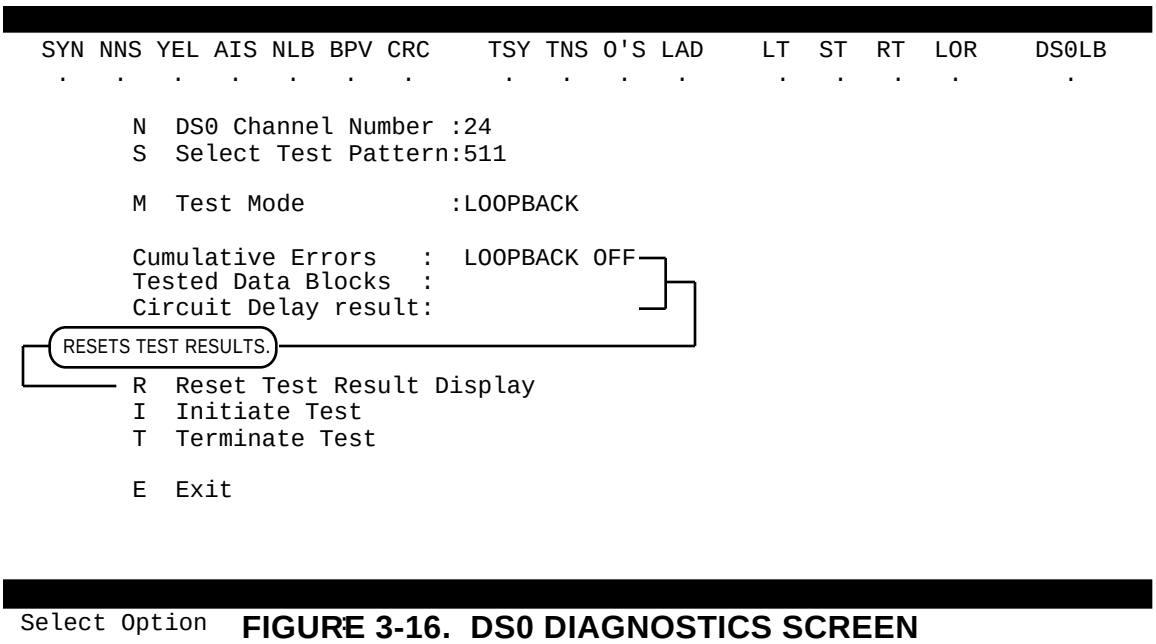


FIGURE 3-16. DS0 DIAGNOSTICS SCREEN

Select Test Pattern

This function selects and displays the test pattern used in the BIT ERROR TEST mode. To use this function, press **S** to step through the three test patterns available:

511	511-bit test pattern
2047	2047-bit test pattern
QRS	Quasi-Random Signal (QRS) test pattern

The test pattern selection is retained when you exit this screen, and when the CSU is reset or powered down.

CAUTION

Always select the same test pattern at both CSUs.

Test Mode

This function selects and displays the test mode. To use this function, press **M** to step through the three test modes available: **LOOPBACK**, **BIT ERROR TEST**, and **DELAY TEST**. These modes are used alone or in combination (in a specific sequence) to perform the tests described in Section 4, as follows:

Test	Use This Mode at Remote CSU	... and Use This Mode at Local CSU
DS0 Circuit Delay Measurement	LOOPBACK	DELAY TEST
DS0 End-to-End Self-Test	BIT ERROR TEST	BIT ERROR TEST
DS0 Remote Test	LOOPBACK	n/a (uses customer data)
DS0 Remote Test with Self-Test	LOOPBACK	BIT ERROR TEST

Cumulative Errors

This displays the total errors counted (not the bit error rate) as an indication of circuit quality for tests using the BIT ERROR TEST mode. The maximum count is 59500. For the DS0 End-to-End Self-Test, errors for the local-to-remote leg are displayed at the remote CSU, while errors for the remote-to-local leg are displayed at the local CSU (that is, test results are always displayed at the receiving end). When the selected test is not running, this displays **LOOPBACK OFF**, **BIT ERROR TEST (INACTIVE)**, or **DELAY TEST (INACTIVE)**.

Tested Data Blocks

This displays the total number of blocks tested using the BIT ERROR TEST mode. The maximum count is 65536. Each block is 1×10^5 (100,000) bits long.

Circuit Delay result

This displays the total round trip delay using the DELAY TEST mode. The delay is displayed in ms (milliseconds). For all delays in excess of 600 ms, **>0.6 sec** is displayed.

Reset Test Result Display

This function resets to 0 the test result displays (**Cumulative Errors**, **Tested Data Blocks**, and **Circuit Delay result**). To use this function, press **R**.

Initiate Test

This function starts the test. You cannot make any changes while the test is running, nor can you exit this screen. To use this function, press **I**.

NOTES

a. You cannot initiate a DS0 diagnostic while a DS1 diagnostic is in progress.

b. The DS0 Circuit Delay Measurement Test stops at the local CSU automatically after computing the delay, but leaves the remote CSU in the LOOPBACK mode.

Terminate Test

This function stops the test. To use this function, press **T**.

The CSU Configuration Screen

The Supervisory terminal can be used to display and configure nearly all of the DataComm 551 options that can be selected via option switches on the pc card. The Supervisory terminal can also be used to restore the factory default configuration for the CSU. Figure 3-17 illustrates the functions available through the CSU CONFIGURATION screen. Configuration selections made via the Supervisory terminal override those made via option switches. Excluded from Supervisory terminal configuration are:

- Network Address (option switches S4-1 through S4-8)
- The options for the baud rate and character format for the Supervisory terminal interface (option switches S6-1, S6-2, S6-4, and S6-5)
- Local Option Override (option switch S7-7)
- Ground (option jumper X2)

The CSU CONFIGURATION screen also indicates the CSU's Privilege mode (whether it is configured as a **MASTER** or **SLAVE** CSU). A slave CSU prevents configuration via the Supervisory terminal. If the user at-

tempts to configure it, the CSU displays the message **Invalid Mode** at the bottom of the screen.

NOTE

If Local Option Override is enabled (option switch S7-7 is ON), configuration via the Supervisory terminal is not allowed.

When the CSU is configured as a slave CSU, the following options cannot be changed via the Supervisory terminal, but their status is displayed:

- DTE Code
- NET Code
- DTE Frame
- NET Frame
- Line Build-Out
- Pre Equalizer
- Update Defaults

An asterisk (*) displayed with an option indicates the CSU is a slave CSU and the option cannot be changed.

NOTE

In Unframed Mode:

- *The Mode function does not apply and is removed.*
- *The DTE Frame and NET Frame functions now include the NONE selection to set the Equipment Frame Format and Network Frame Format options to Unframed Mode.*
- *The MIN 1 IN 8 selection for the Ones Density function does not apply and is removed.*
- *The ILB Frame function is always set to UNFRAMED.*

Use the Update Defaults function to set all options to their factory default values, or use the individual functions to set each option as required.

To set an option, press the letter shown to the left of it. Each time you press the letter, you see a different choice. Stop when you see the desired choice. The information is updated when you begin this function and when you press **RETURN** while this screen is displayed. When you are done with configuration, press **E** to exit this function. The following paragraphs describe each of the configuration functions.

Mode

This sets the Central Office Compatibility option to **ANSI** (complies with the requirements specified in Bellcore TR-TSY-000194 and adopted by ANSI — the American National Standards Institute) or **AT&T** (complies with the requirements specified in AT&T PUB 54016). These publications define, in part, the manner in which signal quality or performance measurements are determined, transmitted, and responded to. The ANSI mode supports Bellcore Scheduled Performance Report Messages (PRMs) and Unscheduled Messages, messages initiated by the Telco and contained in the Data Link subchannel provided in ESF framing. The AT&T mode supports their Telemetry Asynchronous Block Serial Protocol (TABS), a maintenance message protocol initiated by the Telco and contained in the Data Link subchannel provided in ESF framing. This option applies only when ESF on the network side is selected for the Frame Format option. The default setting is **ANSI**. (This option is also set via option switch S7-8.) (In Unframed Mode, this function does not apply and is removed from this screen.)

```
  SYN NNS YEL AIS NLB BPV CRC    TSY TNS O'S LAD    LT  ST  RT  LOR    DS0LB
   .   .   .   .   .   .   .      .   .   .   .      .   .   .   .      .

                                      Privilege:  MASTER

        M  Mode           :  ANSI
        D  DTE Code       :  AMI
        C  NET Code       :  AMI
        F  DTE Frame      :  AUTO- D4
        N  NET Frame      :  AUTO- ESF
        O  Ones Density   :  MAX 15 ZEROS
        P  Front Panel    :  ENABLE
        I  Inband Loop    :  ENABLE
        T  Test Type      :  LLB
        B  ILB Frame      :  UNFRAMED
        L  Line Build-Out:  MAN - 0.0 dB
        Q  Pre Equalizer :  130 ft

        U  Update To Defaults
        E  Exit

 Select Option         :
```

NOTE: SHADED ITEMS ARE NOT SHOWN IN UNFRAMED MODE.

FIGURE 3-17. CSU CONFIGURATION SCREEN

DTE Code

This sets the Line Code option for the equipment side to **AMI** (Alternate Mark Inversion, with no bipolar violations) or **B8ZS** (Bipolar with 8 Zero Substitution, with bipolar violations). Which one you choose depends primarily on the design of the T1 link: all equipment must be compatible with the AMI line code, and some equipment may not be compatible with the B8ZS line code. The default setting is **AMI**. When the CSU is configured as a slave CSU, this option cannot be changed via the Supervisory terminal. (This option, and the NET Code option, are also set via option switch S5-5. When PMC-100 Operation is disabled, option switch S4-8 is used to set the **Transcoding option**, which sets DTE Code to AMI and NET Code to B8ZS.)

CAUTION

Do not select B8ZS for DTE Code and AMI for NET Code. This combination causes data errors when the customer equipment transmits more than 15 consecutive zeros.

NET Code

This sets the Line Code option for the network side to **AMI** (Alternate Mark Inversion, with no bipolar violations) or **B8ZS** (Bipolar with 8 Zero Substitution, with bipolar violations). Which one you choose depends primarily on the design of the T1 link: all equipment must be compatible with the AMI line code, and some equipment may not be compatible with the B8ZS line code. To implement 64 kbps Clear Channel Capability, you must choose the B8ZS line code (the CSU automatically sets the Ones Density option to **INHIBIT**). The default setting is **AMI**. When the CSU is configured as a slave CSU, this option cannot be changed via the Supervisory terminal. (This option, and the DTE Code option, are also set via option switch S5-5. When PMC-100 Operation is disabled, option switch S4-8 is used to set the **Transcoding option**, which sets DTE Code to AMI and NET Code to B8ZS.)

DTE Frame

This sets the Equipment Frame Format option for the equipment side to **AUTO** (Auto Framing), **MAN** (manually-set framing) or **NONE** (no framing), and one of the following framing types: **D4** (D4 Superframe Format) or **ESF** (Extended Superframe Format). With Auto Framing, the CSU adapts to the received framing: the network side transmitter uses the framing received from the network, and the equipment side transmitter uses the framing received from the equipment. When **AUTO** is selected, NET Frame is also set to **AUTO**. Similarly, when **MAN** is selected, NET Frame is also set to **MAN**. When **NONE** is selected, enabling Unframed Mode, DTE Frame is also set to **NONE**. (In Unframed Mode, some Supervisory terminal screens and front panel LEDs are affected. The differences are discussed with the affected items.) The default setting is **AUTO**. When the CSU is configured as a slave CSU, this option cannot be changed via the Supervisory terminal. (This option is also set via option switches S5-2 and S5-3, and S4-7 when PMC-100 Operation is disabled.)

NOTE

Do not enable Auto Framing for both CSUs on a link.

NET Frame

This sets the Network Frame Format option for the network side to **AUTO** (Auto Framing), **MAN** (manually-set framing) or **NONE** (no framing), and one of the following framing types: **ESF** (Extended Superframe Format) or **D4** (D4 Superframe Format). When **AUTO** is selected, DTE Frame is also set to **AUTO**. Similarly, when **MAN** is selected, DTE Frame is also set to **MAN**. When **NONE** is selected, enabling Unframed Mode, DTE Frame is also set to **NONE**. (In Unframed Mode, some Supervisory terminal screens and front panel LEDs are affected. The differences are discussed with the affected items.) The default setting is **AUTO**. When the CSU is configured as a slave CSU, this option cannot be changed via the Supervisory terminal. (This option is also set via option switches S5-1 and S5-3, and S4-7 when PMC-100 Operation is disabled.)

Ones Density

This sets the pulse density to **MAX 15 ZEROS** (maximum of 15 consecutive zeros transmitted toward the network before a "one" is inserted), **MAX 39 ZEROS** (maximum of 39 consecutive zeros), **8(N+1) RESTRICTIONS** (minimum of N "ones" per 8(N+1) bits, where N = 1 to 24; the Line Code option for the network side must be set to **AMI**), **MIN 1 IN 8** (minimum of 1 "one" per 8 bits; pulse density violations are not detected with this selection), or **INHIBIT** (no minimum pulse density is maintained). The default setting is **MAX 15 ZEROS**. (This option is also set via option switch S5-8.) (In Unframed Mode, the **MIN 1 IN 8** selection does not apply and is removed from this function.)

Front Panel

This sets the Inhibit Front Panel Test Switches option to **ENABLE** (switch usage is allowed) or **INHIBIT** (switch usage is inhibited). The default setting is **ENABLE**. (This option is also set via option switch S6-7.)

Inband Loop

This sets the Inband Loopback Code Detection option to **ENABLE** (inband loopback codes are detected and reacted to) or **INHIBIT** (inband loopback codes are ignored). When **ENABLE** is selected, Test Type must also be set. When a loopback activation or deactivation code is detected, the CSU starts or stops the type of loopback test selected with Test Type. The default setting is **ENABLE**. (This option is also set via option switch S6-8.)

Test Type

This sets the Inband Loopback Code Test Type option to **LLB** (DS1 Line Loop is started or stopped when the appropriate inband loopback code is detected) or **TLB** (DS1 Test Loop is started or stopped), when Inband Loop is set to **ENABLE**. The default setting is **LLB**. (This option is also set via option switch S5-6.)

ILB Frame

This sets the Inband Loopback Code Framing option to **UNFRAMED** (CSU transmits unframed inband loopback codes) or **FRAMED** (CSU transmits framed inband loopback codes), when a DS1 Remote Test is started. The default setting is **UNFRAMED**. (This option is also set via option switch S5-7.) (In Unframed Mode, this function is always set to **UNFRAMED**.)

Line Build-Out

This sets the Line Build-Out option for Line Build-Out on the network side to **AUTO** (automatic Line Build-Out, based on the signal level received from the network) or **MAN** (manually-set Line Build-Out), and one of the following attenuation levels: **0 dB** (no attenuation), **7.5 dB** (7.5 dB attenuation), or **15 dB** (15 dB attenuation). Selecting the proper signal level ensures that the signal reaching the Central Office is satisfactory. The default setting is **MAN 0 dB**. When the CSU is configured as a slave CSU, this option cannot be changed via the Supervisory terminal. (This option is also set via option switches S7-4, S7-5, and S7-6.)

NOTE

Do not enable automatic Line Build-Out for both CSUs when they are connected back-to-back.

Pre Equalizer

This sets the Pre-Equalization option for matching the equipment-side line length, providing transmitter pre-equalization for lengths of **130 ft** (0-130 feet), **260 ft** (130-260 feet), **390 ft** (260-390 feet), **530 ft** (390-530 feet), or **655 ft** (530-655 feet). The default setting is **130 ft**. Selecting the proper length ensures that the signal reaching the equipment is satisfactory. When the CSU is configured as a slave CSU, this option cannot be changed via the Supervisory terminal. (This option is also set via option switches S7-1, S7-2, and S7-3.)

Update Defaults

This function to set all options to their factory default values (unless there is a conflict with an option switch, in which case the switch setting prevails). To use this function, press **U**. All options are set to their factory default values, and these values are displayed. (When through updating, the CSU displays the message **Update Is Complete**.) Set individual options, as required. When the CSU is configured as a slave CSU, this option cannot be changed via the Supervisory terminal.

The Maintenance Screen

The Supervisory terminal can be used to set the CSU date and time, to select a new CSU address, and to reset the CSU. Figure 3-18 illustrates the functions available through the MAINTENANCE screen.

Set Date

This function sets the CSU date. The date is entered in the format:

mm-dd-yy

where mm is the month (January = 01, etc.), dd is the day of the month, and yy is the year (1989 = 89). Separate each with a character such as a hyphen, comma, period, diagonal, or space. It will be converted and displayed as a hyphen. To set the date, press **D**.

Set Time

This function sets the CSU time of day. The time is entered in the format:

hh:mm:ss

where hh is the hour in 24-hour military time (midnight = 00, noon = 12, etc.), mm is the minutes, and ss is the seconds. Separate each with a character such as a hyphen, comma, period, diagonal, or space. It will be converted and displayed as a colon. To set the time, press **T**.

NOTE

To abort the Set Date or Set Time functions, leaving the date or time unchanged, enter <Ctl>Z.

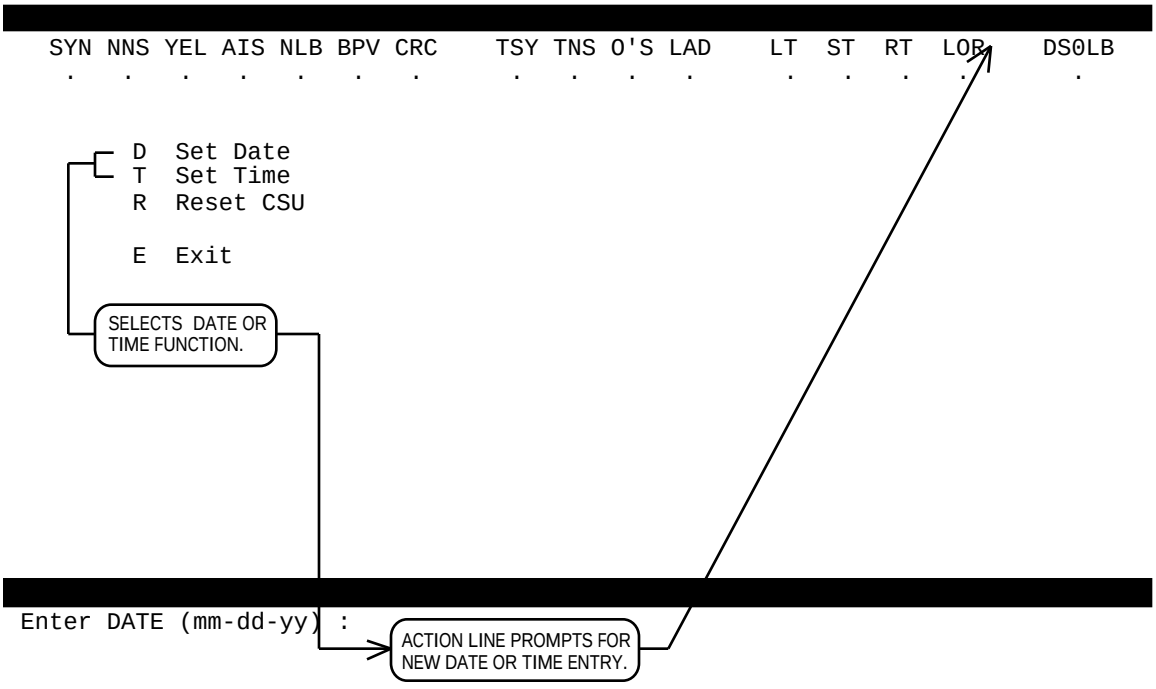


FIGURE 3-18. MAINTENANCE SCREEN

Reset CSU

This function resets the CSU. Resetting the CSU disrupts data transmission and creates alarm conditions for the Central Office, so use it with care. Resetting the CSU returns you to the log-on screen and clears the date and time, so you must set them after a reset. To reset the CSU, press **R**. The CSU responds by first displaying the message **WARNING: Interfering To T1 DATA** to remind you of the consequences of resetting, and then resets.

CAUTION

Resetting the CSU disrupts the network and data transmission and creates alarm conditions for the Central Office, so use this function with care.

NOTE

Occasionally, two CSUs can be in a condition known as a "double loop", where both are in loopback toward the network. You can stop the loopback for a CSU if you started it, but you cannot stop it if the Telco started it, and there are no means to clear this condition by sending loopback deactivation codes to both CSUs. You can clear a double loop condition, however, by resetting each CSU.

SECTION 4

TESTS

OVERVIEW

This section describes the tests that can be performed with the DataComm 551 after installation, whenever the operation of it must be checked, or when problems in the data communications system must be isolated (see Figure 4-1). Some tests prevent normal operation of the CSU and should be performed only when the CSU is not in use, while others have no impact on operation and can be performed anytime. Some tests utilize a minimum of the CSUs' circuitry, while others utilize a maximum. Knowing this helps in analyzing the results of a series of tests to determine the probable source of errors. Each test is described in detail in the following pages (see Figure 4-20 for a summary of the tests available). The tests are grouped and presented as follows:

DS1 Loopback Functions

- DS1 Line Loopback Function
- DS1 Network Interface Loopback Function
- DS1 Test Loopback Function

DS1 Diagnostics

- DS1 Line Loop
- DS1 Local Test
- DS1 Local Test with Self-Test
- DS1 Network Interface Loopback
- DS1 Network Interface Loopback with Self-Test
- DS1 Remote Test
- DS1 Remote Test with Self-Test
- DS1 Self-Test (including DS1 End-to-End Self-Test)
- DS1 Test Loop

DS0 Diagnostics

- DS0 Circuit Delay Measurement Test

- DS0 Remote Test
- DS0 Remote Test with Self-Test
- DS0 Self-Test (including DS0 End-to-End Self-Test)

The tests are controlled in one or more of the following ways: via the front panel pushbutton switches, the Supervisory terminal, or loopback codes received from the network. Refer to Supervisory Terminal Operating Procedures in Section 3 for details on controlling the tests via the Supervisory terminal.

If technical assistance from GDC is required, refer to the Technical Assistance Procedure given at the end of this section.

NOTE

In Unframed Mode, the entire bandwidth is customer payload, so the signal is not channelized and DS0s do not exist. For this reason, there are no channel-level (DS0) diagnostics and the DS0 Diagnostics selection is removed from the MAIN MENU. You cannot perform the DS0 Circuit Delay Measurement Test, DS0 End-to-End Self-Test, DS0 Remote Test, or DS0 Remote Test with Self-Test.

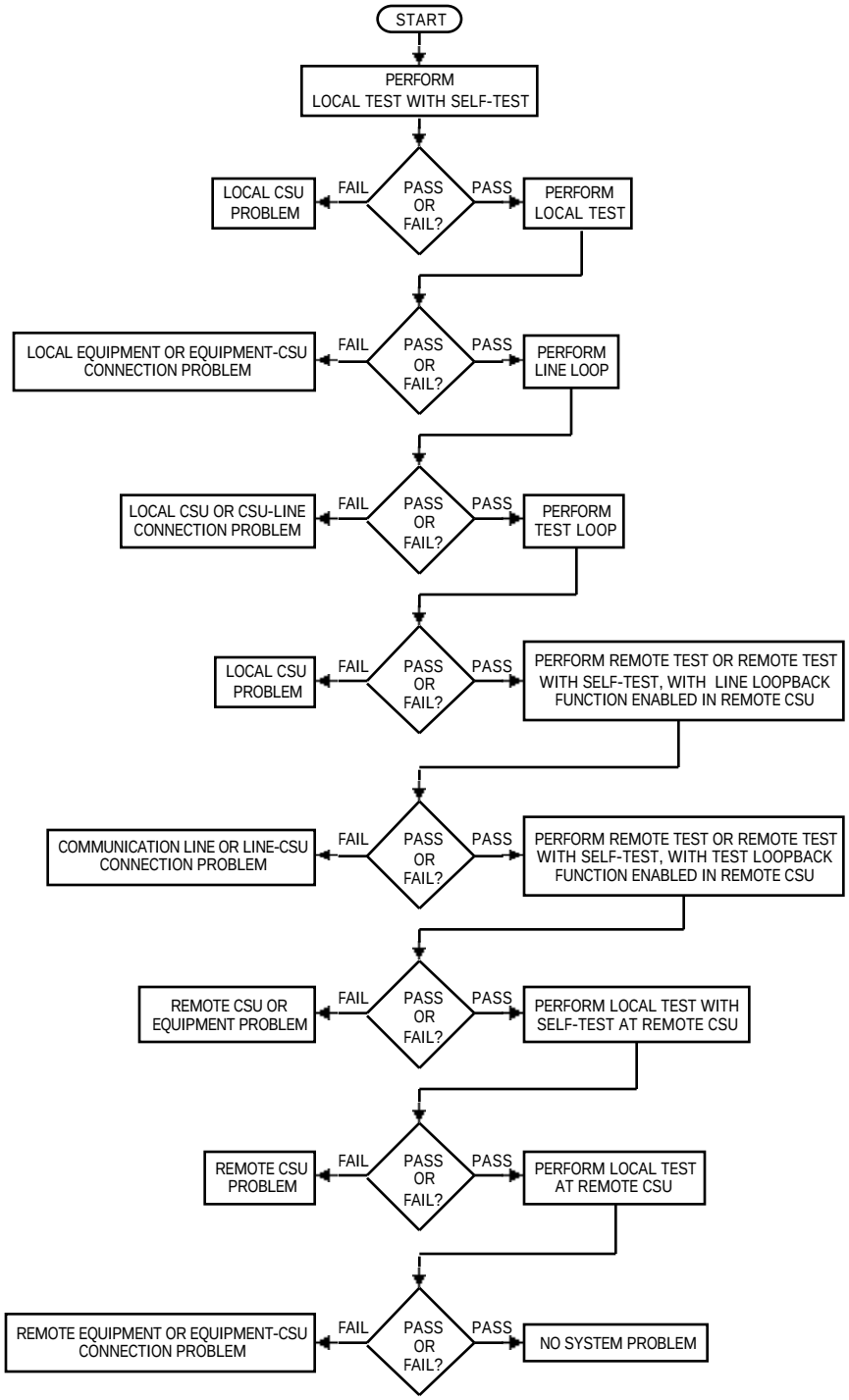


FIGURE 4-1. TROUBLE DIAGNOSTIC FLOWCHART

DS1 LOOPBACK FUNCTIONS

The DS1 Line Loopback and DS1 Test Loopback functions allow the signal received from the network to be looped through the CSU's circuitry and transmitted back toward the network. These functions in themselves are not tests, but are used in conjunction with other DS1 diagnostic tests.

The DS1 Network Interface Loopback function allows the signal received from the network to be looped back toward the network at the Telco-provided DS1 Interface Connector. It is not normally used alone, but used in conjunction with external test equipment or with DS1 Self-Test.

DS1 Line Loopback Function

The DS1 Line Loopback (LLB) function, illustrated in Figure 4-2, allows the signal received from the network to be looped through a minimum of the CSU's circuitry and transmitted back toward the network. Only the CSU's critical circuitry (the Line Build-Out, equalization, and timing regeneration circuits) is utilized, with bipolar violations uncorrected. This tests everything on the network side up to the CSU's critical circuitry. While the LLB function is active, the CSU transmits an Alarm Indication Signal (AIS) toward the equipment.

The LLB function can be activated and deactivated locally via the Supervisory terminal, or remotely via loopback codes as defined in AT&T PUB 54016 (for Extended Superframe Format) or AT&T PUB 62411 (for D4 Superframe Format).

To allow remote activation and deactivation, the LLB function must be enabled via the Supervisory terminal or option switches S5-6 and S6-8.

The LLB function cannot be used alone, but must be used in conjunction with one of the following tests: DS1 Line Loop, DS1 Remote Test, or DS1 Remote Test with Self-Test.

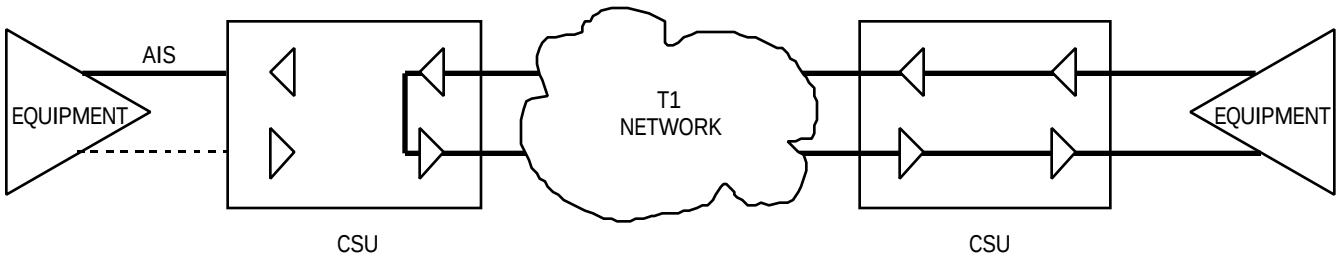


FIGURE 4-2. DS1 LINE LOOPBACK FUNCTION

DS1 Network Interface Loopback Function

The DS1 Network Interface Loopback function, illustrated in Figure 4-3, allows the signal received from the network to be looped back toward the network at the DS1 Interface Connector (a Telco-provided connector installed on the network side intended to enhance maintenance operations). This tests everything on the network side up to the DS1 Interface Connector.

CAUTION

When connected to a DS1 Interface Connector, the DataComm 551 must be configured for manual Line Build-Out, with 0 dB attenuation.

The DS1 Network Interface Loopback function can be activated and deactivated remotely via the Supervisory terminal or by the Telco, using loopback codes as defined in Bellcore TR-TSY-000312.

The DS1 Network Interface Loopback function is not normally used alone, but used in conjunction with DS1 Network Interface Loopback or DS1 Network Interface Loopback with Self-Test.

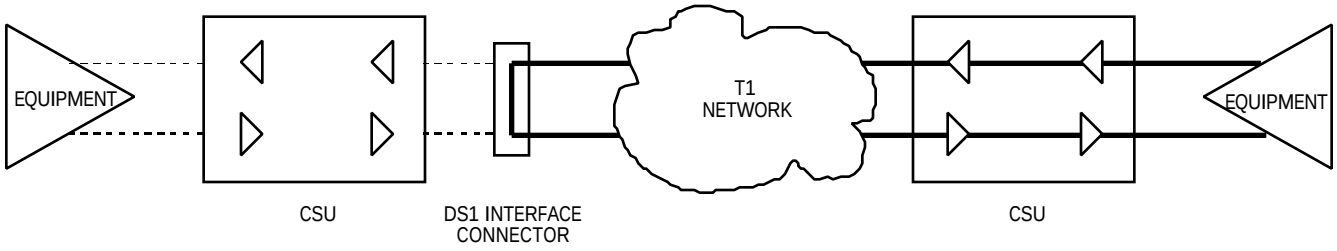


FIGURE 4-3. DS1 NETWORK INTERFACE LOOPBACK FUNCTION

DS1 Test Loopback Function

The DS1 Test Loopback (TLB) function, illustrated in Figure 4-4, allows the signal received from the network to be looped through as much as is practical of the CSU's circuitry and transmitted back toward the network. This tests everything on the network side up to and including the CSU. When the CSU is in the ANSI mode, framing is regenerated; when it is in the AT&T mode, framing is not regenerated. Bipolar violations are corrected in both modes. While the TLB function is active, the CSU transmits an Alarm Indication Signal (AIS) toward the equipment.

The TLB function can be activated and deactivated locally via the Supervisory terminal, or remotely via loopback codes as defined in AT&T PUB 54016 (for Extended Superframe Format).

To allow remote activation and deactivation, the TLB function must be enabled via the Supervisory terminal or option switches S5-6 and S6-8.

NOTE

In ANSI terminology, activation of this function is equivalent to Payload Loopback (PLB), described in Bellcore TR-TSY-000194. In AT&T terminology, it is equivalent to DTE Loopback (DLB).

The TLB function cannot be used alone, but must be used in conjunction with one of the following tests: DS1 Test Loop, DS1 Remote Test, or DS1 Remote Test with Self-Test.

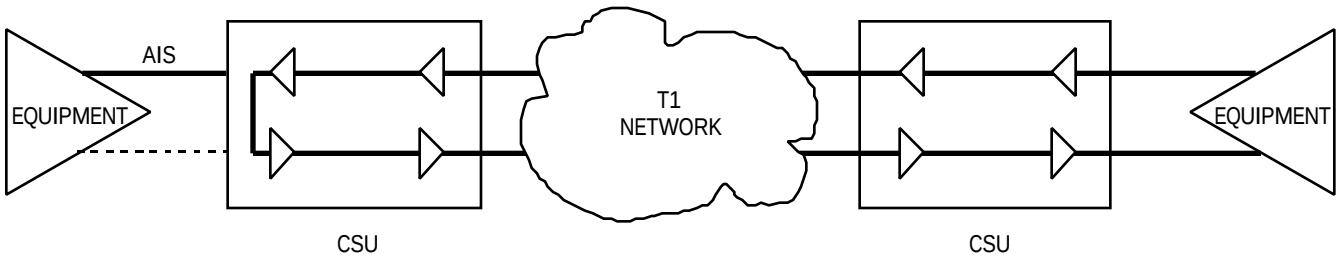


FIGURE 4-4. DS1 TEST LOOPBACK FUNCTION

DS1 DIAGNOSTICS

The DS1 diagnostics described below include link-level diagnostic tests that affect the entire T1 link, or the DS1 (Digital Signal Level 1). Use these tests when you suspect that a problem is impairing data on all channels. Some of these tests can be controlled only via the Supervisory terminal, while others can also be controlled via the front panel switches.

CAUTION

If you initiate a DS1 diagnostic while a DS0 diagnostic is in progress, the DS0 diagnostic is terminated.

DS1 Line Loop

DS1 Line Loop, illustrated in Figure 4-5, activates the local CSU's DS1 Line Loopback function. This tests the local CSU's network interface circuitry and the T1 link by transmitting a remotely-generated test message through the remote CSU to the local CSU and looping it back to the test equipment for verification. No minimum pulse density is maintained.

This test can be controlled only via the Supervisory terminal, using the Line Loop function. To perform this test, refer to Table 4-1.

TABLE 4-1. DS1 LINE LOOP

Step	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment.
2.	Connect the test equipment to the remote CSU's test jacks, as shown.
3.	Initiate Line Loop at the local CSU (on the LOOPBACKS screen). Loop Status should be ON during the test.
4.	Generate a test message. The test equipment should receive the same message it transmitted; if not, a problem exists.
5.	To stop the test, terminate Line Loop.

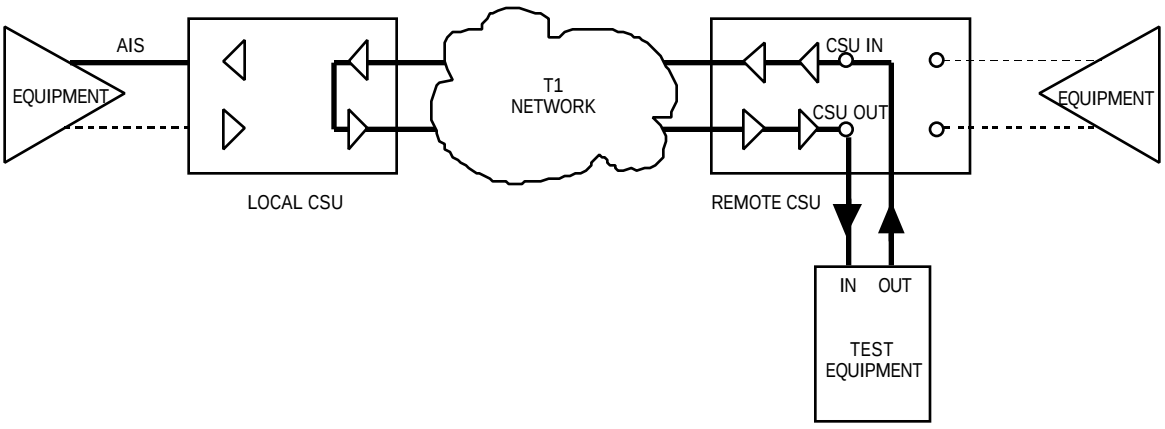


FIGURE 4-5. DS1 LINE LOOP

DS1 Local Test

DS1 Local Test (LT), illustrated in Figure 4-6, loops a locally-generated test message through the CSU and back to the test equipment for verification. As much as is practical of the CSU's circuitry is utilized in this test. During this test, data is also transmitted to the T1 link, with pulse density constraints, but data is not received from the line.

This test can be controlled via front panel switch LT or the Supervisory terminal Local Test. To perform this test, refer to Table 4-2.

TABLE 4-2. DS1 LOCAL TEST

Step	Front Panel Control	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment.	
2.	Connect the test equipment to the local CSU's test jacks, as shown.	
3.	Engage the local CSU's LT switch. The TM indicator should be lit during the test.	Initiate Local Test at the local CSU (on the LOOPBACKS screen). Loop Status should be ON during the test.
4.	Generate a test message. The test equipment should receive the same message it transmitted; if not, a problem exists.	
5.	To stop the test, disengage the LT switch.	To stop the test, terminate Local Test.

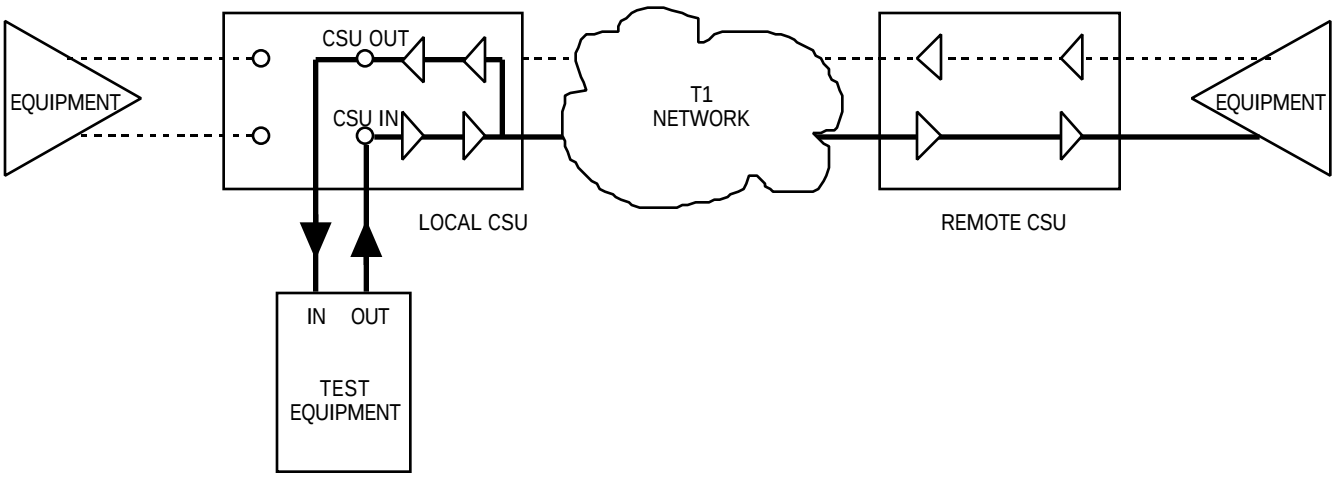


FIGURE 4-6. DS1 LOCAL TEST

DS1 Local Test with Self-Test

DS1 Local Test with Self-Test, illustrated in Figure 4-7, transmits an internally-generated test pattern through the CSU to test the CSU. During this test, data is also transmitted to the T1 link, with pulse density constraints, but data is not received from the equipment or the line. The test pattern is selected via option switch S5-4 or the Supervisory terminal. Within the CSU, a Test Pattern Generator creates the test pattern, and a Test Pattern Recognizer determines if the data it receives matches that which was transmitted.

This test can be controlled via front panel switches LT and ST, or the Supervisory terminal Local Test and Self Test. To perform this test, refer to Table 4-3.

TABLE 4-3. DS1 LOCAL TEST WITH SELF-TEST

Step	Front Panel Control	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment.	
2.	Engage the local CSU's LT and ST switches. The TM indicator should be lit during the test.	Initiate Local Test at the local CSU (on the LOOPBACKS screen) and then Self-Test (on the SELF TEST screen).
3.	Monitor the ERR/ALM indicator. If it blinks, a problem exists.	Monitor Test Results for the averaged BER. A high BER indicates that a problem exists.
4.	To stop the test, disengage the ST and LT switches.	To stop the test, terminate Self-Test and then Local Test.

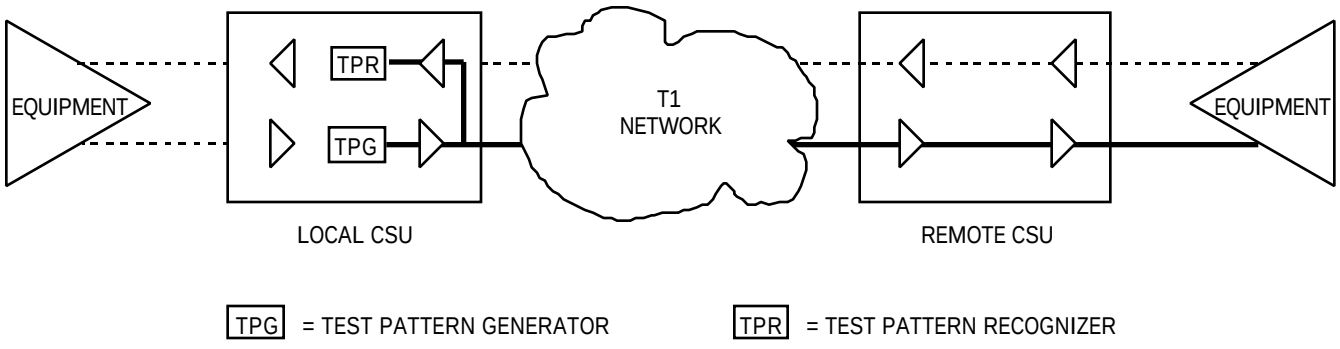


FIGURE 4-7. DS1 LOCAL TEST WITH SELF-TEST

DS1 Network Interface Loopback

DS1 Network Interface Loopback, illustrated in Figure 4-8, tests the local CSU and the T1 link by transmitting a locally-generated test message through the local CSU to the remote DS1 Interface Connector and looping it back to the test equipment for verification. Whether the local CSU transmits framed or unframed loopback codes depends on the selection of the loopback test code framing option.

CAUTION

When connected to a DS1 Interface Connector, the DataComm 551 must be configured for manual Line Build-Out, with 0 dB attenuation.

This test can only be controlled locally via the Supervisory terminal NI Loop test. To perform this test, refer to Table 4-4.

TABLE 4-4. DS1 NETWORK INTERFACE LOOPBACK

Step	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment.
2.	Connect the test equipment to the local CSU's test jacks, as shown.
3.	Initiate NI Loop at the local CSU (on the LOOPBACKS screen).
4.	Wait 5 seconds after starting the test, then generate a test message. The test equipment should receive the same message it transmitted; if not, a problem exists.
5.	To stop the test, terminate NI Loop.

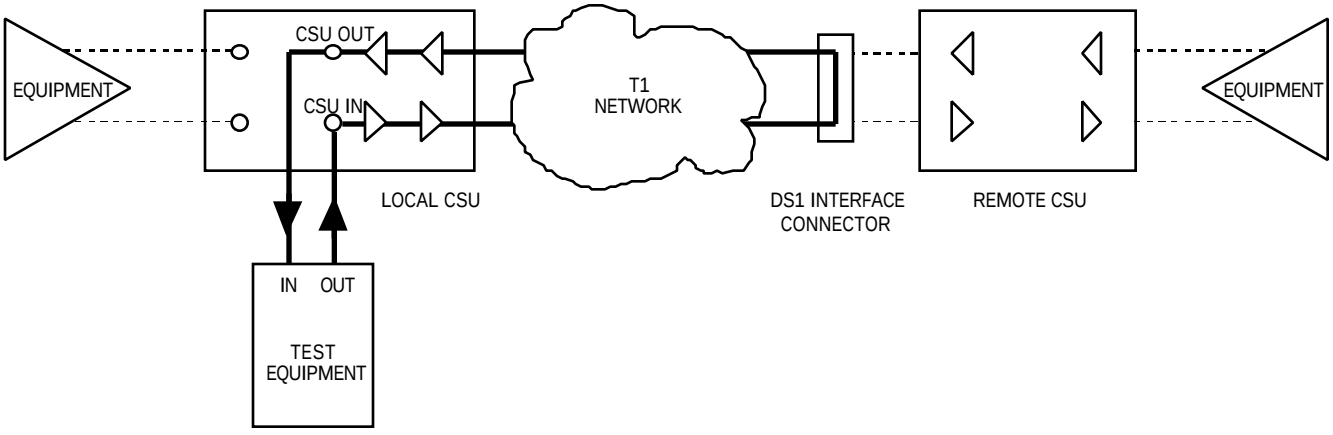


FIGURE 4-8. DS1 NETWORK INTERFACE LOOPBACK

DS1 Network Interface Loopback with Self-Test

DS1 Network Interface Loopback with Self-Test, illustrated in Figure 4-9, tests the local CSU and the T1 link by transmitting a local CSU-generated test pattern to the remote DS1 Interface Connector and looping it back for verification. The test pattern is selected via the Supervisory terminal. Within the local CSU, a Test Pattern Generator creates the test pattern, and a Test Pattern Recognizer determines if the data it receives matches that which was transmitted. Whether the local CSU transmits framed or unframed loopback codes depends on the selection of the loopback test code framing option.

CAUTION

When connected to a DS1 Interface Connector, the DataComm 551 must be configured for manual Line Build-Out, with 0 dB attenuation.

This test can only be controlled locally via the Supervisory terminal NI Loop test and Self-Test. To perform this test, refer to Table 4-5.

TABLE 4-5. DS1 NETWORK INTERFACE LOOPBACK WITH SELF-TEST

Step	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment.
2.	Initiate NI Loop at the local CSU (on the LOOPBACKS screen), and then select the desired test pattern and initiate Self-Test (on the SELF TEST screen). The front panel TM indicator should light and the status line ST indicator should come on.
3.	Monitor Test Results for the averaged BER. A high BER indicates that a problem exists.
4.	To stop the test, terminate Self-Test and then NI Loop.

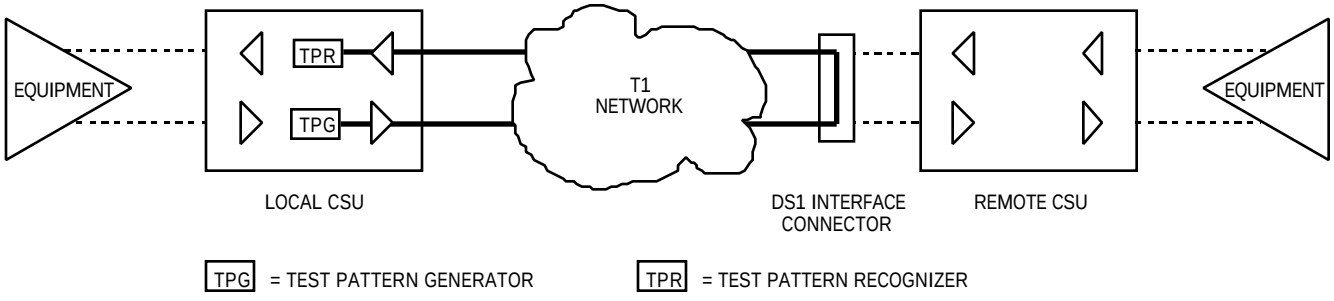


FIGURE 4-9. DS1 NETWORK INTERFACE LOOPBACK WITH SELF-TEST

DS1 Remote Test

DS1 Remote Test (RT) activates the remote CSU's DS1 Line Loopback function (illustrated in Figure 4-10) or DS1 Test Loopback function (Figure 4-11), depending on which one is enabled in the remote CSU. This tests both CSUs and the T1 link by transmitting a locally-generated test message through the local CSU to the remote CSU and looping it back to the test equipment for verification. Bipolar violations are uncorrected during this test when the remote CSU has its LLB function enabled. Whether the local CSU transmits framed or unframed loopback codes depends on the selection of the loopback test code framing option.

This test can be controlled locally via front panel switch RT or the Supervisory terminal Remote Test. To perform this test, refer to Table 4-6.

NOTE

Initiating DS1 Remote Test causes the local CSU to send the loopback code the remote CSU, and to reflect the local CSU's test status via its front panel and status line indicators. These indicators do not imply that the remote CSU is in loopback, as the remote CSU does not acknowledge receipt of loopback codes nor does it inform the local CSU of its test status. Inband Loopback Code Detection must be enabled in the remote CSU.

TABLE 4-6. DS1 REMOTE TEST

Step	Front Panel Control	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment.	
2.	Connect the test equipment to the local CSU's test jacks, as shown.	
3.	Engage the local CSU's RT switch. The TM indicator should be lit during the test.	Initiate Remote Test at the local CSU (on the LOOPBACKS screen). Loop Status should be ON during the test.
4.	Wait 5 seconds after starting the test, then generate a test message. The test equipment should receive the same message it transmitted; if not, a problem exists.	
5.	To stop the test, disengage the RT switch.	To stop the test, terminate Remote Test.

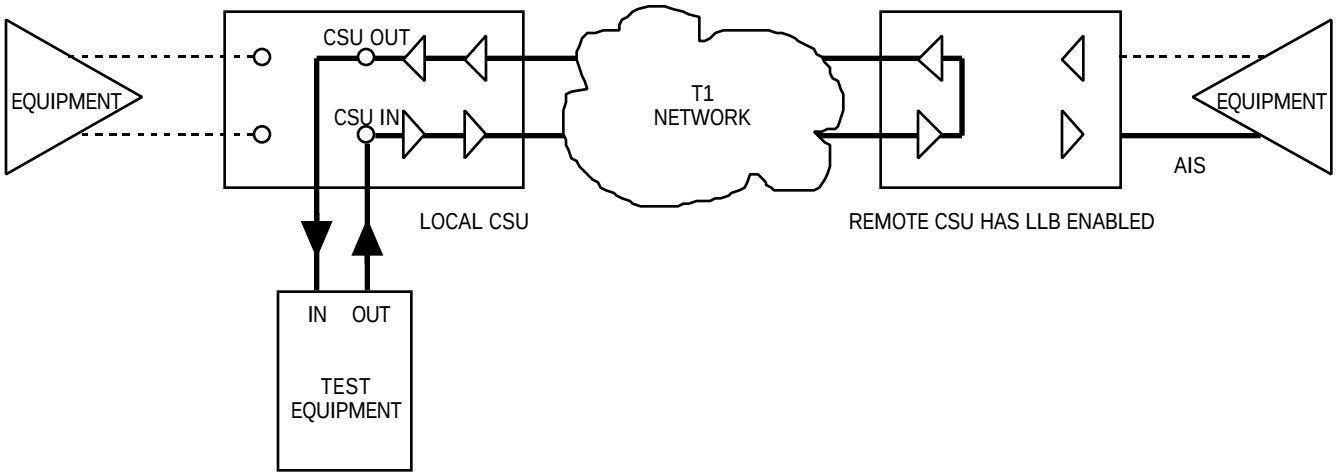


FIGURE 4-10. DS1 REMOTE TEST WITH LINE LOOPBACK

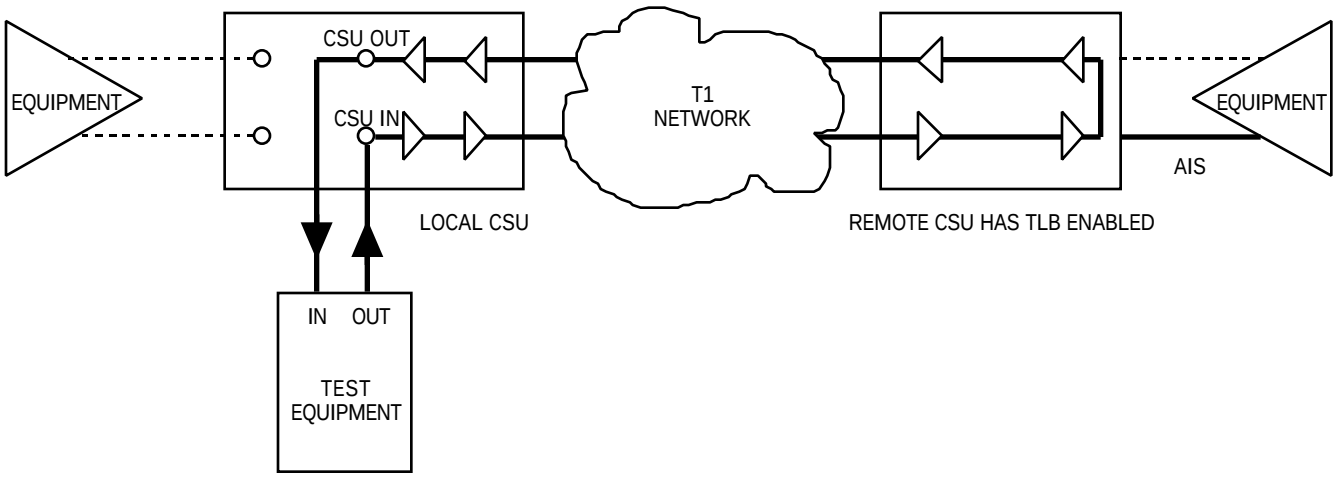


FIGURE 4-11. DS1 REMOTE TEST WITH TEST LOOPBACK

DS1 Remote Test with Self-Test

DS1 Remote Test with Self-Test activates the remote CSU's DS1 Line Loopback function (illustrated in Figure 4-12) or DS1 Test Loopback function (Figure 4-13), depending on which one is enabled in the remote CSU. This tests both CSUs and the T1 link by transmitting a local CSU-generated test pattern to the remote CSU and looping it back for verification. The test pattern is selected via option switch S5-4 or the Supervisory terminal. Within the local CSU, a Test Pattern Generator creates the test pattern, and a Test Pattern Recognizer determines if the data it receives matches that which was transmitted. Bipolar violations are not corrected during this test when the remote CSU has its LLB function enabled. Whether the local CSU transmits framed or unframed loopback codes depends on the selection of the loopback test code framing option.

This test can be controlled locally via front panel switches RT and ST, or the Supervisory terminal Remote Test and Self-Test. To perform this test, refer to Table 4-7.

NOTE

Initiating DS1 Remote Test with Self-Test causes the local CSU to send the loopback code and test pattern to the remote CSU, and to reflect the local CSU's test status via its front panel and status line indicators. These indicators do not imply that the remote CSU is in loopback, as the remote CSU does not acknowledge receipt of loopback codes nor does it inform the local CSU of its test status. Inband Loopback Code Detection must be enabled in the remote CSU.

TABLE 4-7. DS1 REMOTE TEST WITH SELF-TEST

Step	Front Panel Control	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment.	
2.	Engage the local CSU's RT and ST switches. The TM indicator should be lit during the test.	Initiate Remote Test at the local CSU (on the LOOPBACKS screen) and then Self-Test (on the SELF TEST screen).
3.	Monitor the ERR/ALM indicator. If it blinks, a problem exists.	Monitor Test Results for the averaged BER. A high BER indicates that a problem exists.
4.	To stop the test, disengage the ST and RT switches.	To stop the test, terminate Self-Test and then Remote Test.

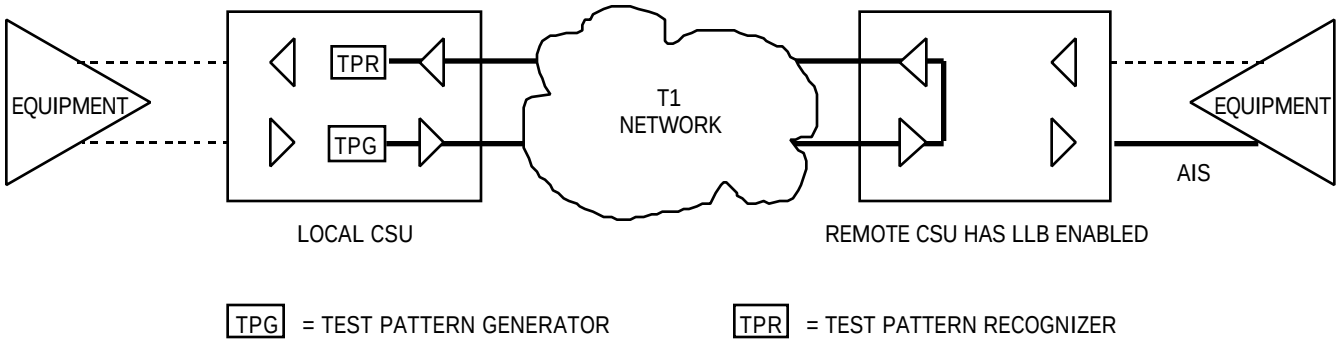


FIGURE 4-12. DS1 REMOTE TEST WITH LINE LOOPBACK AND SELF-TEST

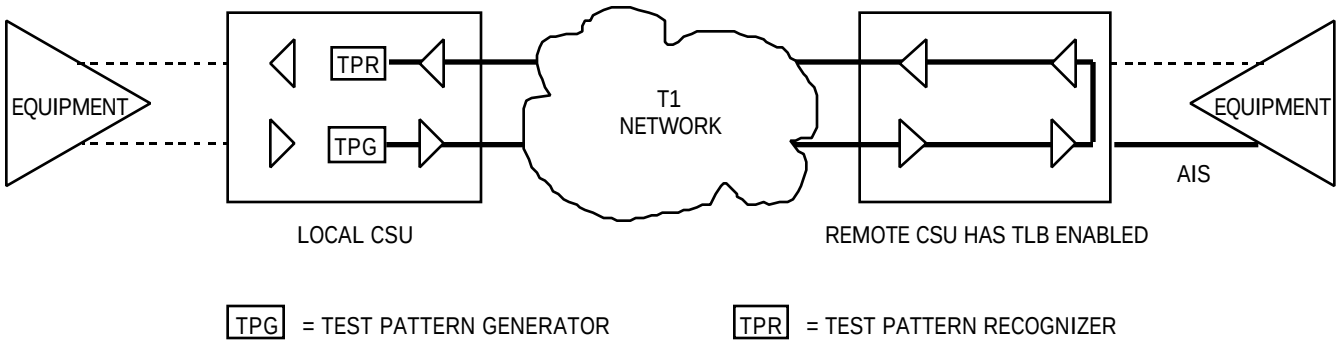


FIGURE 4-13. DS1 REMOTE TEST WITH TEST LOOPBACK AND SELF-TEST

DS1 Self-Test

DS1 Self-Test (ST) causes the CSU to generate and verify a test pattern. The test pattern is selected via option switch S5-4 or the Supervisory terminal. DS1 Self-Test can be used with DS1 Local Test (refer to DS1 Local Test with Self-Test), DS1 Remote Test (refer to DS1 Remote Test with Self-Test) or DS1 Network Interface Loopback (refer to DS1 Network Interface Loopback with Self-Test) to test one CSU, or *alone* as a DS1 End-to-End Self-Test.

DS1 End-to-End Self-Test, illustrated in Figure 4-14, tests both CSUs and the T1 link by transmitting a local CSU-generated test pattern to the remote CSU for verification, and vice versa. (Bipolar violations are corrected during this test.) Within each CSU, a Test Pattern Generator creates the test pattern, and a Test Pattern Recognizer determines if the data it receives matches that which was transmitted.

NOTE

To properly perform DS1 End-to-End Self-Test, both CSUs must be optioned for the same test pattern.

DS1 End-to-End Self-Test can be controlled via front panel switch ST or the Supervisory terminal Self Test at each CSU. To perform this test, refer to Table 4-8.

TABLE 4-8. DS1 END-TO-END SELF-TEST

Step	Front Panel Control	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment.	
2.	Engage the ST switches on both CSUs. The TM indicators should be lit during the test.	Initiate Self Test (on the SELF TEST screen) at both CSUs.
3.	Monitor the ERR/ALM indicator. If it blinks, a problem exists.	Monitor Test Results for the averaged BER. A high BER indicates that a problem exists.
4.	To stop the test, disengage both ST switches.	To stop the test, terminate Self-Test at both CSUs.

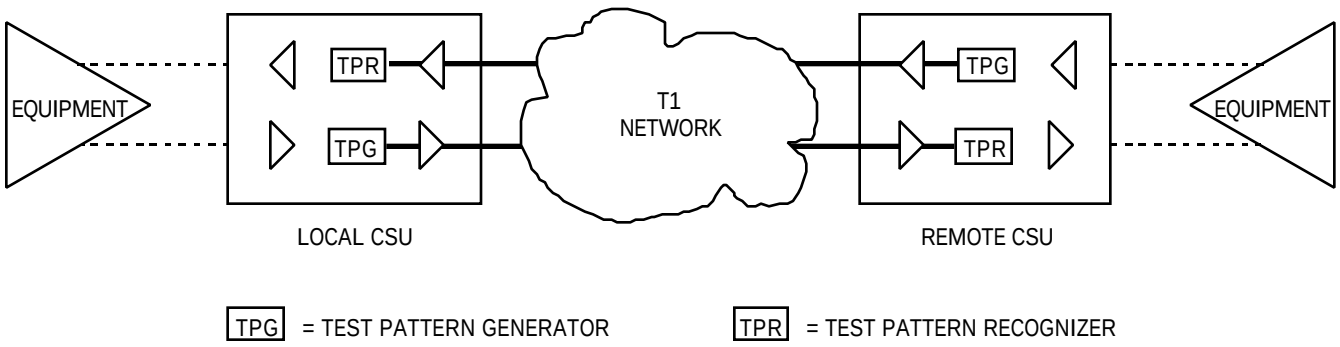


FIGURE 4-14. DS1 END-TO-END SELF-TEST

DS1 Test Loop

DS1 Test Loop, illustrated in Figure 4-15, activates the local CSU's DS1 Test Loopback function. This tests the local CSU and the T1 link by transmitting a remotely-generated test message through the remote CSU to the local CSU and looping it back to the test equipment for verification.

This test can be controlled only via the Supervisory terminal, using the DS1 Test Loop function. To perform this test, refer to Table 4-9.

TABLE 4-9. DS1 TEST LOOP

Step	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment.
2.	Connect the test equipment to the remote CSU's test jacks, as shown.
3.	Initiate Test Loop at the local CSU (on the LOOPBACKS screen). Loop Status should be ON during the test.
4.	Generate a test message. The test equipment should receive the same message it transmitted; if not, a problem exists.
5.	To stop the test, terminate Test Loop.

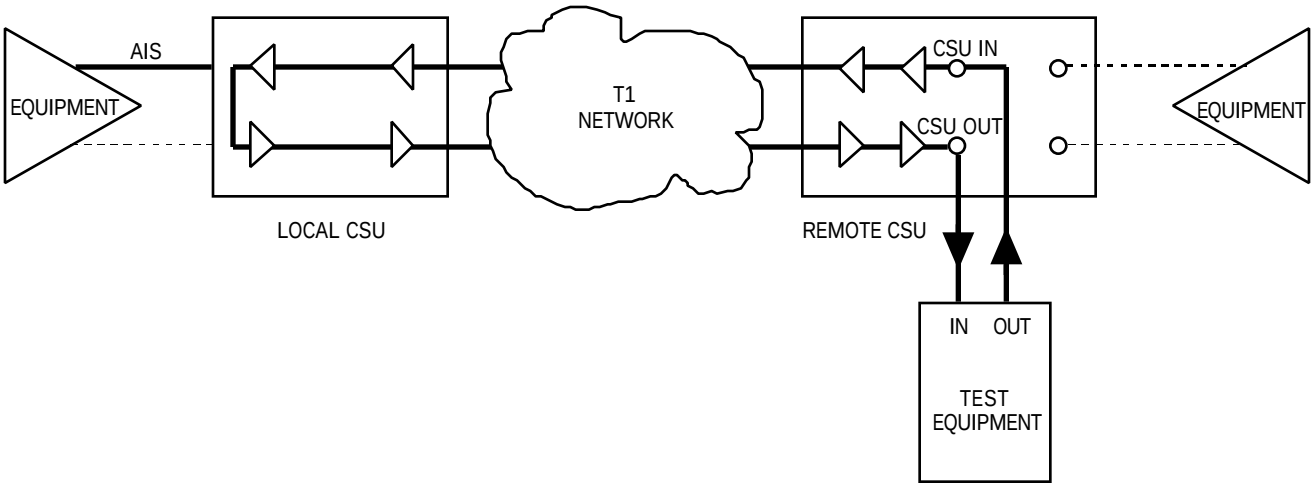


FIGURE 4-15. DS1 TEST LOOP

DS0 DIAGNOSTICS

The DS0 diagnostics described below include channel-level diagnostic tests that affect a single channel, or a DS0 (Digital Signal Level 0). Use these tests when you suspect that a problem is impairing data only on an isolated channel. Only one test, on one of the 24 channels, can be performed at a time. A DS0 diagnostic affects only the selected channel. These tests can be controlled only via the Supervisory terminal.

CAUTION

All DS0 diagnostic functions for the remote CSU must be controlled using only out-of-band communications.

NOTE

a. You cannot initiate a DS0 diagnostic while a DS1 diagnostic is in progress.

b. In Unframed Mode, the entire bandwidth is customer payload, so the signal is not channelized and DS0s do not exist. For this reason, there are no channel-level (DS0) diagnostics and the DS0 Diagnostics selection is removed from the MAIN MENU. You cannot perform the DS0 Circuit Delay Measurement Test, DS0 End-to-End Self-Test, DS0 Remote Test, or DS0 Remote Test with Self-Test.

DS0 Circuit Delay Measurement Test

DS0 Circuit Delay Measurement Test, illustrated in Figure 4-16, computes the round trip (from the local CSU to the remote CSU and back) transmission delay for the selected channel, using an internally-generated message. Transmission delay includes many variables, such as circuit distance, transmission path (terrestrial vs. satellite, primary vs. alternate route), etc. For this reason, no absolute figures of acceptable delay are given here. Use the test result as an indication of network response time and throughput, and compare it to the result of the same test repeated at other times under similar conditions.

To perform this test, refer to Table 4-10.

TABLE 4-10. DS0 CIRCUIT DELAY MEASUREMENT TEST

Step	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment on the channel to be tested.
2.	At the remote CSU, select the desired channel, select LOOPBACK mode, and then initiate the test (all on the DS0 DIAGNOSTICS screen). The status line DS0LB indicator should come on.
3.	At the local CSU, select the same channel, select DELAY TEST mode, and then initiate the test (all on the DS0 DIAGNOSTICS screen).
4.	At the local CSU, the delay (in ms) is displayed in the Circuit Delay result field. The local CSU automatically stops its test.
5.	To stop the test, terminate LOOPBACK at the remote CSU.

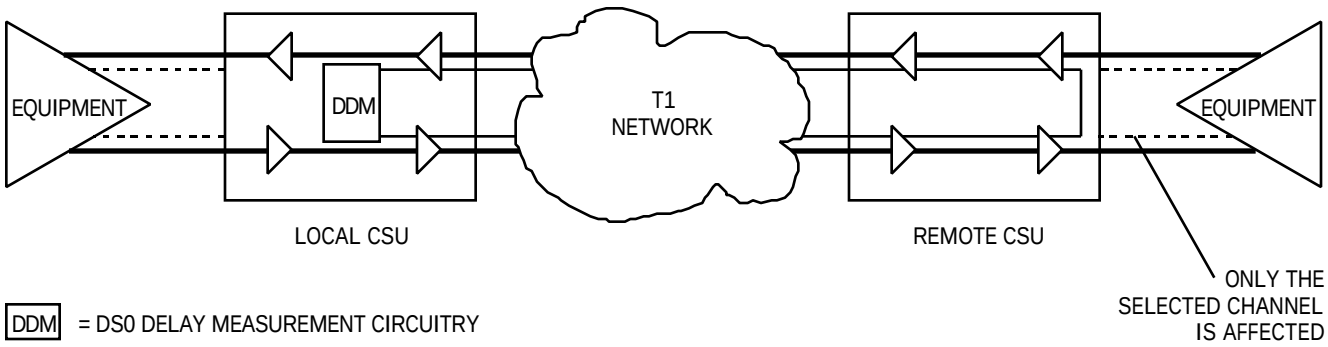


FIGURE 4-16. DS0 CIRCUIT DELAY MEASUREMENT TEST

DS0 Remote Test

DS0 Remote Test, illustrated in Figure 4-17, tests both CSUs and the T1 link by transmitting, on the selected channel, a locally-generated test message through the local CSU to the remote CSU and looping it back to the test equipment for verification.

To perform this test, refer to Table 4-11.

TABLE 4-11. DS0 REMOTE TEST

Step	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment on the channel to be tested.
2.	Connect the test equipment to the local channel to be tested, as shown.
3.	At the remote CSU, select the desired channel, select LOOPBACK mode, and then initiate the test (all on the DS0 DIAGNOSTICS screen). The status line DS0LB indicator should come on.
4.	Generate a test message. The test equipment should receive the same message it transmitted; if not, a problem exists.
5.	To stop the test, terminate LOOPBACK.

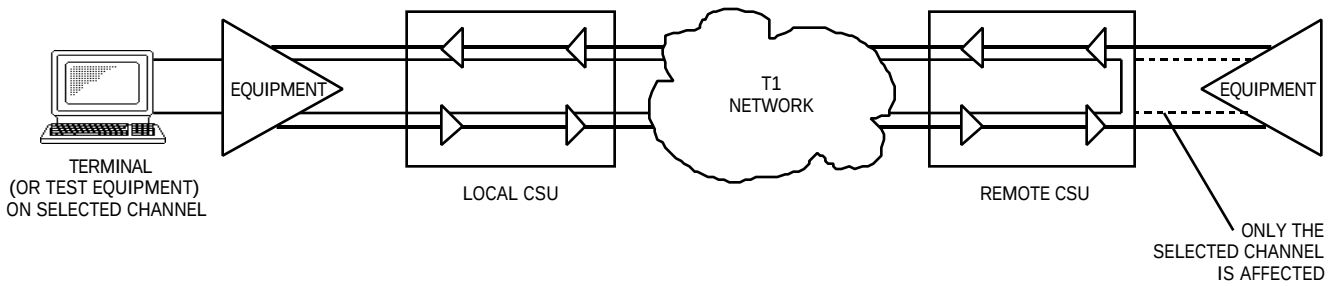


FIGURE 4-17. DS0 REMOTE TEST

DS0 Remote Test with Self-Test

DS0 Remote Test with Self-Test, illustrated in Figure 4-18, tests both CSUs and the T1 link by transmitting, on the selected channel, a local CSU-generated test pattern to the remote CSU and looping it back for verification. The test pattern is selected via the Supervisory terminal. Within the local CSU, a Test Pattern Generator creates the test pattern, and a Test Pattern Recognizer determines if the data it receives matches that which was transmitted.

To perform this test, refer to Table 4-12.

TABLE 4-12. DS0 REMOTE TEST WITH SELF-TEST

Step	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment on the channel to be tested.
2.	At the remote CSU, select the desired channel, select LOOPBACK mode, and then initiate the test (all on the DS0 DIAGNOSTICS screen). The status line DS0LB indicator should come on.
3.	At the local CSU, select the test pattern and the same channel, select BIT ERROR TEST mode, and then initiate the test (all on the DS0 DIAGNOSTICS screen). The front panel TM indicator should light and the status line ST indicator should come on.
4.	At the local CSU, any errors are displayed the Cumulative Errors field and the front panel ERR/ALM indicator lights. A high error count indicates that a problem exists.
5.	To stop the test, terminate BIT ERROR TEST and then LOOPBACK.

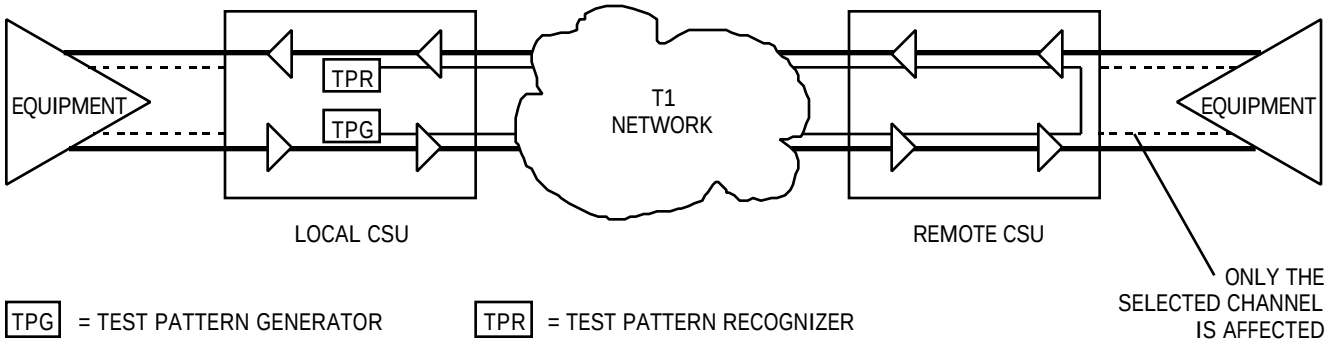


FIGURE 4-18. DS0 REMOTE TEST WITH SELF-TEST

DS0 Self-Test

DS0 Self-Test causes the CSU to generate and verify a test pattern on the selected channel. The test pattern is selected via the Supervisory terminal. DS0 Self-Test can be used with DS0 Remote Test (refer to DS0 Remote Test with Self-Test) to test primarily the T1 link and the remote CSU, or *alone* as DS0 End-to-End Self-Test to also test the local CSU.

DS0 End-to-End Self-Test, illustrated in Figure 4-19, tests both CSUs and the T1 link by transmitting, on the selected channel, a local CSU-generated test pattern to the remote CSU for verification, and vice versa. (Bipolar violations are corrected during this test.) Within each CSU, a Test Pattern Generator creates the test pattern, and a Test Pattern Recognizer determines if the data it receives matches that which was transmitted.

NOTE

To properly perform DS0 End-to-End Self-Test, you must select the same channel and test pattern at both CSUs.

To perform this test, refer to Table 4-13.

TABLE 4-13. DS0 END-TO-END SELF-TEST

Step	Supervisory Terminal Control
1.	To prevent data loss, suspend operation of all associated digital-terminating equipment on the channel to be tested.
2.	At the remote CSU, select the desired channel and test pattern, select BIT ERROR TEST mode, and then initiate the test (all on the DS0 DIAGNOSTICS screen). The front panel TM indicator should light and the status line ST indicator should come on.
3.	At the local CSU, select the same channel and test pattern, select BIT ERROR TEST mode, and then initiate the test (all on the DS0 DIAGNOSTICS screen). The front panel TM indicator should light and the status line ST indicator should come on.
4.	At the local CSU, any errors for the remote-to-local leg are displayed in its Cumulative Errors field and its front panel ERR/ALM indicator lights. At the remote CSU, any errors for the local-to-remote leg are displayed in its Cumulative Errors field and its front panel ERR/ALM indicator lights. A high error count indicates that a problem exists.
5.	To stop the test, terminate the tests at both CSUs.

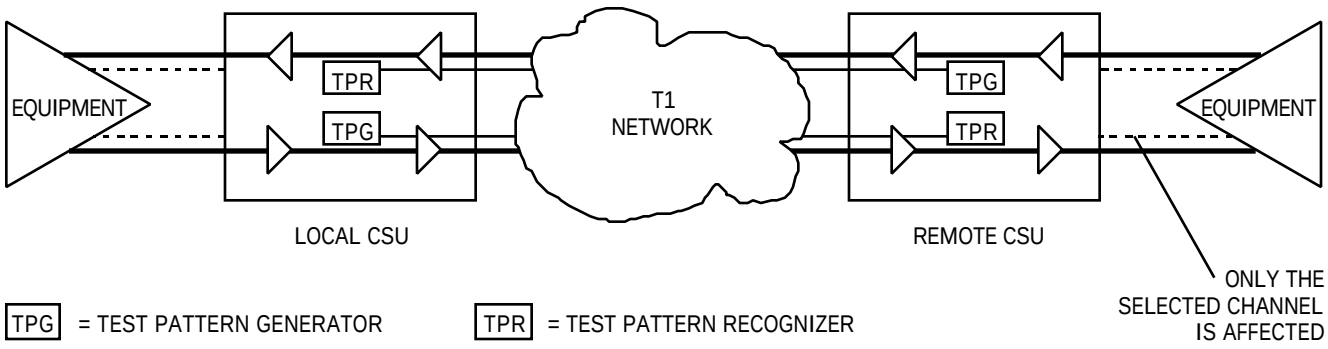


FIGURE 4-19. DS0 END-TO-END SELF-TEST

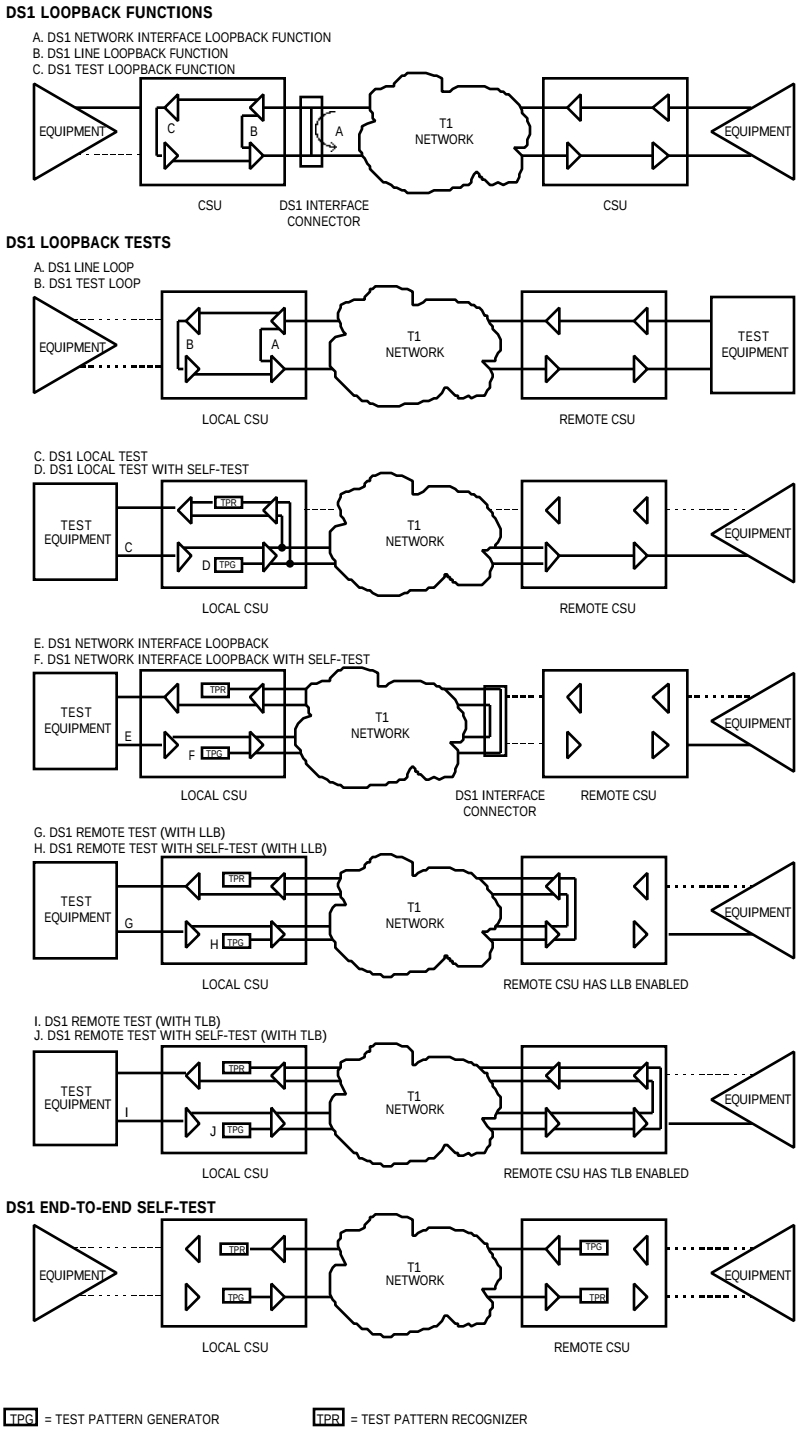


FIGURE 4-20. SUMMARY OF TESTS (Sheet 1 of 2)

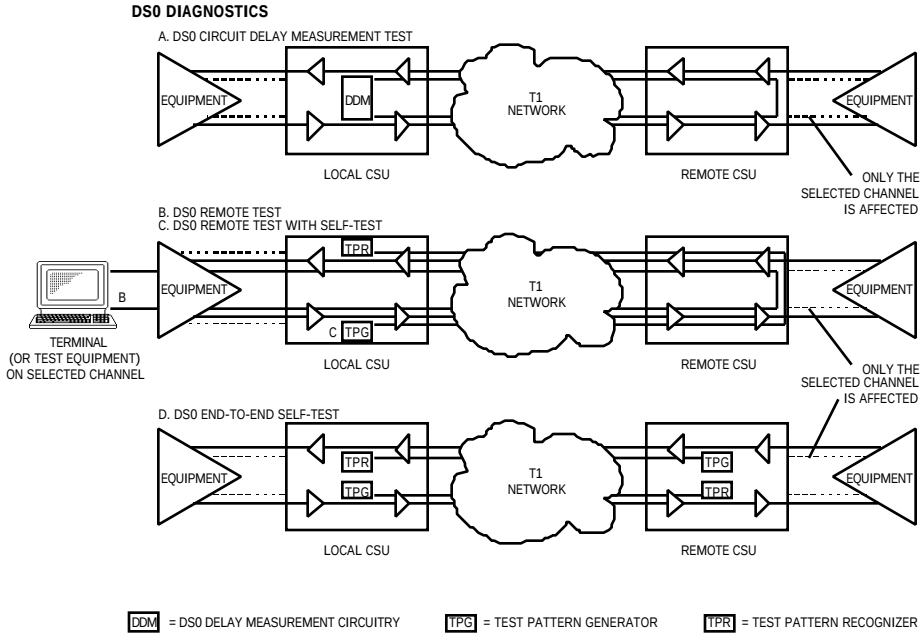


FIGURE 4-20. SUMMARY OF TESTS (Sheet 2 of 2)

TECHNICAL ASSISTANCE PROCEDURE

For technical assistance, customers should call DataComm Service Corporation at 203-598-7526.

In Canada:

General DataComm (Canada) Ltd.
Service and Repair Facility
1790 Beaulac Street
St. Laurent, Montreal, Quebec H4R 1W8
Telephone: 1-514-336-5454
TWX: 610-421-3221
Telex: 05824085

In the United Kingdom, contact the GDC area manager at:

General DataComm (U.K.) Ltd.
Molly Millars Close
Molly Millars Lane
Wokingham, Berkshire
England RG11 2QF
Telephone: 011-44-734-774-868
Telex: 851 847298
Fax: 011-44-734-774-871

In Europe/Africa/Middle East:

General DataComm
3 Batiment Saturne
Parc Club Ariane
Rue Helene Boucher
78284 Guyancourt Cedex, France
Tel: 011-33-1-30570200
Fax: 011-33-1-30443794

In the Pacific:

General DataComm Pty.
Suite 404
275 Alfred Street North
North Sydney, NSW 2060, Australia
Tel: 011-61-2-956-5099
Fax: 011-61-2-956-5083

In Asia:

General DataComm
401 Centry Square
1-13 D'Aguilar Street
Central, Hong Kong
Tel: 011-852-5265511
Telex: 780-80579
Fax: 011-852-5259944

In Latin America:

General DataComm, International
1579 Straits Turnpike
P.O. Box 1299
Middlebury, Connecticut 06762-1299
Telephone: 203-574-1118
Telex: 7400905
Fax: 203-758-9518

To return a unit for repair, *if so authorized by GDC,* use the return tag and address the package:

Product Repair Department
General DataComm, Inc.
1579 Straits Turnpike
P.O. Box 1299
Middlebury, CT 06762-1299

Lease and Maintenance contract customers may call DataComm Service Corporation toll-free at 1-800-243-1030, 24 hours a day, 7 days a week for trouble reporting or installation scheduling. (Installations are normally scheduled between 8 a.m. and 5 p.m.)

TRAINING

Hands-on training courses are available from DataComm Service Corporation's Educational Services in the USA and in the UK. Courses offered range from basic data communications, modems and multiplexers, to complex network systems, and are given at GDC's Connecticut facility or at a customer's location.

For information call:

USA (203) 574-1118, Ext. 6190.
UK 011-44-734-774-868

APPENDIX A

TECHNICAL INFORMATION

TECHNICAL CHARACTERISTICS

Item	Characteristic
Physical	
PC card assembly	
Height	7/8 in (2.22 cm)
Width	10 1/2 in (26.67 cm)
Depth	10 3/4 in (27.31 cm)
Weight	1 lb 12 oz (0.79 kg)
Shipping weight	2 lb 12 oz (1.25 kg)
Single-slot Standalone Enclosure (model DE-7)	
Height	4 1/8 in (10.48 cm)
Width	10 7/8 in (27.62 cm)
Depth	12 in (30.48 cm)
Four-slot DataComm FourPak Enclosure (model DFP-11)	
Height	5 1/4 in (13.34 cm); 5 1/2 in (13.97 cm) with rubber feet
Width	15 in (38.1 cm)
Depth	13 1/2 in (34.29 cm)
Three-slot GDC TriPak Shelf (models TPS-1, TPS-2)	
Height	5 3/4 in (14.61 cm)
Width	19 in (48.26 cm); 23 in (58.42 cm) with adapter ears
Depth	12 in (30.48 cm)
Environmental	
Temperature	
Operating	32˚ to 122˚F (0˚ to 50˚C) (derate by 1˚C/1000 ft above sea level)
Non-operating	-40˚ to 185˚F (-40˚ to 85˚C)
Humidity, operating	5% to 95%, without condensation
Altitude	
Operating	0 to 10,000 ft (0 to 3,048 m)
Non-operating	0 to 40,000 ft (0 to 12,192 m)
Electrical	
Power requirements	
Voltage	117 V ac (+ 10% -15%)
Frequency	60 Hz
Power dissipation	10 W maximum
Fusing (pc card)	Two 1.0 A, 250 V, 3AG (GDC Part No. 215300-100)
Data rate	1,544,000 bps ± 75 bps

TECHNICAL CHARACTERISTICS (Cont.)

Item	Characteristic
Electrical (Cont.)	
Communication line	T1 digital carrier (non-loaded, staggered-twist ABAM, PIC, or pulp-insulated exchange-type cable, 19 to 26 gauge)
Line impedance	100Ω
Network physical interface	RJ48C modular jack
Network transmitter	
Pulse amplitude	May vary over a cycle of 60 Hz current.
Without surge protection	2.70 to 3.30 V at 60˚F
With surge protection	2.40 to 3.00 V at 60˚F
Height variation with pulse pattern	2% (maximum)
Unbalance in height of adjacent negative and positive pulses	200 mV (maximum)
Width of output pulse (half amplitude)	324 nsec ± 45 nsec
Unbalance in width of positive and negative pulses	20 nsec (maximum)
Time between two consecutive pulses of opposite polarity (measured at half amplitude point of leading edges)	648 nsec ± 15 nsec
Maximum rise or falling time	100 nsec
Overshoot at trailing edge of pulse	10% to 30% of pulse amplitude
Line Build-Out	0, 7.5, or 15 dB (selectable or automatic) at 772 kHz
Output jitter	< 0.5 dB
Network receiver	
Operating range	0 to 36 dB of cable loss at 772 kHz
Input impedance	100Ω
Jitter tolerance	Conforms to specifications defined in AT&T PUB 62411, December 1988
Longitudinal balance	35 dB from 50 to 1500 kHz
Equipment interface	
Physical interface	
DataComm Enclosure and DataComm Modem Shelf	DB25S (25-pin subminiature female connector)
Universal System Shelf	DB15S (15-pin subminiature female connector)
Electrical interface	Crystal Semiconductor CS61534/CS61574 PCM Line Interface
Transmitter	
Pre-equalization	0 to 655 feet of line length
Impedance	100Ω
Receiver	
Pre-equalization	0 to 655 feet of line length
Impedance	100Ω
Supervisory terminal interface	
Physical interface	DB25P (25-pin subminiature male connector)
Interface standard	EIA/TIA-232-E
Baud rate	2400, 4800, 9600, and 19,200 bps
Character format	8/N/1, 7/N/1, 7/O/1, and 7/E/1 (word length/parity/stop bits)

TECHNICAL CHARACTERISTICS (Cont.)

Item	Characteristic
Electrical (Cont.)	
Diagnostics	DS1 Line Loop, DS1 Local Test, DS1 Local Test with Self-Test, DS1 Network Interface Loopback, DS1 Network Interface Loopback with Self-Test, DS1 Remote Test, DS1 Remote Test with Self-Test, DS1 Self-Test, DS1 Test Loop, DS0 Circuit Delay Measurement Test, DS0 Remote Test, DS0 Remote Test with Self-Test, DS0 Self-Test
CSU Compatibility	WECO 551
T1 compatibility	
Line code	AMI with no bipolar violations, and B8ZS
Consecutive zeros	15 or 39 maximum
Average pulse density	Minimum 1 “one” per 8 bits, or 24 “ones” per 192 bits
Keep Alive signal	Type 1 (consecutive ones)
Framing format	D4 Superframe Format and Extended Superframe Format (ESF), with automatic conversion
Alarms and status conditions	Out of Frame (OOF), Alarm Indication Signal (AIS or Blue alarm), Loss of Signal (LOS), and Yellow alarm

APPENDIX B

GLOSSARY

Accunet — Data-oriented digital services from AT&T Communications, including Accunet T1.5, terrestrial wide-band at 1.544 Mbps (formerly called T1); Accunet Reserved T1.5, satellite-based channels at 1.544 Mbps primarily for video teleconferencing applications; Accunet Packet Services, packet-switching services; Accunet Dataphone digital service (DDS), private-line digital circuits at 2.4, 4.8, 9.6, and 56 kbps.

Address — A sequence of bits, a character, or a group of characters that identifies a network station, user, or application; used mainly for routing purposes.

Alarm Indication Signal (AIS) — An AIS is a keep alive signal of continuous "ones," and is required by the network in the absence of a normal DS1 signal. In response to receiving an AIS, LOS, or OOF from one side, the CSU returns a Yellow alarm, and transmits an AIS to the other side. An AIS is transmitted until the error condition clears. An AIS is also called a Blue alarm.

Analog — Transmission employing variable and continuous waveforms to represent information values.

Anti-Streaming Timer — Ability in a modem to ignore a Request to Send (RTS) signal from a data terminal if it is held on for longer than a specified amount of time.

Asynchronous — Transmission that is not related to a specific frequency or to the timing of the transmission facility; transmission characterized by individual characters or bytes with start and stop bits from which a receiver derives the necessary timing for sampling bits; start-stop transmission.

Asynchronous Transmission — Serial transmission of data in which each character is individually synchronized by the use of start and stop bits. A start bit precedes and one or more stop bits follow continuous information bits. Also called start-stop transmission. There is no definite time relationship between transmission of successive characters.

Baud — The maximum number of signaling elements, or symbols, per second that are generated; may be different from bps rate as several bits may be encoded per symbol, or baud, with advanced encoding techniques such as phase-shift keying.

BER — Bit Error Rate.

BERT — Bit Error Rate Test, or tester.

Bipolar — The predominant signaling method used for digital transmission services, such as DDS and T1, in which the signal carrying the binary value successively alternates between positive and negative polarities. Zero and one values are represented by the signal amplitude at either polarity, while no-value “spaces” are at zero amplitude; also, polar transmission.

Bit — A binary digit, the representation of a signal, wave, or state, as either a binary zero or a one.

Bit Error Rate (BER) The percentage of received bits that are in error, relative to a specific amount of bits received; usually expressed as a number referenced to a power of 10; e.g., 1 in 10^5.

Blue Alarm Signal See Alarm Indication Signal.

BOC Bell operating company; one of 22 local telephone companies spun off from AT&T as a result of divestiture.

Bps Bits per second; basic unit of measure for serial data transmission capacity; also kbps (kilobits), for thousands of bits per second; Mbps (megabits), for millions of bits per second; Gbps (gigabits), for billions of bits per second; Tbps (terabits), for trillions of bits per second.

Byte Generally an 8-bit quantity of information, used mainly in referring to parallel data transfer, memory capacity, and data storage; also generally referred to in data communications as an octet or character.

Card A card is an assembly of components that can be tested, removed, and replaced as a unit. A card usually refers to a single unit without piggybacks connected to it. Also called pc board.

Channel Part of a circuit path through several entities in a communication system. A channel runs between two nodes.

Channel Service Unit (CSU) A component of customer premises equipment (CPE) used to terminate a digital circuit, such as DDS or T1, at the customer site; performs certain line-conditioning features, ensures network compliance per FCC rules, and responds to loopback commands from central office; also, ensures proper ones density in transmitted bit stream and performs bipolar violation correction.

Character Standard bit presentation of a symbol, letter, number, or punctuation mark.

Clock An oscillator-generated signal that provides a timing reference for a transmission link; used to control the timing of functions as sample interval, signaling rate, and duration of signal elements; an "enclosed" digital network typically has only one "master" clock.

Common Carrier In the United States, any supplier of transmission facilities or services to the general public that is authorized to provide such facilities or services by the appropriate regulatory authority and bound to adhere to the applicable operating rules, such as making services available at a common price and on a nondiscriminatory basis.

Contention Competition among customer channels, on a first in/first out basis, for the right to use a transmission channel, whether a PBX circuit, a computer port, or a time slot, within a multiplexed digital facility.

Control Characters Any transmitted characters, not message or user data, used to control or facilitate data transmission between data terminal equipment (DTE); includes extra characters associated with addressing, polling, message delimiting and blocking, framing, synchronization, and error checking.

Controlled Slip Event A controlled slip event is the occurrence of a replication or deletion of one DS1 frame by the receiving equipment, and is counted as one event. A controlled slip event occurs when the difference in the timing between the synchronous receiving equipment and the received signal is of such magnitude that it exhausts the buffer capability of the equipment.

CRC	Cyclic Redundancy Check.
CRC-6 Error Event	A CRC-6 error event occurs when the CRC code calculated at the receiving end does not match the CRC code calculated by the transmitting end. The CRC is a method of detecting errors in the DS1 signal, and is performed on each ESF superframe.
CSU	Channel Service Unit.
Cyclic Redundancy Check	A characteristic link-level feature of (typically) bit-oriented data communications protocols, wherein data integrity of a received frame or packet is checked using a polynomial algorithm based on the content of the frame, and then matched with the result performed by the sender and included in a (typically 16-bit) field appended to the frame; basic error-checking mechanism for link-level data transmissions.
D4	An AT&T specified frame format that designates every 193rd bit position in an AT&T supplied T1 facility reserved for D4, which allows continuous monitoring and nondestructive diagnostic framing to be implemented by the carrier.
D4 Framing Format	D4 is a digital signal framing format combining 12 frames of 193 bits each into a superframe, and designating every 193rd bit position as reserved for framing and synchronization.
Data	Digitally represented information, which includes voice, text, facsimile, and video.
DataCommonality	General DataComm's term to describe a unique packaging technique that provides (1) high density modular packaging, (2) a broad array of versatile data sets and accessories, (3) system flexibility and ease of expansion, (4) low power consumption, (5) heat dissipation, (6) quick and simple installation, (7) at-a-glance monitoring of system operation, (8) convenient, low-cost maintenance, and (9) high reliability.
Data Communications	Transmitting and receiving coded digital signals between computers or other digital devices or systems according to agreed upon specifications or standards.
Data Communications Equipment (DCE)	Equipment that provides the signal conversion, connection control, and coding required for communication between data terminal equipment and data circuits; may be independent (e.g., a modem) or an integral part of a computer.
Data Frame	A repeating sequence in which channel data is multiplexed into an aggregate data stream.
Data Link	Any serial data communications transmission path, generally between two adjacent nodes or devices with no intermediate switching nodes.
Data Terminal Equipment (DTE)	Generally end-user devices, such as terminals and computers that connect to DCE, which generate or receive the data carried by the network; in RS-232-C and EIA/TIA-232-E connections, designation as DTE or DCE determines signaling role in handshaking.
dB	Decibel; a unit of measurement used to express the ratio of two values, usually the power of electrical or electromagnetic signals; equal to 10 times the logarithm derived from a ratio of the two power levels, which are expressed in watts; the relative gain or loss of a signal when the measured signal value is compared in a ratio to another, usually its input, value.

DCE Data Communications Equipment. A term usually meant to refer to the modem portion of a data communications network. Also, data circuit-terminating equipment. In the case of an EIA/TIA-232-E (RS-232-C) connection, the modem is the DCE; in a CCITT X.25 connection, the network access and packet-switching node is the DCE.

DDS Dataphone digital service; private-line digital service offered intra-LATA by BOCs, inter-LATA by AT&T Communications, with data rates typically at 2.4, 4.8, 9.6, and 56 kbps; now a part of the services listed by AT&T under the Accunet family of offerings.

Dial-up The process of, or the equipment or facilities involved in, establishing a temporary connection via the switched telephone network.

Digital Techniques and equipment in which information is encoded as either a binary "1" or "0"; the representation of information in discrete binary form, discontinuous in time, as opposed to the analog representation of information in variable, but continuous waveforms.

Digital Terminating Equipment (DTE) Terminal equipment on the customer's premises. DTE includes the CSU functionality which may or may not be physically incorporated into the same equipment package as other DTE functions at the manufacturers' or customers' option.

Digital Signal Level 0 (DS0) DS0 designates a 64 kbps digital signal, a channel, comprised of 8,000 8-bit bytes of customer data.

Digital Signal Level 1 (DS1) DS1 designates the combination of 24 DS0 channels plus overhead bits into a 1.544 Mbps T1 data stream. A DS1 signal is one that conforms to DS1 specifications.

DTE Data Terminal Equipment.

EIA Electronic Industries Association.

EIA/TIA-232-E An EIA-specified physical interface, with associated electrical signaling, between data circuit-terminating equipment (DCE) and data terminal equipment (DTE); the most commonly employed interface between computers and modems.

EPROM Erasable programmable read-only memory.

Equalization The process of reducing the effect(s) of amplitude frequency and/or phase distortion of a circuit by the introduction of networks to compensate for the difference in attenuation and/or time delay at the various frequencies in the transmission bands.

Equipment The customer-provided multiplexer (and its attachments) connected to the CSU.

Error Free Second (EFS) An EFS is a second in which no error event has been detected.

Errored Second (ES) An ES is a second with one or more ESF error events.

ESF Error Event An Extended Superframe Format (ESF) error event is an ESF frame that contains a CRC-6 error event or an OOF state, or both. ESF error events are processed to derive ESs and severely ESs.

Excessive Bipolar Violation Condition

An excessive bipolar violation condition occurs when more than 1,544 bipolar violations (BPVs) occur in 1,000 consecutive seconds. The condition clears when no BPVs occur for 85 consecutive seconds. A BPV is the occurrence of two or more consecutive bits in the DS1 signal that do not alternate between signal levels as required by the network for the Alternate Mark Inversion (AMI) line code.

Extended Superframe Format (ESF)

ESF is an extension of the D4 framing format, combining 24 frames of 193 bits each into an extended superframe, and providing improved performance monitoring capabilities and protection against false framing.

Facsimile

The communications process in which graphics or text documents are scanned, transmitted via a (typically dial-up) phone line, and reconstructed by a receiver; facsimile device operation typically follows one of the CCITT standards for information representation and transmission (Group 1 analog, with page transmission in four or six minutes; Group 2, with page transmission in two or three minutes, and Group 3 digital, with page transmission in less than one minute); also Fax.

Failed Second (FS)

An FS is counted for every second a failed signal state exists.

Failed Signal State

A failed signal state occurs when 10 consecutive severely ESs occur. A failed signal state ends when 10 consecutive seconds of data are processed and no severely ESs occur. While in a failed signal state, no ESs are counted. For every second a failed signal state exists, an FS results.

511-Bit Test Pattern

An irregular, quasi-random pattern of 511 bits used to test and measure network jitter.

Frame

A group of bits sent serially over a communications channel; generally a logical transmission unit sent between data-link-layer entities that contains its own control information for addressing and error checking; the basic data transmission unit employed with bit-oriented protocols similar to blocks.

Frame Synchronization Bit Error Event

This is the occurrence of a bit error within the framing-pattern-sequence of an ESF superframe.

Fusible Link

Thin printed circuit fuses on pc boards that open if ground potential exceeds 0.25 V rms between pc board and peripheral equipment.

Ground

An electrical connection or common conductor that, at some point, connects to the earth.

Handshake Protocol

In communications, a predefined exchange of signals or control characters between two devices or nodes that sets up the conditions for data transfer or transmission; also, handshaking.

Interface

A shared boundary; a physical point of demarcation between two devices, where the electrical signals, connectors, timing, and handshaking are defined; the procedure, codes, and protocols that enable two entities to interact for the meaningful exchange of information.

Jitter

The slight movement of a transmission signal in time or phase that can introduce errors and loss of synchronization for high-speed synchronous communications; see Phase Jitter.

Keep Alive Signal

A keep alive signal prevents the network's line regenerators from oscillating (which causes interference with adjacent channels). The network requires that

	the CSU transmit a keep alive signal when conditions are such that a normal data stream cannot be transmitted.
Leased Line	A dedicated circuit, typically supplied by the telephone company, that permanently connects two or more user locations; generally voice-grade in capacity and in range of frequencies supported; typically analog, though sometimes refers to DDS subrate digital channels (2.4 to 9.6 kbps); used for voice (2000 Series leased line) or data (3002-type); point-to-point or multipoint; may be enhanced with line conditioning; also private line.
LED	Light-emitting diode.
Line Code Violation Event	For an AMI-coded signal, this is the occurrence of a received bipolar violation. For a B8ZS-coded signal, it is the occurrence of a received bipolar violation that is not part of the associated zero-substitution code.
Link	The combination of communications devices, media and software intelligence that is required to effect data communications.
Loopback	Diagnostic procedure used for transmission devices; a test message is sent to a device being tested, which is then sent back to the originator and compared with the original transmission; loopback testing may be within a locally attached device or conducted remotely over a communications circuit.
Loss of Signal (LOS)	An LOS condition occurs when the CSU senses an absence of signal from either side for more than 150 milliseconds when in the AT&T mode, or 175 bit periods when in the ANSI mode. A network signal with loss greater than 28.5 dB is considered no signal, while an equipment signal with excessive consecutive zeros is considered no signal. In response to receiving an LOS from one side, the CSU returns a Yellow alarm, and transmits an AIS to the other side.
Master CSU	A DataComm 551 option that allows configuration of the CSU through the Supervisory terminal.
Modem	Modulator/demodulator; electronic device that enables digital data to be sent over (typically) analog transmission facilities.
Multiplex	The interleaving of message elements (bits and characters) from a variety of data sources into one or more combined signals.
Multiplexed Channel	A communications channel capable of servicing a number of devices, or users, at a time.
Multiplexer	Any multiport device that allows two or more users to share a common physical transmission medium; employed in pairs, one at each end of the communications channel, where each device performs both multiplexing of the multiple user inputs and demultiplexing of the channel back into the separate user data streams.
Multiplexing	The combining of multiple data channels onto a single transmission medium; any process through which a circuit normally dedicated to a single user can be shared by multiple users; typically, user data streams are interleaved on a bit or byte basis (time division) or separated by different carrier frequencies (frequency division).
Mux	Multiplexer.
Network	An interconnected group of nodes; a series of points, nodes, or stations connected by communications channels; the assembly of equipment through which connections are made between data stations.

Node — A point where one or more functional units interconnect transmission lines (ISO); a physical device that allows for the transmission of data within a network; an end-point of a link or a junction common to two or more links in a network (IBM SNA); typically includes host processors, communications controllers, cluster controllers, and terminals.

NRZ — Non-return to zero; a binary encoding and transmission scheme where "ones" and "zeros" are represented by opposite, and alternating, high and low voltages; where there is no return to a reference (zero) voltage between encoded bits.

Out of Frame State (OOF) — An OOF state begins when any two out of four or two out of five consecutive framing bits received from either side are incorrect. In response to receiving an OOF from one side, the CSU returns a Yellow alarm, and transmits an AIS to the other side. A Red alarm signal occurs when on OOF state exists for more than 2.5 seconds. An OOF state ends when reframe occurs.

PABX — Private automatic branch exchange.

Packet — A sequence of data, with associated control elements, that is switched and transmitted as a whole; refers mainly to the field structure and format defined within the CCITT X.25 recommendation; multiple packets may be required to carry one complete document or a lengthy block of information.

Packet Switching — A data transmission technique wherein user information is segmented and routed in discrete data envelopes called packets, each with its own appended control information for routing, sequencing, and error checking; a transmission technique that allows a communications channel to be shared by many users, each using the circuit only for the time required to transmit a single packet; a network that operates in this manner.

Parity Bit — An additional non-information bit appended to a group of bits, typically to a 7- or 8-bit byte, which indicates whether the number of ones in the group of bits is an odd or even number; a basic and elementary mechanism for error checking.

Parity Check — Process of error checking using the parity bit; varied methods include longitudinal parity check and transverse parity check.

PBX — Private branch exchange; telephone switch located on a customer's premises that primarily establishes voice-grade circuits, over tie-lines, between individual users and the switched telephone network.

Phase Modulation — A data transmission encoding method wherein the phase angle of the carrier wave is varied, usually by 90 or 180 degrees, to represent a different bit value to the receiver; the encoding technique used in phase shift keying. The process of changing the phase of a carrier waveform to reflect digital (binary) information for the purpose of transmission over analog facilities.

Phase Shift Keying (PSK) — The phase-modulation encoding technique employed by many modems.

Point to Point — A circuit that connects two points directly, with generally no intermediate processing nodes or computers, although there could be switching facilities; a type of connection, such as a phone-line circuit, that links two, and only two, logical entities.

Port — A point of access into a computer, a network, or other electronic device; the physical or electrical interface through which one gains access; the interface between a process and a communications or transmission facility.

Private Line — A leased line, an unswitched circuit.

Protocol Formal set of rules governing the format, timing, sequencing, and error control of exchanged messages on a data network; may also include facilities for managing a communications link and/or contention resolution; a protocol may be oriented toward data transfer over an interface, between two logical units directly connected, or on an end-to-end basis between two end users over a large and complex network.

PSTN Public switched telephone network; the dial-up phone network.

Public Network Generically, a network established and operated by communications common carriers or telecommunications administrations for the provision of circuit-switched, packet- switched, and leased-line circuits to the public.

Quasi-Random Signal (QRS) Test Patten An irregular pattern of bits used to test and measure network jitter, as defined in AT&T PUB 62411.

Red Alarm Signal A Red alarm signal is a locally detected failure. In response to receiving a Red alarm from one side, the CSU transmits a Yellow alarm to the other side.

Request To Send A signal to the sending modem that the terminal is ready to transmit; part of modem handshaking.

RS-232-C An EIA-specified physical interface. *See* EIA/TIA-232-E.

RTS Request To Send.

Severely Errored Framing Event This is the occurrence of two or more frame synchronization bit error events within a 3-ms period.

Severely Errored Second A severely ES is a second with 320 or more ESF error events. Severely ESs are also processed to derive failed signal states.

Simplex One-way data transmission, with no capability for changing direction.

Slave CSU A DataComm 551 option that prevents configuration of the CSU through the Supervisory terminal. A slave CSU displays a warning message when the user attempts to configure it or start a Self-Test or a loopback, although it does not prevent these tests.

SNA Systems Network Architecture. In IBM networks, the layered logical structure, formats, protocols, and procedures that govern information transmission.

Space One of the two possible conditions of an information element (bit), an open line in a neutral circuit.

Start Bit In asynchronous transmission, the first element in each character that prepares the receiving device to recognize the incoming information elements.

Start-Stop Transmission Asynchronous transmission for a group of data elements that are preceded by a start signal and followed by a stop signal; reference employed primarily by IBM for asynchronous transmission.

Stop Bit In asynchronous transmission, the last transmitted element in each character, which permits the receiver to come to an idle condition before accepting another character.

Supervisory Port — An interface on the DataComm 551 to which the Supervisory terminal is connected.

Supervisory Terminal — A terminal that provides software-control of configuration, diagnostics, and maintenance for one or all DataComm 551s in a network.

Switched Network — Communications link for which the physical path, established by dialing, may vary with each use (e.g., a dial-up telephone circuit).

Systems Network Architecture (SNA) — In IBM networks, the layered logical structure, formats, protocols, and procedures that govern information transmission.

T1 — AT&T term for a digital carrier facility used to transmit a DS-1 formatted digital signal at 1.544 Mbps.

Telco — Telephone company.

Terminal — A point in a network at which data can either enter or leave; a device, usually equipped with a keyboard, often with a display, capable of sending and receiving data over a communications link (IBM); generically the same as data terminal equipment (DTE).

Tie Line — A leased or private line dedicated telephone circuit provided by common carriers that links two points together without using the switched telephone network.

Transmission — The dispatching of a signal, message, or other form of intelligence by wire, radio, telegraphy, telephony, facsimile, or other means (ISO); a series of characters, messages or blocks, including control information and user data; the signaling of data over communications channels.

2047-Bit Test Pattern — An irregular, quasi-random pattern of 2,047 bits used to test and measure network jitter.

USOC — The Universal Service Order Code (USOC) is accepted telecommunications industry code for identifying servicing arrangements provided by telephone companies, and is used to identify the standard jack required for the equipment.

Virtual Circuit — A connection established between a channel from the calling DTE and a channel to the called DTE before any data packets may be sent. May be a Switched Virtual Circuit (SVC) or a Permanent Virtual Circuit (PVC).

Voice-Grade Channel — A telecommunications circuit used primarily for speech transmission but suitable for the transmission of analog or digital data or facsimile; typically supporting a frequency range of 300 to 3,400 Hz; also voice band.

Yellow Alarm Signal — A Yellow alarm signal is a remotely detected failure. A Yellow alarm is transmitted as a specific bit pattern contained in the data stream when using D4 framing, or in the data link when using ESF framing. In response to receiving a Yellow alarm from one side, the CSU transmits a Yellow alarm to the other side in the proper format (D4 or ESF).

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