DataComm 554

Data Service Unit

Installation & Operation Manual

048R147-000
Issue 3
April 2002

General DataComm
Smart Solutions for Service Providers

Copyright

If you have comments or suggestions concerning this manual, please contact:

General DataComm, Inc.
Technical Publications
6 Rubber Avenue
Naugatuck, Connecticut USA 06770

Telephone: 1 203 729 0271

Trademarks

All brand or product names are trademarks or registered trademarks of their respective companies or organizations.

Documentation

Revision History - GDC P/N 048R147-000

Issue Number	Date	Description of Change
1		Initial Release and Product Update
2	August 1996	Updates
3	April 2002	Reformatting and updates.

Related Publications

Description	Part Number
DataComm 10 1/2 Inch Shelf (Model DS-1) Instruction Manual	010R310-REV
DataComm 10 1/2 Inch DC-to-DC Shelf (Model DS-5) Instruction Manual	010R340-REV
DataComm 10 1/2 Inch DC-to-DC Shelf (Model DS-6) Instruction Manual	010R341-REV
Universal System Shelf (Models USS-1D, -1E, -1J, -1U, -1H Instruction Manual	010R380-REV

`-REV` is the hardware revision (`-000`, `-001`, etc.)
`-VREF` is the most current software version (`-V400` is Version 4.0.0.)
In addition to the publications listed above, always read Release Notes supplied with your products.

Preface

Chapter 1: Introduction & Specifications

Chapter 2: Installation & Setup

Preface

Scope of this Manual

This manual describes installing the DataComm 554A Data Service unit (DC554 DSU) and placing it into service. The information contained in this manual has been carefully checked and is believed to be entirely reliable. This information is intended for installers, service technicians and users and assumes a working knowledge of data interfaces and data transmission services.

As General DataComm improves the reliability, function, and design of their products, it is possible that the information in this dopcument may not be current. Contact General DataComm, your sales representative or point your browser to `http:\\www.gdc.com` for the latest information on this and other General DataComm products.

General DataComm, Inc.
6 Rubber Avenue
Naugatuck, Connecticut, USA 06770
Tel: 1 203 729-0271

Manual Organization

This manual is divided into the following chapters. When using the digital version of this manual, click on any link (shown in blue text) to jump to that section.

- *Chapter 1, Introduction & Specifications*
  describes the Data Service Unit, its features, and its options. This chapter contains the typical application diagrams, an equipment list and technical specifications.

- *Chapter 2, Installation & Setup*
  provides directions for installing the DSU in a SpectraComm shelf system or enclosure.

- *Chapter 3, Operation*
  describes and provides instructions on the use of the DSU front panel and the terminal interface.

- *Chapter 4, Tests*
  describes tests that can be performed on the DSU by means of its front panel push-button switch or from the terminal interface.

Safety Information

This manual should be read in its entirety and all procedures completely understood before installing or operating the unit, including all notes, cautions and warnings (examples below). The CAUTION, WARNING, and DANGER statements that appear throughout this manual are intended to provide critical information for the safety of both the service engineer and operator. These statements also enhance equipment reliability. The following definitions and symbols for CAUTION, WARNING, and DANGER as they are used comply with ANSI Z535.2, American National Standard for Environmental and Facility Safety Signs, and ANSI Z535.4, Product Safety Signs and Labels, issued by the American National Standards Institute. .

Note   *Indicates a note. It is something you should be particularly aware of; something not readily apparent. A note is typically used as a suggestion.*

Important   *Indicates an emphasized note. It is something you should be particularly aware of; something not readily apparent. Important is typically used to prevent equipment damage.*

CAUTION *Indicates a potentially hazardous situation which, if not avoided, may result in minor to moderate injury. It may also be used to alert against unsafe practices.*

WARNING *indicates an imminently hazardous situation which, if not avoided, could result in death or serious injury.*

DANGER *indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.*

Safety Guidelines

- Always use caution and common sense, especially when unsafe conditions or potentially hazardous voltages are present.
- Repairs must be performed by qualified service personnel only.
- To reduce the risk of electrical shock, do not operate equipment with the cover removed.
- Never install telephone jacks in a wet location unless the jack is designed for that location.
- Never touch uninsulated telephone wires or terminals unless the telephone line is disconnected at the network interface.
- Never install telephone wiring during an electrical storm.

Antistatic Precautions

This product may contain static-sensitive devices that are easily damaged by electrostatic discharge (ESD. ESD occurs when a person whose body has built up static electricity touches a computer component. ESD can cause computer components to fail. Take proper handling, grounding and precautionary ESD measures when installing parts or cards. Keep parts and cards in antistatic packaging when not in use or during transport. If possible, use antistatic pads on floor and workbench. When handling components, always use an antistatic wrist strap connected to a grounded equipment frame or chassis. *If a wrist strap is not available, periodically touch an unpainted metal surface on the equipment.* Never use a conductive tool, like a screwdriver or a paper clip, to set switches.

Compliance

FCC Part 68 Compliance

Connection of data communications equipment to the public telephone network is regulated by FCC Rules and Regulations. This equipment complies with Part 68 of these regulations which require all of the following:

For single or multi-line equipment that connects to the telephone network via a plug and jack, the plug and jack must comply with the FCC Part 68 rules. This device is designed to be connected to the telephone or premises wiring, using a compatible modular jack which is Part 68 compliant.

The telephone company may discontinue your service if the unit causes harm to the telephone network. If possible, you will be notified of such an action in advance. If advance notice is not practical, you will be notified as soon as possible and will be advised of your right to file a complaint with the FCC. The telephone company may change its communication facilities, equipment, operations and procedures where reasonably required for operation. If so, the telephone company will notify you in writing. All repairs or modifications to the equipment must be performed by General DataComm. Any other repair or modification by a user voids the FCC registration and the warranty.

To connect the product to the Public Telephone Network, you are required to give the following information to the telephone company:

- Port ID: DC554

- FCC Registration Number: AG6USA-20702-DE-N

- Telephone Company jack type: RJ48S

- Facility Interface Codes: 04DU9-BN, 04DU9-DN, 04DU9-1K9, 04DU9-ISN

- Service Order Code: DDS- 6.04

Industry Canada Notification

The Industry Canada label identifies certified equipment. This certification means that the equipment meets telecommunications network protective, operation and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). 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. 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 coordinated by a representative 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.

Notice: The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

Avis D'industrie Canada

L'étiquette d'Industrie Canada identifie le matériel homologué. Cette étiquette certifie que le matériel est conforme aux normes de protection, d'exploitation et de sécurité des réseaux de télécommunications, comme le prescrivent les documents concernant les exigences techniques relatives au matériel terminal. Le Ministère n'assure toutefois pas que le matériel fonctionnera à la satisfaction de l'utilisateur.

Avant d'installer ce matériel, l'utilisateur doit s'assurer qu'il est permis de le raccorder aux installations de l'entreprise locale de télécommunication. Le matériel doit également être installé en suivant une méthode acceptée de raccordement. L'abonné ne doit pas oublier qu'il est possible que la comformité aux conditions énoncées ci-dessus n'empêche pas la dégradation du service dans certaines situations.

Les réparations de matériel homologué doivent être coordonnées par un représentant désigné par le fournisseur. L'entreprise de télécommunications peut demander à l'utilisateur de débrancher un appareil à la suite de réparations ou de modifications effectuées par l'utilisateur ou à cause de mauvais fonctionnement.

Pour sa propre protection, l'utilisateur doit s'assurer que tous les fils de mise à la terre de la source d'énergie électrique, des lignes téléphoniques et des canalisations d'eau métalliques, s'il y en a, sont raccordés ensemble. Cette précaution est particulièrement importante dans les régions rurales.

Avertissement: L'utilisateur ne doit pas tenter de faire ces raccordements lui-même; il doit avoir recours à un service d'inspection des installations électriques, ou à un électricien, selon le cas.

Avis: L'indice d'équivalence de la sonnerie (IES) assigné à chaque dispositif terminal indique le nombre maximal de terminaux qui peuvent être raccordés à une interface. La terminaison d'une interface téléphonique peut consister en une combinaison de quelques dispositifs, à la seule condition que la somme d'indices d'équivalence de la sonnerie de tous les dispositifs n'excède pas 5.

Electromagnetic Compatibility

This Class A digital apparatus complies with Canadian ICES-003.

La Compatibilité d' Eléctro-magnetique

Cet appareil numerique de la classe A est conforme a la norme NMB-003 du Canada.

Service Support and Training

VITAL Network Services is a leading single source, data communications organization which provides network service and support for General DataComm customers throughout the world. VITAL Network Services provides the support and training required to install, manage and maintain your GDC equipment. Training courses are available at centers in the US, UK, France, Singapore and Mexico, as well as at a customer's site.

For more information on VITAL Network Services or for technical support assistance, contact VITAL Network Services:

VITAL Network Services World Headquarters

6 Rubber Avenue	Telephones:	Faxes:
Naugatuck, Connecticut 06770 USA	1 800 243 1030	1 203 723 5012
	1 888 248 4825	1 203 729 7611
http//www.vitalnetsvc.com	1 203 729 2461	

VITAL Network Services Regional Sales and Service Offices:	

North American Region Office
6 Rubber Avenue
Naugatuck, Connecticut 06770 USA
Telephones: 1 800 243 1030
                 1 888 248 4825
                 1 203 729 2461
                 1 800 361 2552 (French Canadian)
Training: 1 203 729 2461
Faxes: 1 203 723 5012
                 1 203 729 7611
	Central America, Latin America
	VITAL Network Services
	Periferico Sur 4225, Desp. 306
	C.P. 14210, Mexico D.F., Mexico
	
	Telephone: 52 5 645 2238
	Training: 52 5 645 2238
	Fax: 52 5 645 5976

Europe, Middle East, Africa VITAL Network Services Molly Millars Close Molly Millars Lane Wokingham, Berkshire RG41 2QF UK Telephone: 44 1189 657200 Training: 44 1189 657240 Fax: 44 1189 657279	**Asia Pacific** VITAL Network Services 501 Orchard Road 05-05 Wheelock Place, Singapore 238880 Telephone: 65 735 2123 Training: 65 735 2123 Fax: 65 735 6889

Chapter 1: Introduction & Specifications

DC 554 DSU Overview

The DataComm 554 Data Service Unit (DSU) is a highly efficient means of transmitting and receiving digital data over a T1 line supplied by a telephone company (Telco) or other service provider. The DSU is available in standalone or rack-mount versions. The rack-mount unit employs GDC's DataComm packaging which accepts a variety of data communications products mounted in the same high-density shelf system. Each 16-slot shelf can hold 16 single-card devices, such as the CD 554 DSU, or a mix of single- or two-card devices.

The DC 554 DSU base card is a 10.5-inch by 10.75-inch (267mm by 273mm) printed circuit card which can operate in the following enclosures/shelf systems: a GDC DataComm AC-powered Standalone enclosure, a GDC DataComm Shelf (DS-1, DS-5 or DS-6 models) or a GDC Universal Shelf System (USS).

Intended Use

The DC 554 DSU's Fractional T1 (FT1) interface utilizes only the bandwidth you need, from 56 Kbps up to the full T1 rate of 1.536 Mbps. The unit allows the linking of FT1 services with traditional Dataphone Digital Service (DDS) and generic digital services, including support for ANSI T1.403 PN 127 loop up/loop down codes.

The DC 554 DSU provides interface between the customer's equipment and a Fractional T1 (FT1) digital carrier facility provided by the Telco or other carrier. It performs both the Data Service Unit (DSU) function of converting the customer's data stream to bipolar format, and the Channel Service Unit (CSU) functions of network interfacing and protection. The DC 554 DSU is ideal for medium-sized, low-channel-density networks.

DC 554 DSU Features and Benefits

- Supports one high-speed serial data port for customer equipment.

    - ITU-T V.35-compatible interface is standard.

    - EIA-530-compatible channel interface is available as an option.

- Permits configuration of network transmitter timing from a variety of sources:

    - Timing recovered from network data

    - External timing

    - Internal clock

- Provides configurable Auto Framing option that automatically adapts the DSU to Extended Superframe format (ESF) or D4 Superframe Format on the network side.

- 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 TR54016 and Bellcore TR-TSY-000194 (ANSI) procedures for collection and monitoring of network performance.

- Provides network registers for TABS performance data.

- Provides T1- and channel-level diagnostics for extensive diagnostic capabilities.

Fractional T1 Capabilities

A T1 line's DS1 signal consists of 24 DS0 channels. The DC 554 DSU can be configured to map user data into either consecutive or alternate DS0s to provide rates from 56 Kbps (1 DS0) to 1.536 Mbps (24 DS0s at 64 Kbps each). Rates that use less than the full 1.536 Mbps are referred to as Fractional T1 (FT1).

The output rates available from the DSU are multiples of 56 and 64 Kbps because each of the T1 line's 24 DS0s provides a data rate of 56 or 64 Kbps depending on the form of line coding being used. The DSU can be configured to start a group of DS0s on any DS0 in the T1 line.

The full T1 bandwidth is available when consecutive DS0s are used, but restrictions on ones density may limit the actual usable bandwidth. Use of consecutive DS0s for N x 64 Kbps requires either B8ZS coding on the network line or provisioning in the DTE to guarantee mark density requirements.

Using alternate DS0s reduces the T1 bandwidth available for user data by one-half, but it eliminates restrictions on the content of user data. When the DSU is configured to use alternate DS0s it maintains minimum ones density at 50% by filling the unused DS0s with ones.

DTE Interface

The DC 554 DSU's standard DTE interface is an ITU-T V.35-compatible port for connection to synchronous serial customer equipment. Examples of customer equipment are Front End Processors (FEPs), Local Area Network (LAN) bridges, video codecs, CAD/CAM workstations, and Group 4 facsimile equipment.

An optional EIA-530 compatible interface is available to replace the standard V.35 channel interface.

Shelf / Enclosure Options

The DC 554 DSU can be deployed in a standalone enclosure, in a DataComm Shelf System, or in a Universal Shelf System. Refer to *Table 1-1* for shelf / enclosure descriptions and part numbers. For more information on any shelf / enclosure system, refer to its manual as listed in the front section of this manual.

Piggyback Cards Options

The following optional piggyback cards may be mounted on the DC 554 base card:

- The EIA/TIA-530 Interface Daughter Card supports the use of an EIA-530 DTE interface. When the 530 Interface Card is not installed, the DSU provides an TIA/EIA-232-F or V.35 interface as selected by hardware jumpers on the base card.

- The Option Card adapts data rates, timing and other switch options for synchronous operation.

Equipment List

Table 1-1 lists the DataComm 554 device part numbers and compatible equipment.

Table 1-1   Equipment List

Type	Description	GDC Part No.
DC 554 Data Service Units	DC 554 DSU, standalone enclosure (Model DE-7 base), 117 VAC, V.35 channel interface	048A121-001
	DC 554 DSU, standalone enclosure (Model DE-7 base), 117 VAC, EIA-530 channel interface	048A121-011
	DC 554 DSU, rack-mount card, V.35 channel interface	048M121-001
	DC 554 DSU, rack-mount card, EIA-530 channel interface	048M121-011
Enclosure	DataComm FourPak Standalone Enclosure, Model DFP-11, 117 VAC	010B115-001
DataComm Shelves (rack-mount)	Model DS-1, 117 VAC	010B015-001
	Model DS-5R, DC-powered with redundant power supplies	010M011-001
	Model DS-5NR, DC-powered with non-redundant power supplies	010M011-002
	Model DS-6R, DC-powered with redundant power supplies, with Telco, VF and DTE cables	010M047-001
	Model DS-6NR, DC-powered with non-redundant power supplies, with Telco, VF and DTE cables	010M047-002
	Model DS-6R-1, DC-powered with redundant power supplies, with Telco and VF cables only	010M047-003
	Model DS-6NR-1, DC-powered with non-redundant power supplies, with Telco and DTE cables only	010M047-004
Universal System Shelves (rack-mount)	Model USS-1D, 117 VAC	010B080-001
	Model USS-1DC/R, DC-powered with redundant power supplies	010M040-002
	Model USS-1DC/NR, DC-powered with non-redundant power supplies	010M040-001
	Domestic DataComm Backplane (for USS installation)	048B015-001
Options	EIA-530 Channel interface Daughter Card	048P042-001
Interface Cable	ITU-T V.35 34-pin male-to-male, (5-50 ft lengths) (DSU channel port to customer equip)	027H516-XXX
Adapter Cable	34-pin female to 25-pin male, use with Cable P/N 027H516-XXX for a ITU-T V.35 channel port in any housing except the DataComm DE-7 Enclosure	027H560-001
Interface Cable	EIA-232-D/EIA-530 male to 25-pin male, 26-, 43-inch lengths and 2- to 100-ft lengths, (DSU channel port to customer equip with a female connector)	028H502-XXX
Interface Cable	EIA-232-D/EIA-530 25-pin female to 25-pin male, 6-, 26-, 43-inch lengths and 2- to 100-ft lengths (DSU channel port to customer equip with a male connector)	027H511-XXX
Interface Cable	EIA-449 37-pin male to 37-pin male, 1- to 50-ft lengths, Use with adapter P/N 027H501-001 and optional EIA-530 interface.	027H603-001
Adapter Cable	EIA-449 37-pin female to 25-pin male, Use with adapter P/N 027H603 and optional EIA-530 interface.	027H501-001
Interface Cable	EIA-449 37-pin male to 25-pin male, 1- to 50-ft lengths, Use with optional EIA-530 interface.	023H603-XXX
Interface Cable	25-pin male to 25-pin male, 1- to 50-ft lengths), EIA-422 multiplexer aggregate to optional EIA_530 interface.	027H531-XXX

Table 1-1   Equipment List (Continued)

Type	Description	GDC Part No.
GND Jumper	Grounding jumper for customer equipment cables, required for a DataComm shelf housing only.	024H005-X03
Interface Cable	RJ48C plug to plug, 10- to 50-ft lengths, DSU network port to the T1 line, for any housing except a DataComm shelf.	022-H024-XXX
Interface Cable	RJ48C plug to 15-pin male, DSU network port to T1 line, optional Cascade port to DTE, 10- to 50-ft lengths, - for any housing except a DataComm shelf, or - for Canadian installations	022-H022-XXX
Interface Cable	RJ48C plug to 15-pin female, DSU network port to T1 line, 10- to 125-ft lengths, for Canadian installations only	022-H020-XXX
Interface Cable	RJ48C plug-to-plug, DSU network port to T1 line, 10- to 50-ft lengths, for a DataComm housing only	022-H026-XXX
Interface Cable	RJ48C plug-to-terminal lugs, DSU network port to T1 network interface, for DataComm shelf only	022-H025-XXX
Adapter	RJ48C plug-to-jack, DSU network port to T1 line, 10- to 50-ft lengths, for a DataComm housing only	029H203-001
Interface Cable,	RJ48C plug to 25-pin male, optional Cascade port to multiplexer/DTE, for any housing except a DataComm shelf.	027H218-XXX
Interface Cable,	EIA-530 25-pin male to 25-pin male (DCE-to-DCE crossover cable)	027H527-XXX
Interface Cable,	V.35 34-pin male to 34-pin male (DCE-to-DCE crossover cable)	027H521-XXX
Patch Cable,	Male to male, 24- and 60-in lengths (Front panel access test jack)	830-021-S001
Patch Cable,	Bantam-to-WECO 310, 4 ft length (Front panel access test jack)	209-026-S001
Adapter Plug	Bantam-to-WECO 310	209-026-S001

Note   *When ordering cables, the XXX in the part number designates the cable length in feet.*

Technical Specifications

The following tables describes the physical, operational, and environmental specifications for the DataComm 554 DSU. Conforming to these specifications ensures maximum system performance and reduces the chances of mechanical breakdown and personnel hazard.

Table 1-2   Technical Specifications

Specification	Description	Detail
Port Interfaces	Network port physical interface	RJ48Cmodular jack
	Channel port interface (customer equipment) (	Standard: ITU-T V.35-compatible synchronous serial data port Optional: EIA-530-compatible synchronous serial data port
Physical Interface	DataComm Enclosure Model DE-7	ITU-T V.35 (34-pin female connector) or DB25S (25-pin female subminiature-D connector
	All other housings	DB25S (25-pin female subminiature-D connector
T1 Compatibility	Data encoding	AMI with no bipolar violations, and B8ZS
	Clear channel capacity	B8ZS
	Network interface	1.544 Mbps channelized DS1 in consecutive or alternate DS0s (complies with AT&T 54019A specifications for FT1 transmission)
	Consecutive zeros enforcement	15 or 39 maximum
	Average pulse density enforcement	Minimum 1 "one" per 8 bits or 24 "ones" per 192 bits
	Keep alive signal	Type 1 (consecutive, framed ones filling the unused bandwidth)
	Framing format	D4 Superframe, AT&T 54016 Extended Superframe (ESF), ANSI T1.403 ESF with automatic frame format option
	Alarm and status conditions	Out of Frame (OOF), Alarm indication Signal (AIS or Blue alarm), Loss of Signal (LOS)
Network Transmitter	Frequency	1,544,000 bps +/-50 bps
	Pulse Amplitude (with surge protection)	2.40 to 3.60 V at 60 deg F. (may vary over a cycle of 60 Hz current)
	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	648 nsec +/- 15 sec (measured at half amplitude point of leading edges)
	Maximum rise or fall time	100 nsec
	Overshoot at trailing edge of pulse	10% to 30% of pulse amplitude
	Line Buildout	0, 7.5, or 15 dB (selectable or automatic) at 772 kHz
	Timing Source	Internal clock External clock (from Channel A) Slave (received timing loopback)

Table 1-2   Technical Specifications (Continued)

Specification	Description	Detail
Network Receiver	Operating Range	0- 36 dB of cable loss at 772 kHz (relative to 3.0V launch pulse)
	Input impedance	100 Ω
	Jitter Tolerance	Conforms to specifications defined in AT&T PUB 62411, December 1988
	Longitudinal balance	35 dB from 50 to 1500 kHz
Transmitter	Pre-equalization	0 to 655 ft of line length
	Impedance	100 Ω
Service	Communication line	T1 digital carrier (non-loaded, staggered-twist ABAM, PIC or pulp-insulated exchange-type cable, 19-26 gauge)
	Line impedance	100 Ω
	Data Rates	N X 64 Kbps or N X 56 Kbps (N= 1 to 24), Maximum aggregate (payload) rate of 1,536,000 bps.
Diagnostics	DS1 Line Loop with Self-Test, DS1 Local Test with Self-Test, DS1 Remote Test with Self-Test, DS1 Self-Test, Channel Digital Loop, Channel Remote Digital Loop with Self-Test, Channel Self-Test	
Power Requirements	Voltage	99 to 129 VAC
	Frequency	60 Hz
	Power Dissipation	20 W maximum
	Fusing (PC card)	Two 1.0 A 250V, 3AG (GDC P/N 215300-100)
Dimensions	DC 554 DSU (circuit card only)	Height: 1.9 cm (0.75 in) Width: 26.7 cm (10.5 in) Depth: 27.3 cm (10.75 in) Weight: 0.4 kg (14 oz) Shipping weight: 0.65 kg (1 lb 6 oz)
	DataComm Enclosure (Model DE-7)	Height: 9.8 cm (3.875 in) Width: 27.6 cm (10.875 in) Depth: 31.8 cm (12.5 in) Weight: 3.2 kg (7 lb 1 oz) Shipping weight: 3.7 kg (8 lb 1 oz)
	Four-slot DataComm FourPak (Model DFP-11)	Height: 13.3 cm (5.25 in) Height with rubber feet: 14 cm (5.5 in) Width: 38.1 cm (15 in) Depth: 34.3 cm (13.5 in) Weight: 3.2 kg (7 lb 1 oz) Shipping weight: 3.7 kg (8 lb 1 oz)
	Four-slot DataComm FourPak (Model DFP-11)	Height: 13.3 cm (3.5 in) Width: 48.3 cm (19 in) Width with adapter ears: 58.4 cm (23 in) Depth: 30.5 cm (12 in) Weight: 7 kg (15 lb 7 oz) Shipping weight: 9.3 kg (20 lb 7 oz)

Table 1-2   Technical Specifications (Continued)

Specification	Description	Detail
Environment	Operating Temperature	0 to 50°C (32° to 122°F) (Derate by 1°C/1000 ft above sea level.)
	Non-operating Temperature	-40 to 70°C (-40° to 158°F)
	Operating Altitude	0 m to 3,047 m (0 to 10,000 ft)
	Non-operating Altitude	0 m to 12,191 m (0 to 40,000 ft)
	Operating Humidity	5% to 95% humidity (non-condensing)

Chapter 2: Installation & Setup

Installation Overview

This chapter describes the installation of the DC 554 DSU and also includes information on setting configuration options for operation of the DSU in your communication network. The DT 554A DSU should be installed in a ventilated area where the ambient temperature does not exceed 122 deg F. (50 deg C). Do not install the DSU above other equipment that generates large amounts of heat (e.g., power supplies).

The DSU is shipped in a protective box with packing material. The unit is pre-assembled, tested, and ready to use. Inspect the unit when you receive it and notify the shipper of any damage immediately. Keep the box and packing material in case you ever need to reship the unit. After unpacking and inspecting the unit, perform the setup and installation procedures for the unit and its shelf/enclosure system as described in this chapter.

Shelf and Enclosure Systems

You can mount the DC 554 unit in a variety of shelves and enclosures. Instructions for installing the DC 554 DSU in each type of housing is provided below. For more information on a specific shelf or enclosure, refer to its associated Instruction manual.

DataComm Enclosures

The DC 554 DSU can be installed in two types of DataComm enclosures. The cover removal procedures are the same for both types, as shown in Figure 2-1.
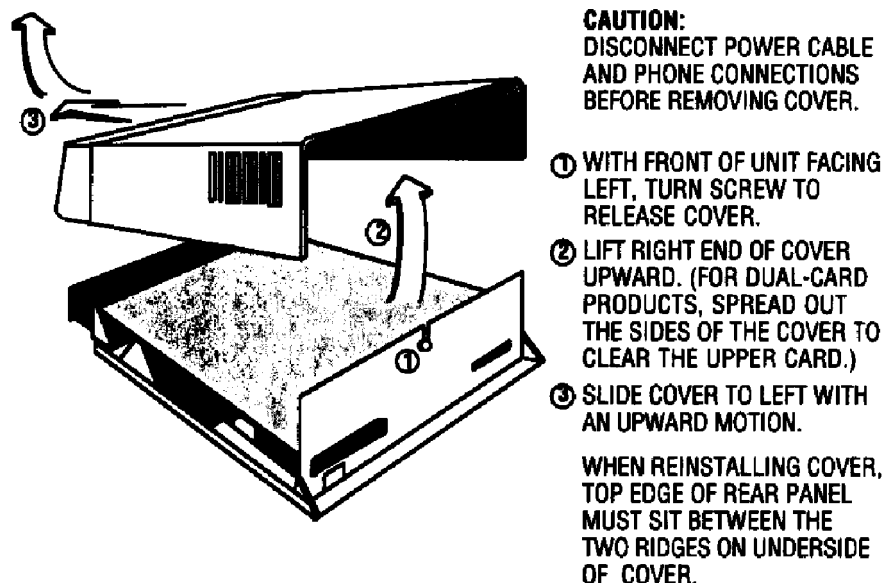
- Standalone DataComm Enclosure, Model DE-7
  Can hold one DC 544 DSU
  (Refer to *Figure 2-2* for rear panel view.)

- DataComm FourPak Enclosure, Model DFP-11
  Can hold up to four DC 544 DSUs or a combination of other compatible devices, such as the NMS 553D-1/IFP and NMS 553D-3/IFP DSUs and DataComm 596 modems.
  (Refer to *Figure 2-3* for rear panel view.)

DataComm Enclosure Procedure

The following procedure applies to removing and replacing a PC card in a DataComm Standalone enclosure or a DataComm FourPak enclosure.

Note   *ALWAYS disconnect power supply or power cable and T1 communications line BEFORE removing the enclosure cover.*

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

2. Disconnect the telephone line connections.

3. Remove the cover as shown in *Figure 2-1*.

4. Disconnect the power supply connector from J7, which is mounted at the rear of the PC card.

5. When re-installing a PC card, reconnect the power supply connector at J7 before you reconnect the enclosure to AC power.

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 2-1   DataComm Enclosure Cover Removal
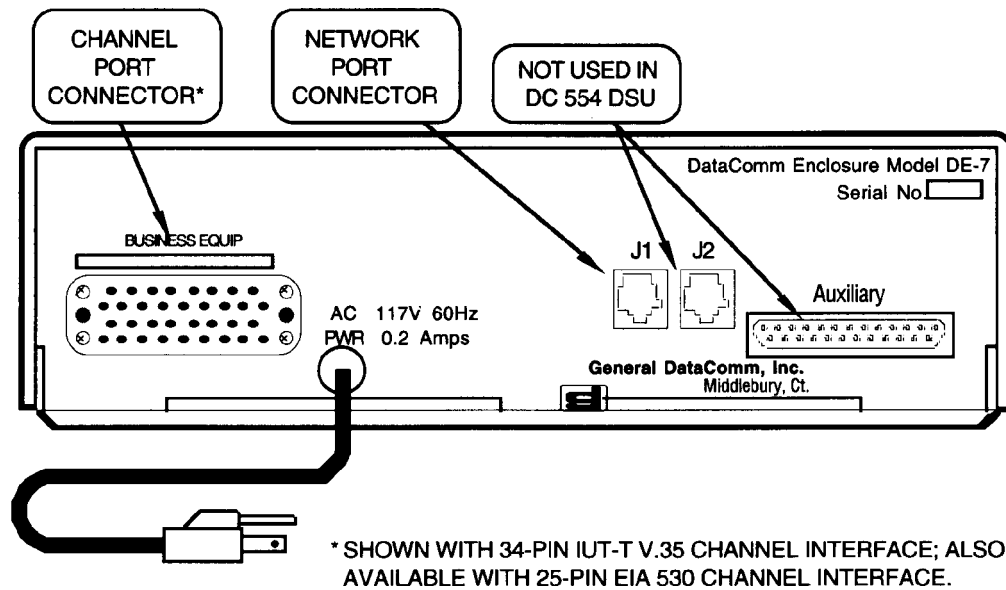
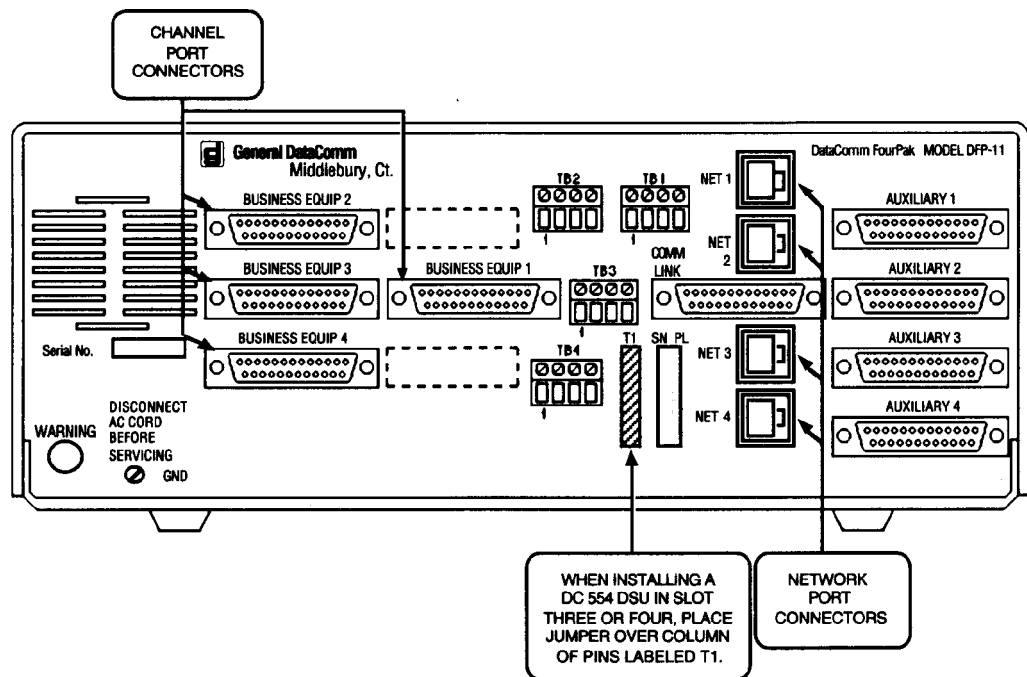**Figure 2-2**   Back Panel: Standalone DataComm Enclosure

Figure 2-3   Back Panel: DataComm FourPak Enclosure

GDC Shelf Systems

The DC 554 DSU can be installed in three types of GDC shelf systems. Each type of shelf can be rack-mounted into 19- and 23-inch wide equipment racks.

- DataComm Shelf (Models DS-1, DS-5R, DS-5NR, DS-6R/-1 and DS-6NR/-1)
  Can hold up to 16 DC 544 DSUs or a combination of other compatible devices
  (Refer to *Figure 2-4* for rear panel view and connection requirements.)

- Universal System Shelf (Models USS-1D, USS-1DC/R and USS-1-DC/NR)
  Can hold up to 16 DC 544 DSUs or a combination of other compatible devices
  (Refer to *Figure 2-5* for rear panel view and connection requirements.)

- TriPak Shelf (Models TPS-1 and TPS-2)
  Can hold up to three DC 544 DSUs or a combination of other compatible devices.
  (Refer to *Figure 2-6* for rear panel view and connection requirements.

Installing Cards in a DataComm Shelf

The DC 554 can be installed in any DataComm shelf slot. An adapter cable (P/N 027H242-X04) and coupler (P/N 209-038-002) are required to connect each DC 554 DSU to the T1 line.


Note   *When you install a DC 554 DSU in a DataComm Shelf, you must ground the customer equipment cables, as described in later sections of this chapter.*

)
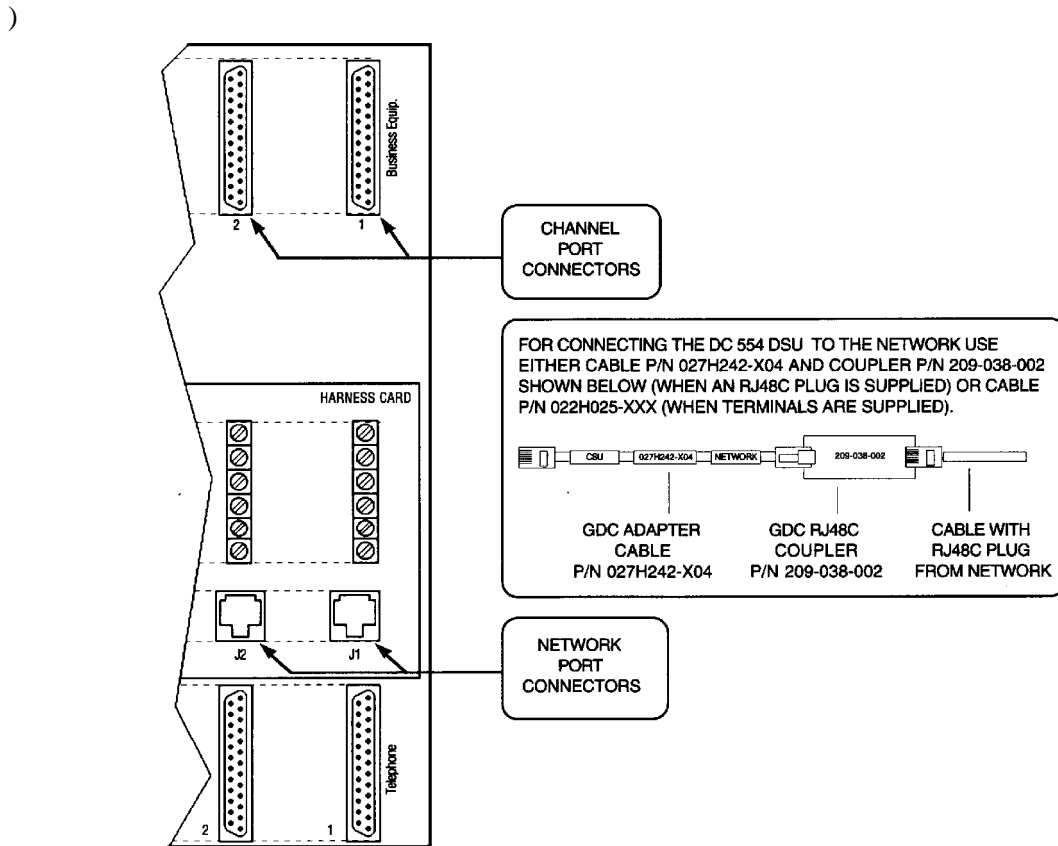

Figure 2-4   Back Panel: DataComm Shelf

Installing Cards in a Universal System Shelf

For each group of four plug-in cards, you must install one Domestic DataComm Backplane (P/N 048B015-000). The backplane occupies four slots (one quadrant) in the shelf and provides the connectors required to support DSU operation (see *Figure 2-5*).
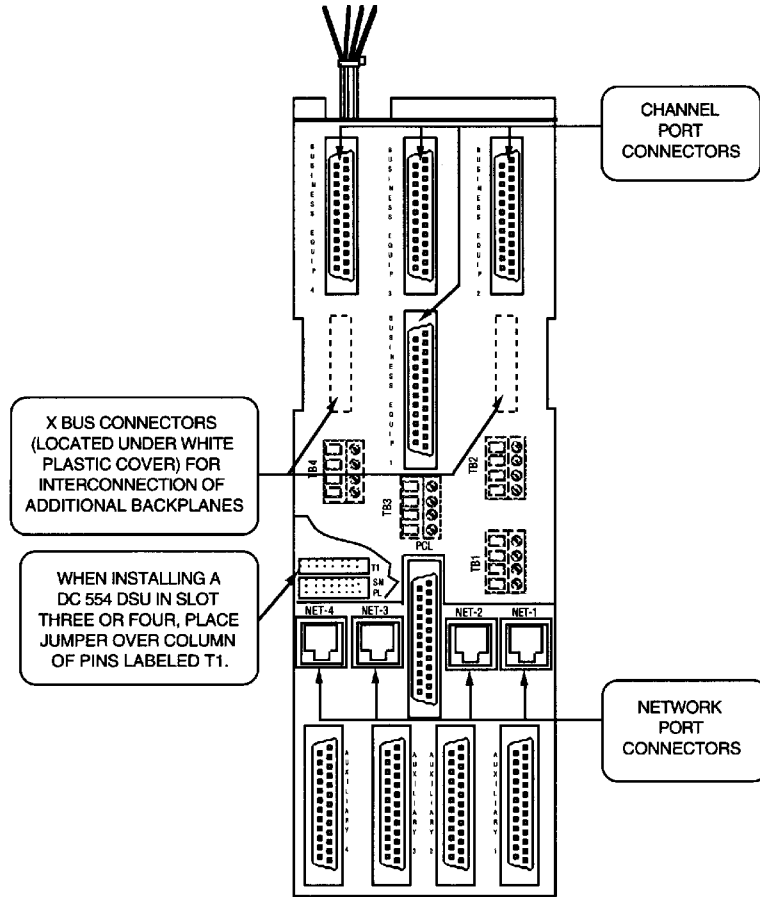
Figure 2-5   Universal System Shelves:

Installing Cards in a TriPak
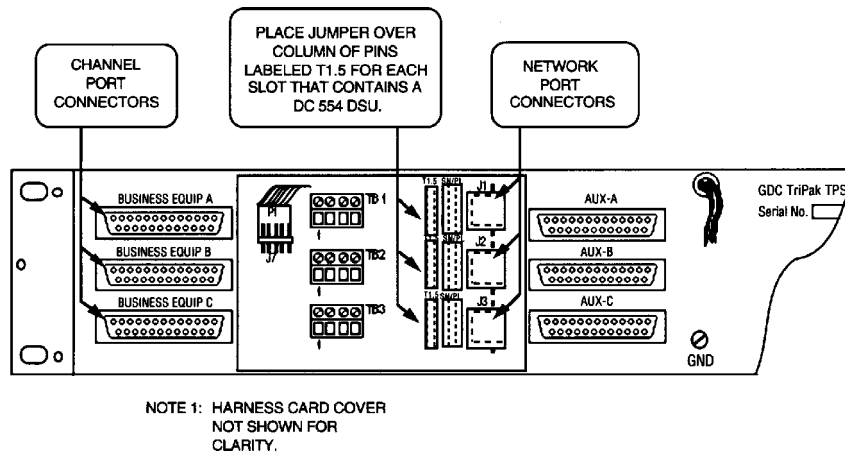
Figure 2-6   Back Panel: Tri-Pak

Option Selections

The DC 554 DSU provides a number of field-selectable options which adapt it to a variety of configurations. Option selections are made by positioning DIP switches and jumper straps on the DSU base card and Option card.

- *Figure 2-7* illustrates the layout of the DC 554 base card and the location of its option switchbanks.

- *Figure 2-8* illustrates the locations of Option Card option switchbanks.

- Figure illustrations the locations of the Interface Daughter card option switchbanks.

DC 544 Card Option Switch Settings

Refer to *Figure 2-7* and to *Table 2-1* for the location and description of base card switch settings.
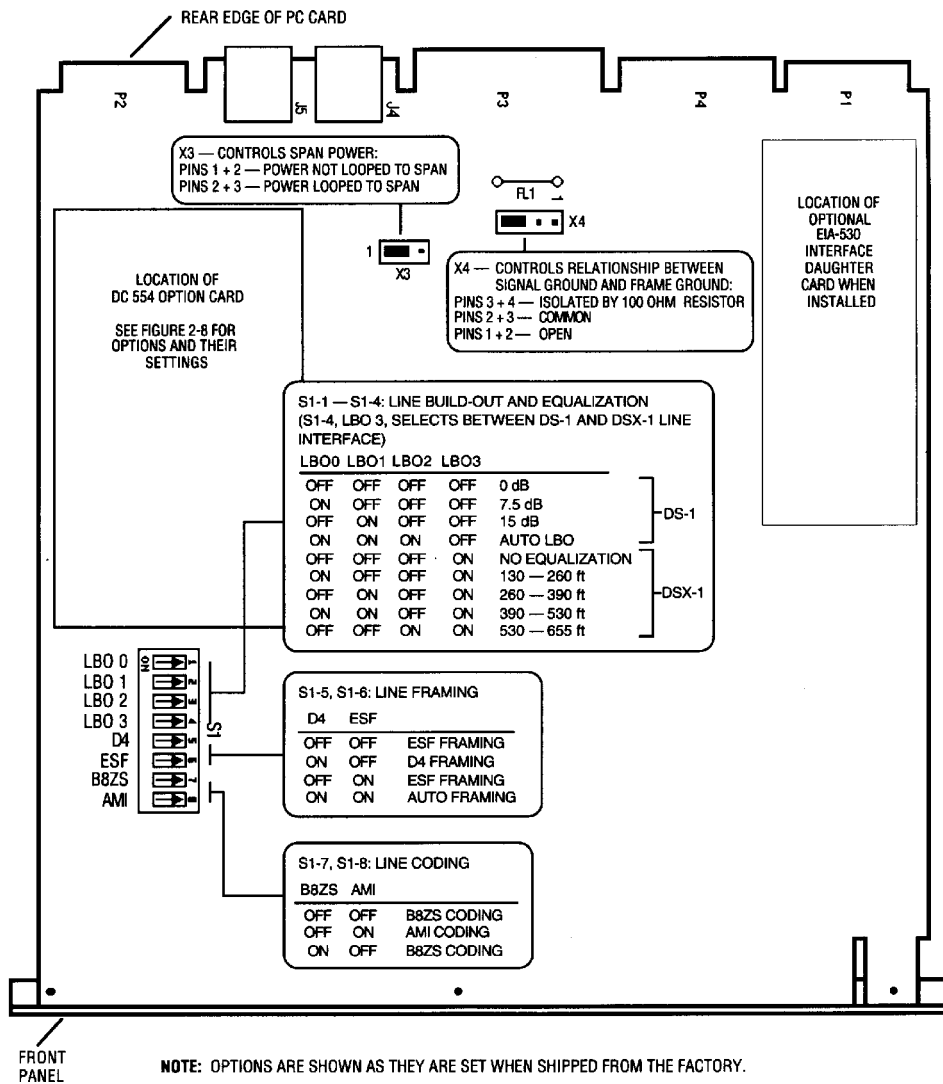
Figure 2-7   DC 554 Base Card Layout and Switch Settings

Note   *If the Auto Framing option is to be used, enable it at only one of the two DSUs that make up a link.*

Note   *If you connect two DSUs in a direct cable connection (back-to-back) and automatic Line buildout is to be used, enable it at only one of the DSUs.*

Table 2-1   DC 554 Base Card Option Switch Settings

Option	Selection	Switch (S) Jumper (X)	Position	Description
Line Buildout/ Equalization	LBO	S1-1 S1-2 S1-3	Default: All OFF = 0 dB For other settings refer to Figure 2-7.	These switches control LBO when a DS-1 line interface is selected at S1-4: Selects between automatic and manual LBO (attenuation of signal transmitted to the network.) Selects amount of attenuation for manual LBO.
		CAUTION: *Do not enable automatic LBO for both DSUs when they are connected back-to-back.* *Do not enable automatic LBO when the DSU is connected to a DS1 Interface* *Connector (Smart Jack); use manual LBO with 0 dB attenuation.*		
	Equalization	S1-1 S1-2 S1-3	For equalization seatings, see Figure 2-7.	These switches control Equalization to match transmitter to network gain characteristics when a DSX-1 line interface is selected at S1-4:
Line Interface Selection	DS-1	S1-4	Default: OFF	Selects the line interface to operate as a DS-1 network interface for connection to a T1 line.
	DSX-1	S1-4	ON	Selects the line interface to operate as a DSX-1 interface for connection to the cascade port of another DSU or to a CSU.
Line Framing	Default: ESF	S1-5 S1-6	Default: OFF or OFF Default: OFF or ON	Selects ESF Framing
	D4	S1-5 S1-6	ON OFF	Selects D4 Framing
	Auto Framing	S1-5 S1-6	ON OFF	Enables Auto Framing; the DC 554 DSU adapts to the framing it receives.
		CAUTION: *Do not enable Auto Framing for both DSUs on a link.*		
Line Coding	Default: B8ZS	S1-7 S1-8	Default: OFF or ON Default: OFF or OFF	Selects Bipolar with 8 Zero Substitution (B8ZS) encoding for the network side.
	AMI	S1-7 S1-8	OFF ON	Selects Alternate Mark Inversion (AMI) encoding for the network side.
Power to span	Default:Disabled	X3	1 - 2	DC 554 does not loop power to the span.
	Enabled	X3	2 - 3	DC 554 loops power to the span.
Ground	Default: Open	X4	1 - 2	Selects frame (chassis) ground completely isolated from signal (reference) ground.
	Common	X4	2 - 3	Selects common frame (chassis) and signal (reference) grounds. Grounds are connected through fusible link FL1.
	Isolated	X4	3 - 4	Selects frame and signal grounds isolated by 100 Ω.

Option Card Switch Settings

Refer to *Figure 2-8* and to *Table 2-2* for the location and description of Option card switch settings.
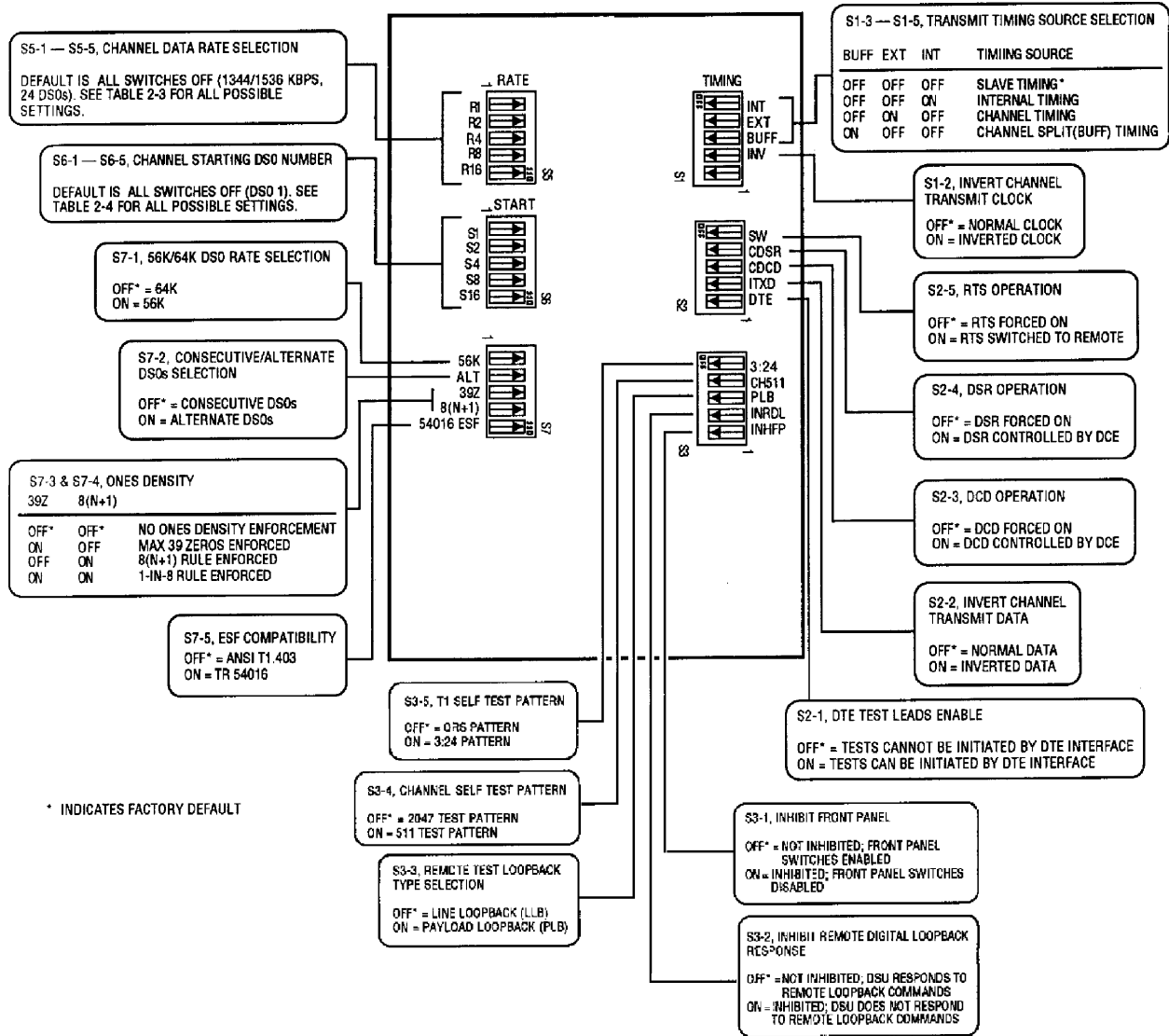
Figure 2-8   Option Card Switch Locations and Setting

Option Card Switch Settings

Table 2-2   Option Card Switch Settings

Option	Selection	Switch (S) Jumper (X)	Position	Description
Channel Clock Invert	Normal	S1-2	OFF	Channel transmit clock not inverted.
	Inverted	S1-2	ON	Channel transmit clock inverted.
Timing Source	Slave Timing	S1-3 S1-4 S1-5	OFF OFF OFF	DSU recovers receive T1 clock from the network receive T1 data and uses it as the send timing source for T1 data output to the network.
	Internal Timing	S1-3 S1-4 S1-5	OFF OFF ON	DSU provides the send timing source for T1 data output to the network.
	Channel Timing	S1-3 S1-4 S1-5	OFF ON OFF	DSU translates the clock taken from the Ext Clk signal provided by the customer equipment and uses it as the send timing source for T1 data output to the network.
	Channel Split (BUFF) Timing	S1-3 S1-4 S1-5	ON OFF OFF	DSU uses timing recovered from received data to clock the T1 transmit data, and uses the Ext Clk signal provided by the customer equipment to clock channel send data.
DTE Test Leads Enable	Disabled	S2-1	OFF	DTE Test Leads LL and RL disabled.
	Enabled	S2-2	ON	DTE Test Leads LL and RL enabled.
Channel Data Invert	Normal	S2-2	OFF	Channel transmit data not inverted.
	Inverted	S2-2	ON	Channel transmit data inverted.
DCD Operation	Forced ON	S2-3	OFF	DCD forced on.
	Normal	S2-3	ON	DCD controlled by DCE.
DSR Operation	Forced ON	S2-4	OFF	DSR forced on.
	Normal	S2-4	ON	DSR controlled by DCE.
RTS Operation	Forced ON	S2-5	OFF	RTS forced on.
	Switched	S2-5	ON	RTS switched to remote.
Inhibit Front Panel	Enabled	S3-1	OFF	Allows use of Front panel test switches.
	Disabled	S3-1	ON	Disables use of Front panel test switches.
Inhibit RDL Response	Enabled	S3-2	OFF	Enables response to in-band remote digital loopback codes.
	Disabled	S3-2	ON	Disables response to in-band remote digital loopback codes.
Remote Test Loopback Type	Line Loop	S3-3	OFF	DSU starts or stops a Line Loop test when it detects the appropriate loopback code.
	Payload loop	S3-3	ON	DSU starts or stops a Line Loop test when it detects the appropriate loopback code.
Channel Self-Test Pattern	2047	S3-4	OFF	Selects 2047-bit self-test.
	511	S3-4	ON	Selects 511-bit self-test.
T1 Self-Test Pattern	QRS	S3-5	OFF	Selects quasi-random signal pattern for T1 self-test (per PUB 62411).
	3:24	S3-5	ON	Selects 3:24 pattern for self-test.

Table 2-2 Option Card Switch Settings (Continued)

Option	Selection	Switch (S) Jumper (X)	Position	Description
Channel Data Rate	56 Kbps - 1536 Kbps	S5-1 S5-2 S5-3 S5-4 S5-5	Default: All OFF (1344/1536 Kbps)	Selects channel data rate by determining how many DS0s are to be used: 56/64 Kbps (1 DS0) through 1344/1536 (24 DS0s) *(See Table 2-3).* S7-1 determines the rate of individual DS0s.
Channel Starting DS0	1 - 24	S6-1 S6-2 S6-3 S6-4 S6-5	Default: All OFF (DS01)	Selects lowest numbered DS0 in the group that conveys channel data. Remaining DS0s required to support the selected channel data rate channel data rate follow sequentially after the number selected here. *(See Table 2-4).*
DS0 Type	64 Kbps	S7-1	OFF	All bits of each DS0 are used for payload.
	56 Kbps	S7-1	ON	7 bits of each DS0 are used for payload. The 8th bit can be used to pass control information by setting S2-5 ON.
Alternate DS0s	Consecutive	S7-2	OFF	Selects consecutive DS0s for payload.
	Alternate	S7-2	ON	Selects alternate DS0s for payload. Unused DS0s are forced to marks.
Ones Density	No enforcement	S7-3 S7-4	ON OFF	No Ones density enforcement.
	39 zeros	S7-3 S7-4	ON OFF	Allows a maximum of 39 consecutive zeros to be sent towards the network.
	8(N+1)	S7-3 S7-4	ON OFF	Enforces 8(N+1) rule for Ones Density.
	1-in-8	S7-3 S7-4	ON OFF	Enforces 1-in-8 rule for Ones density.
Central Office Compatibility	ANSI mode	S7-5	OFF	Selects compliance with ANSI network performance messages (per Bellcore TR-TSY-000194), available only with ESF framing.
	TR54015 mode	S7-5	ON	Selects compliance with network maintenance messages (per PUB 54016), available only with ESF framing.

Channel Data Rate Selection

Table 2-3   Channel Data Rate Selection

Rate	# of DS0s	S5-5	S5-4	S5-3	S5-2	S5-'
56/64	1	OFF	OFF	OFF	OFF	ON
112/128	2	OFF	OFF	OFF	ON	OFF
168/192	3 (1/8)	OFF	OFF	ON	ON	ON
224/256	4	OFF	OFF	ON	OFF	OFF
280/320	5	OFF	OFF	ON	OFF	ON
336/384	6 (1/4)	OFF	OFF	ON	ON	OFF
392/448	7	OFF	ON	OFF	ON	ON
448/512	8	OFF	ON	OFF	OFF	OFF
504/576	9 (3/8)	OFF	ON	OFF	OFF	ON
560/640	10	OFF	ON	OFF	ON	OFF
616/704	11	OFF	ON	ON	ON	ON
672/768	12 (1/2)	OFF	ON	ON	OFF	OFF
728/832	13	OFF	ON	ON	OFF	ON
784/896	14	OFF	ON	ON	ON	OFF
840/960	15 (5/8)	OFF	ON	ON	ON	ON
896/1024	16	ON	OFF	OFF	OFF	OFF
952/1088	17	ON	OFF	OFF	OFF	ON
1088/1152	18 (3/4)	ON	OFF	OFF	ON	OFF
1064/1216	19	ON	OFF	ON	ON	ON
1120/1280	20	ON	OFF	ON	OFF	OFF
1176/1344	21 (7/8)	ON	OFF	ON	OFF	ON
1232/1408	22	ON	OFF	ON	ON	OFF
1288/1472	23	ON	OFF	ON	ON	ON
1344/1536	24	ON	ON	OFF	OFF	OFF

Special Considerations

• When there is one DS0, the individual DS0 rate is controlled by option switch S7-1: ON for 56 Kbps, OFF for 64 Kbps.

• In the # of DS0s, the parenthetical value is the fraction of the full T1 bandwidth represented by the selected number of DS0s.

• The factory default for the number of DS0s is 24 DS0s at a rate of 1344/1536 Kbps.

Channel Starting DS0 Selection

Table 2-4   Channel Starting DS0 Selection

Starting DS0	S6-5	S6-4	S6-3	S6-2	S6-1
1	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	ON	OFF
3	OFF	OFF	ON	ON	ON
4	OFF	OFF	ON	OFF	OFF
5	OFF	OFF	ON	OFF	ON
6	OFF	OFF	ON	ON	OFF
7	OFF	ON	OFF	ON	ON
8	OFF	ON	OFF	OFF	OFF
9	OFF	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON	OFF
11	OFF	ON	ON	ON	ON
12	OFF	ON	ON	OFF	OFF
13	OFF	ON	ON	OFF	ON
14	OFF	ON	ON	ON	OFF
15	OFF	ON	ON	ON	ON
16	ON	OFF	OFF	OFF	OFF
17	ON	OFF	OFF	OFF	ON
18	ON	OFF	OFF	ON	OFF
19	ON	OFF	ON	ON	ON
20	ON	OFF	ON	OFF	OFF
21	ON	OFF	ON	OFF	ON
22	ON	OFF	ON	ON	OFF
23	ON	OFF	ON	ON	ON
24	ON	ON	OFF	OFF	OFF

Special Consideration

- The factory default for the Starting DS0 = 1.

EIA-530 Interface Daughter Card

Figure 2-9 shows the EIA-530 Interface Daughter card and its various positions on the base card.
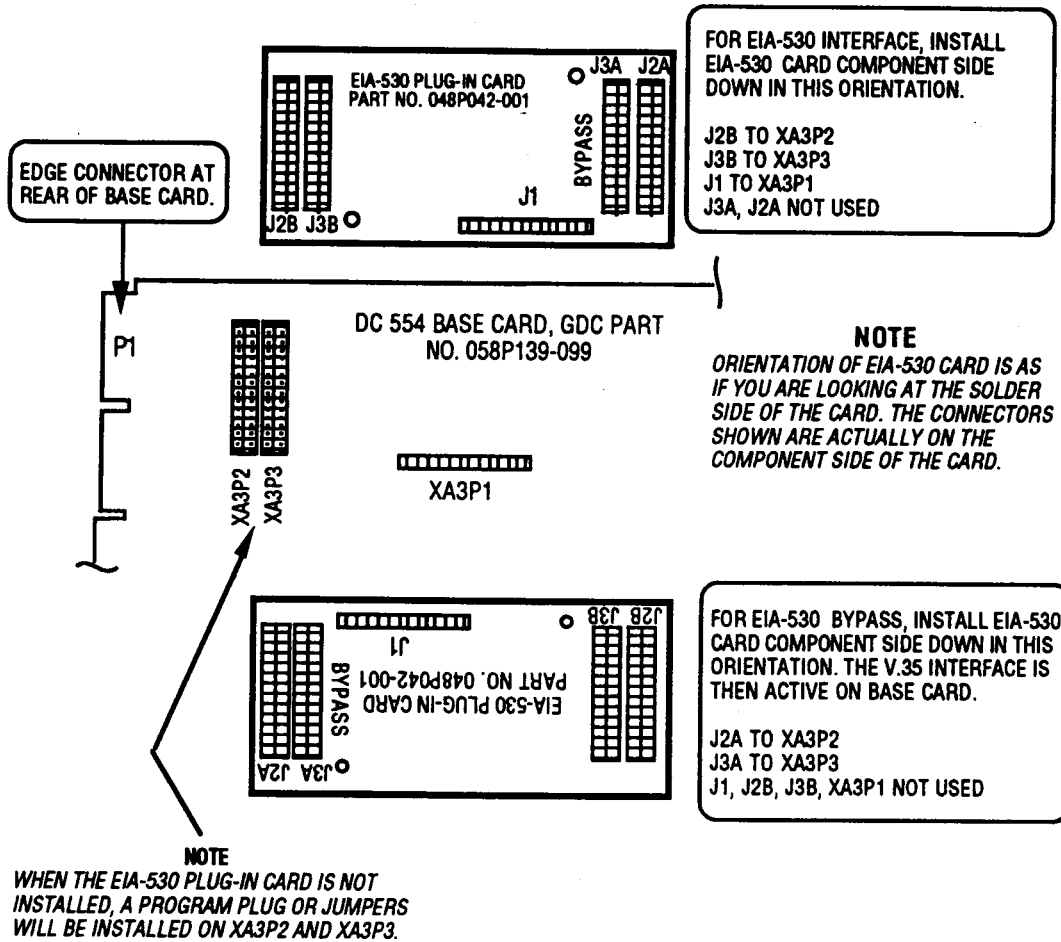
Figure 2-9   EIA-530 Interface Daughter Card

Channel Port Connections

The DC 554A DSU provides one data channel port. In its standard configuration it is compatible with ITU-T V.35. It can also be ordered with the daughter card that makes the port EIA-530 compatible. The EIA-530 interface, through the use of adapter cables, can also support connection of EIA-422 or EIA-449 data terminal equipment. For all housings, *Figure 2-11* shows the DTE with EIA-449 interface to DSU with the EIA-530 interface.
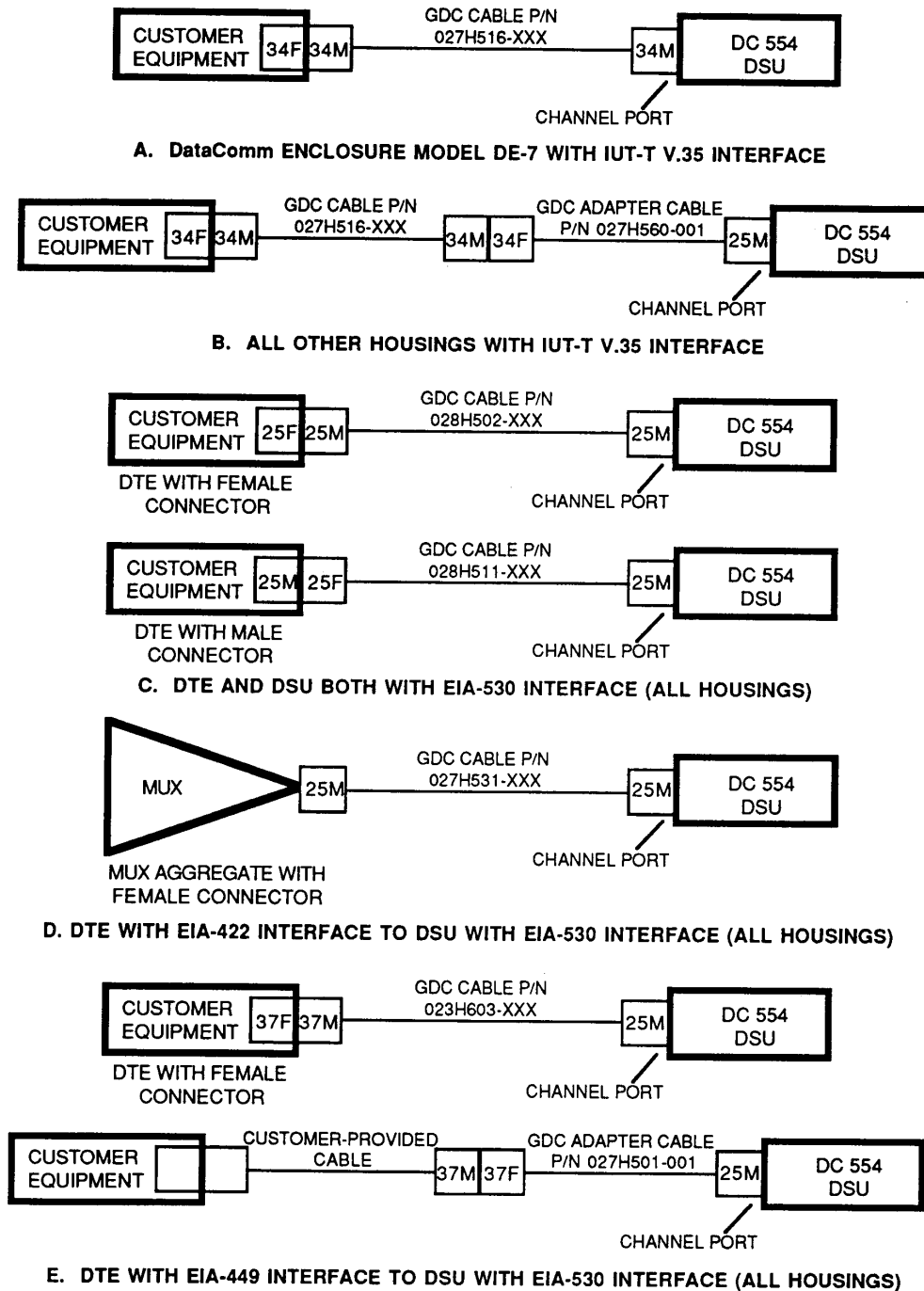
Figure 2-10   Channel Port Cables

Note   *The optional EIA-530 interface card attaches to connectors XA3P1, XA3P2, and XA3P3 on the base card.*
         Figure 2-8 illustrates enable and disable positions for the daughter card. When it is not present, shorting
         jumpers (P/N 208-011-716) must be installed on the connectors as described in the figure.

Unless otherwise noted, the channel port interface is a 25-pin female subminiature-D (DB25S)
connector located on the rear panel. Refer to Table 1-1and Figure 2-9 for the appropriate interface
cable. Refer to Appendix B for interface/pin signal assignments.

DataComm Enclosure Model DS-7 Channel port Connection

Connect the customer equipment to Channel A of the DC 554 DSU by means of the connector
labeled Business Equip 1, as shown in Figure 2-2. The channel port interface on DataComm
Enclosure Model DE-7 is a 34-pin, female V.35 connector or a 25-pin female, subminiature-D
connector (for the optional EIA-530 interface), depending on port configuration.

DataComm FourPak Enclosure Channel Port Connection

The back panel of the FourPak enclosure has four 25-pin, female, subminiature-D connectors for
the connection of customer equipment. The connectors are labeled BUSINESS EQUIP 1 through
corresponding to the enclosure's four card slots. Connect customer equipment to Channel A of the
DC 554 DSU by means of the connector for its slot, as shown in Figure 2-3.

The same 25-pin connector is used for either an EIA-530 interface or a V.35 Interface. Appendix B
lists the connector's pin/signal assignments for each interface.

DataComm Shelf Channel Port Connection

The back panel of the DataComm Shelf has 16 25-pin, female, subminiature-D connectors for the
connection of customer equipment. The connectors are labeled BUSINESS EQUIP 1 through
BUSINESS EQUIP 16, corresponding to the enclosure's 16 card slots. Connect customer equipment
to Channel A of the DC 554 DSU by means of the connector for its slot, as shown in Figure 2-4.

The same 25-pin connector is used for either an EIA-530 interface or a V.35 interface. Appendix B
lists the connector's pin/signal assignments for each interface.

Note   *When you install a DSU in a DataComm Shelf, you must ground the customer equipment cables, as shown*
         in Figure 2-11.

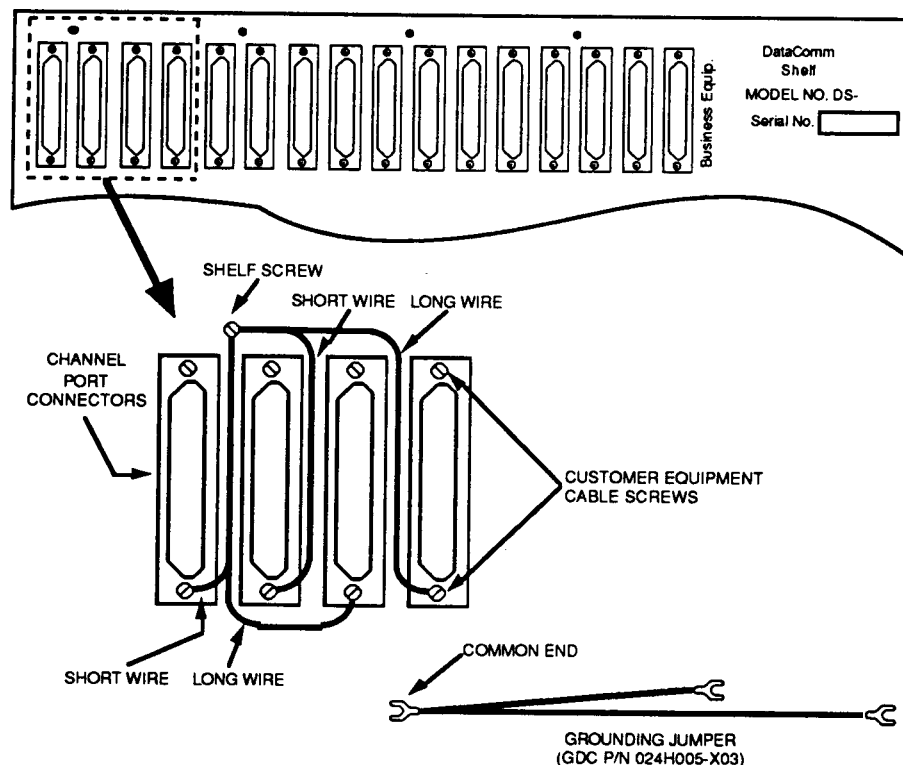## DataComm Shelf Grounding Jumpers

In order to meet FCC radio frequency (RF) suppression requirements when you install an DC 554 DSU in a DataComm Shelf, you must install grounding jumpers to ground the shielded customer equipment cables connected to the channel port connectors. One grounding jumper, GDC P/N 024H005-X03, is required for each DSU.

The grounding jumper consists of two pieces of wire - a short wire (2" long) and a long wire (3.5" long) - connected together at one end and terminated in a lug. The other ends are separate and each is terminated in a lug. Each jumper grounds two customer equipment cables.

Note   *For compliance with FCC Part 15, Subpart J, Class A requirements, this installation procedure must be followed.*

To install a grounding jumper:

1. Securely attach the common end of the jumper to the closest shelf screw, as shown in Figure 2-10. You can attach two jumpers to each shelf screw, grounding four cables.

2. Securely attach the other end of each wire to a customer equipment cable, using the cable mounting screw. When one channel is not used, connect both wires to the same cable

Figure 2-11   Grounding DataComm Shelf Cables

Universal System Shelf Channel Port Connection

Each Universal System Shelf Domestic DataComm Backplane has four 25-pin, female, subminiature-D connectors for the connection of customer equipment. The connectors are labeled BUSINESS EQUIP 1 through BUSINESS EQUIP 4, corresponding to the four card slots supported by the backplane. Connect customer equipment to Channel A of the DC 554 DSU by means of the connector for its slot, as shown in Figure 2-5.

The same 25-pin connector is used for either an EIA-530 interface or a V.35 interface. Appendix B lists the connector's pin/signal assignments for each interface.

GDC TriPak Shelf

The back panel of the TriPak enclosure has three 25-pin, female, subminiature-D connectors for the connection of customer equipment. The connectors are labeled BUSINESS EQUIP A through BUSINESS EQUIP C, corresponding to Slots 1 through 3 in the enclosure. Connect customer equipment to Channel A of the DC 554 DSU by means of the connector for its slot, as shown in Figure 2-6.

The same 25-pin connector is used for either an EIA-530 interface or a V.35 interface. Appendix B lists the connector's pin/signal assignments for each interface.

Network Connections

Connect the network (T1 line) to the DC 554 DSU as described below.

Note   *The Telco continuously monitors the TI link and the equipment connected to it. Notify the Telco before connecting the DC 554 DSU to the network. The DC 554 DSU must remain continuously powered on and connected to the T1 service. FCC Part 68 rules require the user to notify the service provider if the DSU is removed from service or turned off.*

Note   *For Canadian installations only, a special cable is required for the network connection. Use GDC cable PIN 022HO20 (RJ48C to DB15F) to connect the network port to the TI line.*

Unless otherwise noted, the network port interface is an RJ48C jack located on the rear panel. Refer to Table 1-1 and Figure 2-11 for the appropriate interface cable.

For all installations except those in a DataComm Shelf, you must use either GDC cable P/N 022HO24-XXX (RJ48C plug-to-plug) or 022HO21-XXX (RJ48C plug-to-terminal lugs) to connect the T1 line to the DSU. The plug-to-plug cable is labeled NETWORK and CSU to indicate where each end is used.

For a DataComm Shelf installation, you must either use cable 027H242-X04 (RJ48C plug-to-plug) with coupler 209-038-002, or use cable 022H025-XXX (RJ48C plug-to-terminal lugs). The plug-to-plug cable is labeled NETWORK and CSU to indicate where each end is used. Using any other cable in a DataComm Shelf installation can cause damage to the DSU or the network.

Table 2-5   Network Interface Cables Pinouts

Function	Direction	027H2420X04 022H024-XXX Pin No.	022H025-XXX 022H021-XXX Wire Color
Receive Data (Ring)	To DSU	1	ORN/WHT
Receive Data (Tip)	To DSU	2	WHT/ORN
Send Data (Ring)	From DSU	4	BLU/WHT
Send Data (Tip)	From DSU	5	WHT/BLU
Shield (Frame GND)	-	7	DRAIN

Note   *The remaining leads are not used.*

Special Considerations

• If you connect two DSUs back-to-back (a direct cable connection), automatic line buildout must not be enabled for both. It may be enabled in one of the units, if desired.

• The following installation procedure must be followed for compliance with FCC Part 15, Subpart J, Class A requirements.

• For Canadian installations only, a special cable is required for the network port connection. Use GDC P/N 022H020-XXX (RJ48C plug-to-15-pin female) to connect the network port to the T1 line.
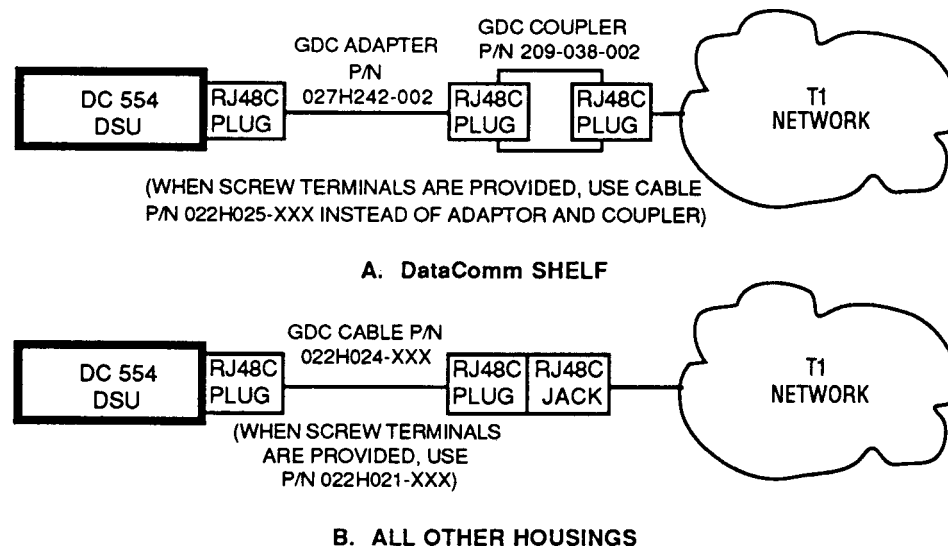
Figure 2-12   Network Cables

DataComm Enclosure Model DS-7 Network Connection

Connect the network to the DC 554 DSU by means of the jack labeled Network, as shown in Figure 2-2. Use either GDC cable P/N 022HO24-XXX (RJ48C plug-to-plug) or 022HO21-XXX (RJ48C plug-to-terminal lugs). The plug-to-plug cable is labeled NETWORK and CSU to indicate where each end is used.

DataComm FourPak Enclosure Network Connection

The back panel of the FourPak enclosure has four jacks for network connection. The jacks are labeled NET 1 through NET 4, corresponding to the enclosure's four card slots, as shown in Figure 2-3. Connect the network to the DC 554 DSU by means of the jack for its slot. Use either GDC cable P/N 022HO24-XXX (RJ48C plug-to-plug) or 022H021-XXX (RJ48C plug-to-terminal lugs). The plug-to-plug cable is labeled NETWORK and CSU to indicate where each end is used.

When you install an DC 554 DSU in either slot three or four (the lower two slots), you must install the rear panel option jumper in the T1 position.

DataComm Shelf Network Connection

The back panel of the DataComm Shelf has 16 jacks for network connection. The jacks are labeled J1 through J16, corresponding to the shelf's 16 card slots, as shown in Figure 2-4. Connect the network to the DC 554 DSU by means of the jack for its slot.

Special Considerations

CAUTION: The pinouts of the RJ48C network jack on the back panel of the DataComm Shelf are different from those for all other housings for the DC 554 DSU. Because of that:

a. You must either use GDC cable PIN 027H242-X04 (RJ48C plug-to-plug) and coupler PIN 209-038-002, or use GDC cable P/N 022HO25-XXX (RJ48C plug-to terminal lugs) for connecting the DC 554 DSU to the network. Using any other cable can cause damage to the DSU or the network. The pinouts for the network end of the cables are listed above.

b. If you are connecting the network interface of an DC 554 DSU in a DataComm Shelf to the cascade port of another DSU (such as an NMS 553D-3 IFP DSU in a DataComm Enclosure) you must use GDC cable PIN 027H235-XXX. Using any other cable can cause damage to the DSUs.

Universal System Shelf Network Connection

Each Universal System Shelf Domestic DataComm Backplane has four jacks for network connection. The jacks are labeled NET 1 through NET 4, corresponding to the four card slots supported by the backplane, as shown in Figure 2-5. Connect the network to the DC 554 DSU by means of the jack for its slot.

Use either GDC cable P/N 022HO24-XXX (RJ48C plug-to-plug) or 022H021-XXX (RJ48C plug-to-terminal lugs). The plug-to-plug cable is labeled NETWORK and CSU to indicate where each end is used.

When you install a DC 554 DSU in slot three or four (the right-most two slots of a quadrant, you must install the rear panel option jumper in the T1 position.

GDC TriPak Shelf Network Connection

The back panel of the TriPak enclosure has three jacks for network connection. The jacks are labeled J1 through J3, corresponding to the enclosure's three card slots, as shown in Figure 2-6. Connect the network to the DC 554 DSU by means of the jack for its slot.

Use either GDC cable P/N 022HO24-XXX (RJ48C plug-to-plug) or 022H021-XXX (RJ48C plug-to-terminal lugs). The plug-to-plug cable is labeled NETWORK and CSU to indicate where each end is used. You must also install the appropriate rear panel option jumper in the T1.5 position.

Primary Power Connections

After the DC 554 DSUs have been installed and the above connections have been made, connect primary power to the system.

The DataComm Enclosure and DataComm FourPak Enclosure are each equipped with a captive ac power cord terminated in a molded three-prong plug. Plug the cord into a polarized outlet that provides the required ac power.

The DataComm Shelf, Universal System Shelf, and TriPak Shelf are each available with a variety of power supply arrangements. When installing an DC 554 DSU in any of these housings, refer to the shelf's Instruction Manual for details concerning power connection.

The outlet that provides ac power, where applicable, should not be under switch control. The DC 554 DSU should be powered by the same ac source as the customer equipment connected to it. Use of the same ac source will prevent large circulating currents caused by differences in ground potential. If you cannot be sure that the customer equipment is powered by the same ac source as the DSU, verify that the potential difference between the grounding circuits of their respective outlets is less than 0.25 V rms.

Special Consideration

CAUTION:
This unit incorporates an internal fusible link, FLI, on the pc card (illustrated in Figure 2-1). The fusible link 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, re-turn the unit for repair.

Port Channel Interface Signals

ITU-T V.35 - Standard Interface

Table 2-6   ITU-T V.35 - Standard Interface

34-Pin	25-Pin	Function	Direction
A	1	Frame Ground, AA	n/a
P	2	Send Data (a). BA	To DSU
S	14	Send Data (b. BA	To DSU
R	3	Receive Data (a), BB	From DSU
T	16	Receive Data (b), BB	From DSU
C	4	RTS, CA	To DSU
D	5	CTS, CB	From DSU
E	6	DSR, CC	From DSU
B	7	Signal Ground, AB	n/a
F	8	DCD, CF	From DSU
CC	18	LL	To DSU
U	12	Ext Clk (a), DA	To DSU
W	24	Ext Clk (b), DA	To DSU
V	13	Receive Clk (a), DD	From DSU
X	17	Receive Clk (b), DD	From DSU
Y	19	Tx Clk (a) DB	From DSU
AA	15	Tx Clk (b) DB	From DSU
H	20	DTR, CD	To DSU
BB	21	RDL, RL	To DSU
K	25	Test Mode, TM	From DSU

EIA-530 - Optional Interface

Table 2-7   EIA-530 - Optional Interface

25-Pin	Function	Direction
1	Frame Ground, AA	n/a
2	Send Data (a). BA	To DSU
14	Send Data (b. BA	To DSU
3	Receive Data (a), BB	From DSU
16	Receive Data (b), BB	From DSU
4	RTS (a), CA	To DSU
19	RTS (b), CA	To DSU
5	CTS (a), CB	From DSU
13	CTS (b), CB	From DSU
6	DSR (a), CC	From DSU
22	DSR (b), CC	From DSU
7	Signal Ground, AB	n/a
8	DCD (a), CF	From DSU
10	DCD (b), CF	From DSU
17	Receive Clk (a), DD	From DSU
9	Receive Clk (b), DD	From DSU
24	Ext Clk (a), DA	To DSU
11	Ext Clk (b), DA	To DSU
15	Tx Clk (a) DB	From DSU
12	Tx Clk (b) DB	From DSU
20	DTR (a), CD	To DSU
23	DTR (b), CD	To DSU
21	RDL, RL	To DSU
25	Test mode TM	From DSU
18	LL	To DSU

Chapter 3: Operation

Overview

This section of the manual describes the DC 554 DSU front panel functions. The front panel provides indicator displays, test functions, and connectivity to external test equipment. Section 4: Tests, describes test procedures that can be performed from the front panel.

Controls, Indicators and Connectors

Figures 3-1 and 3-2 illustrate the DC 554 DSU's front panel and explain the function of each control and indicator. Figure 3-3 explains the function of the front panel jacks.

Refer to Section 2, Figure 2-2, which illustrates the standalone enclosure rear panel connectors for 117 V ac voltage bases.

Rack-Mount Shelf Controls and Indicators

Each rack-mount shelf front panel controls, indicators and fuses are described in the manual supplied with the shelf. Refer to it if you have a rack-mount shelf. In this manual, the shelf's rear panels are illustrated in Section 2.

Figure 3-1   DC 554 Front Panel Controls
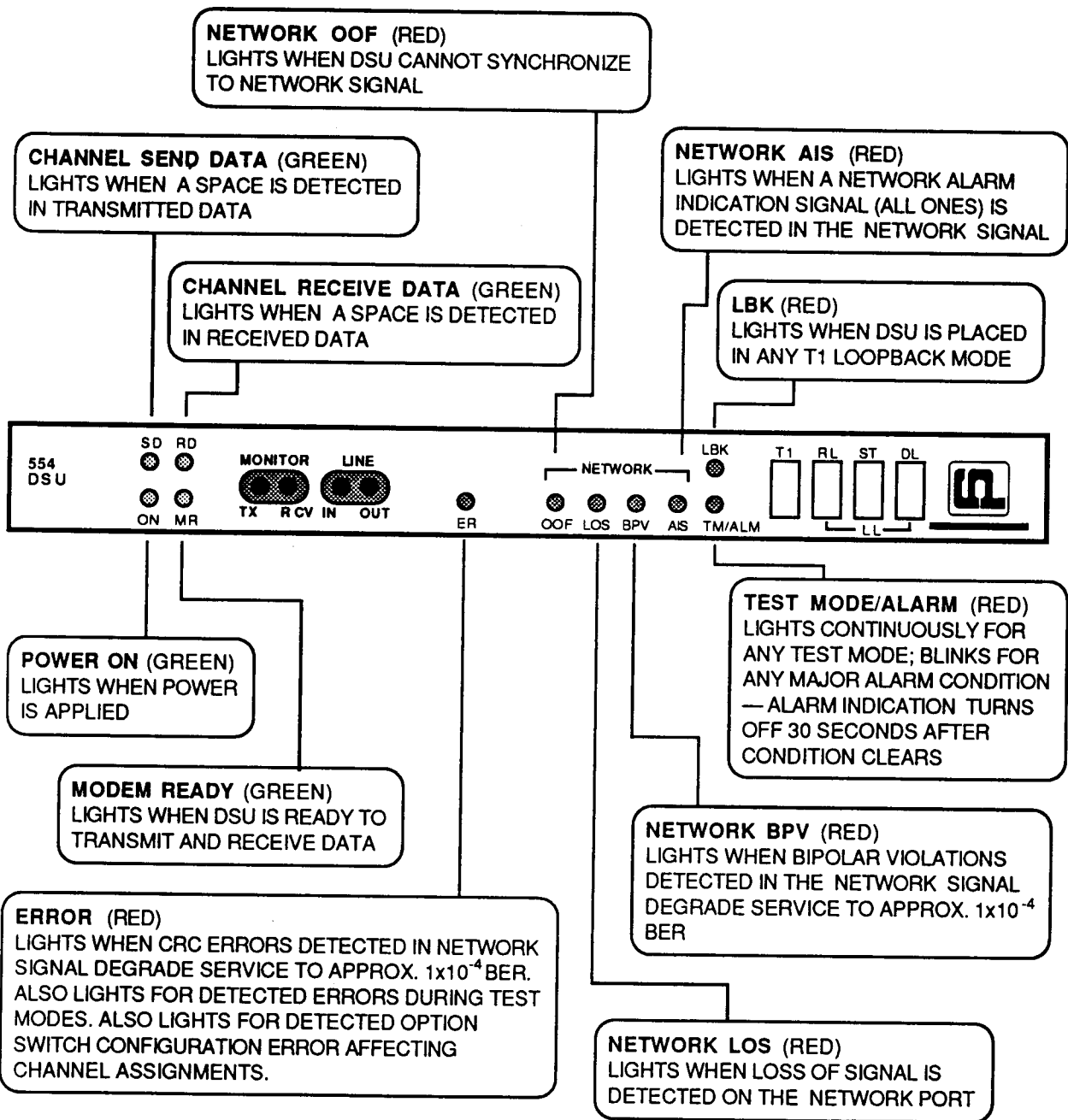
Figure 3-2   DC 554 Front Panel Indicators
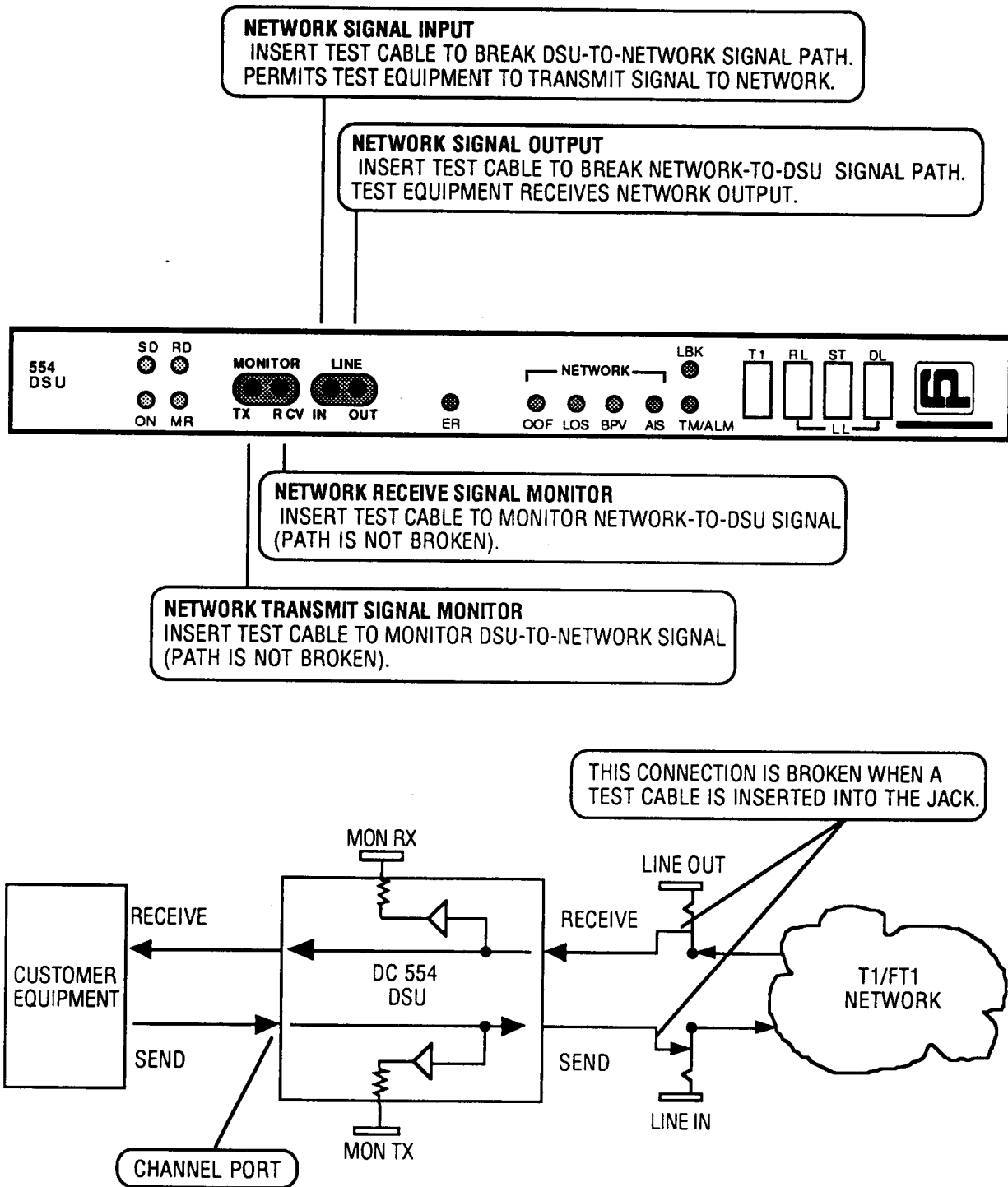
Figure 3-3   DC 554 Front Panel Test Jacks

Chapter 4: Tests

Overview

This chapter describes the tests you can perform on the DC 554 DSU from the front panel and from the terminal interface. You should test the equipment when it is first installed to verify correct installation. After the equipment is in service, you can use the tests to diagnose any problems that occur in the operation of the DSU or the data communications system. See *Figure 4-1*.
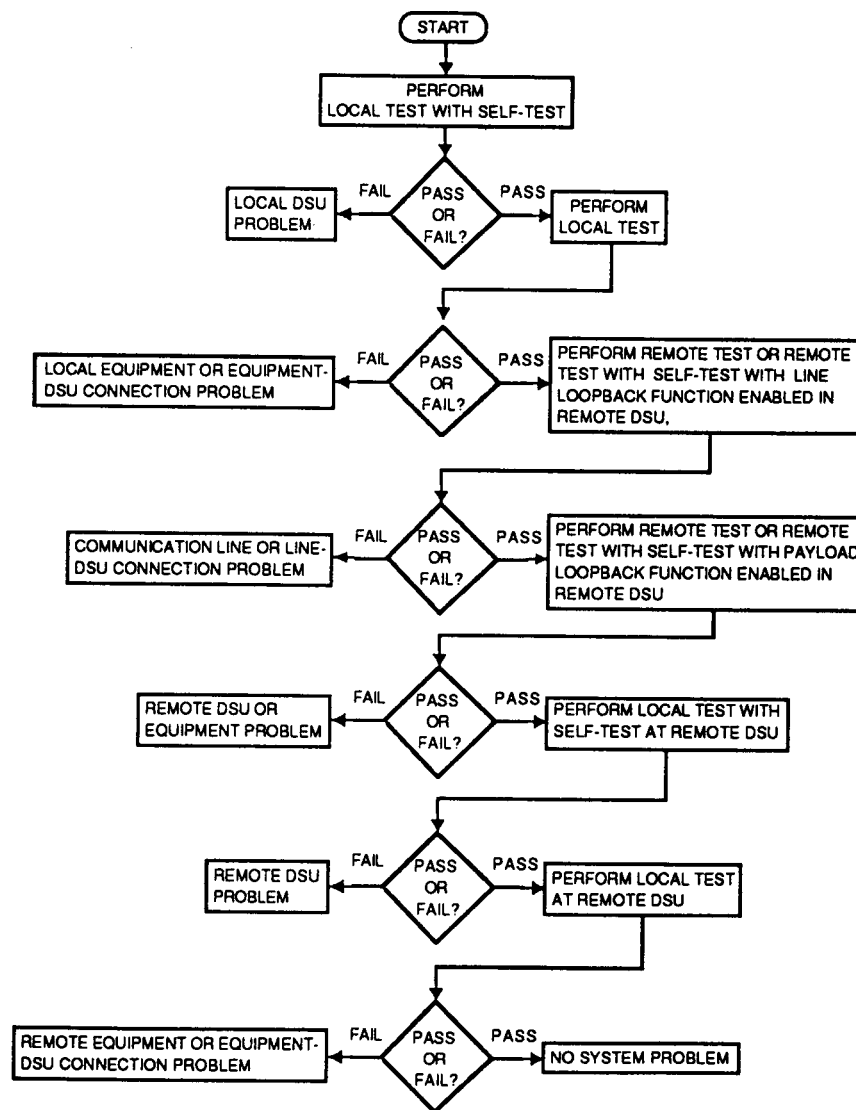
Figure 4-1 Fault Isolation Procedure

DS1 Diagnostics

The DS1 diagnostics described below include diagnostic tests that focus on the DSU's network interface. Use these tests when you suspect that a problem involves the DS1 interface. The tests are controlled by the front panel switches.

DS1 Local Test

To initiate a DS1 Local Test (without use of the internal test pattern) push in the T1, RL, and DL switches:

*   The DSU loops the transmit signal back to the receive path at the Network Interface. While the loop is in effect the DSU transmits an Alarm Indication Signal (all ones) on the T1 line.

*   The DSU's channel interface remains active so that a test signal can be generated and checked by an external device.

Local Test checks the local DSU's circuits, including the channel interface, isolated from the T1 line. Error detection and reporting is entirely the responsibility of the external device that supplies the test signal.

The Test Mode (TM) and Loopback (LBK) indicators will be On during the Local Test.

Once started, the test remains in effect until you return the switches to the released position.
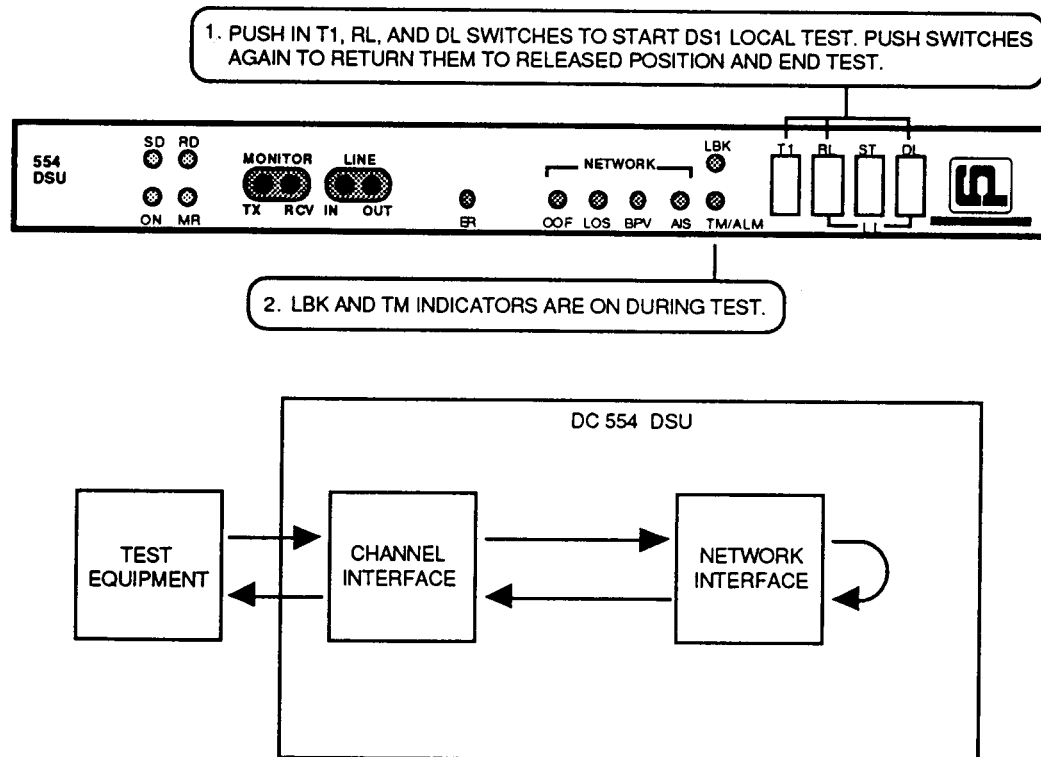
Figure 4-2   DS1 Local Test

DS1 Local Test with Self-Test

To initiate a DS1 Local Test with Self-Test push in the T1, RL, DL and ST switches. The test procedure involves two functions:

• Local Test - the DSU loops the transmit signal back to the receive path at the Network Interface (this electronically disconnects the DSU from the T1 line).

• Self-Test - the DSU enables its internal Test Pattern Generator to provide the signal for the Local Test loop and enables its Test Pattern Checker to verify the signal. The DSU is electronically disconnected from its DTE while the Test Pattern Generator and Checker are enabled.

DS 1 Local Test with Self-Test checks the local DSU's internal circuits isolated from both the T1 line and the DTE. It does not check the DSU's channel interface to the DTE.

The Test Mode (TM) and Loopback (LBK) indicators will be On during the test. The Error (ER) indicator flashes if an error is detected in the test pattern; it remains Off while the test pattern is being received correctly.

Once started, the test remains in effect until you return the switches to the released position.
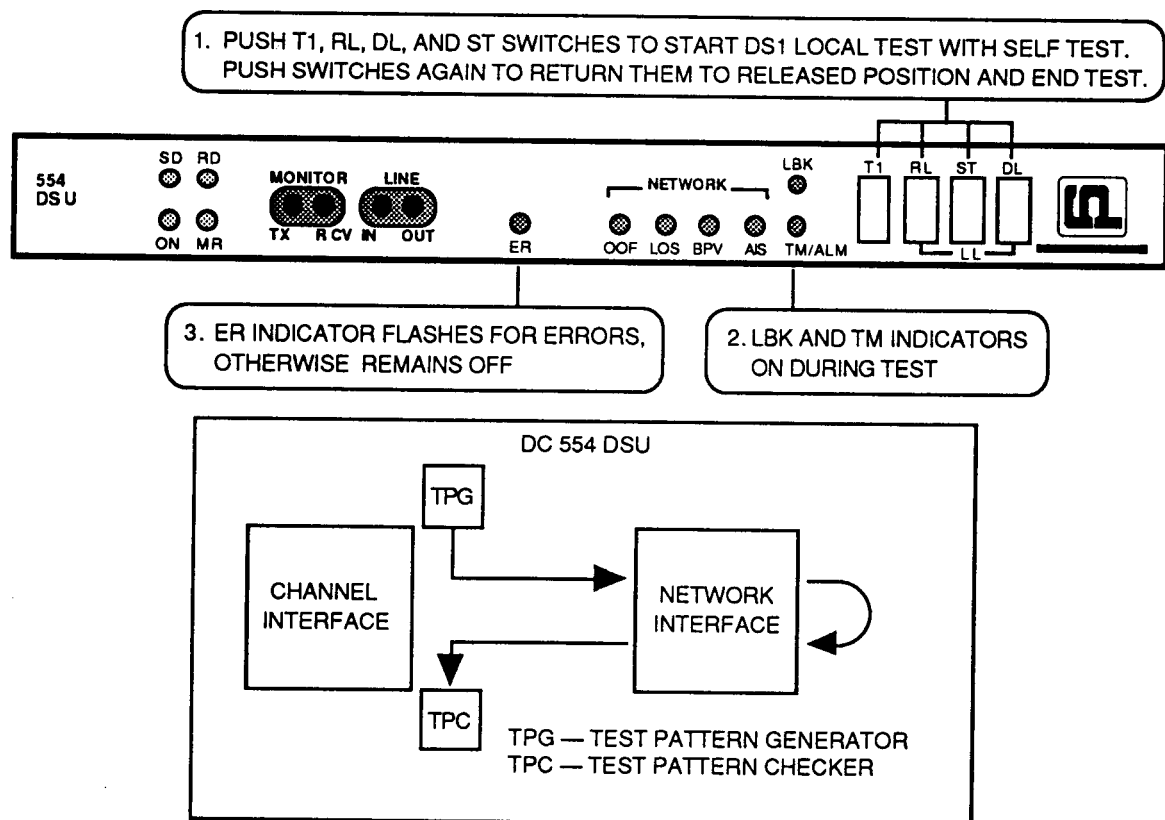
Figure 4-3   DS1 Local Test with Self-Test

DS1 Self Test

To initiate a DS1 Self-Test push in the T1 and ST switches. The test causes the DSU to generate and verify a QRS or 3:24 test pattern. DS1 Self-Test can be used with DS1 Remote Test (refer to DS1 Remote Test with Self-Test). In cooperation with an operator at another site, it can be used with DS1 Loopback, or to perform a DS1 End-to-End Self-Test.

In a DS1 End-to-End Self-Test two DSUs transmit their self test patterns to each other for verification. Bipolar violations are corrected during this test. Within each DSU, a Test Pattern Generator creates the test pattern, and a Test Pattern Recognizer determines if the data it receives matches that which was transmitted. The test checks both DSUs and the T1 link.
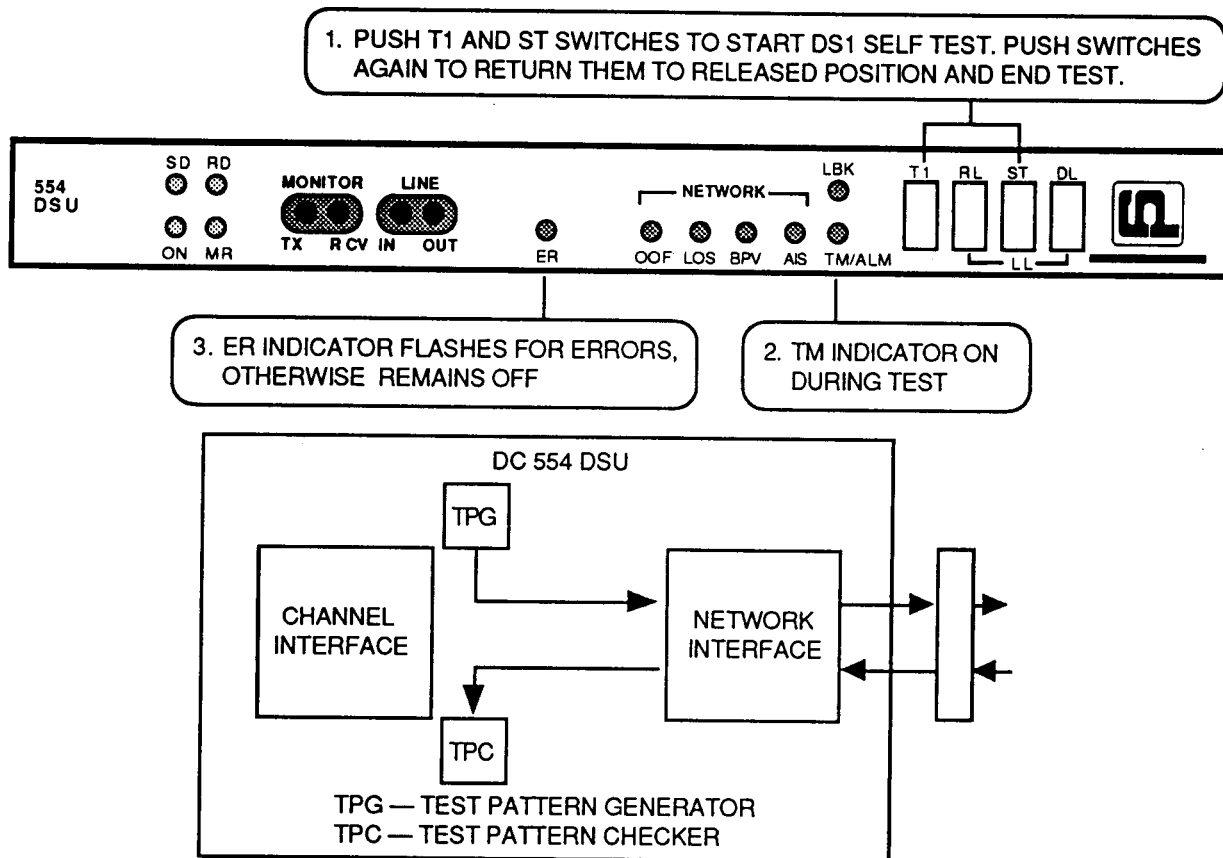
Figure 4-4   DS1 Self Test

DS1 Loopback

A DS1 Loopback causes the local DSU to direct incoming signals back to the remote DSU. To initiate a DS 1 Loopback push in the T1 and DL switches. The DSU engages either a Line or a Payload Loopbacks (determined by its optioning).

A Line Loopbacks loops the receive signal back to the transmit path at the Network Interface. This permits the remote DSU to test the line and its own circuitry. A Payload Loopbacks extends the test to include the local DSU's network interface circuitry.

The Test Mode (TM) and Loopback (LBK) indicators will be On during the test.

Once started, the test remains in effect until you return the switches to the released position.
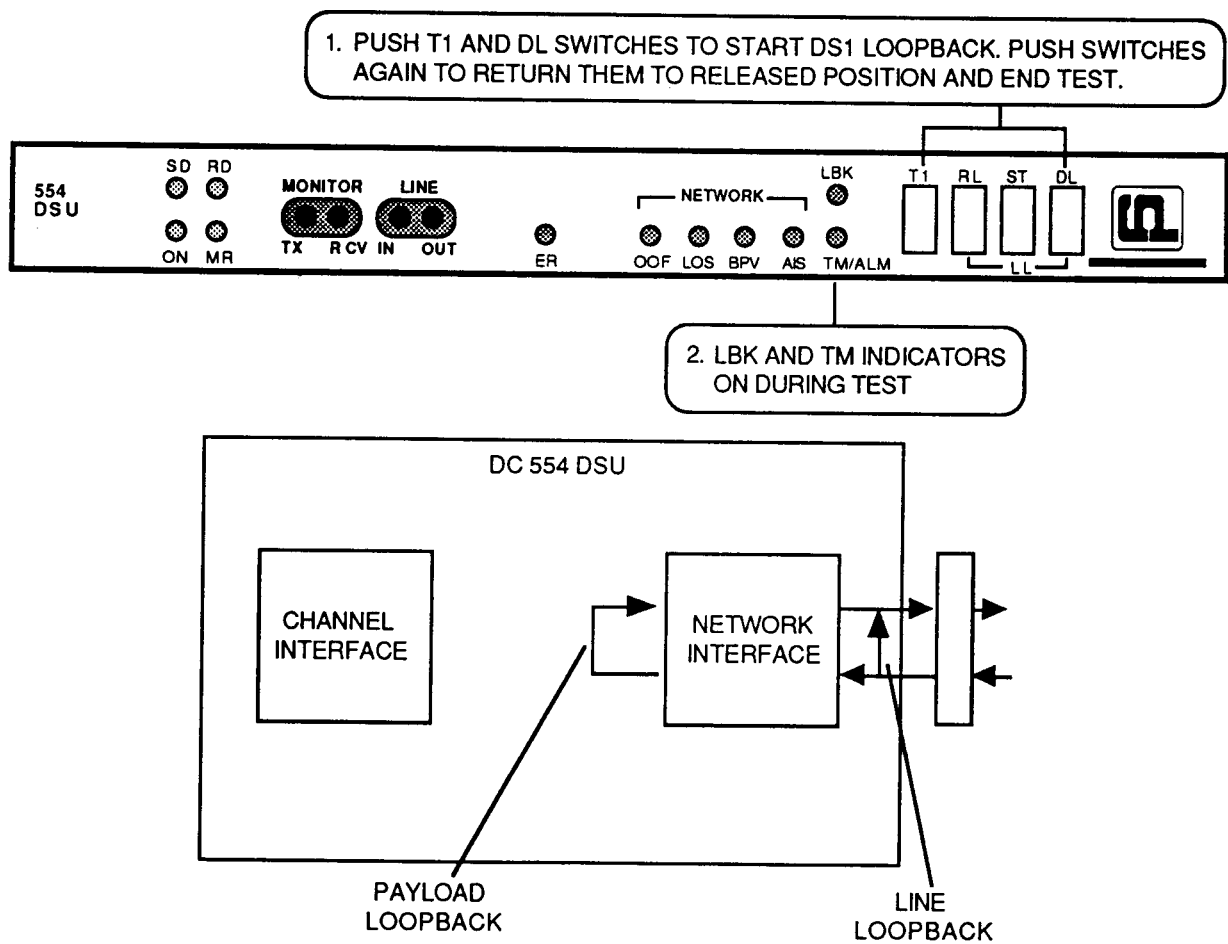
Figure 4-5   DS1 Loopback

DS1 Remote Test

To initiate a DS1 Remote Test (without use of the internal test pattern) push in the T1 and RL switches. The DSU transmits a loop-up code to the remote unit for approximately five seconds. The remote unit responds by engaging either a line or a payload loopback (determined by it's optioning).

After the loop is established, connect test equipment to the local DSU's front panel jack as shown. Generate a test message. The test equipment should receive back the same message it transmits. A problem exists if it does not.

DS1 Remote Test with a Line Loopback tests the line and the remote DSU's network interface. DS1 Remote Test with payload loopback extends the test to include the remote DSU's network interface circuitry.

To stop the test. disconnect the test equipment and then return T1 and RL to the released position.
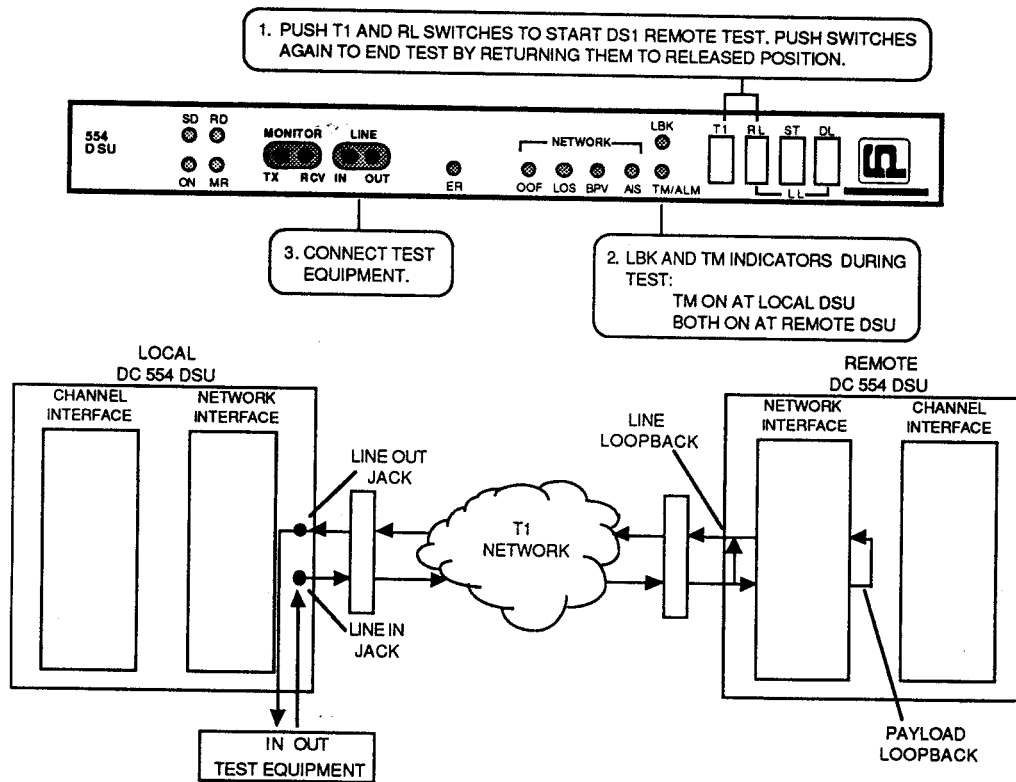
Figure 4-6   DS1 Remote Test

DS1 Remote Test with Self-Test

To initiate a DS1 Remote Test with Self Test push in the T1, RL, and ST switches. The test procedure involves two functions:

- Remote Test: the DSU transmits a loop-up code to the remote unit for approximately five seconds. The remote unit responds by engaging either a Line or a Payload loopback (determined by its optioning - bipolar violations are not corrected in a Line loopback).

- Self-Test: the DSU enables its internal Test Pattern Generator to provide the signal for the Remote Test loop and enables its Test Pattern Checker to verify the signal. The DSU is electronically disconnected from its DTE while the Test Pattern Generator and Checker are enabled.

When used with a Line loopback, DS1 Remote Test with Self Test tests the communication channel and the remote DSU's network interface. Use of a Payload loopback extends the test to include the remote DSU's network interface circuitry. To stop the test, return T1, RL, and ST to the released position.
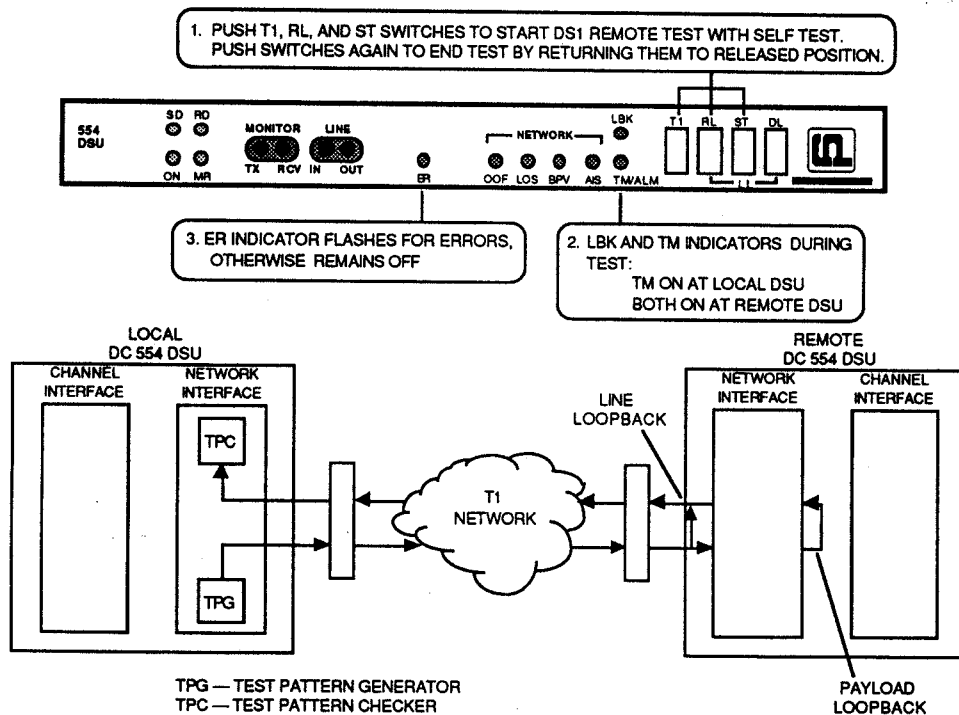

Figure 4-7   DS1 Remote Test with Self-Test

Channel Diagnostics

The channel diagnostics described below include channel-level diagnostic tests that affect the customer equipment signal on the channel. Use these tests when you suspect that a problem is impairing data on the channel. The tests are controlled by the front panel switches.

Channel Digital Loop

Channel Digital Loop permits testing of the remote channel equipment, both DSUs, and the T1 link. It does so by looping the received signal at the local DSU's channel interface and transmitting the signal back to the remote DSU. In this way a test signal from the remote DSU is returned to the remote DSU for checking. The test signal can be internally generated by the remote DSU (see Channel Self Test) or it can be provided by external test equipment. In either case, operators are required at both sites.This test is controlled by front panel switch DL.
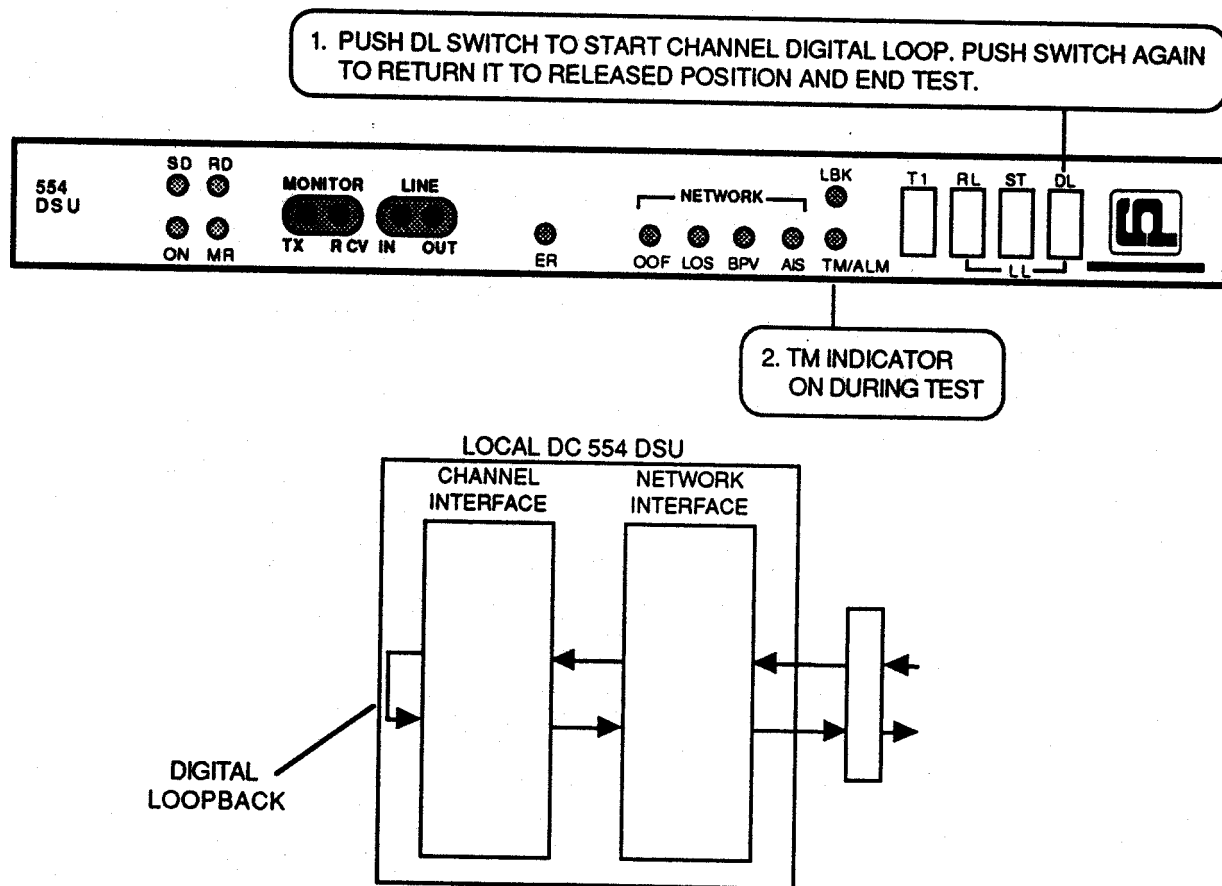

Figure 4-8   Channel Digital Loop

Channel Remote Digital Loop

Channel Remote Digital Loop tests the local channel equipment, both DSUs, and the T1 link. It does so by transmitting an externally generated test message through the local DSU to the remote DSU, looping it back at the remote channel interface, and returning it to the test equipment for verification. Loopback of the remote channel is controlled by inband loopback codes transmitted by the local DSU after you start or stop the test.

This test is controlled at the local DSU, either by front panel switch RL or by a control pin on the channel interface connector.
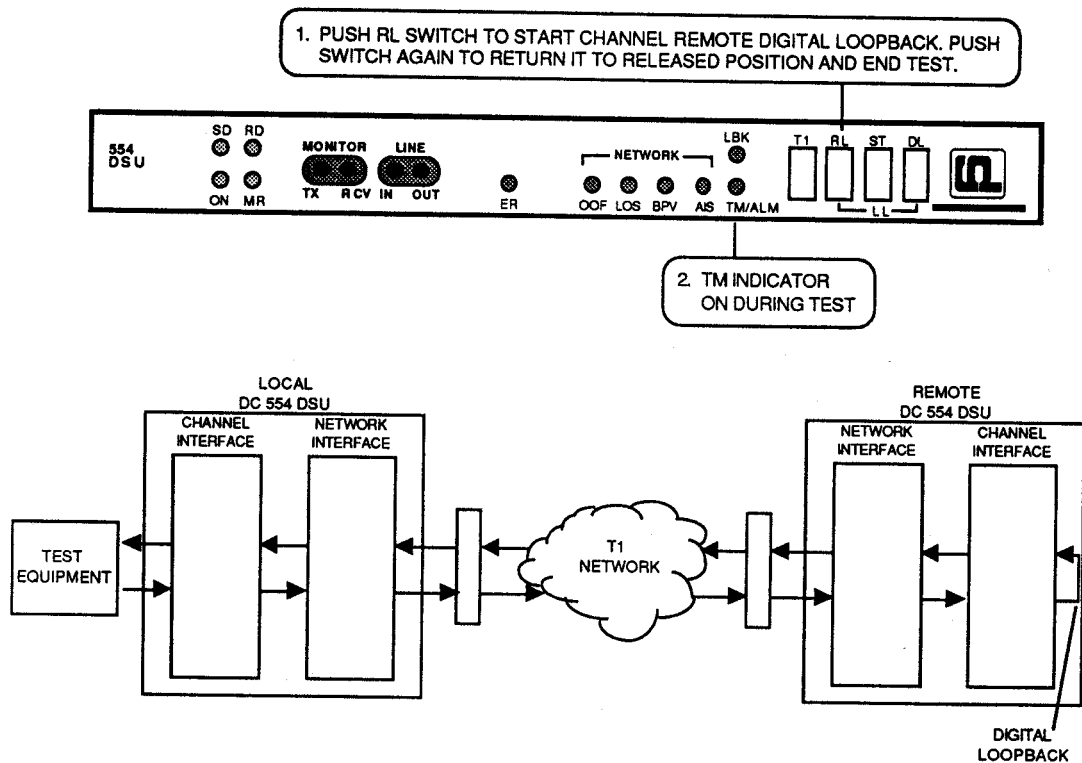
Figure 4-9   Channel Remote Digital Loop

Channel Remote Digital Loop with Self-Test

Channel Remote Digital Loop with Self-Test tests both DSUs and the T1 link. It does so by transmitting a test pattern, generated by the local DSU through the local DSU to the remote DSU, then looping it back at the remote channel interface and returning it to the local DSU for verification. Loopback of the remote channel is controlled by inband loopback codes transmitted by the local DSU after you start or stop the test. This test is controlled locally by front panel switches RL and ST.
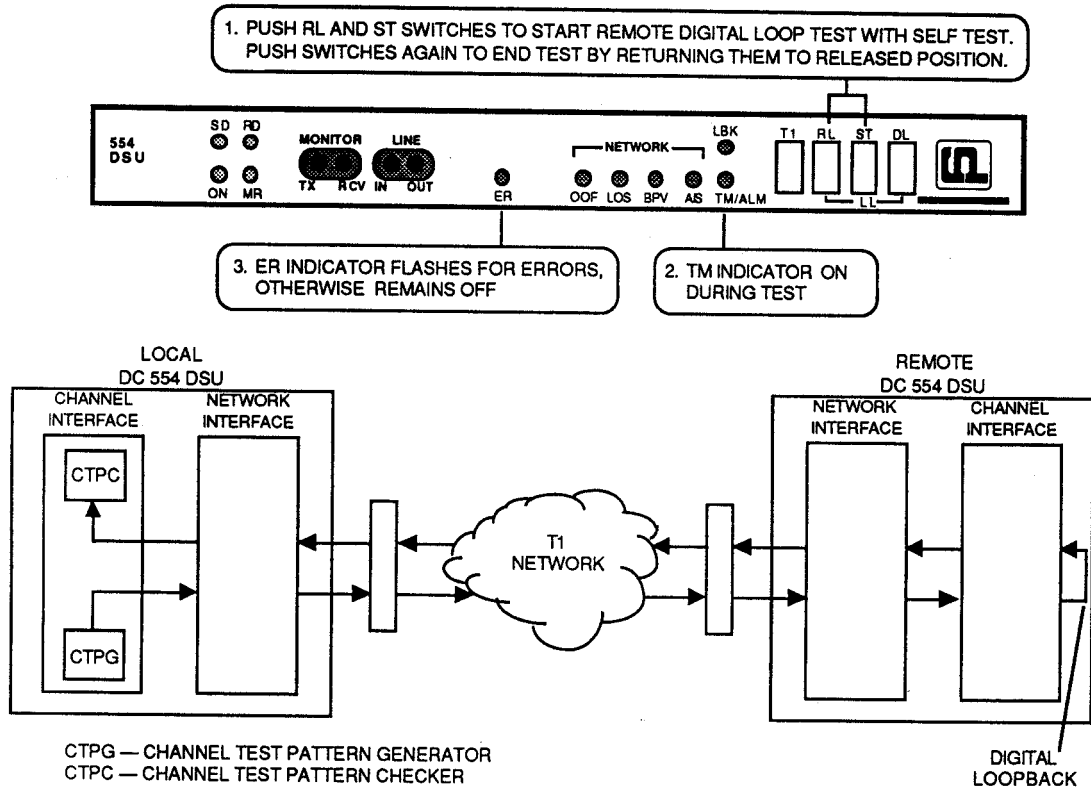
Figure 4-10   Channel Remote Digital Loop with Self-Test

Channel Self-Test

Channel Self-Test causes the DSU to generate and verify a 511-bit or 2047 bit test pattern. Channel Self-Test can be used with Channel Remote Digital Loop (refer to Channel Remote Digital Loop with Self-Test). In cooperation with an operator at another site, it can be used with Channel Digital Loop, or to perform a Channel End-to-End Self-Test.

In a Channel End-to-End Self-Test two DSUs transmit their self test patterns to each other for verification. Bipolar violations are corrected during this test. Within each DSU, a Test Pattern Generator creates the test pattern, and a Test Pattern Recognizer determines if the data it receives matches that which was transmitted. The test checks both DSUs and the T1 link. This test is controlled locally by front panel switch ST
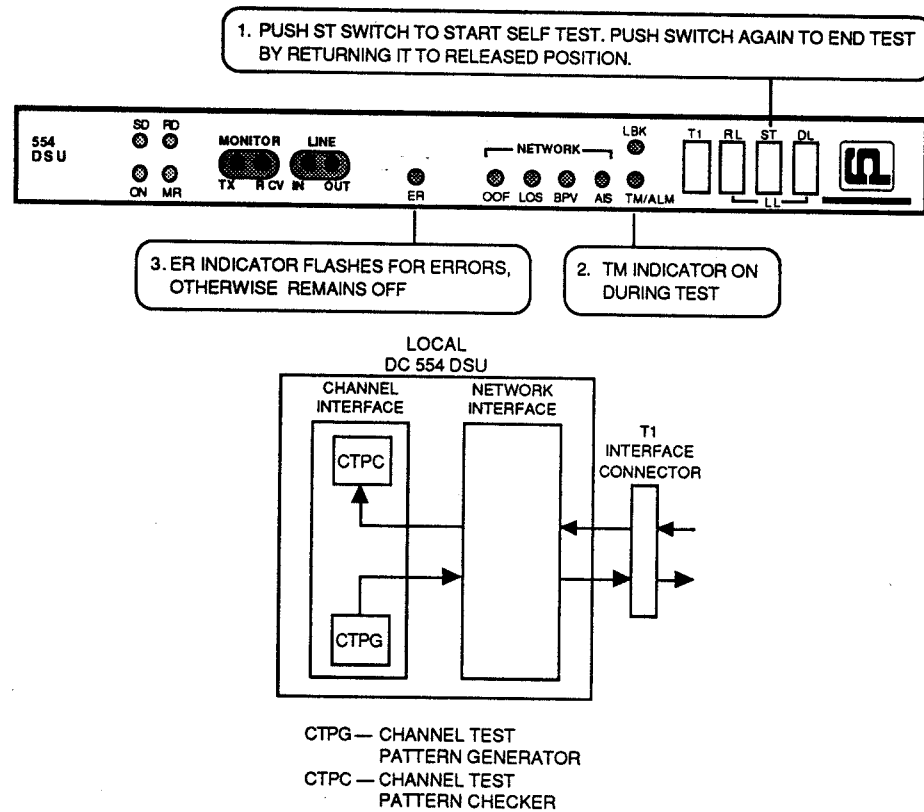

Figure 4-11   Channel Self-Test

Channel Local Loopback

Channel Local Loop causes the local DSU to loop channel data received from its DTE back toward the DTE at the channel interface. It tests everything up to the channel interface. During this test the DSU clamps channel data transmitted to the T1 link.

This test can be controlled locally by front panel switches DL and RL, or by a control pin on the channel interface connector.
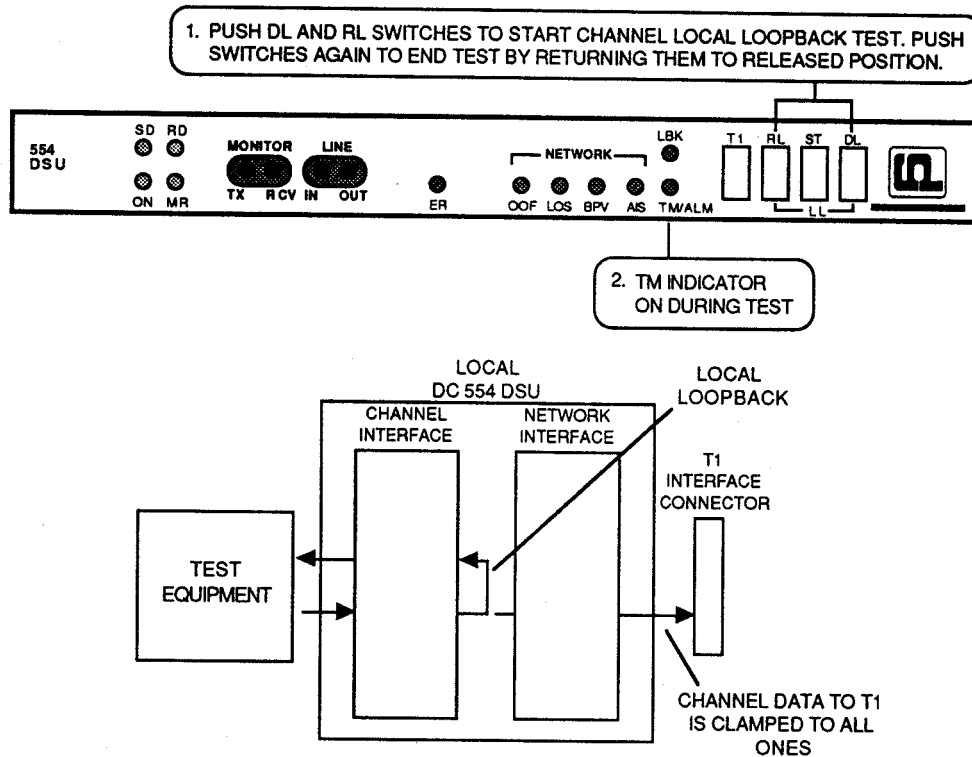
Figure 4-12   Channel Local Loopback

Channel Local Loopback with Self-Test

Channel Local Loop with Self Test activates the local DSU's Channel Test Pattern Generator (CTPG) and Channel Test Pattern Checker (CTPC) along with a Local Loopback. It tests the DSU's channel interface isolated from the network interface and the DTE. Channel data transmitted to the T1 link is clamped during the test.

This test can be controlled locally by front panel switches DL, RL, and ST or by a control pin on the channel interface connector
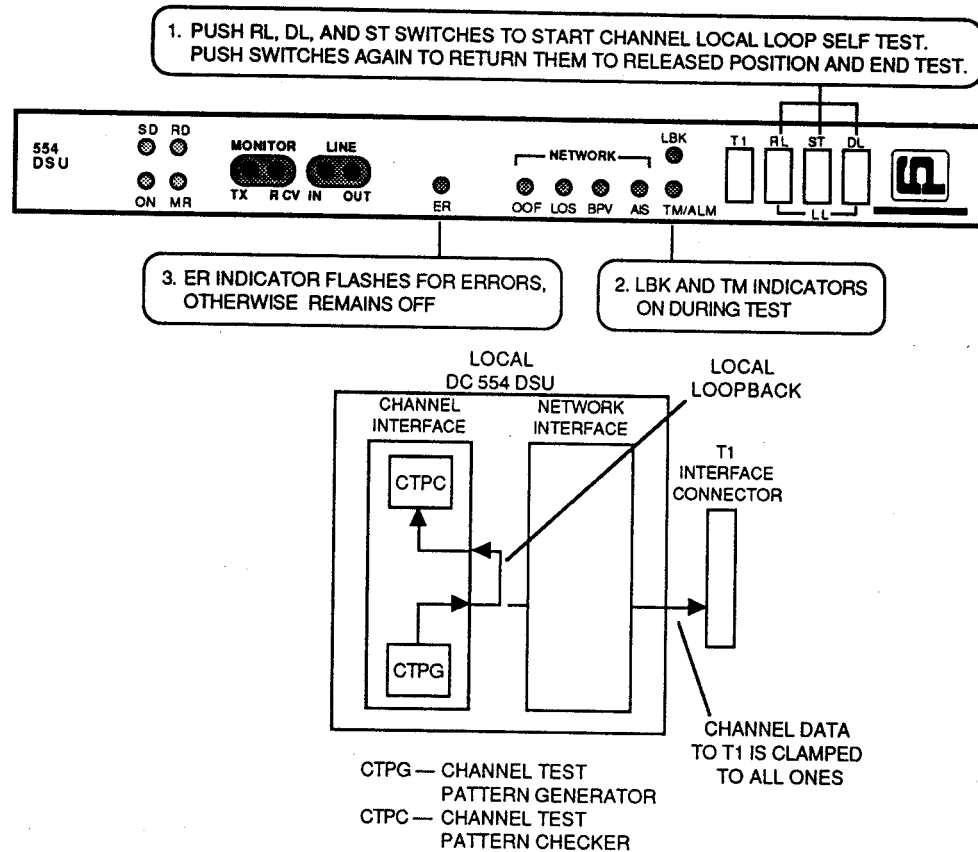
Figure 4-13 Channel Local Loopback with Self-Test

Chapter 5: Timing Options

Overview

The flexibility and complexity of the timing options for the DC 554A DSU require explanations that are more detailed than those normally provided. This appendix therefore describes details and applications of the DC 554A DSU timing options:

- Receive Timing

- Internal Timing

- DTE Timing

- DTE Split Timing

Each description is accompanied by an illustration that shows how the timing clock is distributed throughout the network and explaining how to set option switch S1 on the option card, as well as typical applications. Following the timing option descriptions are some representative network applications showing how to apply the timing options in a variety of network configurations.

Timing Option Descriptions

In synchronous networks, all device transmitters and receivers are usually referenced to a single master timing source. This timing source, or clock, is frequently provided by the network and is highly accurate and stable. The DSU recovers the embedded clock from the data stream and uses it to synchronize its own internal timing reference to the master clock. This allows the DSU to extract the data reliably and further to distribute timing to other devices connected to it. (Timing is embedded in the data stream on the network port, but is provided on a separate lead in the DTE interface.) The network clock is the preferred timing source, but the DC 554A DSU supports other timing options for use in applications where timing from the network clock is either not available or not applicable.

Special Considerations

Several techniques exist for providing timing to the customer equipment: smooth clock and variations of gapped clock. With a smooth or continuous clock, the type employed by the DC 554A DSU, every clock pulse is the same length and occurs at the same interval. With a gapped clock, however, pulses are intentionally omitted. Customer equipment that is expecting a smooth clock may not function properly with a gapped clock. It may interpret the missing pulses as loss of timing. A gapped clock, moreover, may never be used as a timing reference or to convey network timing. On the other hand, equipment that can tolerate a gapped clock will probably work well with a smooth clock, making the smooth clock technique more universally acceptable.

The default timing option for the DC 554A DSU is Slave Timing, used when the network provides the timing source. When the network does not provide the timing source, one DC 554A DSU must use Internal Timing (or Channel Timing when customer equipment connected to it provides timing) and the others must use Slave Timing. When the network and the customer equipment both provide timing, you may need to use Channel Split (BUFF) Timing, a combination of Slave Timing and Channel Timing.

One thing is common to all DC 554A DSU timing options: the DSU uses the clock it recovers from network receive data, then uses it to clock data into the receive buffer and to provide the channel receive clock signal for the channel. What differs is the source of the master clock reference and the source of the channel transmit clock signals, as shown in Table 5-1:

- With Slave Timing, the master clock comes from the network, and channel transmit clock signals are derived from the clock recovered from the network receive data.

- With Internal Timing, the DSU provides the master clock, but channel transmit clock signals are still derived from the recovered clock.

- With Channel Timing, the customer equipment connected to the DSU provides its own transmit clock signal, from which the DC 554A DSU derives a master clock. For this method, the DTE must be the master source of timing.

- With Channel Split (BUFF) Timing, the customer equipment connected to the DSU provides its own transmit clock signal (like Channel Timing), but the network provides the master clock for the rest of the network (like Slave Timing).

Note   *All timing options that include split timing require each timing source to be traceable to the same Stratum 1 clock.*

The data rate on the network port is 1.544 Mbps. On the Channel port, however, the data rate may be from 56 Kbps to 1.536 Mbps. The DC 554A DSU compensates for the difference in data rates by translating the clock frequency when passing it from one port to another.

Table 5-1   Timing Options

Timing Options	Master Clock Source			Ch. Trans Clock Source	
	Net.	554	Ch.	Net.	Ch.
Slave Timing	✔			✔	
Internal Timing		✔		✔	
Channel Timing			✔		✔
Channel Split (BUFF) Timing	✔				✔

Slave Timing

With Slave Timing, illustrated in Figure 5-1, the network (or a device at the remote end) provides the timing source (1). The DC 554A DSU recovers the receive T1 clock from the network receive T1 data and uses it both to clock T1 data into the receive buffer (2) and to provide the send timing source for T1 data output from the transmit buffer (3) to the network. The DSU also translates (4) the receive T1 clock to provide the channel transmit and receive clock signals on the appropriate channel interface leads.

Select Slave Timing when using the DC 554A DSU in a network (or with a device at the remote end) that supplies the clock, as in a DACS (Digital Access and Cross-connect System) network.

Note   *Select the appropriate timing option for the customer equipment. The DC 554A DSU provides transmit timing on the DCE interface Tx Clk lead.*
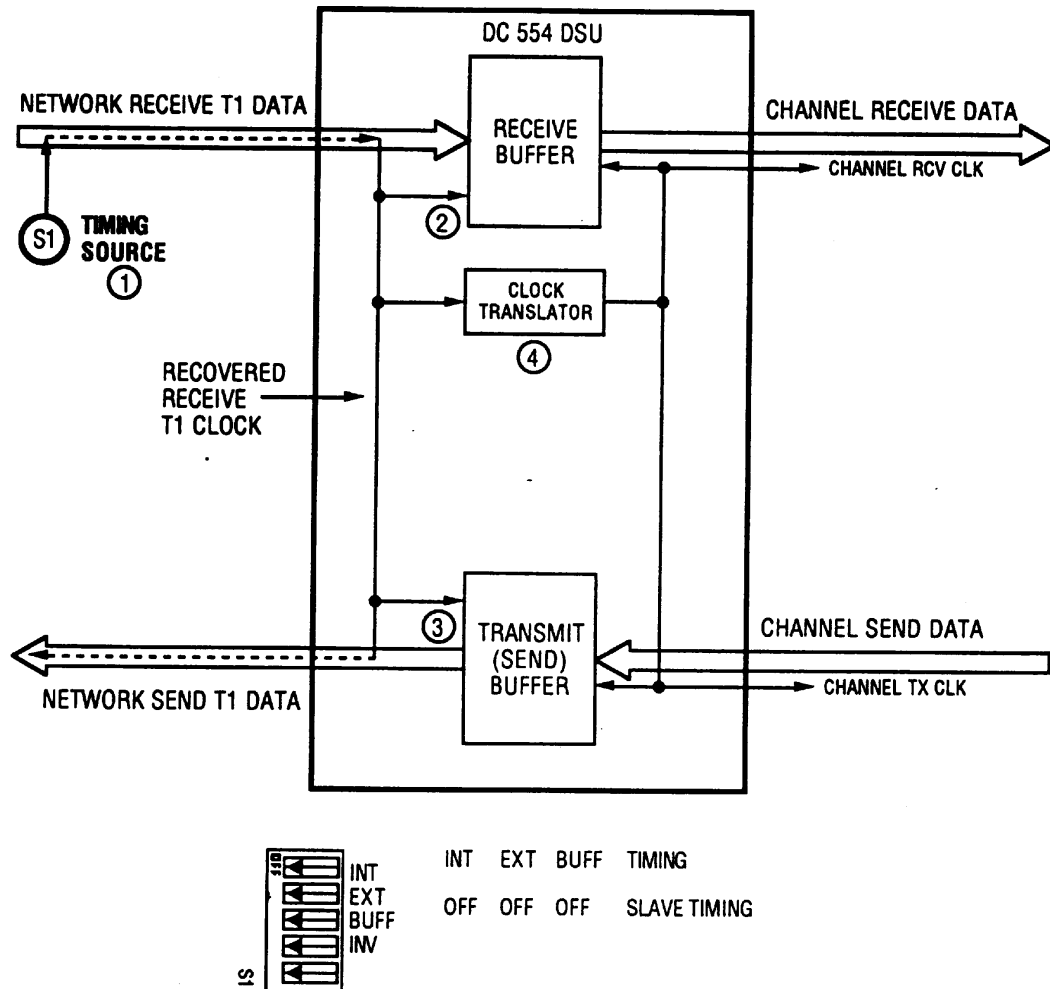

Figure 5-1   Slave Timing

Internal Timing

With Internal Timing, illustrated in Figure 5-2, the DC 554A DSU provides the send timing source (1) for T1 data output from the transmit buffer (2) to the network. (This clock satisfies the requirements of a Stratum 4, Level II clock, as defined in AT&T Technical Reference 62411.) The remote DSU uses this as its timing reference (3) and loops it back to the DC 554A DSU (4). The DC 554A DSU recovers the receive T1 clock from the network receive T1 data and uses it to clock T1 data into the receive buffer (5). The DC 554A DSU also translates (6) the receive T1 clock to provide the channel transmit and receive clock signals on the appropriate channel interface leads. Select Internal Timing when using the DC 554A DSU in a private network that does not provide timing (e.g., a non-DACS based service).

Special Considerations

• Configure only one DC 554A DSU in your network for Internal Timing, and configure the others for Slave Timing.

• Select the appropriate timing option for the customer equipment. The DC 554A DSU provides transmit timing on the channel's Tx Clk lead.
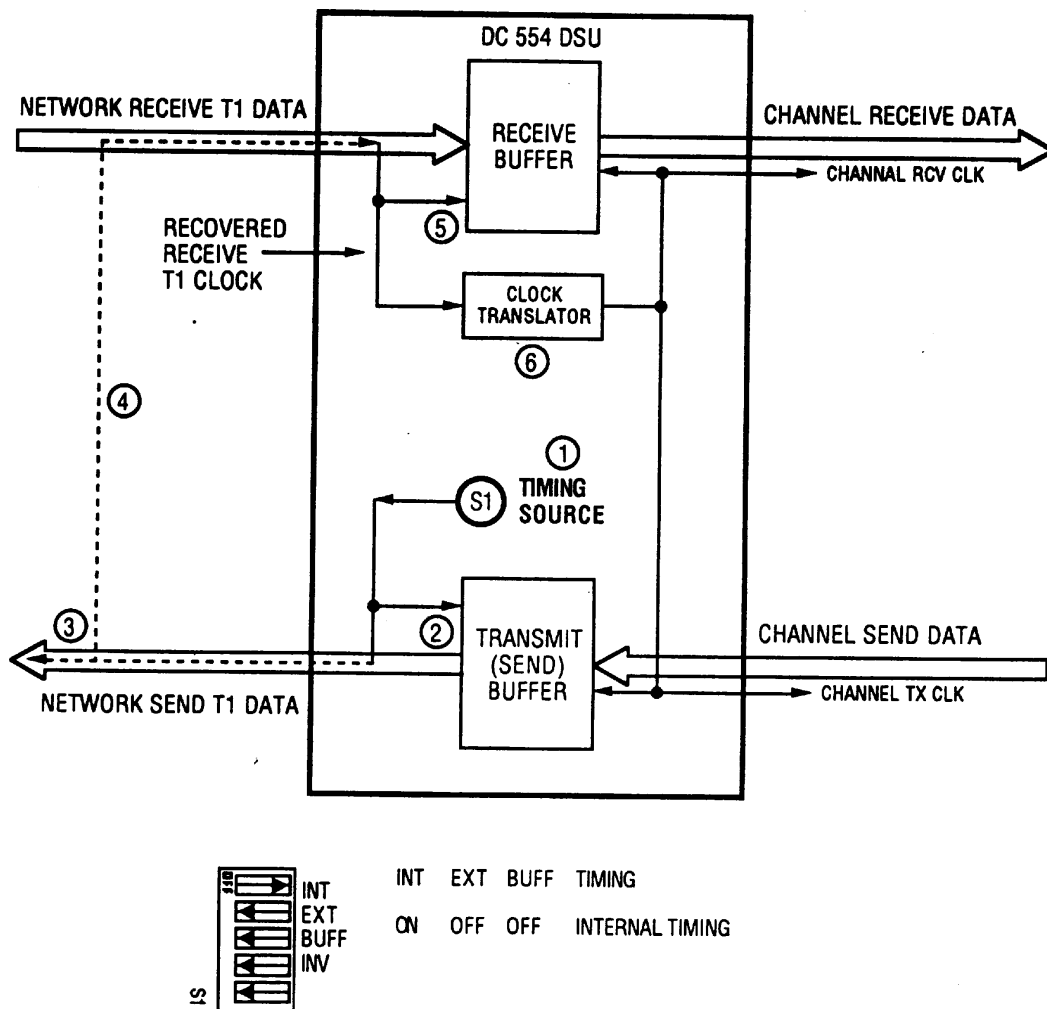

Figure 5-2   Internal Timing

Channel Timing

With Channel Timing, illustrated in Figure 5-3, the customer equipment connected to the DSU's channel interface provides its own channel transmit clock signal (1) on the appropriate interface lead. The DC 554A DSU translates (2) this clock to provide the send timing source for T1 data output from the transmit buffer (3) to the network. The remote DSU uses this as its timing reference (4) and loops it back to the DC 554A DSU (5). The DC 554A DSU recovers the receive T1 clock from the network receive T1 data and uses it to clock T1 data into the receive buffer (6). The DC 554A DSU also translates (7) the receive T1 clock to provide the receive clock signals for the channel on the appropriate interface leads.

In order for this application to work, the DTE device that acts as timing source S1 must be the network source of timing. The DTE must not be passing along timing that is derived from another source or from a rate conversion. Select DTE Timing when using the DC 554A DSU in a private network with the customer equipment supplying the clock.

Note   *Select the appropriate timing option for the customer equipment. The DC 554A DSU expects external timing on the channel's Ext Clk lead.*
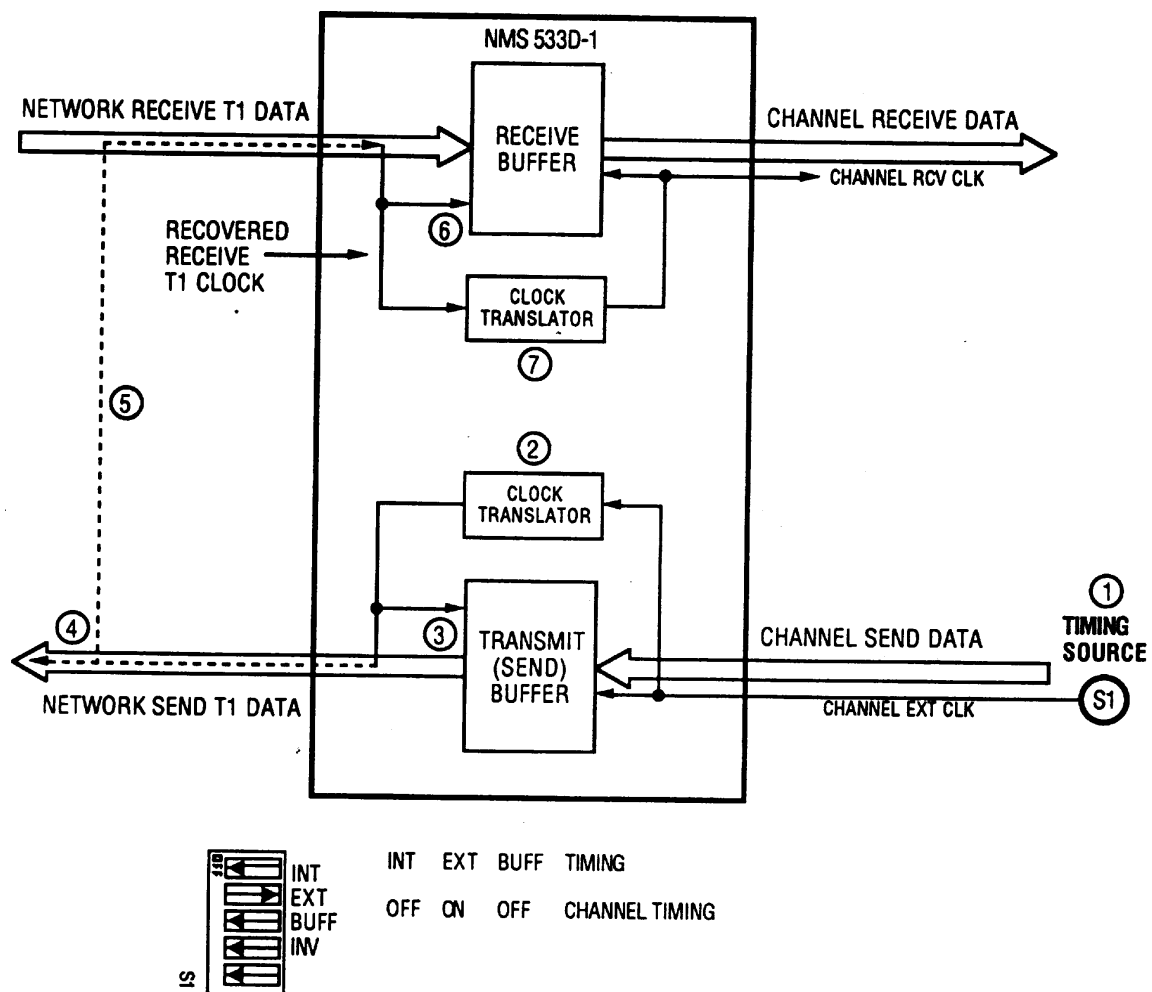

Figure 5-3   Channel Timing

Channel Split (BUFF) Timing

Channel Split (BUFF) Timing, illustrated in Figure 5-4, is a combination of Slave Timing and Channel Timing that utilizes two clock sources. As in Slave Timing, the network (or a device at the remote end) provides one timing source (1). The DC 554A DSU recovers the receive T1 clock from the network receive T1 data and uses it to clock T1 data into the receive buffer (2) and to provide the send timing source for T1 data output from the transmit buffer (3) to the network. The DC 554A DSU also translates (4) the receive T1 clock to provide the receive clock signal, on the appropriate interface lead. As in Channel Timing, the customer equipment on the channel interface provides the other timing source, its own channel transmit clock signal (5) on the appropriate interface lead, but the DC 554A DSU uses it for nothing else.

Select Channel Split (BUFF) Timing when there are timing sources provided by both the network and the customer equipment.

Special Considerations

- Select the appropriate timing option for the customer equipment. The DC 554A DSU expects external timing on the channel's interface Ext Clk lead.

- All timing options that include split timing require every timing source to be traceable to the same Stratum 1 clock.
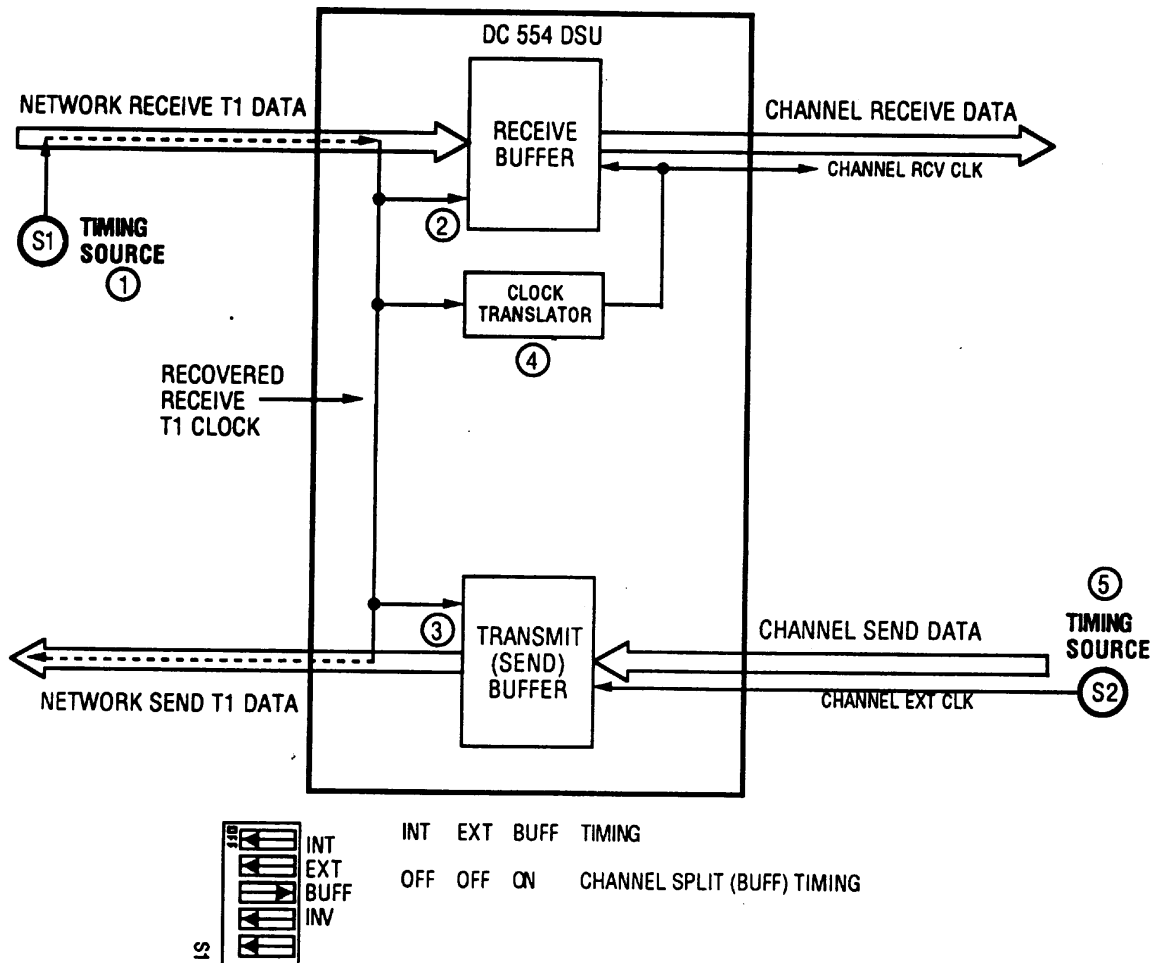

Figure 5-4   Channel Split (BUFF) Timing

Typical Network Applications

Although you can use the DC 554A DSU in various network configurations with different types of equipment, the following simple applications illustrate the fundamental reasoning you use to select the appropriate timing option.

DSU-supplied Timing

In an in-house data communications network, two DC 554A DSUs are connected back-to-back. The only component connecting them is cable, so there is no network to provide the timing source.

If the customer equipment connected to the channel cannot provide timing, select Internal Timing for the master or host end, and select Slave Timing for the other, as shown in Figure 5-5. In this example, the DC 554A DSU at Site A is configured for Internal Timing, making it the timing source.
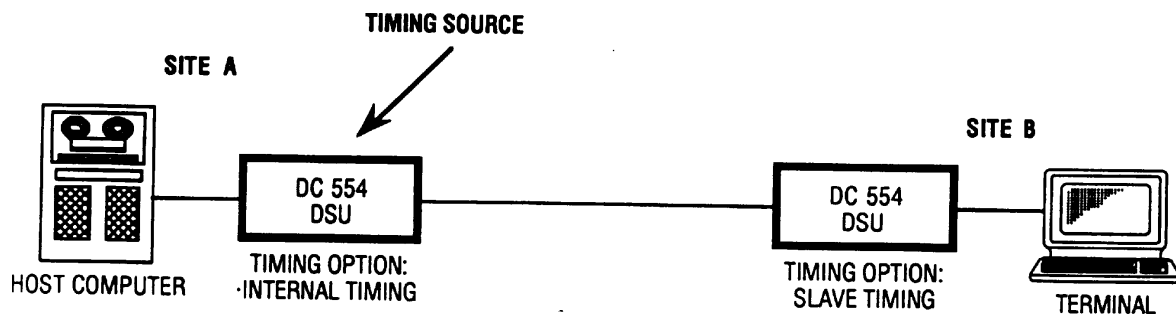
Figure 5-5   Timing Supplied by DC 554 DSU at Site A

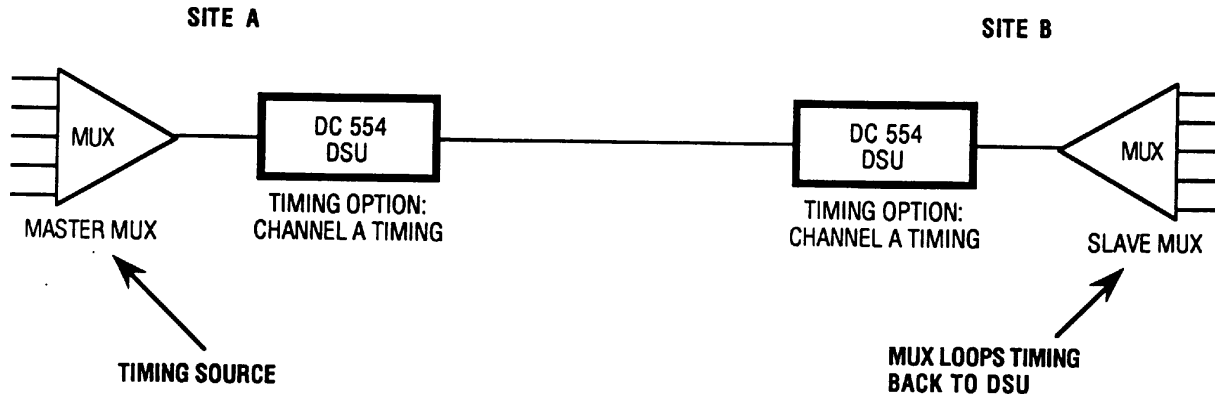### Customer-supplied Timing

If the customer equipment is to provide an external timing source, select Channel Timing for the DC 554A DSU connected to that equipment and select Slave Timing for the other, as shown in Figure 5-6. In this example, the host computer at Site A is providing timing, so its DC 554A DSU is configured for Channel Timing.
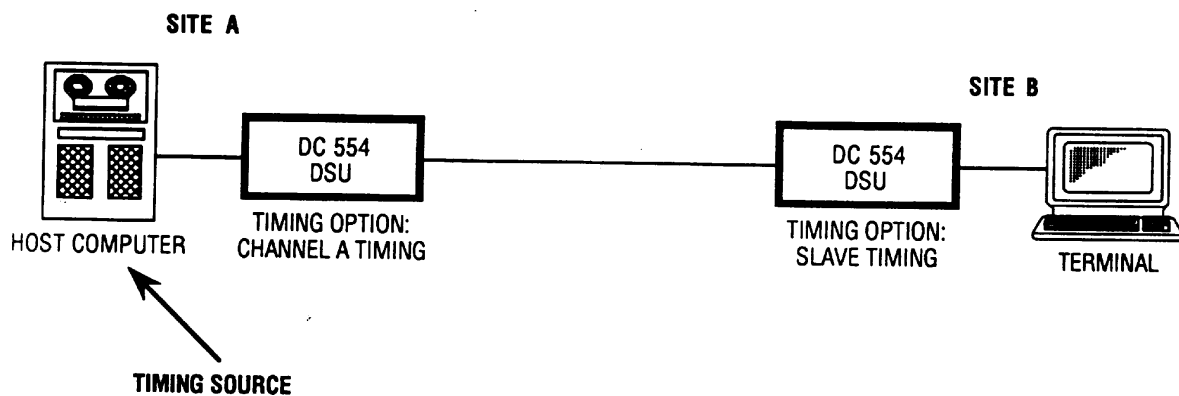
Figure 5-6   Customer-supplied Timing

Master/Slave Multiplexer Application

In the master/slave multiplexer application illustrated in Figure 5-7, the multiplexer at Site A is configured as the master (i.e., the timing source) and the multiplexer at Site B is configured as a slave. With Channel Timing selected for both DC 554A DSUs, the master multiplexer provides timing and the slave multiplexer loops back timing so timing is dependent on the customer equipment.

Figure 5-7   Master/Slave Multiplexer Timing

General DataComm
Smart Solutions for Service Providers