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Installation and Operation

DeskTop T1

Data Service Unit



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Preface

Scope

This manual describes how to install and configure a General DataComm Desktop T1 Data Service Unit. It is written for installers, service technicians, and users. It assumes a working knowledge of data interfaces, and T1 and Fractional T1 data transmission services.

Revision History

This is the initial issue of the manual.

Organization

This manual has four chapters and four appendices. The information is arranged as follows:

- *Chapter 1 - Technical Overview* describes the Data Service Unit, its features, and its options. This chapter contains the Equipment List table.
- *Chapter 2 - Installation* provides directions for installing the DSU and configuring it by means of the switchbanks located on the pc board.
- *Chapter 3 - Operation* describes the use of both the DSU front panel controls and indicators, and the VT100-compatible terminal interface that can be accessed through the Console port.
- *Chapter 4 - Tests* describes tests that can be performed on the DSU.
- *Appendix A - Technical Characteristics*
- *Appendix B - DTE Interface Signals* lists pin/signal assignments for the two DTE interfaces that the DSU can support: ITU-T V.35 and EIA-530.
- *Appendix C - Timing Options* illustrates the arrangements that can

be used to provide transmit timing for the DSU.

- *Appendix D - Alarm Definitions* identifies the conditions that can cause the DSU to generate an alarm.

Document Conventions

Level 1 paragraph headers introduce major topics.

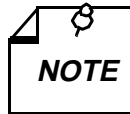
Level 2 paragraph headers introduce subsections of major topics.

Level 3 paragraph headers introduce subsections of secondary topics.

This typewriter font shows output that is displayed on the screen.

This bold font shows specific input that you type at the keyboard.

This bold italicized font shows variable input that you type at the keyboard.



Notes present special instructions, helpful hints or general rules.

Service and Support

General DataComm is committed to providing the service and support needed to install, manage, and maintain your equipment. For information about service programs or for assistance with your support requirements, contact your local Sales Representative or call General DataComm Service at the 24-hour, toll-free number listed below.

- in the U.S. dial 1-800-243-1030
- outside the U.S. dial 1-203-598-7526

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Be ready with the site name and phone number, and a description of the problem. The next available support representative will promptly return your call.

Hands-on training courses are provided by GDC Educational Services. Courses range from basic data communications, modems and multiplexers, to complex network and ATM systems and are taught in Connecticut or at a customer location. To discuss educational services or receive a course schedule, call 1-800-243-1030 and follow the menu instructions.

Safety Instructions

Antistatic Precautions

Electrostatic discharge (ESD) results from the buildup of static electricity and can cause computer components to fail. Electrostatic discharge occurs when a person whose body contains a static buildup touches a computer component.

The equipment may contain static-sensitive devices that are easily damaged, so proper handling and grounding are essential. Use ESD precautionary measures when installing parts or cards, and keep the parts and cards in antistatic packaging when not in use. If possible, use antistatic floor pads and workbench pads.

When handling components or setting switch options 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, such as a screwdriver or a paper clip, to set switches.

Safety Guidelines

The following symbols are used in this manual to draw your attention to potential hazards. A Caution indicates a hazard to equipment or data. A Warning indicates a hazard to personnel.



Caution statements identify conditions or practices that can result in damage to the equipment or in loss of data.



Warning statements identify conditions or practices that can result in personal injury or loss of life.

Always use caution and common sense. *To reduce the risk of electrical shock, do not operate any equipment with the cover removed.* Repairs must be performed by qualified service personnel only.

Regulatory Notices

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:

All connections to the telephone network must be made using standard plugs and telephone company provided jacks or equivalent.

Connection of this equipment to party lines and coin telephones is prohibited. A label on the bottom of the DT T1 enclosure provides the FCC Registration number for the unit. If requested, give this information to the telephone company.

To connect the DeskTop T1 DSU to the Public Telephone Network you are required to give the following information to the Telephone Company:

FCC Registration Number: AG6USA-24144-DE-N

FIC (Facility Interface Code): 04DU9-DN, 04DU9-BN, 04DU9-1KN,
04DU9-1SN

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SOC (Service Order Code):6.0Y

Telephone Company jack type:RJ48C

The telephone company may discontinue your service temporarily 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.

Canada DOC Notification

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

1 Technical Overview

Overview

This manual contains instructions for installing the DeskTop T1 DSU and placing it into service.

DeskTop T1 DSU Features

The General DataComm DeskTop T1 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 DeskTop T1 DSU:

- Provides interface to Fractional T1 (FT1) services, giving you the flexibility to utilize only the bandwidth you need, from 56 Kbps up to the full T1 rate of 1.536 Mbps
- 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.
- Supports one ITU-T V.35-compatible, high-speed, serial data interface for customer equipment.
- Permits configuration of network transmitter timing from a variety of sources:
 - Timing recovered from network data
 - External timing
 - Internal clock
- Supports Extended Superframe (ESF) and D4 framing formats; also supports unformatted (unframed) operation, for use with proprietary formats
- Provides configurable Auto Framing option that automatically adapts the DSU to ESF or D4 format
- With ESF framing selected, supports both TABS Maintenance Messages (Technical Reference 54016) and ANSI Performance

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Report Messages (Bellcore TR-TSY-000194) procedures for collection and monitoring of network performance information provided by the Central Office

- Provides independent user and network register sets for TABS performance data
- 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 a VT100-compatible terminal interface for configuration, diagnostic, and monitoring functions through the Console port on the back panel
- Provides T1- and channel-level diagnostics for extensive diagnostic capabilities

Description

The DeskTop T1 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 DeskTop T1 DSU is ideal for medium-sized, low-channel-density networks.

Fractional T1 Capabilities

A T1 line's DS1 signal consists of 24 DS0 channels. The DeskTop T1 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.

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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 DeskTop T1 DSU provides DTE interface through 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.

Table 1-1 Equipment List

Description	GDC Part No.
GDC DeskTop T1 DSU, 117 V ac, V.35 channel interface	048A102-005
Power Supply	
Power supply, 19 V ac, 0.6A, 60 Hz wall mount transformer	700-053-002
Cables	
Interface cable, ITU-T V.35 34-pin male-to-male (DSU channel port to customer equipment) (5- to 50-foot lengths)	027H570-XXX
DCE-to-DCE crossover interface cable, V.35 34-pin male to 34-pin male	027H521-XXX
Interface cable, RJ48C plug-to-plug (DSU network port to the T1 line) (10- to 50-foot lengths; 10-foot length included with standalone enclosure models)	022H024-XXX
Interface cable, RJ48C plug-to-15-pin male (DSU network port to the T1 line, Canadian installation only) (10- to 50-foot lengths)	022H022-XXX
Interface cable, RJ48C plug to 15-pin female (DSU network port to the T1 line, for Canadian installation only) (10- to 125-foot lengths)	022H020-XXX
Adapter, RS-232 DB25 male to RS-561 8-pin modular jack (connects to VT100-compatible terminal to support connection of interface cable 830-028-XXX)	029H210-001
Interface cable, RS-561 8-pin modular plug to plug (connects DSU Console port to adapter 029H210-001)	830-028-8XX

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2 Installation

Overview

This chapter describes the installation of the DeskTop T1 DSU.

The DeskTop T1 DSU is shipped pre-assembled, tested, and ready to use. The normal procedure after unpacking the unit is to connect it to ac power and perform the Preoperational Check described in this chapter. When the test is successfully completed you may proceed to make cable connections to the DSU.

The DeskTop T1 DSU should be installed in a ventilated area where the ambient temperature does not exceed 122°F (50°C). Do not install the DSU above other equipment that generates large amounts of heat (e.g., power supplies).

This chapter includes information on setting configuration options for the DSU by means of the hardware switchbanks located on the pc board.

Unpacking and Handling

The DeskTop T1 DSU is shipped in packing material that is enclosed in a corrugated box. Inspect the DeskTop T1 DSU when you receive it. If you observe any damage, notify the shipper immediately.

Do not discard the box and packing material. Save them for use if it is ever necessary to reship the DeskTop T1 DSU.

Preoperational Check

You should give the DeskTop T1 DSU a preoperational check before you connect it to the network or customer equipment, and *before you change any factory-set options*. The factory default setting for all options is all switches set to Off. Perform a Local Test with Self-Test to verify normal operation. Refer to *Chapter 4* for instructions on performing the test. Perform the test on the DeskTop T1 DSU before you connect it to anything other than ac power.

If the DeskTop T1 DSU does not check out properly, replace it with a spare, if available, and repeat the test. Do not attempt to repair the DeskTop T1 DSU. For assistance, contact General DataComm Service as described in the *Preface*.

If the DeskTop T1 DSU 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 may be other faulty devices or connections. Recheck the connections and option selections, and if necessary perform the Fault Isolation Procedure in *Chapter 4* to isolate the fault. Also verify that the customer equipment and remote DSU are compatible (that is, operating at the same rate).

Option Selection

The DeskTop T1 DSU provides a number of field-selectable options by which you can adapt it to a variety of configurations. The most convenient way to set options is to use the VT100-compatible terminal interface. Directions for connecting to the back panel Console port appear in this chapter; directions for using the terminal interface appear in *Chapter 3, Operation*.

You can also make option selections by positioning switches on the DSU pc card. *Figure 2-1* illustrates the locations of the option switchbanks. The options are described in *Tables 2-1, 2-2, 2-3, 2-4, and 2-5*.



- a. If the Auto Framing option is to be used, enable it at only one of the two DSUs that make up a link.
- b. If you connect two DSUs back-to-back (direct cable connection) and automatic Line Build-Out is to be used, enable it in only one of the DSUs.

Timing Options

Timing options determine the clock source for the data the DeskTop T1 DSU transmits to the network and receives from the customer channel equipment. The default timing option for the DSU is Receive timing, in which the network provides the timing source.

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Although the network clock is the preferred timing source, the DeskTop T1 DSU provides other timing options for use in applications where a network clock is either not available or not applicable. The flexibility and complexity of the DSU's timing options require detailed explanations. Refer to *Appendix C* for details and applications of the DeskTop T1 DSU timing options.

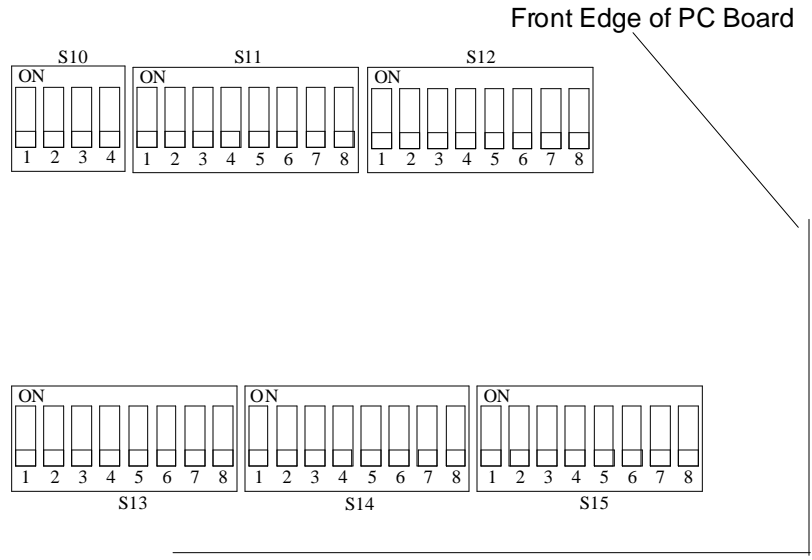


Figure 2-1 Position of Configuration Option Switchbanks on DeskTop T1 PC Card

Table 2-1 Option Application Notes — Switchbank S13, CSU Characteristics

Option	Selection	Switch	Position	Description
Configuration Mode	Soft	S13-1	Off*	DSU can be configured by a VT100-compatible terminal connected to the Console port. The positions of other switches may not reflect the actual configuration of the unit when this is selected. View the terminal interface Configuration screen for current settings.
	Hard	S13-1	On	DSU can only be configured by means of pc board hardware switches
Line Framing	ESF*	S13-2 S13-3	Off* Off	Selects ESF Framing
	D4	S13-2 S13-3	Off On	Selects D4 Framing
	Unframed	S13-2 S13-3	On Off	Selects unframed data transmission
	Auto Framing	S13-2 S13-3	On On	Enables Auto Framing; the Desktop T1 DSU adapts to either ESF or D4 framing based on the signal it receives. <i>Caution:</i> <i>Do not enable Auto Framing for both DSUs on a link.</i>
Network Line Type	DS-1	S13-4	Off*	Selects the line interface to operate as a DS-1 network interface for connection to a T1 line.
	DSX-1	S13-4	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.
* Factory default selection.				

(Continued on next page)

Table 2-1 Option Application Notes — Switchbank S13, CSU Characteristics (Continued)

Option	Selection	Switch	Position	Description
DS-1 Line Build-Out (LBO)/DSX-1 Pre-equalization	LBO	S13-5 S13-6 S13-7 S13-8	All Off* = 0 dB S13-5 On = -7.5 dB S13-6 On = -15 dB S13-7 On = -22.5 dB S13-8 On = Auto LBO	These switches control LBO when a DS-1 line interface is selected at S13-4. Set all Off for 0 dB manual LBO. Set 5, 6, or 7 On for the specified manual LBO. Set 8 On for automatic LBO. Set only one switch On. <i>Caution:</i> <i>Do not enable automatic LBO for both DSUs in a pair 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.</i>
	Pre-equalization	S13-5 S13-6 S13-7 S13-8	All Off* = 0-133 ft S13-5 On = 133 -266 ft S13-6 On = 266 -399 ft S13-7 On = 399 -533 ft S13-8 On = 533 -655 ft	These switches control Pre-equalization when a DSX-1 line interface is selected at S13-4. Pre-equalization matches transmitter to network gain characteristics for DSX-1. Select the lowest value that equals or exceeds the distance between units.
* Factory default selection.				

Table 2-2 Option Application Notes — Switchbank S14, Network Characteristics

Option	Selection	Switch	Position	Description
Network Coding	B8ZS*	S14-1	Off*	Selects Bipolar with 8 Zero Substitution (B8ZS) encoding for the network side
	AMI	S14-1	On	Selects Alternate Mark Inversion (AMI) encoding for the network side. The DSU enforces an 8 x (N+1) ones density requirement when AMI is selected in combination with framed N x 64k operation and consecutive DSOs, or with unframed operation.
Network ESF Mode	ANSI T1.403*	S14-2	Off*	Selects compliance with ANSI network performance messages (per Bellcore TR-TSY-000194), available only with ESF framing.
	TR 54016	S14-2	On	Selects compliance with network maintenance messages per PUB 54016, available only with ESF framing.
Network TX Timing	Receive*	S14-3	Off* or On Off* On	The 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. <i>Note:</i> <i>Both settings provide the same result.</i>
		S14-4		
	DTE	S14-3 S14-4	Off On	The DSU translates the clock taken from the Ext Clk signal provided by the DTE and uses it as the send timing source for T1 data output to the network.
Internal	S14-3 S14-4	On Off	The DSU provides the send timing source for T1 data output to the network.	
* Factory default selection.				

(Continued on next page)

Table 2-2 Option Application Notes — Switchbank S14, Network Characteristics (Continued)

Option	Selection	Switch	Position	Description
Network Inband Loop	Inhibit*	S14-5 S14-6	Off* <i>or</i> On Off* On	Disables response to in-band T1 loop codes <i>Note:</i> <i>Both settings provide the same result.</i>
	Line	S14-5 S14-6	Off On	DSU starts or stops a Line Loop test when it detects the appropriate inband loopback code.
	Payload	S14-5 S14-6	On Off	DSU starts or stops a Payload Loop test when it detects the appropriate inband loopback code.
Base Rate	64k*	S14-7	Off*	Each DS0 supports 64 kbps; all 8 bits of each DS0 are used for payload.
	56k	S14-7	On	Each DS0 supports 56 kbps; 7 bits are used for payload and the 8th bit can be used to pass control information
Allocation	Consecutive*	S14-8	Off*	Selects consecutive DS0s for payload.
	Alternate	S14-8	On	Selects alternate DS0s for payload; unused DS0s are forced to marks
* Factory default selection.				

Table 2-3 Option Application Notes — Switchbank S15, DTE Characteristics

Option	Selection	Switch	Position	Description
DTE CTS	Forced ON*	S15-1	Off*	CTS forced On
	Follow RTS	S15-1	On	CTS controlled by RTS
DTE DCD	Forced ON*	S15-2	Off*	DCD forced On
	Follow OOF	S15-2	On	DCD Off when network signal is Out Of Frame
DTE DSR	Forced ON*	S15-3	Off*	DSR forced ON
	Follow LOS	S15-3	On	DSR Off when network Loss Of Signal is detected
DTE Receive Data	Normal*	S15-4	Off*	Channel Receive Data not inverted.
	Invert	S15-4	On	Channel Receive Data inverted.
DTE Send Data	Normal*	S15-5	Off*	Channel Transmit Data not inverted.
	Invert	S15-5	On	Channel Transmit Data inverted.
DTE Split Timing	Disable*	S15-6	Off*	DSU uses selected Network TX Timing (S14-3&4) to clock T1 transmit data and channel send data
	Enable	S15-6	On	DSU uses selected Network TX Timing (S14-3&4) to clock T1 transmit data, and uses the Ext Clk signal provided by DTE to clock channel send data
DTE Receive Clock	Normal*	S15-7	Off*	Channel Receive Clock not inverted.
	Invert	S15-7	On	Channel Receive Clock inverted.
DTE Send Clock	Normal*	S15-8	Off*	Channel Transmit Clock not inverted.
	Invert	S15-8	On	Channel Transmit Clock inverted.
* Factory default selection.				

Table 2-4 Option Application Notes — Switchbank S10, DTE Characteristics

Option	Selection	Switch	Position	Description
DTE Auto Clock Invert	Disable*	S10-1	Off*	Normal/Invert condition of DTE Receive and Send Clocks controlled by S15-7&8
	Enable	S10-1	On	DSU monitors for data/clock mismatches in DTE data, and automatically toggles between Normal and Invert conditions to compensate for detected mismatch conditions. Overrides settings of S15-7&8
DTE Test Leads	Disable*	S10-2	Off*	DTE Test Leads LL and RL disabled.
	Enable	S10-2	On	DTE Test Leads LL and RL enabled.
DTE Test Pattern	2047*	S10-3	Off*	Selects 2047-bit Self-Test pattern for channel tests
	511	S10-3	On	Selects 511-bit Self-Test pattern for channel tests
LL Switch Mode	Bilateral	S10-4	Off*	T1 Line Loop test loops full T1 back to network interface, and loops channel back to DTE. Channel Line Loop test loops channel back to DTE, and loops DS0s allocated to the channel back to network interface.
	Unilateral	S10-4	On	T1 Line Loop test loops full T1 back to network interface. Channel Line Loop test loops channel back to DTE.
* Factory default selection.				

Table 2-5 Option Application Notes — Switchbanks S11 & S12, DS0 Assignments

Option	Selection	Switch	Position	Description
Starting DS0	1* — 24	S11-4 S11-5 S11-6 S11-7 S11-8	Default: All Off = DS0 1 See <i>Table 2-7</i> for other settings	Selects lowest numbered DS0 in the group that conveys channel data. The rest of the DS0s required to support the selected Channel Data Rate follow sequentially after the one selected here.
Number of DS0s	1 — 24*	S12-4 S12-5 S12-6 S12-7 S12-8	Default: All Off = 24 DS0s See <i>Table 2-6</i> for other settings	Selects how many DS0s are to be used for channel data. S14-7 determines rate of individual DS0s.
* Factory default selection.				

Table 2-6 DTE Data Rate Selection — Switchbank S12

Rate*	# of DS0s**	S12-4	S12-5	S12-6	S12-7	S12-8
1344/1536 Default Setting	24	Off	Off	Off	Off	Off
56/64	1	Off	Off	Off	Off	On
112/128	2	Off	Off	Off	On	Off
168/192	3 (1/8)	Off	Off	Off	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	Off	On	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	Off	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
1008/1152	18 (3/4)	On	Off	Off	On	Off
1064/1216	19	On	Off	Off	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

* Individual DS0 rate is controlled by option switch S14-7: On for 56 kbps, Off for 64 kbps.
**Figure in parentheses is the fraction of the full T1 bandwidth represented by the selected number of DS0s.

Table 2-7 DTE Starting DS0 Selections — Switchbank S11

Starting DS0	S11-4	S11-5	S11-6	S11-7	S11-8
1 Default Setting	Off	Off	Off	Off	Off
1	Off	Off	Off	Off	On
2	Off	Off	Off	On	Off
3	Off	Off	Off	On	On
4	Off	Off	On	Off	Off
5	Off	Off	On	Off	On
6	Off	Off	On	On	Off
7	Off	Off	On	On	On
8	Off	On	Off	Off	Off
9	Off	On	Off	Off	On
10	Off	On	Off	On	Off
11	Off	On	Off	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	Off	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

Connections

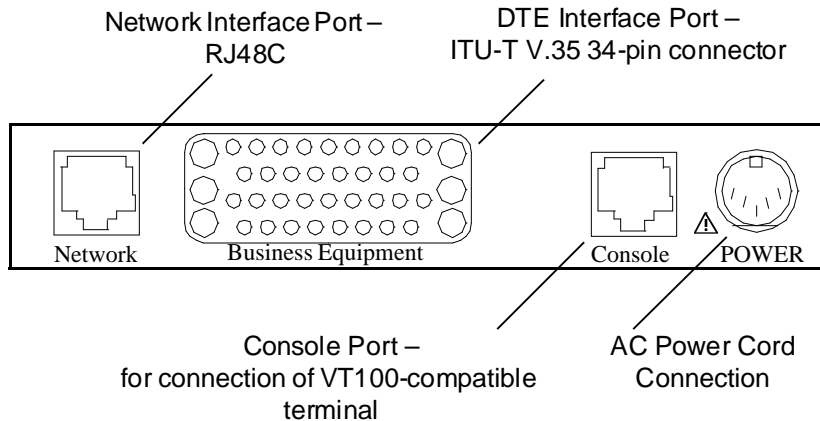


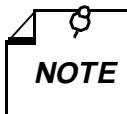
Figure 2-2 Back Panel Connectors

DTE Interface Port Connection

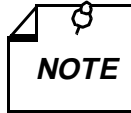
The DeskTop T1 DSU provides one ITU-T V.35-compatible DTE interface port. The port is a 34-pin female (V.35) connector located on the rear panel. Refer to *Table 1-1* for the appropriate interface cable. Refer to *Appendix B* for interface pin/signal assignments.

Network Connection

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



The Telco continuously monitors the T1 link and the equipment connected to it. Notify the Telco before connecting the DeskTop T1 DSU to the network. The DeskTop T1 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.



For Canadian installations only, a special cable is required for the network connection. Use GDC cable P/N 022H020 (RJ48C to DB15F) to connect the network port to the T1 line.

The network port interface is an RJ48C jack located on the rear panel. 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 T1 line to the DSU. The plug-to-plug cable is labeled NETWORK and CSU to indicate where each end is used.

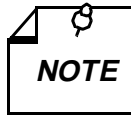
Pinouts for the network end of the network interface cables are listed below:

Function	Direction	027H242-X04	022H025-XXX
		022H024-XXX Pin No.	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.)	n/a	7	DRAIN

Note: The remaining leads are not used.



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



- a. *This installation procedure must be followed for compliance with FCC Part 15, Subpart J, Class A requirements.*
- b. *For Canadian installations only, a special cable is required for the network port connection. Use GDC cable P/N 022H020-XXX (RJ48C plug to 15-pin female) to connect the network port to the T1 line.*

Primary Power Connection

After the DeskTop T1 DSU has been installed and the above connections have been made, connect primary power to the system. The DSU is provided with an external power transformer that plugs into a three-prong electrical outlet.

Connect the power cord from the transformer to the back panel of the DSU and insert the plug-in transformer into a polarized outlet that provides the required ac power.



Use only GDC Part No. 700-053-002 plug-in transformer to power the DSU. This unit is a Class 2 power source, rated 19 Vac, 0.6A, at 60 Hz.

The outlet that provides ac power should not be under switch control. The DeskTop T1 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.

Terminal Connection

If you are using a VT100-compatible terminal for configuration and control of the DeskTop T1 DSU, make the connection at the back panel Console port identified in *Figure 2-2*. The port is RS-561 compatible. Refer to *Table 1-1* for the appropriate interface cable.

Use of a terminal is optional. Configuration can be accomplished entirely by means of the hardware switches on the pc card.

3 Operation

Overview

This chapter provides instructions for operating the DeskTop T1 DSU. You can control and monitor DSU functions in two ways: by means of the switches and LED indicators on the front panel, and by means of a VT100-compatible terminal connected to the back panel Console port.

The front panel provides a group of monitoring functions through its indicators and enables you to invoke a subset of the DSU test functions through its four switches.

The terminal interface provided by the Console port supports a broader range of functions than does the front panel. Through the terminal interface you can alter the configuration of the DSU, invoke the full range of its diagnostic test functions, view the current status of DTE interface signals and unit alarm conditions, and display information on the unit.

This chapter describes the use of front panel switches and the terminal interface for accessing the DSU diagnostic functions. *Chapter 4, Tests*, describes in detail the actual test procedures that you can perform by those means.

Controls and Indicators

Figure 3-1 illustrates the DeskTop T1 DSU front panel and explains the function of each control and indicator.

The four switches on the front panel are momentary action pushbuttons. One push on switch initiates its function, a second push terminates the function.

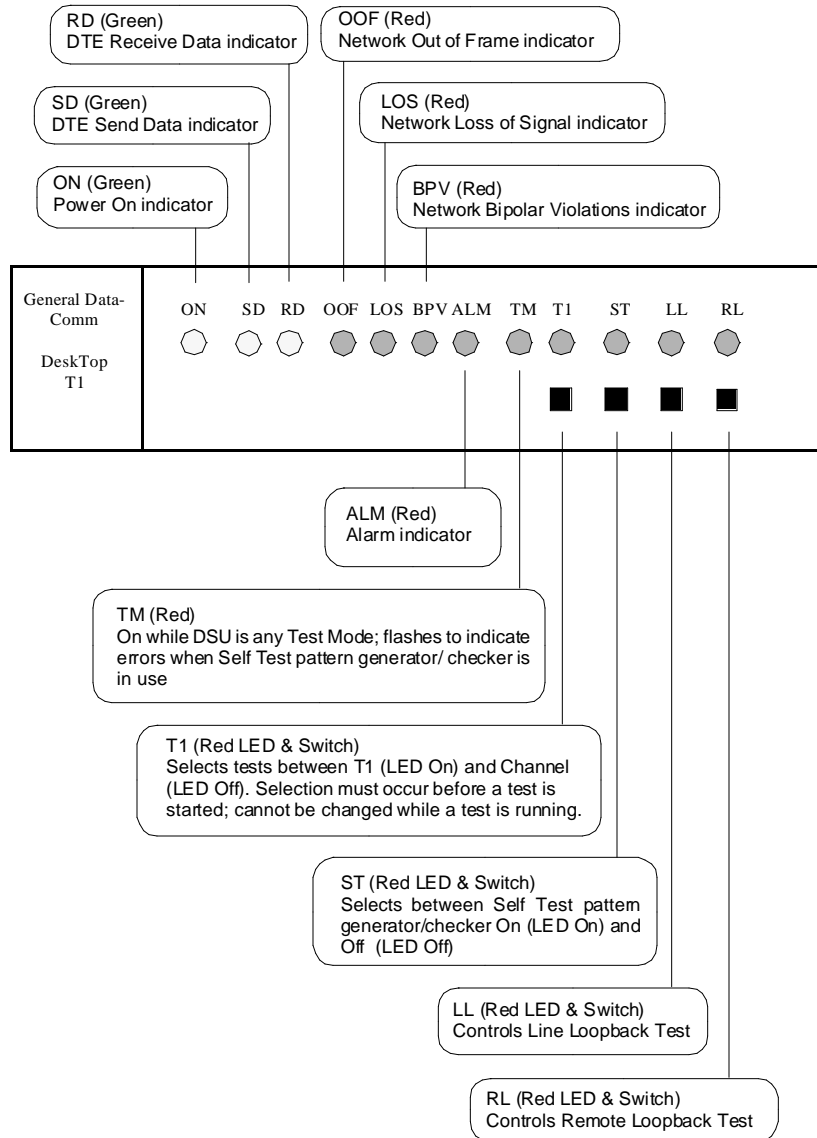


Figure 3-1 DeskTop T1 Front Panel Controls and Indicators

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Terminal Interface

When you connect a VT100-compatible terminal to the DSU back panel Console Port it provides on-screen interface functions for configuration, diagnostics, status monitoring, and display of information concerning the unit.

To access the terminal interface, connect a VT100-compatible terminal as described in *Chapter 2, Installation*, and press the Enter key. The initial display contains the following Main Menu:

```

*****
*                                     *
*                                     *
*          *****                   *
*          *****                   *
*          ****      *****          *
*          ****      *****          *
*          ****      *****          *
*          *****                   *
*          *****                   *
*          *****                   *
*          *****                   *
*          *****                   *
*          *****                   *
*          *****                   *
*          *****                   *
*****
*   G E N E R A L   D A T A C O M M   I N D .   I N C .   *
*****
                                     DT T1 Console Port
                                     [1] Configuration
                                     [2] Diagnostics
                                     [3] Monitor
                                     [4] Maintenance
Next Selection: [ ]
    
```

Type the number that corresponds to the function with which you intend to work.

Configuration

The Configuration function presents a screen of configuration options. Each option is identified by a selection number or letter, and displays its current setting. When Soft Configuration Mode is selected by hardware switch S13-1 this screen enables you to change configuration option settings from the terminal. The screen is display-only when Hard Configuration Mode is selected.

DT T1 Configuration	
[0] Return to Main Menu	Unit is under Software Control
[1] Network Framing:	ESF
[2] Network Coding:	B8ZS
[3] Network Line Type:	DS-1
[4] Network Line Buildout:	Manual 0dB
[5] Network ESF Mode:	ANSI T1.403
[6] Network Timing:	Receive
[7] Network Inband Loop:	Inhibit
[8] DTE DS0 Format:	N x 64 Kbps
[9] DTE Starting DS0:	1
[A] DTE Rate:	1536 Kbps (24 DS0s)
[B] DTE Allocation:	Consecutive
[C] DTE CTS Control:	Forced ON
[D] DTE DCD Control:	Forced ON
[E] DTE DSR Control:	Forced ON
[F] DTE Invert Data:	Normal
[G] DTE Invert Timing:	Normal
[H] DTE Split Timing:	Disable
[I] DTE Test Leads:	Disable
Next Selection:	

Figure 3-2 Configuration Screen, with Default Settings

The procedure for changing configuration option settings involves the following steps:

1. Type the selection number or letter of the option you intend to change. Highlighting appears on the current setting field for the corresponding option.
2. Use the left and right arrow keys to toggle the highlighted field

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through its potential settings.

3. When the desired setting is displayed, press Enter. The changed setting goes into effect immediately.
4. Repeat steps 1 through 3 for each option you need to change.
5. After you've made all required changes, type selection 0, Return to Main Menu.

Table 3-1, which starts below, lists the configuration options that appear on the terminal interface display and all the settings available for each. For more detailed descriptions of the individual option settings and their effects on operation of the DSU you can consult *Tables 2-1 through 2-5* in *Chapter 2, Installation*.

Table 3-1 DeskTop T1 Configuration Option Settings

Option	Potential Settings
[0] Return to Main Menu	Unit is under Software Control*
	Unit is under Hardware Control*
[1] Network Framing:	ESF
	D4
	Unframed
	Auto
[2] Network Coding:	B8ZS
	AMI
[3] Network Line Type:	DS-1
	DSX-1
* The setting of hardware switch S13-1 determines the Hard Mode/Soft Mode status that is displayed with the Return to Main Menu selection. This screen is display-only when the unit is in Hard Mode.	

(Continued on next page)

Table 3-1 DeskTop T1 Configuration Option Settings (Continued)

Option	Potential Settings
[4] Network Line Buildout:	Manual 0 dB
[4] is Line Buildout when Line Type is DS-1	Manual -7.5 dB
	Manual -15 dB
	Manual -22.5 dB
	Auto
[4] Network Pre-Equalization:	0-133 ft
[4] is Pre-Equalization when Line Type is DSX-1	133-266 ft
	266-399 ft
	399-533 ft
	533-655 ft
[5] Network ESF Mode:	ANSI T1.403
	TR 54016
[6] Network Timing:	Internal
	Receive
	DTE
[7] Network Inband Loop:	Inhibit
	Payload Loop
	Line Loop
[8] DTE DS0 Format:	N x 56 Kbps
	N x 64 Kbps
[9] DTE Starting DS0:	1 through 24, or None
[A] DTE Rate:	56Kbps (1 DS0) through 1344 Kbps (24 DS0s) or 64Kbps (1 DS0) through 1536 Kbps (24 DS0s)

(Continued on next page)

Table 3-1 DeskTop T1 Configuration Option Settings (Continued)

Option	Potential Settings
[B] DTE Allocation:	Consecutive
	Alternate
[C] DTE CTS Control:	Forced ON
	Follow RTS
[D] DTE DCD Control:	Forced ON
	Follow OOF
[E] DTE DSR Control:	Forced ON
	Follow LOS
[F] DTE Invert Data	Normal
	Invert SD
	Invert RD
	Invert SD & RD
[G] DTE Invert Timing	Normal
	Invert SC
	Invert RC
	Invert SC & RC
	Auto
[H] DTE Split Timing	Disable
	Enable
[I] DTE Test Leads	Disable
	Enable

Diagnostics

The terminal interface DeskTop T1 Diagnostics function supports two screens: one by which you select and initiate tests on the DSU, and one that displays test results. The results screen also contains the control function for ending a test.

You can perform a wider variety of tests from the terminal than are available by means of the DSU front panel switches. When you perform a test that employs the DSU Self Test pattern generator and checker, the results displayed on-screen are more detailed than the error indication provided by the front panel TM LED.

Figure 3-3 illustrates the Diagnostics selection screen, and *Figure 3-4* illustrates the Diagnostics results screen. Detailed instructions for using these screens appear in *Chapter 4, Tests*, together with descriptions of the diagnostic functions.

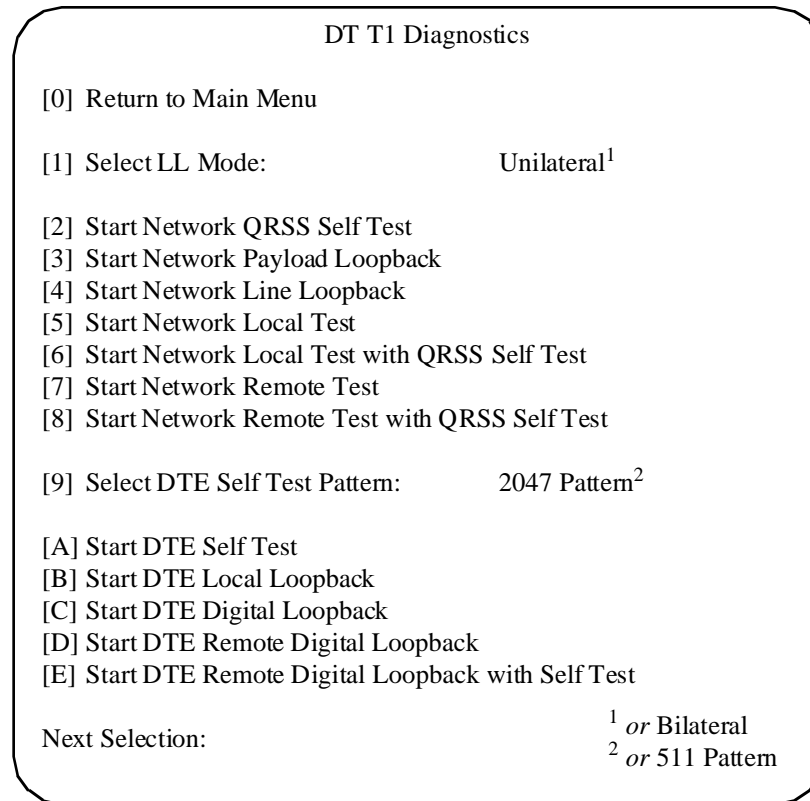


Figure 3-3 Diagnostics Selection Screen

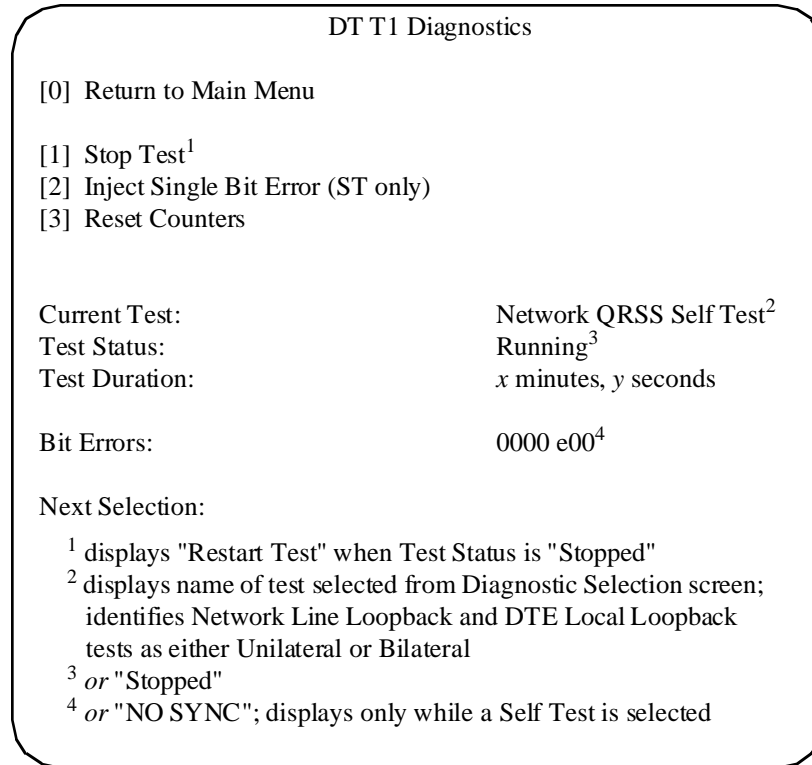


Figure 3-4 Diagnostics Results Screen

Monitor

The terminal interface DeskTop T1 Monitor function displays a screen of status information concerning DTE interface signals and alarm conditions.

Figure 3-5 illustrates the Monitor screen.

The DTE Status portion of the screen displays the current status of nine DTE interface signals as OFF, ON, or TRANS. TRANS indicates that the signal is transitioning, as opposed to being in a prolonged On

or Off condition.

The Alarm Status portion of the screen displays the current status, INACTIVE or ACTIVE, of the nine alarm conditions that the DSU can report. Definitions of the alarm conditions appear in *Appendix D, Alarm Definitions*.

When you are done viewing the Monitor screen, type 0 to return to the Main Menu.

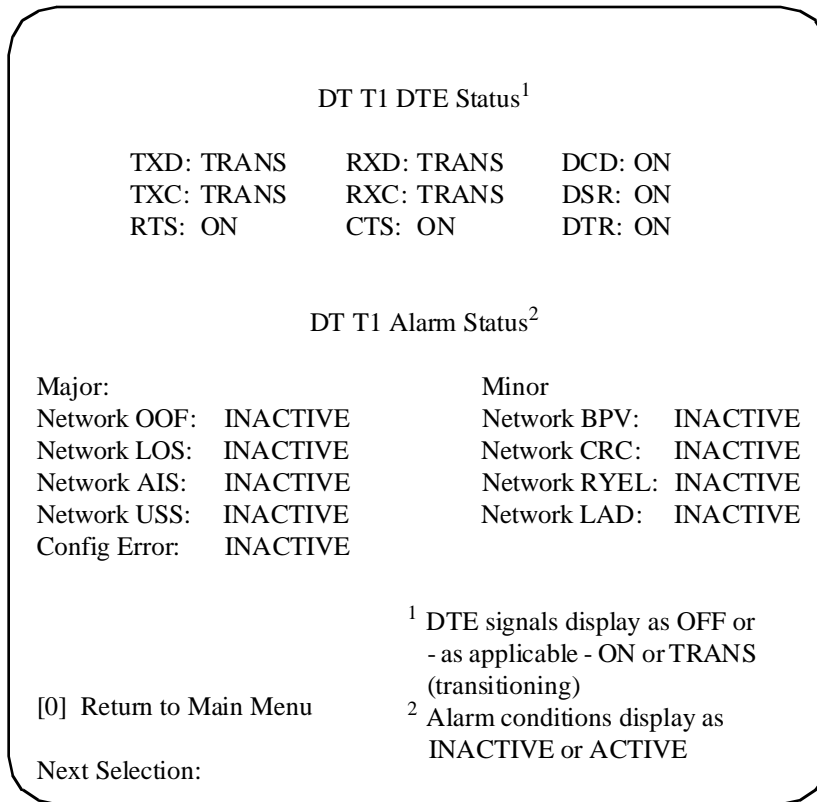


Figure 3-5 Monitor Screen

What Are You?

The terminal interface DeskTop T1 What Are You? function displays a screen of information that identifies the unit, its firmware revision level, and the type of DTE interface installed in it.

Figure 3-6 illustrates the What Are You? screen.

When you are done viewing the What Are You? screen, type 0 to return to the Main Menu.

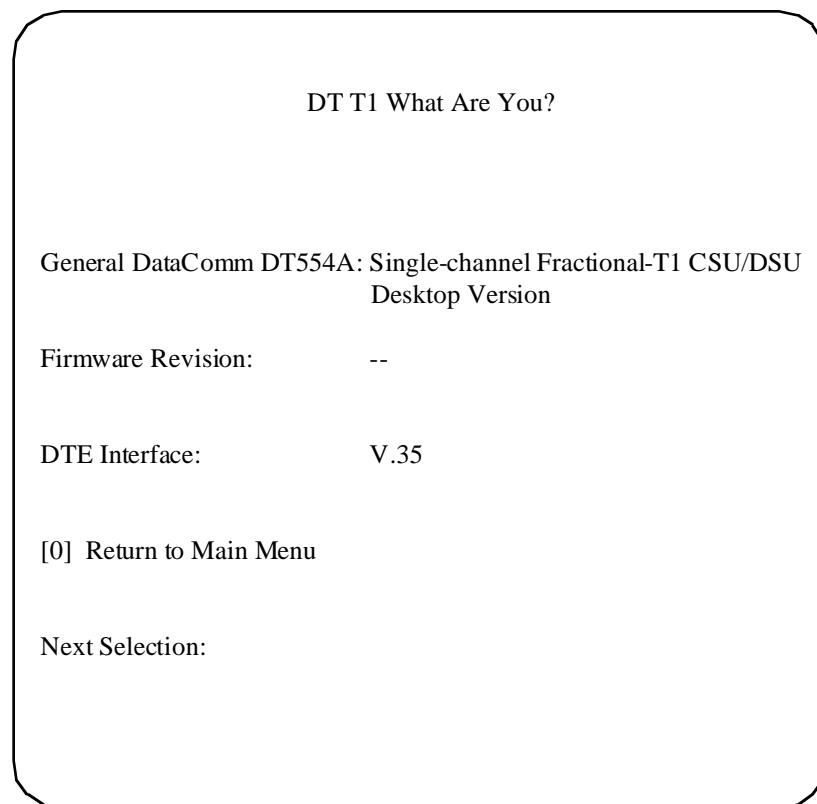


Figure 3-6 What Are You? Screen

4 Diagnostics

Overview

This chapter describes the test functions of the DeskTop T1 DSU and provides instructions for their use. There are three ways to control tests locally:

- Terminal Interface Diagnostics Selection screen enables you to command all DSU tests
- Front panel switches enable you to command all but three of the DSU tests
- DTE interface signals can command two tests – DTE Local and Remote Loopbacks.

The DSU can also be commanded remotely into tests that involve looping the networks signal back to be checked for errors at the remote site. The remote site DSU transmits inband loop codes to command remote loopbacks at the local unit. This chapter identifies the tests that can be commanded remotely.

The structure of the chapter is based on the terminal interface Diagnostic Selection screen since it includes all the the test functions. The other two means of diagnostic control are limited to subsets.

The table on the following page lists the available tests and how each can be commanded.

Test:	Can be commanded by –
Network QRSS Self Test	Terminal Interface, Front Panel Switch ST (T1 indicator, controlled by T1 switch, must be On)
Network Payload Loopback	Terminal Interface
Network Line Loopback	Terminal Interface, Front Panel Switch LL (T1 indicator, controlled by T1 switch, must be On)
Network Local Test	Terminal Interface
Network Local Test with QRSS Self Test	Terminal Interface
Network Remote Test	Terminal Interface, Front Panel Switch RL (T1 indicator, controlled by T1 switch, must be On)
Network Remote Test with QRSS Self Test	Terminal Interface, Front Panel Switches RL and ST (T1 indicator, controlled by T1 switch, must be On)
DTE Self Test	Terminal Interface, Front Panel Switch ST
DTE Local Loopback	Terminal Interface, Front Panel Switch LL, DTE Interface pin L
DTE Digital Loopback	Terminal Interface
DTE Remote Digital Loopback	Terminal Interface, Front Panel Switch RL, DTE Interface pin BB
DTE Remote Digital Loopback with Self Test	Terminal Interface, Front Panel Switches RL and ST

The local diagnostic functions work on a "first come, first served" basis: only one of the three means of control can be in effect at a time, and a test that has begun cannot be overridden by either of the other two types of control. While the terminal interface Diagnostic screens are open the DSU ignores the front panel switches and the DTE interface test leads.

Inband loop codes received from the remote site DSU take precedence over local diagnostic functions. If a locally initiated test is running when a loop code is received, the DeskTop T1 DSU terminates the test and performs the remote loopback.

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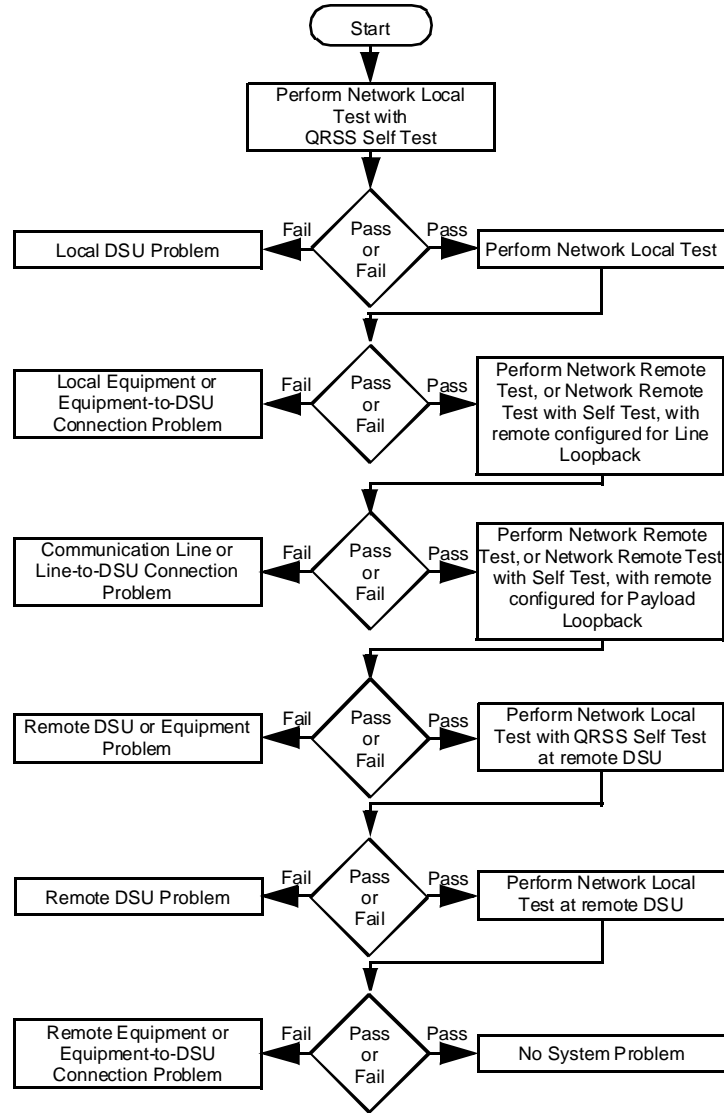


Figure 4-1 Fault Isolation Procedure

Tests can be used at the time of installation or whenever operation of the DSU must be checked. You can also use these tests as an aid in isolating problems in the data communications system (refer to *Figure 4-1, Fault-Isolation Procedure*).

Terminal Interface Test Procedure

All tests that you perform by means of the terminal interface involve the same basic procedure, which is described below. Descriptions of the individual tests appear on the following pages.

DT T1 Diagnostics

[0] Return to Main Menu

[1] Select LL Mode: Unilateral¹

[2] Start Network QRSS Self Test

[3] Start Network Payload Loopback

[4] Start Network Line Loopback

[5] Start Network Local Test

[6] Start Network Local Test with QRSS Self Test

[7] Start Network Remote Test

[8] Start Network Remote Test with QRSS Self Test

[9] Select DTE Self Test Pattern: 2047 Pattern²

[A] Start DTE Self Test

[B] Start DTE Local Loopback

[C] Start DTE Digital Loopback

[D] Start DTE Remote Digital Loopback

[E] Start DTE Remote Digital Loopback with Self Test

¹ or Bilateral

² or 511 Pattern

Next Selection:

Figure 4-2 Diagnostics Selection Screen

Employ the following procedure to initiate tests using the terminal interface:

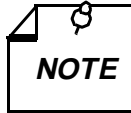
1. If the test is one that involves cooperation with an operator at a remote site, contact that person and make arrangements to perform the test. Tests that must be initiated (and later terminated) at both sites include end-to-end self tests, Line Loopbacks, and Payload Loopbacks.
2. Select [2] DIAGNOSTICS from the terminal interface Main Menu. The DSU responds by displaying the DeskTop T1 Diagnostics Selection screen, as shown in *Figure 4-1*.
3. Make any preliminary setups required for the test you intend to perform. Two selections fall into this category:

[1] Select LL Mode must be set correctly if you are doing a Network Line Loopback or a DTE Local Loopback. When Unilateral is selected the function creates only one loopback: incoming data back onto the T1 line in the case of the network test, or transmit data back as receive data in the case of the DTE test. When Bilateral is selected each test function loops data in both directions.

[9] Select DTE Self Test Pattern can be set to 2047 Pattern or 511 Pattern as needed for either of the two functions that involve DTE Self Test. This is particularly important when doing an end-to-end self test.

To change the setting of either of these

- A. Type the selection number or letter of the option you intend to change. Highlighting appears on the current setting field for the corresponding option.
- B. Use the left and right arrow keys to toggle the highlighted field through its potential settings.
- C. When the desired setting is displayed, press Enter.



A. The DSU must be optioned for Soft Configuration mode in order for you to perform LL Mode or DTE Self Test Pattern selection from the Diagnostics Selection screen. If you attempt either selection while the DSU is in Hard Configuration mode, the screen displays a message that the function is not available.

B. When the DSU is in Soft Configuration mode, changes you make to the LL Mode or DTE Self Test Pattern selection from the Diagnostics Selection screen also apply to how those functions operate in response to the front panel switches.

4. Type the selection number of the test you intend to perform. The DSU responds by initiating the test and displaying the DeskTop T1 Diagnostics results screen, as shown in *Figure 4-3*.

The Diagnostics Results screen displays four lines of information about the current test and a menu with four selections:

Current Test: identifies the test that is running, including Unilateral/Bilateral specification for Network Line Loopback or DTE Local Loopback.

Test Status: displays Running when the screen first appears; it displays Stopped when you select [1] Stop Test from the Results screen menu. The menu selection changes to [1] Restart Test when Stopped is displayed here.

Test Duration: displays how long the test has run.

Bit Errors: is displayed only when the Self Test function is in use; it normally displays the number of detected errors; it displays NO SYNC if no test pattern is being received during an end-to-end test.

In addition to [1] Stop/Restart Test, described together with Test Status above, and [0] Return to Main Menu the menu contains two selections:

[2] Inject Single Bit Error enables you to insert

an intentional error as check on the error detector when running a self test.

[3] Reset Counters clears both the Bit Errors count and the Test Duration.

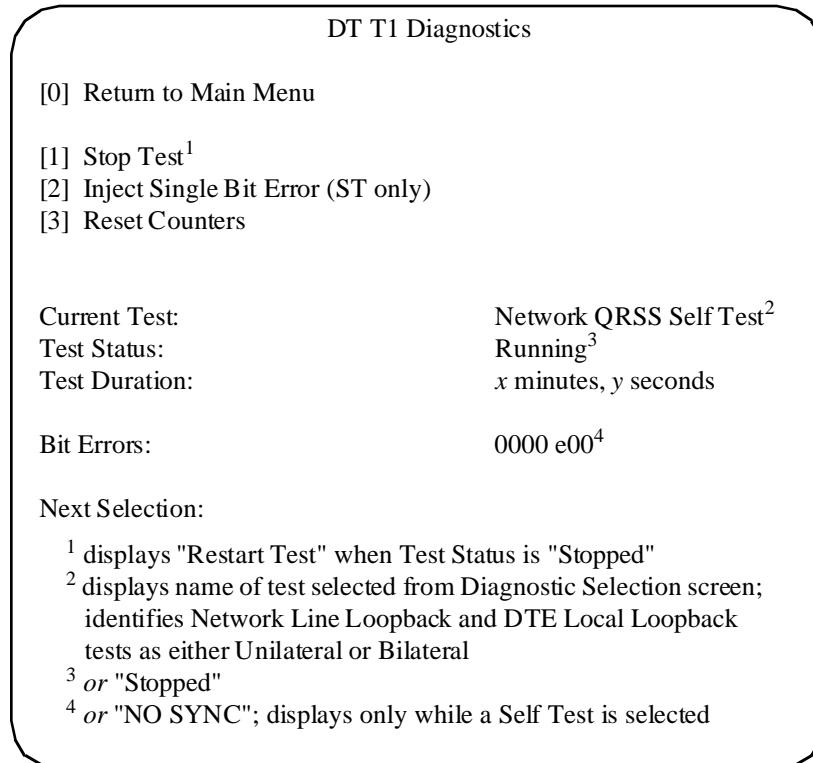


Figure 4-3 Diagnostics Results Screen

Network QRSS Self Test

The Network QRSS Self Test function provides test pattern generation and checking that involves the network interface while excluding the DTE interface. The pattern it provides is a quasi-random signal (QRSS).

The Network QRSS Self Test function appears three times in the terminal interface Diagnostics Selection menu: once by itself and twice in combination with loopback tests. The loopback-with-self test functions are discussed on later pages under their own headings.

You can use the Network QRSS Self Test function by itself to perform an End-to-End Self Test as illustrated in *Figure 4-4*. You can command the test by means of either the terminal interface screen or the front panel switches. Use of the terminal interface provides greater detail in the test results. The test requires the cooperation of an operator at the remote site to initiate the function in the remote DSU, observe the results, and terminate the function.

In the Network End-to-End Self Test, two DSUs transmit internally generated 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 checker determines if the data it receives matches that which was transmitted. The test checks both DSUs and the T1 link.

To initiate the test from the terminal interface Diagnostics Selection screen, select [2] Start Network QRSS Self Test.

Figure 4-5 shows the switches and indicators that are involved when you command a Network End-to-End Self Test from the front panel. Remember that when you initiate the test from the front panel the only display of results is the TM indicator flashing in response to detected errors. The terminal interface Diagnostics Results screen does not display the results of tests initiated from the front panel.

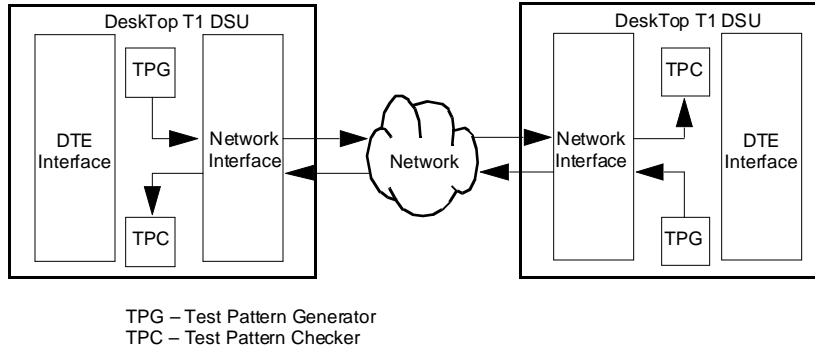


Figure 4-4 Data Path for Network End-to-End Self Test

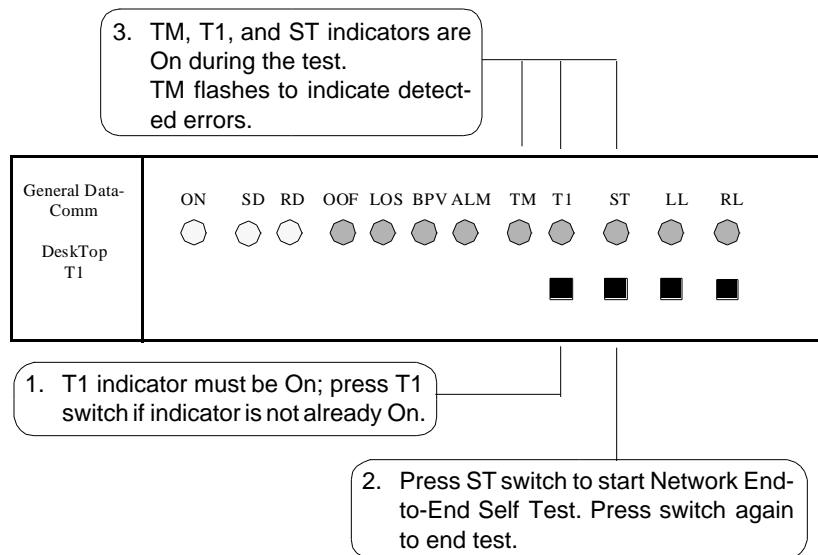


Figure 4-5 Network End-to-End Self Test, Front Panel Control

Network Payload Loopback

The Network Payload Loopback function provides a data path for a test signal that is originated and checked at the remote site. The Payload Loopback, illustrated in *Figure 4-6*, loops back onto the T1 line only the receive DS0s that carry DTE channel data. The loopback occurs at a point within the DSU at which the data has already passed through most of the network interface circuitry.

You can command the loopback by means of either the terminal interface screen or the front panel switches:

- On the terminal interface Diagnostic Selection screen this function is selection [3] Start Network Payload Loopback. You can command the payload loopback from the terminal interface regardless of how DSU hardware configuration switches are set.
- The Network Payload Loopback function is performed as part of the DTE Local Loopback when DSU hardware configuration switch S10-4, LL Switch Mode, is set to Bilateral (Off). *Figure 4-18* shows how to perform the DTE Local Loopback using the front panel switches.

The payload loopback can also be initiated by a loop code transmitted to the local DSU from the remote site. Local DSU optioning determines whether it can be commanded into the loopback by the remote. For the DSU to accept the remote payload loop code, set switches S14-5 & -6 to 5 On, 6 Off.

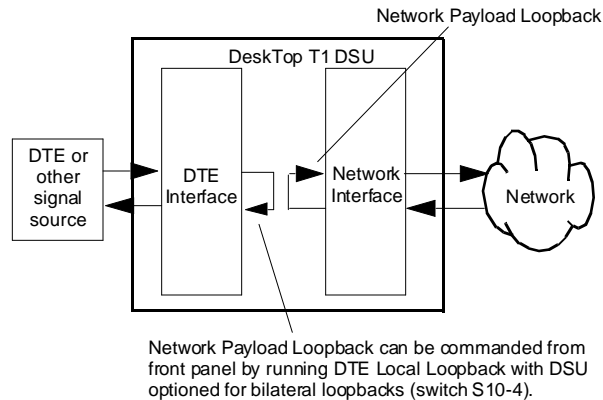


Figure 4-6 Data Path for Network Payload Loopback

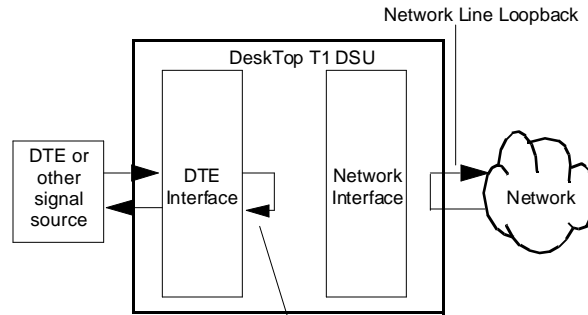
Network Line Loopback

The Network Line Loopback function provides a data path for a test signal that is originated and checked at the remote site. The Line Loopback, illustrated in *Figure 4-7*, loops back the entire T1 line. The loopback occurs at a point within the DSU at which the data has passed through only a minimum of the network interface circuitry.

You can command the loopback by means of either the terminal interface screen or the front panel switches:

- On the terminal interface Diagnostic Selection screen this function is selection [4] Start Network Line Loopback.
- *Figure 4-8* shows the switches and indicators that are involved when you command a Network Line Loopback from the front panel. The DSU also establishes a DTE Local Loopback when DSU hardware configuration switch S10-4, LL Switch Mode, is set to Bilateral (Off).

The line loopback can also be initiated by a loop code transmitted to the local DSU from the remote site. Local DSU optioning determines whether it can be commanded into the loopback by the remote. For the DSU to accept the remote line loop code, set switches S14-5 & -6 to 5 Off, 6 On.



When DSU is optioned for bilateral loopbacks (switch S10-4) a DTE Local Loopback is also initiated when Network Line Loopback is commanded.

Figure 4-7 Data Path for Network Line Loopback

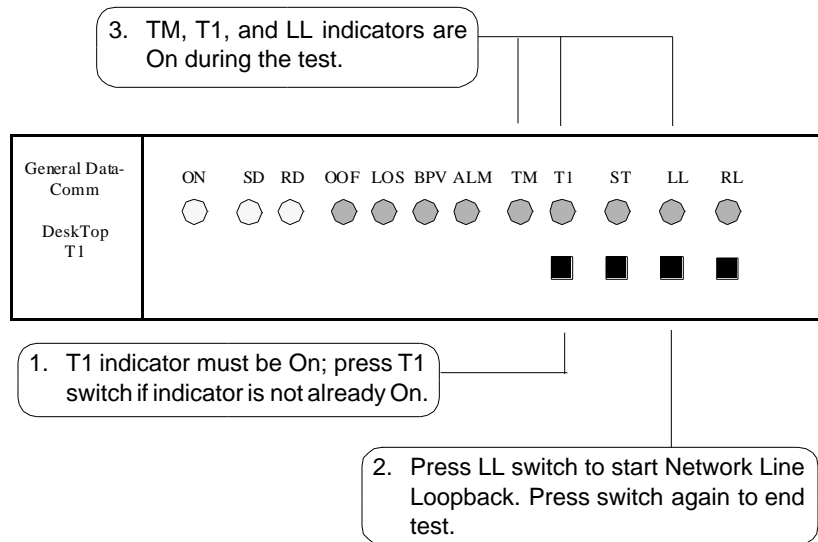


Figure 4-8 Network Line Loopback, Front Panel Control

Network Local Test

The data path for the Network Local Test is illustrated in *Figure 4-9*. This test can only be commanded from the terminal interface Diagnostics Selection screen.

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 DTE interface remains active so that a test signal can be generated and checked by an external device.

Local Test checks the local DSU, 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.

To initiate the loopback from the Diagnostics Selection screen, select [5] Start Network Local Test.

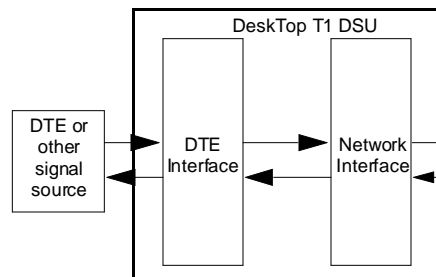


Figure 4-9 Data Path for Network Local Test

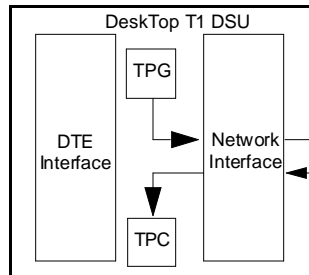
Network Local Test with QRSS Self Test

The data path for the Network Local Test with QRSS Self Test is illustrated in *Figure 4-10*. This test can only be commanded from the terminal interface Diagnostics Selection screen.

The DSU generates a QRSS test pattern, loops the transmit signal back to the receive path at the network interface, and checks the returned test pattern for errors. While the loop is in effect the DSU transmits an Alarm Indication Signal (all ones) on the T1 line. The DSU is electronically disconnected from its DTE during the test.

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

To initiate the test from the Diagnostics Selection screen, select [6] Start Network Local Test with QRSS Self Test.



TPG – Test Pattern Generator
TPC – Test Pattern Checker

Figure 4-10 Data Path for Network Local Test with Self Test

Network Remote Test

The data path for the Network Remote Test is illustrated in *Figure 4-11*. You can command the loopback by means of either the terminal interface screen or the front panel switches.

When you initiate a Network 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).

After the loop is established, connect test equipment to the local DSU DTE interface. Generate a test message. The test equipment should receive back the same message it transmits. A problem exists if it does not.

Network Remote Test with a Line loopback tests the line and the network interface at the remote DSU. Network Remote Test with a Payload loopback extends the test to include network interface circuitry at the remote DSU.

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To initiate the test from the terminal interface Diagnostics Selection screen, select [7] Start Network Remote Test.

Figure 4-12 shows the switches and indicators that are involved when you command a Network Remote Test from the front panel.

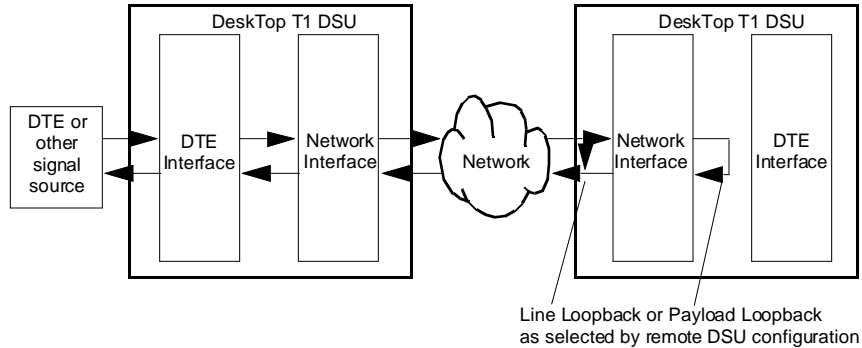


Figure 4-11 Data Path for Network Remote Test

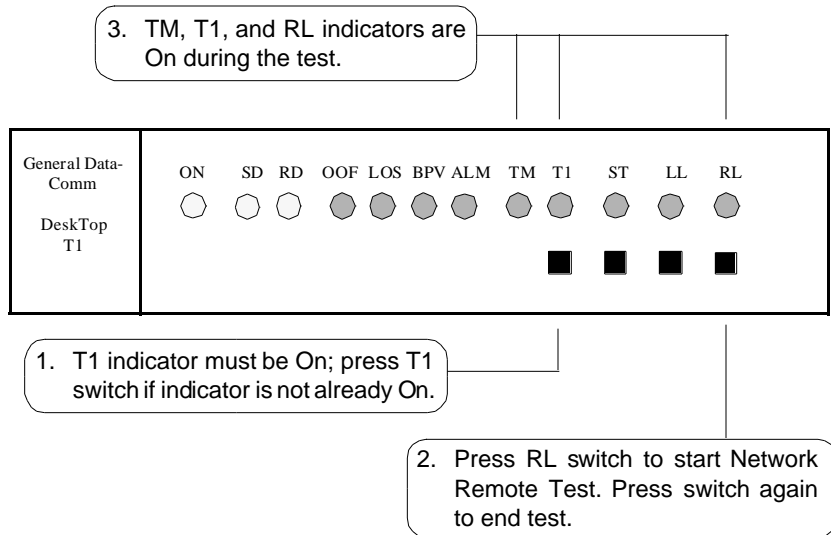


Figure 4-12 Network Remote Test, Front Panel Control

Network Remote Test with QRSS Self Test

The data path for the Network Remote Test with QRSS Self Test is illustrated in *Figure 4-13*. You can command the loopback by means of either the terminal interface screen or the front panel switches.

When you initiate a Network 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).

When the loop is established the DSU generates a QRSS test pattern and transmits it to the remote DSU which loops it back to be checked for errors at the local DSU. The DSUs are electronically disconnected from their DTEs during the test.

Network Remote Test with a Line loopback tests the line and the network interface at the remote DSU. Network Remote Test with a Payload loopback extends the test to include network interface circuitry at the remote DSU.

To initiate the test from the terminal interface Diagnostics Selection screen, select [8] Start Network Remote Test with QRSS Self Test.

Figure 4-14 shows the switches and indicators that are involved when you command a Network Remote Test with QRSS Self Test from the front panel.

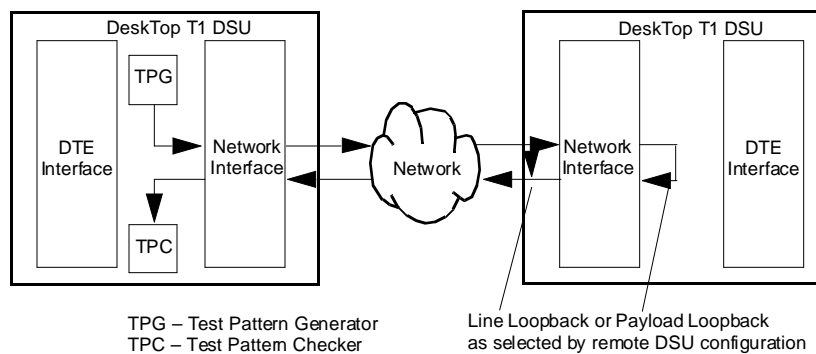


Figure 4-13 Data Path for Network Remote Test with Self Test

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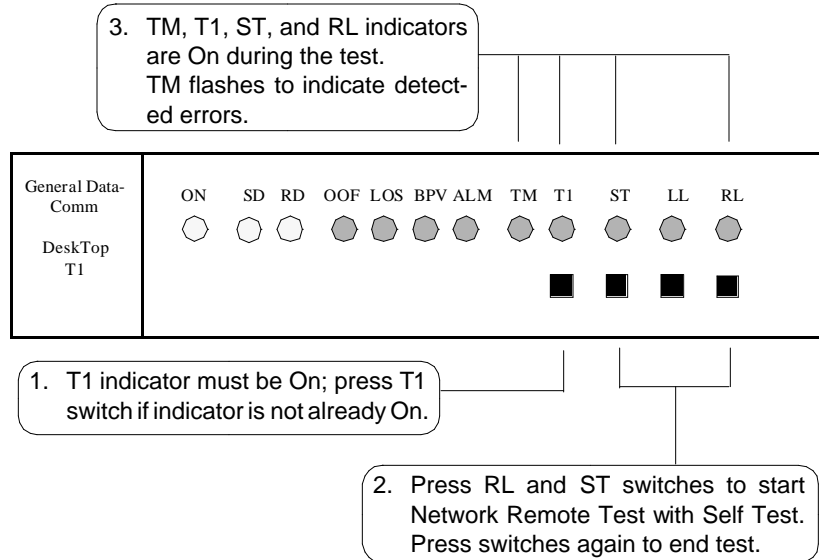


Figure 4-14 Network Remote Test with Self Test, Front Panel Control

DTE Self Test

The DTE Self Test function provides test pattern generation and checking that involves the DTE interface. The test pattern is selectable to be either a 2047-bit or a 511-bit pattern. You can select the pattern by means of hardware switch S10-3 or by means of the terminal interface DeskTop T1 Diagnostics Selection screen, [9] Select DTE Self Test Pattern.

The DTE Self Test function can be initiated from two selections in the terminal interface Diagnostics Selection menu: once by itself and once in combination with a loopback test. The Remote Digital Loopback with Self Test is discussed on a later page under its own heading.

You can use the DTE Self Test function by itself to perform an End-to-End Self Test as illustrated in *Figure 4-15*. You can command the

test by means of either the terminal interface screen or the front panel switches. Use of the terminal interface provides greater detail in the test results. The test requires the cooperation of an operator at the remote site to initiate the function in the remote DSU, observe the results, and terminate the function.

In the DTE End-to-End Self Test, two DSUs transmit internally generated 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 checker determines if the data it receives matches that which was transmitted. The test checks both DSUs and the T1 link.

To initiate the test from the terminal interface Diagnostics Selection screen, select [A] Start DTE Self Test.

Figure 4-16 shows the switches and indicators that are involved when you command a DTE End-to-End Self Test from the front panel. Remember that when you initiate the test from the front panel the only display of results is the TM indicator flashing in response to detected errors. The terminal interface Diagnostics Results screen does not display the results of tests initiated from the front panel.

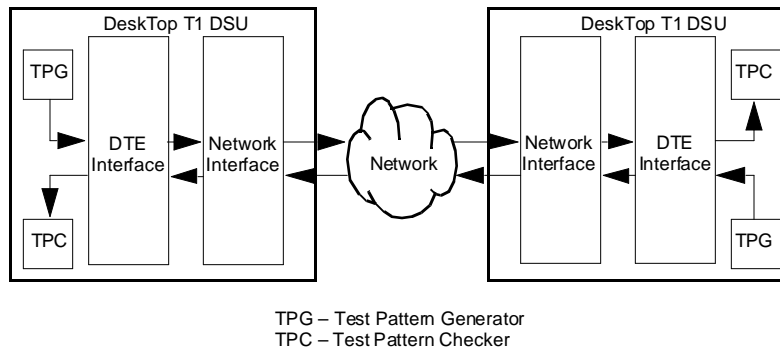


Figure 4-15 Data Path for DTE End-to-End Self Test

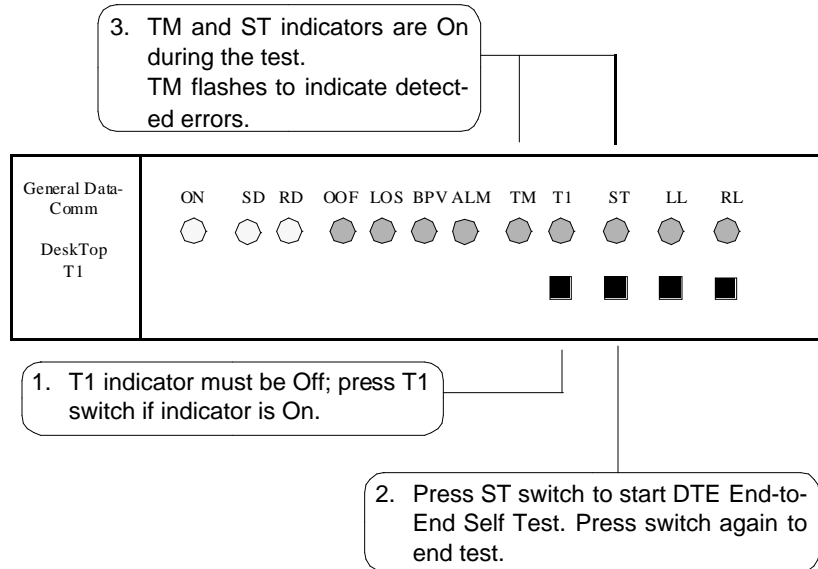


Figure 4-16 DTE End-to-End Self Test, Front Panel Control

DTE Local Loopback

The data path for the DTE Local Loopback is illustrated in *Figure 4-17*. The DSU loops the transmit signal back to the receive path just beyond the DTE interface, which remains active so that a test signal can be generated and checked by an external device.

DTE Local Loopback checks the DTE interface and the DTE-to-DSU connection. Error detection and reporting is entirely the responsibility of the external device that supplies the test signal.

To initiate the loopback from the Diagnostics Selection screen, select [B] Start DTE Local Loopback.

Figure 4-18 shows the switches and indicators that are involved when you command a DTE Local Loopback from the front panel. You can also command the test by means of DTE interface pin L when the DTE Test Leads configuration option is enabled (switch S10-2 On).

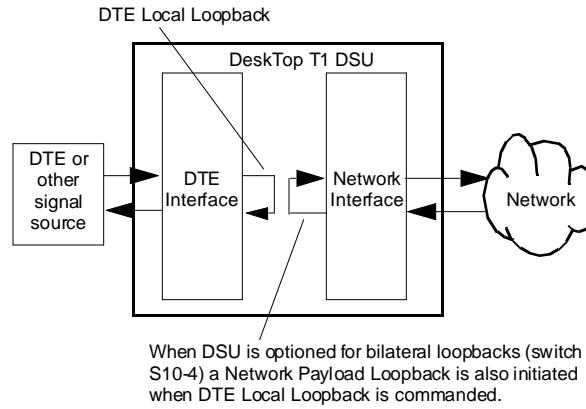


Figure 4-17 Data Path for DTE Local Loopback

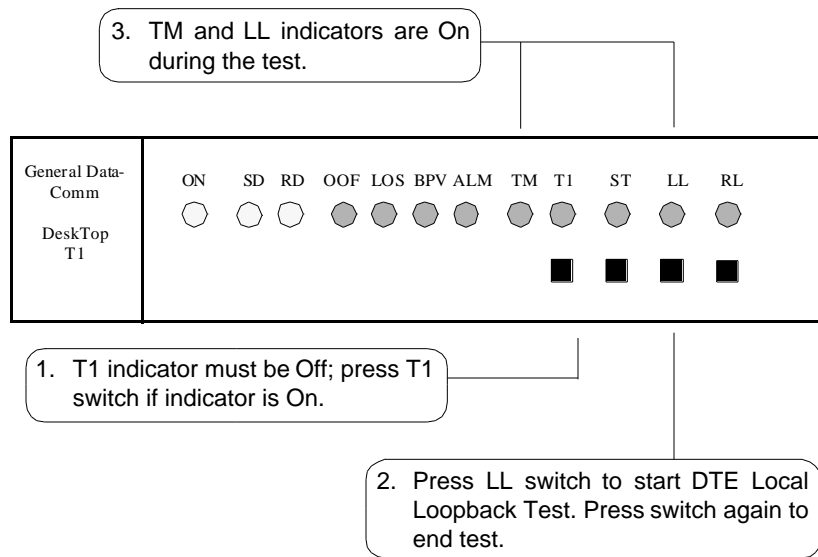


Figure 4-18 DTE Local Loopback, Front Panel Control

DTE Digital Loopback

The DTE Digital Loopback function provides a data path for a test signal that is originated and checked at the remote site. The Digital Loopback, illustrated in *Figure 4-19*, loops receive data back through the transmit portion of the DTE interface.

You can command the loopback only by means of the terminal interface DeskTop T1 Diagnostics Selection screen.

To initiate the loopback from the terminal interface DeskTop T1 Diagnostics Selection screen, select [C] Start DTE Digital Loopback.

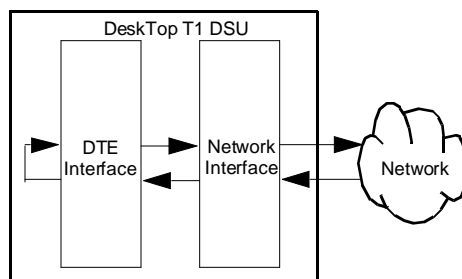


Figure 4-19 Data Path for DTE Digital Loopback

DTE Remote Digital Loopback

The data path for the DTE Remote Digital Loopback is illustrated in *Figure 4-20*. You can command the loopback by means of the terminal interface screen, the front panel switches, or a signal on the DTE interface.

When you initiate a DTE Remote Digital Loopback the DSU transmits a PN127 code to the remote unit. The remote unit responds by establishing a digital loopback toward the local DSU. After the loop is established, connect test equipment to the local DSU DTE interface. Generate a test message. The test equipment should receive back the same message it transmits. A problem exists if it does not. DTE Remote Digital Loopback tests the local DSU, the line, and most of the the remote DSU.

To initiate the test from the terminal interface Diagnostics Selection screen, select [D] Start DTE Remote Digital Loopback.

Figure 4-21 shows the switches and indicators that are involved when you command a DTE Remote Digital Loopback from the front panel.

You can also command the test by means of DTE interface pin BB when the DTE Test Leads configuration option is enabled (switch S10-2 On).

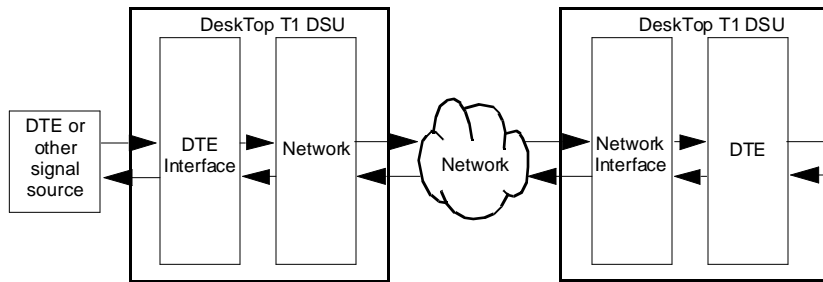


Figure 4-20 Data Path for DTE Remote Digital Loopback

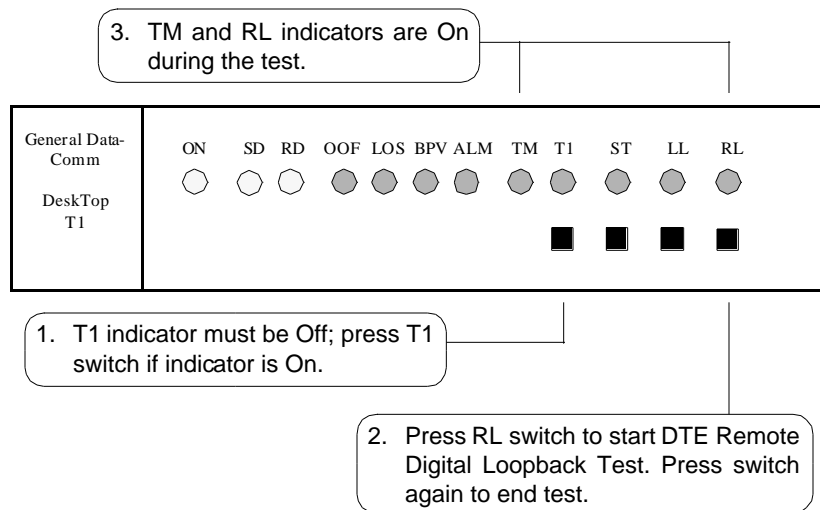


Figure 4-21 DTE Remote Digital Loopback, Front Panel Control

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DTE Remote Digital Loopback with Self Test

The data path for the DTE Remote Digital Loopback with Self Test is illustrated in *Figure 4-22*. You can command the loopback by means of the terminal interface screen or the front panel switches.

When you initiate a DTE Remote Digital Loopback with Self Test the DSU transmits a PN127 code to the remote unit. The remote unit responds by establishing a digital loopback toward the local DSU.

When the loop is established the DSU generates the selected test pattern and transmits it to the remote DSU which loops it back to be checked for errors at the local DSU. The DSUs are electronically disconnected from their DTEs during the test.

To initiate the test from the terminal interface Diagnostics Selection screen, select [E] Start DTE Remote Digital Loopback with Self Test.

Figure 4-23 shows the switches and indicators that are involved when you command a DTE Remote Digital Loopback with Self Test from the front panel.

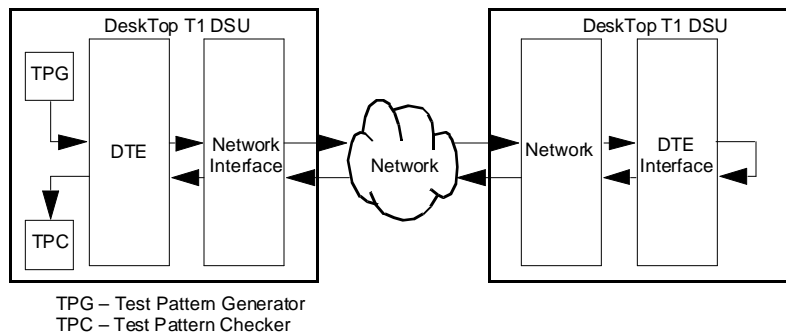


Figure 4-22 Data Path for DTE Remote Digital Loopback with Self Test

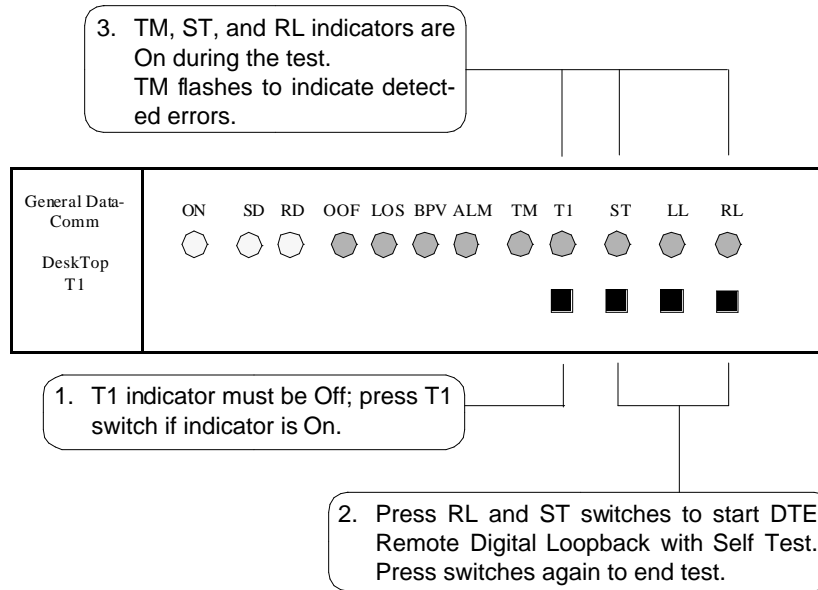


Figure 4-23 DTE Remote Digital Loopback with Self Test, Front Panel Control

A Technical Characteristics

Item	Characteristic
Physical	
PC card assembly in enclosure	
Height	1.4 in. (36 mm)
Width	7.4 in. (188 mm)
Depth	11.0 in. (279 mm)
Weight	1 lb. (0.45 kg)
Shipping weight	2 lb. (0.9 kg)
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	99 to 129 V ac
Frequency	60 Hz
Power dissipation	20 W maximum
Fusing (pc card)	Two 1.0 A, 250 V, 3AG (GDC Part No. 215300-100)

(Continued on next page)

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Item	Characteristic
Electrical (Continued)	
Data rates	N x 64 kbps or N x 56 kbps (N = 1 to 24); maximum aggregate (payload) rate of 1,536,000 bps (1,544,000 bps in unframed mode)
Communication line	T1 digital carrier (non-loaded, staggered-twist ABAM, PIC, or pulp-insulated exchange-type cable, 19 to 26 gauge)
Line impedance	100 Ω
Network port physical interface	RJ48C modular jack
Network port physical interface	RJ48C modular jack
Network transmitter	<p>Frequency</p> <p>Pulse amplitude — with surge protection</p> <p>Unbalance in height of adjacent negative and positive pulses</p> <p>Width of output pulse (half amplitude)</p> <p>Unbalance in width of positive and negative pulses</p> <p>Time between two consecutive pulses of opposite polarity</p> <p>Maximum rise or falling time</p> <p>Overshoot at trailing edge of pulse</p> <p>Line Build-Out</p>
	1,544,000 bps \pm 50 bps
	2.40 to 3.60 V at 60°F — may vary over a cycle of 60 Hz current.
	200 mV (maximum)
	324 nsec \pm 45 nsec
	20 nsec (maximum)
	648 nsec \pm 15 nsec (measured at half amplitude point of leading edges)
	100 nsec
	10% to 30% of pulse amplitude
	0, 7.5, 15, or 22.5 dB (selectable or automatic) at 772 kHz

(Continued on next page)

Item	Characteristic
Electrical (Cont.)	
Timing source	Internal clock, external clock, slave (received timing loopback)
Network receiver	
Operating range	0 to 30 dB of cable loss at 772 kHz (relative to 3.0V launch pulse)
Input impedance	100 Ohm
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 feet of line length
Impedance	100Ω
Channel port (customer equipment) interface	One ITU-T V.35-compatible synchronous serial data port
Physical interface	ITU-T V.35 (34-pin female connector)
T1 compatibility	
Data encoding	AMI with no bipolar violations, and B8ZS
Clear Channel Capability	B8ZS
Network interface	1.544 Mbps channelized DS1 in consecutive or alternate DS0s (complies with AT&T 54019A specifications for FT1 transmission) Can be optioned for unchannelized operation.

(Continued on next page)

Item	Characteristic
Electrical (Cont.)	
Consecutive zeros enforcement	8 x (N+1) when configured for AMI, consecutive, N x 64, framed; or AMI, unframed
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, unframed option
Alarms and status conditions	Out of Frame (OOF), Alarm Indication Signal (AIS or Blue alarm), Loss of Signal (LOS)
Diagnostics	Network Self-Test; Network Line Loop; Network Payload Loop; Network Local Test, with Self-Test; Network Remote Test, with Self-Test; DTE Self-Test; DTE Local Loop; DTE Digital Loop; DTE Remote Digital Loop, with Self-Test. Front panel test switch EIA test leads for LL, RL

B Interface Signals

Table B-1 ITU-T V.35

34-Pin Pin No.	Function	Direction
A	Frame Ground, AA	n/a
P	Send Data (a), BA	To DSU
S	Send Data (b), BA	To DSU
R	Rcv Data (a), BB	From DSU
T	Rcv Data (b), BB	From DSU
C	RTS, CA	To DSU
D	CTS, CB	From DSU
E	DSR, CC	From DSU
B	Sig Gnd, AB	n/a
F	DCD, CF	From DSU
L	LL	To DSU
U	Ext Clk (a), DA	To DSU
W	Ext Clk (b), DA	To DSU
V	Rcv Clk (a), DD	From DSU
X	Rcv Clk (b), DD	From DSU
Y	Tx Clk (a), DB	From DSU
AA	Tx Clk (b), DB	From DSU
H	DTR, CD	To DSU
BB	RDL, RL	To DSU
K	Test Mode, TM	From DSU

C Timing Options

Overview

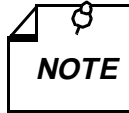
The flexibility and complexity of the timing options for the DeskTop T1 DSU require explanations that are more detailed than those normally provided. This appendix therefore describes details and applications of the DeskTop T1 DSU timing options:

- 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. The timing option descriptions are followed by some representative network applications that show 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 DeskTop T1 DSU supports other timing options as well, for use in applications where timing from the network clock is either not available or not applicable.



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 DeskTop T1 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.

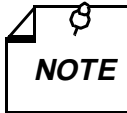
The default timing option for the DeskTop T1 DSU is Receive Timing, used when the network provides the timing source. When the network does not provide the timing source, one DeskTop T1 DSU must use Internal Timing (or DTE Timing when customer equipment connected to it provides timing) and the others must use Receive Timing. When the network and the customer equipment both provide timing, you may need to use DTE Split Timing, a combination of Receive Timing and DTE Timing.

One thing is common to all DeskTop T1 DSU timing options: the DSU uses the clock it recovers from network receive data 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 C-1*:

- With Receive 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 DTE Timing, the customer equipment connected to the DSU provides its own transmit clock signal, from which the DeskTop

T1 DSU derives a master clock. For this method, the DTE must be the master source of timing.

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



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 DTE port, however, the data rate may be from 56 Kbps to 1.536 Mbps (1.544 Mbps when using unframed mode). The DeskTop T1 DSU compensates for the difference in data rates by translating the clock frequency when passing it from one port to another.

Table C-1 Timing Option Reference

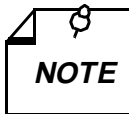
Timing Option	Master Clock Source			Ch. Trans. Clock Source	
	Net.	INT	DTE	Net.	DTE
Receive Timing	☑			☑	
Internal Timing		☑		☑	
DTE Timing			☑		☑
DTE Split Timing	☑				☑

Receive Timing

With Receive Timing, illustrated in *Figure C-1*, the network (or a device at the remote end) provides the timing source (1). The DeskTop T1 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 Receive Timing when using the DeskTop T1 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.



Select the appropriate timing option for the customer equipment. The DeskTop T1 DSU provides transmit timing on the DTE interface Tx Clk lead.

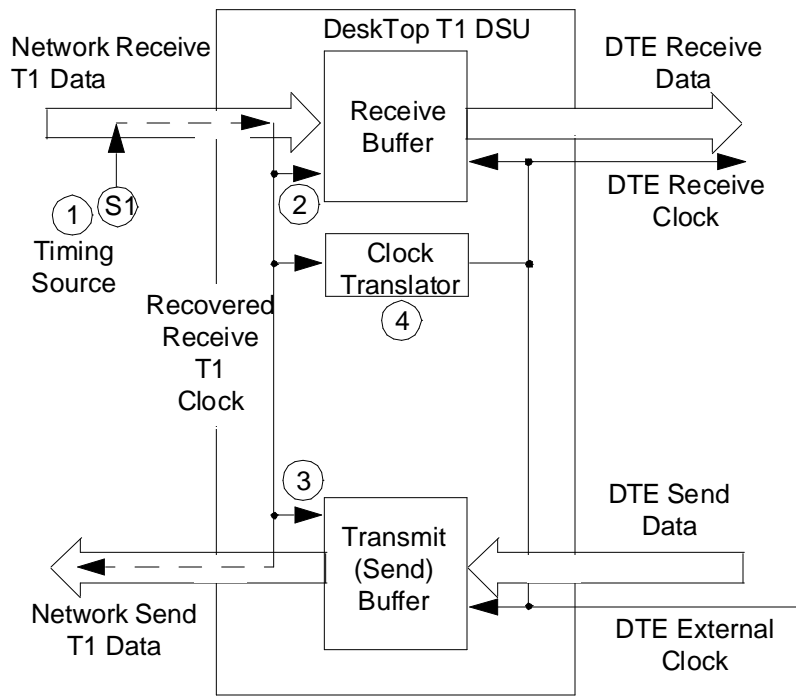
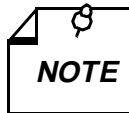


Figure C-1 Receive Timing

Internal Timing

With Internal Timing, illustrated in *Figure C-2*, the DeskTop T1 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 DeskTop T1 DSU (4). The DeskTop T1 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 DeskTop T1 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 DeskTop T1 DSU in a private network that does not provide timing (e.g., a non-DACS based service).



- a. *Configure only one DeskTop T1 DSU in your network for Internal Timing, and configure the others for Receive Timing.*
- b. *Select the appropriate timing option for the customer equipment: The DeskTop T1 DSU provides transmit timing on the DTE interface Tx Clk lead.*

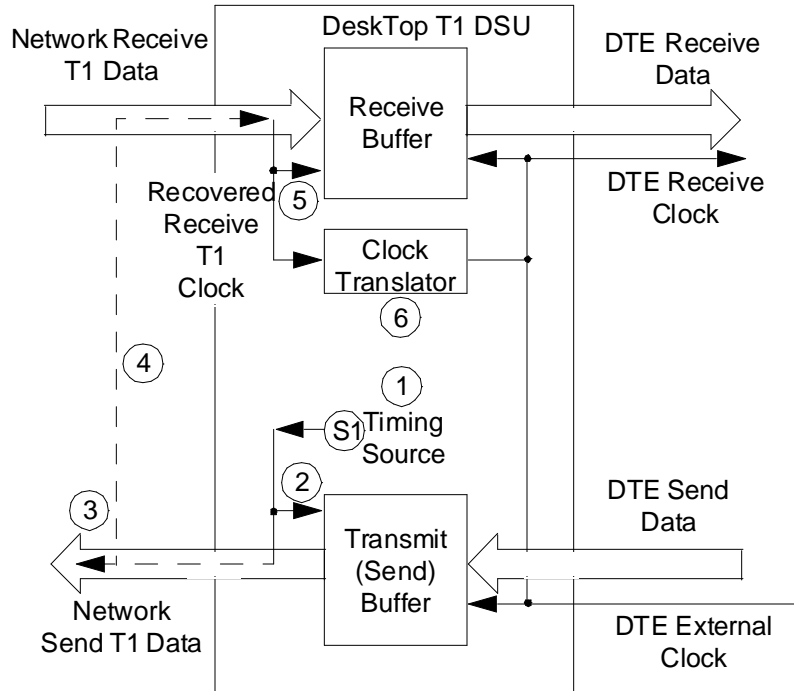


Figure C-2 Internal Timing

DTE Timing

With DTE Timing, illustrated in *Figure C-3*, the customer equipment connected to the DSU DTEI interface provides its own channel transmit clock signal (1) on the appropriate interface lead. The DeskTop T1 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 DeskTop T1 DSU (5). The DeskTop T1 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 DeskTop T1 DSU also translates (7) the receive T1 clock to provide the receive clock signals for the channel on the appropriate interface leads.

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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 DeskTop T1 DSU in a private network with the customer equipment supplying the clock.



Select the appropriate timing option for the customer equipment: The DeskTop T1 DSU expects external timing on the DTE interface Ext Clk lead.

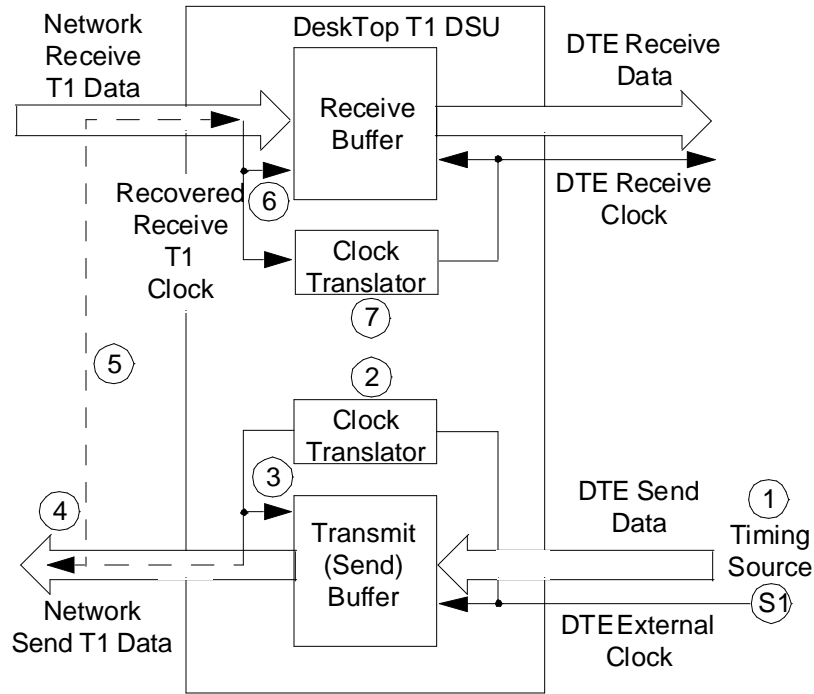


Figure C-3 DTE Timing

DTE Split Timing

DTE Split Timing, illustrated in *Figure C-4*, is a combination of Receive Timing and DTE Timing that utilizes two clock sources. As in Receive Timing, the network (or a device at the remote end) provides one timing source (1). The DeskTop T1 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 DeskTop T1 DSU also translates (4) the receive T1 clock to provide the receive clock signal, on the appropriate interface lead. As in DTE 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 DeskTop T1 DSU uses it for nothing else.

Select DTE Split Timing when there are timing sources provided by both the network and the customer equipment.



- a. *Select the appropriate timing option for the customer equipment: The DeskTop T1 DSU expects external timing on the DTE interface Ext Clk lead.*
- b. *All timing options that include split timing require every timing source to be traceable to the same Stratum 1 clock.*

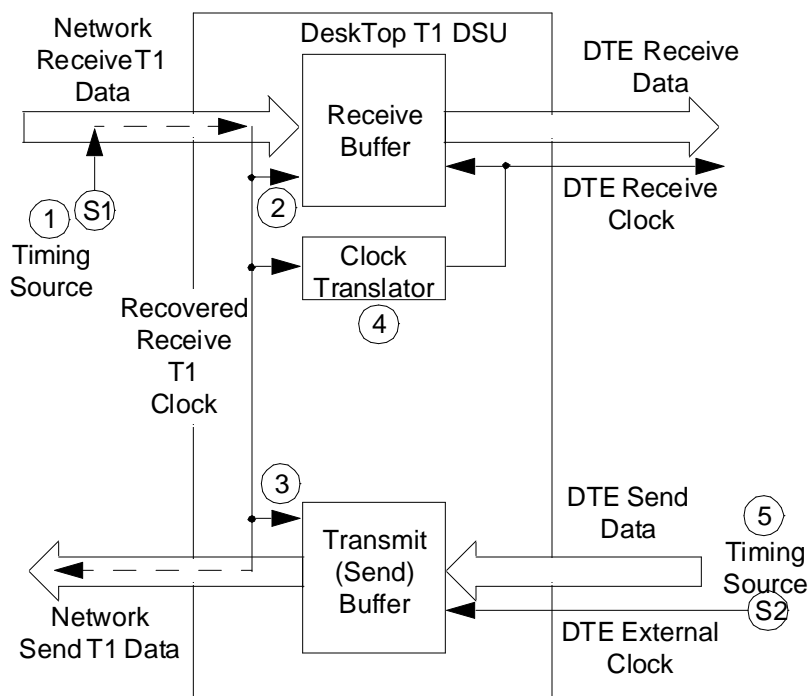


Figure C-4 DTE Split Timing

Typical Network Applications

Although you can use the DeskTop T1 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.

Back-to-Back Application

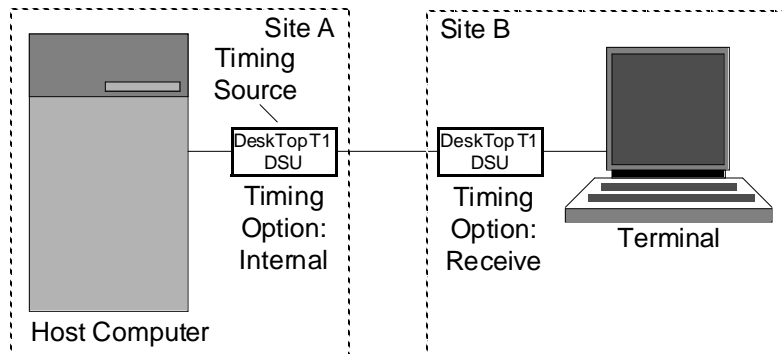
In an in-house data communications network, two DeskTop T1 DSUs are connected back-to-back. The only component connecting them is cable, so there is no network to provide the timing source.

If the customer equipment connected to the channel cannot provide

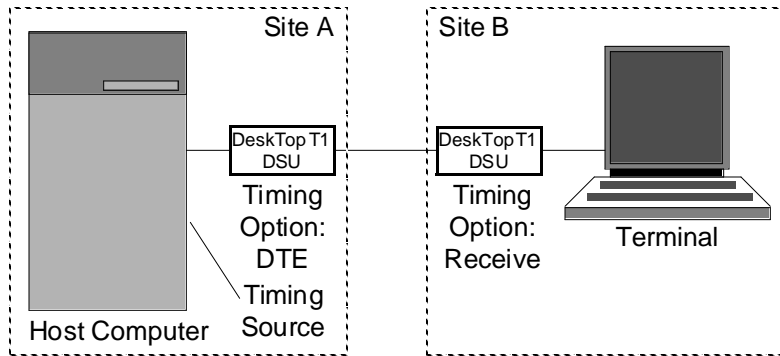
timing, select Internal Timing for the master or host end, and select Receive Timing for the other, as shown in *Figure C-5 A*. In this example, the DeskTop T1 DSU at Site A is configured for Internal Timing, making it the timing source.

If the customer equipment is to provide an external timing source, select Channel Timing for the DeskTop T1 DSU connected to that equipment and select Receive Timing for the other, as shown in *Figure C-5 B*. In this example, the host computer at Site A is providing timing, so its DeskTop T1 DSU is configured for Channel Timing.

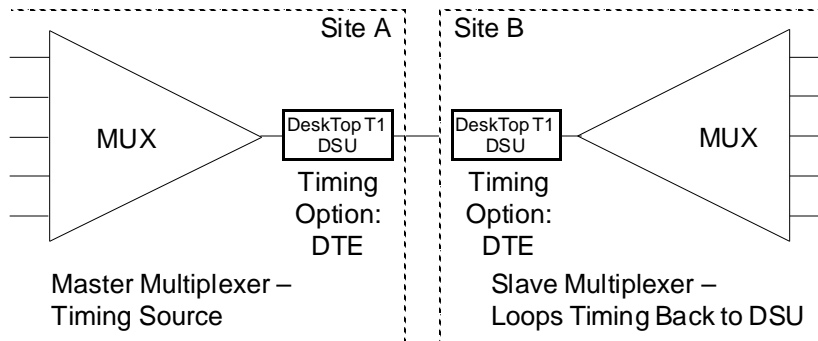
In the master/slave multiplexer application illustrated in *Figure C-5 C*, the multiplexer at Site A is configured as the master (i.e., the timing source) and the multiplexer at Site B is configured as a slave. With Channel Timing selected for both DeskTop T1 DSUs, the master multiplexer provides timing and the slave multiplexer loops back timing so timing is dependent on the customer equipment.



A. DeskTop T1 DSU at Site A Supplies Timing



B. Customer Equipment at Site A Supplies Timing



C. Master/Slave Multiplexer Timing

Figure C-5 Typical Back-to-Back Applications

D Alarm Definitions

Overview

This appendix describes the DeskTop T1 DSU alarms that can appear on the terminal interface Monitor screen Alarm Status display:

Network OOF	(Network Out of Frame)
Network LOS	(Network Loss of Signal)
Network USS	(Network Unavailable Signal State)
Network AIS	(Network Alarm Indication Signal)
Network BPVS	(Network Bipolar Violations)
Network CRCS	(Network Cyclic Redundancy Checksum)
Network RYEL	(Network Received Yellow Alarm)
Network LAD	(Network Low Average Density)
Config Error	(Configuration Error)

Network Alarms

Network Out Of Frame

A Network Out Of Frame (NETWORK OOF) alarm event occurs when the DSU misses two out of four framing bits in the signal coming from the network. The front panel OOF indicator reflects the current status of DSU-to-network synchronization.

Network Loss Of Signal

A Network Loss of Signal (NETWORK LOS) alarm event occurs when the DSU senses an absence of network signal. The absence of signal for a time equivalent to 175 bits (± 75) is considered no signal. The front panel LOS indicator reflects the current status of the network signal condition.

Network Unavailable Signal State

A Network Unavailable Signal State (NETWORK USS) alarm event occurs when 10 consecutive severely errored seconds occur. It ends when the DSU has processed 10 consecutive seconds of data without the occurrence of a severely errored second.

Network Alarm Indication Signal

A Network Alarm Indication Signal (NETWORK AIS) alarm event occurs when the DSU receives an AIS from the network.

Network Bipolar Violations

A Network Bipolar Violation (NETWORK BPV) alarm event occurs when the signal the DSU receives from the network does not alternate between signal levels as required for Alternate Mark Inversion (AMI) or Bipolar with 8 Zero Substitution (B8ZS) data encoding.

The front panel BPV indicator reflects the current status of BPV error events.

Network Cyclic Redundancy Checksum

A Network Cyclic Redundancy Checksum (NETWORK CRCS) error alarm event occurs when ESF framing is in use and the CRC-6 code calculated at the receiving DSU does not match the CRC-6 code calculated by the DSU that transmitted the signal. The DSU performs the CRC check on each ESF frame to detect errors in the DS1 signal.

Network Received Yellow

A Network Received Yellow (NETWORK RYEL) alarm event occurs when the DSU receives a Yellow alarm from the network.

Network Low Average Density

A Network Low Average Density (NETWORK LAD) alarm event occurs when the 8(N+1) Ones Density Requirement is being enforced (DSU operating mode either Unframed/AMI or Framed/AMI/Nx64k/Consecutive) and the DSU has to insert ones in the signal it transmits toward the network. The DSU inserts ones and declares a NETWORK LAD alarm when the signal from the DTE at its DTE interface port contains fewer ones than the Ones Density option requires.

Configuration Error

A Configuration Error (CONFIG ERROR) alarm indicates that the DSU has detected one of the following conditions:

- The checksum computed by the DSU for its configuration does not match the one it stored at the time the configuration was performed.
- The settings of switchbanks S11, Starting DS0, and S12, Number of DS0s, are such that the configured group of DS0s would extend DS0s beyond number 24.

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