1558D APS
CSU/DSU

TXPORT®
TRANSPORT

34-00255
1st Edition

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1. General

The TxPORT 1558D APS CSU/DSU (Automatic Protection Switch with integral V.35 DSU/CSU) provides the ideal solution for mission-critical high speed data applications requiring redundant path T1 access. The 1558D supports both T1 and FT1 high speed applications and can automatically restore your application when a problem arises on either the primary or standby T1 facility. See the 'Operation' chapter for a typical APS application. Switching from the failed T1 line (Path A or Path B) to the standby (Path A or Path B) is based upon user definable switching alarm thresholds (errored seconds, consecutively severely errored seconds, loss of signal, loss of frame). The 1558D APS CSU/DSU is fully compatible with AT&T 54017 T1 protection standards, AT&T 54016 ESF performance standards and TR 62411 T1 standards.

Features

The APS CSU/DSU unit is designed so that it can be configured to support a wide variety of user applications and speeds. The key features and functions are:

- Mission-Critical Automatic Protection Switching from a Fail or Impaired T1 Facility to a Standby T1 Facility
- AMI or B8ZS Line Coding
- Integral ESF CSUs (TR 54016 compliant)
- 24 Hour Performance History
- Revertive and Non-revertive Operation
- User-Definable Alarm Switching Thresholds
- Proactive Call-on-Alarm Reporting (requires manager)
- V.35 high speed interface (N x 56/64)
- Desk Top or Rack Mount
- Bantam Test Access Jacks
- Complies with AT&T 54017 Automatic Protection Switching, 1991
- FCC, IC, UL, and CSA Compliant

Specifications

T1 Network Interface

Line Rate:	1.544 Mbps
Framing:	ESF
Line Code:	AMI or B8ZS
DS1 Interface:	+1 to -27 dB ALBO, 100 Ω (± 5%)
Connector:	RJ-48 modular jack
Overvoltage	Primary and Secondary lightning Protection:fusing for line cross

V.35 CPE (Equipment Interface)

Standards:	Complies with CCITT V.35
Data Rates:	56Kb to 1.536 Mbps (n x 56/64)
Clocking:	Internal, External, Network
Looping:	Local and Remote (per V.54)
Data Invert:	Enable/Disable
Connector:	Female, 34-pin

Diagnostics

Line Loop:	Signal regeneration only (bidirectional)
Payload Loop:	Signal regenerated with new frame synchronization, CRC6, and data.
Loop Activation	Industry standard formats and De-activation:(54016, 62411, T1-403)
Performance:	Per AT&T TR54016, TR54017
SUPV Port:	Local diagnostics and configuration interface (RS-232/RJ-11)

Test Jacks

Network Side	Bantam jacks Tx, Rx, and Bridging for sides A and Side B

Alarms

Contacts:	Normally Opened (NO) and Normally Closed (NC)
Rating:	0.6A @ 125 VAC 2.0A @ 30 VDC

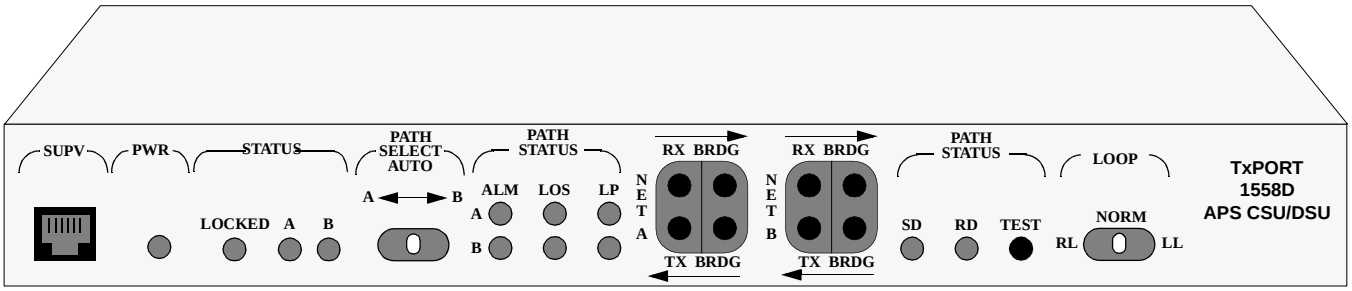


Figure 1-1 1558D Automatic Protection Switch CSU/DSU

Power

Unit: 115 VAC, ≤75 mA, 35 BTU maximum

Mechanical

Mounting: Desk, wall, or rack installation (comes with 19” rack mount hardware)

Dimensions: 17.25" W, 1.75" H, 12" D

Weight: 5 lbs.

Environmental

Operating Temp: 0° to 50° C (32° to 122°F)

Storage Temp: -20° to 85° C (-4° to 185°F)

Humidity: 95% maximum (non-condensing)

Compatibility

PUB 54017: Automatic Protection Switching Equipment, 1991

TR 62411: T1 interface and CSU specifications

PUB 54016: ESF requirements

CCITT: V.35

Industry Listings

FCC Compliance: Part 15 Subpart B, Class A

FCC Part 68 Registration:

UL Listed:

CSA Certified:

IC/CS03:

FCC Requirements

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user is required to correct the interference at his own expense. **Shielded cables must be used to ensure compliance with the Class A FCC limits.**

> ⚠ ***Modifications to this unit not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.***

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Notice to Users of 1.544 Mb/s Service: The following instructions are provided to ensure compliance with FCC Rules, Part 68:

1. All direct connections to T1 lines must be made using standard plugs and jacks.
2. The following information may be required by the local telephone company when applying for leased line facilities:

Table 1-A. Leased Line Information

Port ID	REN / SOC	FIC	USOC
P/N/12 - 00635	6.0 N	04DU9-BN 04DU9-DN 04DU9-IKN 04DU9-ISN	RJ-48C

3. If the unit appears to be malfunctioning, it should be disconnected from the telephone lines until you learn whether the source of trouble is your equipment or the telephone line. If your equipment needs repair, it should not be reconnected until it is repaired.
4. The unit has been designed to prevent harm to the T1 network. If the telephone company finds that the equipment is exceeding tolerable parameters, they can temporarily disconnect service. In this case, the telephone company will give you advance notice, if possible.
5. Under FCC rules, no customer is authorized to repair this equipment. This restriction applies regardless of whether the equipment is in or out of warranty.
6. If the telephone company alters their equipment in a manner that will affect the use of this device, they must give you advance warning so that you can have the opportunity for uninterrupted service. You will be advised of your right to file a complaint with the FCC.
7. The attached affidavit must be completed by the installer.
8. In the event of equipment malfunction, all repairs should be performed by our company or an authorized agent. It is the responsibility of users requiring service to report the need for service to our company or to one of our authorized agents.

Canadian Emissions Requirements

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

End users should use existing 48 VDC battery sources or a CSA certified power supply.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques (de la class A) prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

Warranty

TxPORT warrants each unit against defects in material and workmanship for a period of five years from the date the unit was shipped to the customer. If the unit malfunctions at any time during the warranty period, TxPORT will repair, or at TxPORT's option, replace the unit free of charge.

The remedies listed herein are the users sole and exclusive remedies. TxPORT shall not be liable for any indirect, direct, incidental or consequential damages. The owner must return the unit to the factory, shipping prepaid and packaged to the best commercial standard for electronic equipment. TxPORT will pay shipping charges for delivery on return. The customer is responsible for mode and cost of shipment to TxPORT. This warranty does not apply if the unit has been damaged by accident, misuse or as a result of service or modification by other than TxPORT personnel.

When returning the unit for warranty work, a Return Material Authorization (RMA) number must be obtained from customer service at the address/phone number given at the end of this chapter. When calling TxPORT to obtain a Return Material Authorization number or to arrange service, please have the following information available:

- Model number(s) and serial number(s) for the unit(s).
- Reason for return and symptoms of problem.
- Warranty status (if known).
- Purchase order number to cover charges for out-of-warranty items.
- Name and phone number of person we can contact if we have questions about the unit(s).
- Mode of shipment required (second day air is the normal mode of shipment for all returned material unless otherwise specified).

As soon as TxPORT has the above information, the RMA that must accompany the item(s) returned can be issued.

Ordering Numbers

The 1558D is shipped from the factory with the following standard items:

- The 1558D reference manual
- 19" rack mount hardware
- Local Access PC software
- One PC to 1558D user interface cable
- AC Power Cord
- Two 10' RJ-48 modular T1 cables

The following is a list of the standard and optional equipment which may also be needed.

Table 1-B. Available Equipment and Part Numbers

Part Number	Equipment
F-1558-001D-1111	1558D unit with integral ESF CSUs and V.35 DSU, 110 VAC operation.
6-3030-035-1	19" Rack Mount Hardware for 1558D. Standard with 1558D unit.
6-3030-036-1	23" Rack Mount Hardware for 1558D. Ordered as an option to the 1558D.
9-1558D-003-1	PC DOS Local Access software on 3.5" Disk. Allows the user to access unit performance, status, and configuration information and to perform local loop testing.
9-1001-029-2	PC to 1558D data cable, 10' DB-9 to 6-pin modular. Standard with 1558D unit.
9-1001-004-010	RJ-48 8-pin modular 10' cable Contact the factory for additional cable lengths and types.

TxPORT Customer Service

Address: TxPORT
127 Jetplex Circle
Madison, Alabama 35758

Telephone: 888-4TxPORT
800-926-0085 or
205-772-3770

Customer Service Returns: 800-926-0085, ext. 2227

Product Technical Support
Normal Hours - 8 a.m. to 5 p.m. Central, Monday – Friday

Telephone: 888-4TxPORT
800-285-2755 or
205-772-3770

Emergency - Nights / Weekends / Holidays:
Telephone: 800-285-2755
E-Mail (Internet address): support@txport.com

2. Installation

Proper installation of the 1558D unit involves the following key steps:

- Site Survey and Preparation
- Unpacking and Inspecting Equipment
- Equipment Mounting
- T1, Alarm, and Power Connections
- Setting Equipment Options
- Preservice Testing

The following paragraphs contain information and instructions to assist the user in preparing the 1558D for operation. A tear-out configuration guide (P/N 45-00083) is included in the back of this manual. It is recommended that the user sequentially follow the site preparation and unit installation steps described.

Site Preparations

The following site preparations should be performed before starting installation of the 1558D APS CSU/DSU unit. First, determine the physical location of 1558D unit and perform the following:

1. Determine the distance from the APS unit to the AC power outlet. The 1558D is shipped from the factory with a industry standard 3-prong, 5.5 ft. AC power cord. The maximum current draw of the 1558D is ≤75 milliamps.
2. Determine the distance from the T1 facility demark and the actual location of the 1558D. After determining distance, verify that the proper cable lengths and types have been ordered to connect from the T1 demark to the 1558D unit. The 1558D is shipped with three RJ-48 modular T1 cable, 10 feet in length.
3. Normally, the provider of the T1 facility will provide the required LBO setting (transmit signal level) required for connection to the T1 facilities. This value should be used when setting the 1558D LBO transmit values (0, 7.5, 15, or 22 dB) in the 1558D unit. If the value cannot be obtained from the provider, the LBO transmit values for Path A and Path B should be set to 0 dB.
4. Verify that the T1 line is operating properly before you attempt to install the 1558D unit. Both of the T1 lines should be checked for error free operation for at least one hour to ensure that they are performing error free.
5. If the unit is to be installed in a 19’ equipment be rack, verify that there is enough rack space available in the rack (requires 1.75 inches per 1558D unit). Four pan head (type 12-24 x 1/2 inch) screws are provided for mounting the unit. An optional 23” rack mount kit is available for applications using this size rack.
6. Verify that no external CSUs (channel service units) preexist at the location where the 1558D is being installed.

   The 1558D unit provides internal ESF CSU functions and cannot operate properly if another CSU is also co-located with the 1558D.

Unpacking and Inspection

This unit is carefully packaged to prevent damage in shipment. Upon receipt, inspect the shipping container for damage. If the shipping container or cushioning material is damaged, notify the carrier immediately and make a notation on the delivery receipt that the container was damaged (if possible, obtain the signature and name of the person making delivery). Retain the packaging material until the contents of the shipment have been checked for completeness and the instrument has been checked both mechanically and electrically.

If the contents of the shipment are incomplete or, if there is mechanical damage or defect, notify TxPORT. If the shipping container is also damaged, or the cushioning material shows signs of stress, notify the carrier of the damage as well as TxPORT. Keep the shipping materials for carrier’s inspection. TxPORT will arrange for repair or replacement without waiting for claim settlement.

Mounting

If the 1558D is to be installed in an equipment rack, simply mount the 1558D in the equipment rack using the provided mounting screws and rack mount adapters. If the equipment is to be located on a desktop, remove the rack mount adapters and set the unit on any flat surface. Once the equipment has been physically located, the following rear panel wiring connections should be performed.

Wiring & Connections

There are several wiring connections that must be performed to install the 1558D. The following paragraphs describe how to attach the APS unit to the associated T1 lines, power connections, alarm connections, and COM BUS connections. Figure 2-1 should be used as a reference for the following paragraphs concerning installation of the 1558D APS unit.

Chassis Ground Connection

The 1558D unit should be connected to a good earth ground. To connect ground to the unit, attach a 26 gauge or larger

wire from the rear panel screw terminal labeled 'GND' to a good earth ground.

Voltages in excess of 100 VDC may be present on the T1 telecommunications lines. Before connecting the APS unit to telecommunication lines, ensure that the rear panel screw terminal labeled 'GND' has been connected to a good earth ground.

Alarm Connections

The 1558D has alarm contacts provided at the rear panel screw terminals labeled 'COMMON', 'NC', and 'NO'. The alarm relay is operated when power is present to the 1558D. To connect the APS alarm relay to an external customer alarm surveillance system, perform the following:

- Connect a 26-gauge wire to the rear panel screw terminal labeled 'COMMON' to the external alarm system.
- Connect a 26-gauge wire to the rear panel screw terminal labeled 'ALARM NO' (normally open) or to 'ALARM NC (normally closed) to the external alarm system. The alarm relay is normally operated when power is connected to the unit.

T1 Connections

All T1 lines are connected to the 1558D unit using modular 8-pin RJ-48 cables (two 10' RJ-48 cables come with the unit). Insert the RJ48 connectors into the rear panel receptacles labeled NET A, and NET B. Connect the other ends of the cable to the appropriate external T1 A and B facility equipment. The modular RJ-48 Pinouts and their functions are shown in Table 2-C.

Table 2-C RJ-48 Pinouts

Pin	NET A & B, RJ-48
1	Data In, Tip
2	Data In, Ring
3	Not Used
4	Data Out, Tip
5	Data Out, Ring
6	Not Used
7	Not Used
8	Not Used

COM Bus Connections

The rear panel COM BUS connectors (IN/OUT) are used to communicate to/from the optional APS 1559 site manager. These connections are only used when a 1559 Network manager is co-located with the 1558D(s). Bus connections from the manager to one or more 1558D units is done in a daisy chain fashion. That is, the COM BUS Out from the 1559 is connected to the COM BUS IN of the 1558D and the COM BUS OUT of the 1558D is connected to the COM BUS IN of the 1559. Physically, the connections to the COM Bus IN/OUT are RJ-11, 6-pin miniature modular jacks. The function of the six pins associated with the jacks are shown below in Table 2-D.

Table 2-D RJ-11 Pinouts

PIN	COM BUS IN	COM BUS OUT
1	Not Used	Not Used
2	Signal Ground	Signal Ground
3	Data, output	Data, Output
4	Data, input	Not Used
5	Signal Ground	Signal Ground
6	Not Used	Not Used

V.35 Interface

The 1558D high speed DTE port is a 34-pin female connection. The interface is fully compatible with CCITT V.35 standards. To connect external CPE equipment to the 1558D, simply attach a male V.35 cable to the V.35 DTE port found at the rear of the 1558D. Be sure to mechanically secure the cable in place by tightening the provided thumb screws. The operating speed and clocking arrangements are described in the section entitled Configuration Modes on page 2-3. The pinouts for the V.35 interface are shown in Table 2-E.

Table 2-E V.35 Pinouts

Function	CCITT	Name	Direction DTE/DCE	1558D V.35
Frame Ground	101	FG		A
Signal Ground	102	SG	→	B
Send Data	103	SD	←	P, S
Receive Data	104	RD	→	R, T
Request to Send	105	RTS	←	C
Clear to Send	106	CTS	→	D
Data Set Ready	107	DSR		E

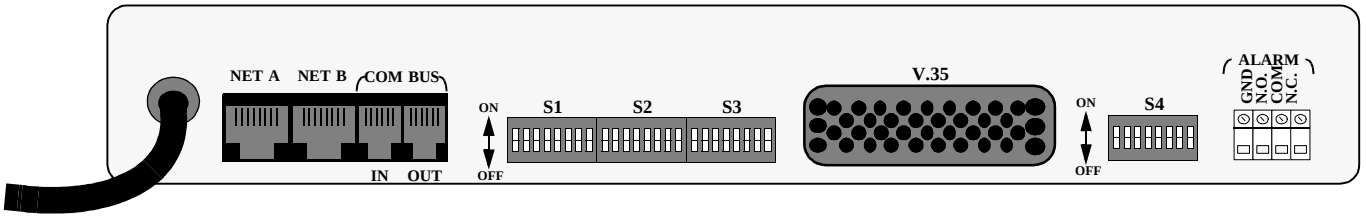


Figure 2-1 1558D Rear View

Table 2-E V.35 Pinouts

Function	CCITT	Name	Direction DTE/DCE	1558D V.35
Data Terminal Ready	108	DTR	→	H
Data Carrier Detect	109	DCD	←	F
Transmit Clock	113,114	TC	←	Y, AA
Receive Clock	115	RC	←	V, X
External Clock	113	ext.TC	→	U, W
Test Mode	142	TM	←	K

AC Power

The 1558D unit operate from 115 VAC, 75 mA maximum. The unit is shipped with a 5.5 foot 3-prong industry standard AC power cord. After all wiring connections have been completed, attach the unit to the AC wall receptacle. The unit responds by turning on the front panel (green) LED power indicator. The user is now ready to configure the 1558D. The following sections describe how to quickly configure the 1558D unit.

Configuration Modes

Any time that the 1558D unit is initialized (power removed, then reapplied), all key configuration data is read by the 1558D CPU and implemented based upon the particular configuration boot mode options selected by the user. There are four possible configuration boot modes:

- Configure/Boot from Switches.
- Configure/Boot from ROM.
- Configure/Boot from RAM.
- Configure/Boot from Manager. This requires the optional 1559 manager.

All factory default settings in this manual are shown underlined.

Switch Configuration

After the equipment has been unpacked and inspected and mounted, the next step is to configure the unit. All unit options are set by the manual DIP switch positions located on the four rear panel option switches (S1, S2, S3, and S4). The 1558D is shipped from the factory with all option switches in the OFF (factory default) positions. The following paragraphs briefly describe the 1558D option switches and there functions.

After the option switches have been set to the desired operating mode, recycle the power to the unit. At power up, the CPU will read and implement the switch settings.

OPTION SWITCH S1

Switch S1 is an eight position DIP switch used to set the following unit options.

- Master or Slave Card Operation
- Boot general parameters from Switches, ROM, RAM, or Manager
- Boot alarm parameters from ROM or RAM
- Enable/Disable Framing Error Alarm
- Enable/Disable Loss of Signal Alarm
- AMI/B8ZS Line Encoding, NET A, NET B

The following table describes the DIP switch settings controlled by Switch S1.

Table 2-F Switch S1

Position	Selection	Switch S1 Description
1	Off	Card Function, Slave
	On	Card Function, Master
2,3	Off, Off	Boot from Switches
	Off, On	Boot from Manager
	On, Off	Boot from RAM
	On, On	Boot from ROM
4	Off	ARM from ROM
	On	ARM from RAM
5	Off	Enable Frame Error Alarm
	On	Disable Frame Error Alarm
6	Off	LOS, Enabled
	On	LOS, Disabled
7	Off	NET/A, B8ZS
	On	NET/A, AMI
8	Off	NET/B, B8ZS
	On	NET/B, AMI

OPTION SWITCH S2

Switch S2 is an eight position DIP switch used to set the following unit options.

- CSU Mode, Enable/Disable
- Path Revert, Enable/Disable
- NET A, LBO Value
- NET B, LBO Value
- Clocking Mode, Internal, External, Network

Table 2-G describes the DIP switch settings controlled by Switch S2.

Table 2-G Switch S2

Position	Selection	Switch S2 Description
1	Off	CSU Mode, Enabled
	On	CSU Mode, Disabled
2	Off	Path Revert, Disabled
	On	ON = Path Revert, Enabled
3,4		NET A LBO Value
	Off, Off	0.0 dB
	Off, On	7.5 dB
	On, Off	15.0 dB
	On, On	22.5 dB

Table 2-G Switch S2

Position	Selection	Switch S2 Description
5,6		NET A LBO Value
	Off, Off	0.0 dB
	Off, On	7.5 dB
	On, Off	15.0 dB
	On, On	22.5 dB
7,8	Off, Off	Network Clocking
	Off, On	Network Clocking
	On, On	Internal Clocking
	On, Off	External DTE Clocking

OPTION SWITCH S3

Switch S3 is an eight position DIP switch used to configure the 1558D unit address ID for the NET A hardware and the NET B hardware. Unique addresses must be optioned for each 1558D unit when multiple units are co-located and a 1559 Site Manager is being used. If no manager is being used, the user should leave the DIP switches in the factory default positions (all in the OFF or DOWN position). This configures the unit for NET A address 1 and NET B address 2. Table 2-H indicates how to configure the address settings for the first six 1558D units.

Table 2-H Address Settings

*APS Mgr. Unit Pos.	NET A/B Address	Pos 1	Pos 2	Pos 3	Pos 4	Pos 5 - 8
1.01	1/2	**Off**	**Off**	**Off**	**Off**	**Off**
1.02	3/4	On	On	Off	Off	Off
1.03	5/6	On	Off	On	Off	Off
1.04	7/8	On	On	On	Off	Off
1.05	9/10	On	Off	Off	On	Off
1.06	11/12	On	On	Off	On	Off

When connecting to the SUPV port using the APS local access software, the 1558D NET A and NET B addresses are viewed as a single unit address and are displayed as 1.01 for addresses 1 and 2, 1.02 for addresses 3 and 4, etc.

OPTION SWITCH S4

Switch S4 is a ten position DIP switch used to configure the following DTE interface options.

- Set DSU Operating Speed (56kb - 1.536 Mbps)
- Set Rate Multiple, 56kb or 64kb
- Set DS0 Assignment Mode, Contiguous/Alternate
- Set Flow Control, On/OFF
- Set Data Invert, Yes/No

Switch 4, (Pos. 1 - 6) - These six DIP switches allow the user to select the operating speed of the 1558D DTE port and whether or not the DS0s are assigned sequentially, beginning with DS0#1 or Alternately, beginning with DS0#1, 3, 5, etc. The table below shows the option position settings for the various combinations of speed and DS0 channel assignments. The 1558D can be configured to operate from 56 kb to 1.536 Mbps.

Table 2-I Speed Settings

Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Pos 6 Off (64Kb)	Pos 6 On (56Kb)	DS0
Off	Off	Off	Off	Off	1536	1344	24
Off	Off	Off	On	Off	1472	1288	23
On	Off	Off	On	Off	1408	1232	22
Off	On	Off	On	Off	1344	1176	21
On	On	Off	On	Off	1280	1120	20
Off	Off	On	On	Off	1216	1064	19
On	Off	On	On	Off	1152	1008	18
Off	On	On	On	Off	1088	952	17
On	On	On	On	Off	1024	896	16
Off	Off	Off	Off	On	960	840	15
On	Off	Off	Off	On	896	784	14
Off	On	Off	Off	On	832	728	13
On	On	Off	Off	On	768	672	12
Off	Off	On	Off	On	704	616	11
On	Off	On	Off	On	640	560	10
Off	On	On	Off	On	576	504	9
On	On	On	Of	On	512	448	8
Off	Off	Off	On	On	448	392	7
On	Off	Off	On	On	384	336	6
Off	On	Off	On	On	320	280	5
On	On	Off	On	On	256	224	4
Off	Off	On	On	On	192	168	3
On	Off	On	On	On	128	112	2
On	On	On	On	On	64	56	1

Switch 4 (Pos. 7 - 10) - These option switches are used to set the following:

- Contiguous or Alternate DS0 assignment
- Set control lines to either ON or OFF
- Enable or disable data invert feature

Table 2-J displays the various options/positions controlled by SW4, positions 7 - 10.

Table 2-J Switch SW4-7 thru SW4-10

Position	Selection	Switch S4 Description
7	Off	Contiguous DS0s
	On	Alternate DS0s
8	Off	Control Lines (CTS, DSR,CD) are set to *On*
	On	Control Lines follow (DSR follows T1 sync, CTS follows RTS, and CD follows T1 density status)
9	Off	Data Invert Disabled
	On	Data Invert Enabled
10	—	Not Used

DS0 channel speed assignments are sequentially assigned beginning with DS0 #1 if SW4, Position 7 is set to the OFF position (contiguous channel assignment). When SW4, Position 7 is set to ON, the channels will be assigned in alternate DS0s, beginning with DS0#1, DS0#3, etc.

ROM Configuration

The 1558D may be configured to boot operational parameters from the internal ROM (read only memory). To configure the 1558D to boot from ROM, set SW1, Position 2 and SW1, Position 3 to the ON position and SW1, Position 6 to the OFF position. With these settings, the 1558D will always boot (at power up) the unit configuration parameters from the internal ROM settings. The ROM unit parameters set when the user selects 'boot from ROM' are listed below:

- Slave Unit Operation
- B8ZS line coding, Path A and Path B
- ESF framing, Path A and Path B
- Revert mode, Disabled
- Availability timer set to 60 seconds
- Errored seconds set to 20
- Consecutively errored seconds set to 2
- Loss of frame set to Enabled
- Loss of signal set to Enabled

When the 1558D is being configured to boot from ROM the user must still review and set the manually selected operating parameters listed below.

- LBO transmit level setting for both NET A and NET B
- 1558D unit address (if optional 1559 manager is installed)
- DSU Operating Speed (56kb - 1.536 Mbps)
- Rate Multiple, 56kb or 64kb
- DS0 Assignment Mode, Contiguous/Alternate
- Flow Control, On/OFF
- Data Invert, Yes/No

RAM Configuration

The 1558D can be optioned to boot all alarm and operating parameters from the battery backed RAM at power up. To configure the 1558D for this mode of operation, simply set SW1, Position 7 to ON, and SW1, Position 8 to OFF. Keep in mind that the user must still manually configure the following unit operating features:

- LBO transmit level setting for both NET A and NET B
- 1558D unit address (if optional 1559 manager is installed)
- DSU Operating Speed (56kb - 1.536 Mbps)
- Rate Multiple, 56kb or 64kb
- DS0 Assignment Mode, Contiguous/Alternate
- Flow Control, On/OFF
- Data Invert, Yes/No

Manager Configuration

The 1558D may be configured and controlled using the optional 1559 APSM site manager. The manager, co-located with one or more 1558D units (up to 56), provides both local and remote access and control/alarm reporting to one or more remote locations. When the 1558D has been configured to 'Boot from Manager', the 1559 can access and change all options except the following:

- LBO transmit level setting for both NET A and NET B
- 1558D unit address (if optional 1559 manager is installed)
- DSU Operating Speed (56kb - 1.536 Mbps)
- Rate Multiple, 56kb or 64kb
- DS0 Assignment Mode, Contiguous/Alternate
- Flow Control, On/OFF
- Data Invert, Yes/No
- Boot Mode (Switches, RAM, ROM, Manager)

To configure the 1558D to 'Boot from Manager', set S1-7 to OFF and S1-8 to ON. For additional information concerning the use and operation of the 1559 manager, refer to the TxPORT 1559 APSM reference manual.

Unit configuration of the 1558D APS is now complete. The final steps to complete installation is to perform the 1558D preservice testing steps describe in the following sections.

Pre-service Testing

The pre-service test checks the operational integrity of the 1558D unit and the T1 facilities (Net A and Net B). The local pre-service testing is made independently of any DTE or T1 connections. The end-to-end testing requires that the T1 facilities be connected to the 1558D unit. Local 1558D Test Diagram, Path A and Path B on page 2-8 illustrates the testing described in the following pre-service steps. Pre-service Testing verifies the following:

- Path Integrity for Path A and Path B (local)
- Path Integrity for Path A and Path B (end-to-end)

The following T1 test equipment and miscellaneous cables will be required to perform the 1558D pre-service tests:

- A Data BERT Test Set with a V.35 Interface
- One V.35 cable (1558 to Test Set)

Before proceeding, the user should read and understand the background information presented in the following paragraphs concerning the basic operation theory of an APS service (also refer to Figure 3-1 on page 3-2 and Figure 3-4 on page 3-10).

APS service is different from “normal” point-to-point T1 service. The 1558D APS unit accepts a single source signal from the attached DTE equipment, verifies signal density, duplicates the signal, and then transmits it on two T1 lines (Path A, Transmit and Path B, Transmit). This duplication and dual transmission is also done at the far-end APS equipment.

In addition to the unique transmitting function performed by the APS, the unit also performs a unique receiving function. There are two identical signals being received from two T1 lines by the APS equipment (Path A, Receive and Path B, Receive). The 1558D constantly monitors both of these lines for satisfactory signal performance. In the event that the present active receive line exceeds an alarm value, the APS will automatically switch the service from the failed receive path to the standby receive path. The active receive signal is the path connected to the DTE equipment.

Once a path has declared an alarm condition from Errored Seconds, Consecutively Severely Errored Seconds, Loss of Frame, or Loss Of Signal, it will not be available for service until the Line Availability Timer has determined that the line is available for service (line has run error free for the user defined time period, 0 to 900 seconds, user definable). At that time, the path alarm circuitry will be reset and then the path will be ready to accept service.

Path A Pre-service Testing

Perform the following test steps to verify that the 1558D can run error free data from the DTE V.35 port to the NET A port and back (local loop test). The test setup for performing this test is depicted in Local 1558D Test Diagram, Path A and Path B on page 2-8.

1. Connect a data BERT test set to the DTE V.35 port at the rear of the 1558D unit. The test set should be configured to generate a BERT pattern (511, 2047, etc.) at the data rate set previously by the user (56kb - 1.536Mbps). Also, the test set clocking should be configured to operate per the clocking options set in the 1558D (Internal, External). Typically, the 1558D will supply clocking to the DTE equipment.
2. Manually operate the DTE Loop Switch from the AUTO position to the LL (Local Loop) position. This manually loops the data coming from the DTE port back to the DTE port.
3. Optionally, the user can insert a bantam test cord into the NET A Bridge jacks (transmit and receive). This places a metallic loop of the transmit signal of the 1558D back to the receive of the 1558D.

   Verify that there is no connection at the NET A jack when looping the 1558D at the Tx and Rx bridge bantam jacks.
4. Manually operate the front panel Path Select Switch to the (A) position. This forces and locks the unit to Path A. The following unit status LEDs associated with Path A testing should be illuminated on the unit:
   - Power A or B LED ON (green)
   - Status ‘Locked’ LED ON (yellow)
   - Status Path Active ‘A’ ON (green)
   - The Path Status, Alarm A (red) LED may be ON or OFF depending on the alarm timer setting (0 to 900 seconds) configured in the 1558D.
5. The 1558D unit is now looped back to the V.35 DTE port and the BERT test set should be running in sync and error free. If not, verify that the test set speed and clocking settings are set to work with the speed and clocking options configured for the 1558D.

Path B Pre-service Testing

Perform the following test steps to verify that the 1558D can run error free data from the DTE port to the NET B Port and back (local loop test). The test setup for performing this test is depicted in Figure 2-2.

1. Connect a data BERT test set to the DTE V.35 port at the rear of the 1558D unit. The test set should be configured to generate a BERT pattern (511, 2047, etc.) at the data rate set previously by the user (56kb - 1.536Mbps). Also, the test set clocking should be configured to operate per the clocking options set in the 1558D (Internal, External). Typically, the 1558D will supply clocking to the DTE equipment.
2. Manually operate the DTE Loop Switch from the AUTO position to the LL (Local Loop) position. This manually loops the data coming from the DTE port back to the DTE port.
3. Optionally, the user can insert a bantam test cord into the NET B bantam Bridge jacks (transmit and receive). This places a metallic loop of the transmit signal of the 1558D back to the receive of the 1558D.

   Verify that there is no connection at the NET B jack when looping the 1558D at the Tx and Rx bridge bantam jacks.
4. Manually operate the front panel Path Select Switch to the (B) position. This forces and locks the unit to Path B. The following unit status LEDs associated with Path B testing should be illuminated on the unit:
   - Power A or B LED ON (green)
   - Status ‘Locked’ LED ON (yellow)
   - Status Path Active ‘B’ ON (green)

- The Path Status, Alarm B (red) LED may be ON or OFF depending on the alarm timer setting (0 to 900 seconds) configured in the 1558D.

5. The 1558D unit is now looped back to the V.35 DTE port and the BERT test set should be running in sync and error free. If not, verify that the test set speed and clocking settings are set to work with the speed and clocking options configured for the 1558D.

Standalone pre-service testing verifies the operational integrity of the 1558D using both the A and B path circuitry. If either Path A or Path B fails, but not both, and the options have been verified, contact the TxPORT Customer Service for additional assistance.

End-to-End Pre-Service Testing

The following paragraphs describe pre-service APS testing of the 1558D when it is initially connected to the T1 facilities (Path A and Path B) and is configured with another 1558D APS at the far-end.

After completing the stand-alone pre-service test procedures, the 1558D is ready to be connected to the Path A and Path B T1 facilities for verification of end-to-end operation. These test procedures will verify the following:

- End-to-End Performance of Path A
- End-to-End Performance of Path B
- Ability to generate remote V.54 loop of 1558D port

The following steps assume that there is a near end unit and a far-end unit and a technician with a BERT test is at both locations (near and far).

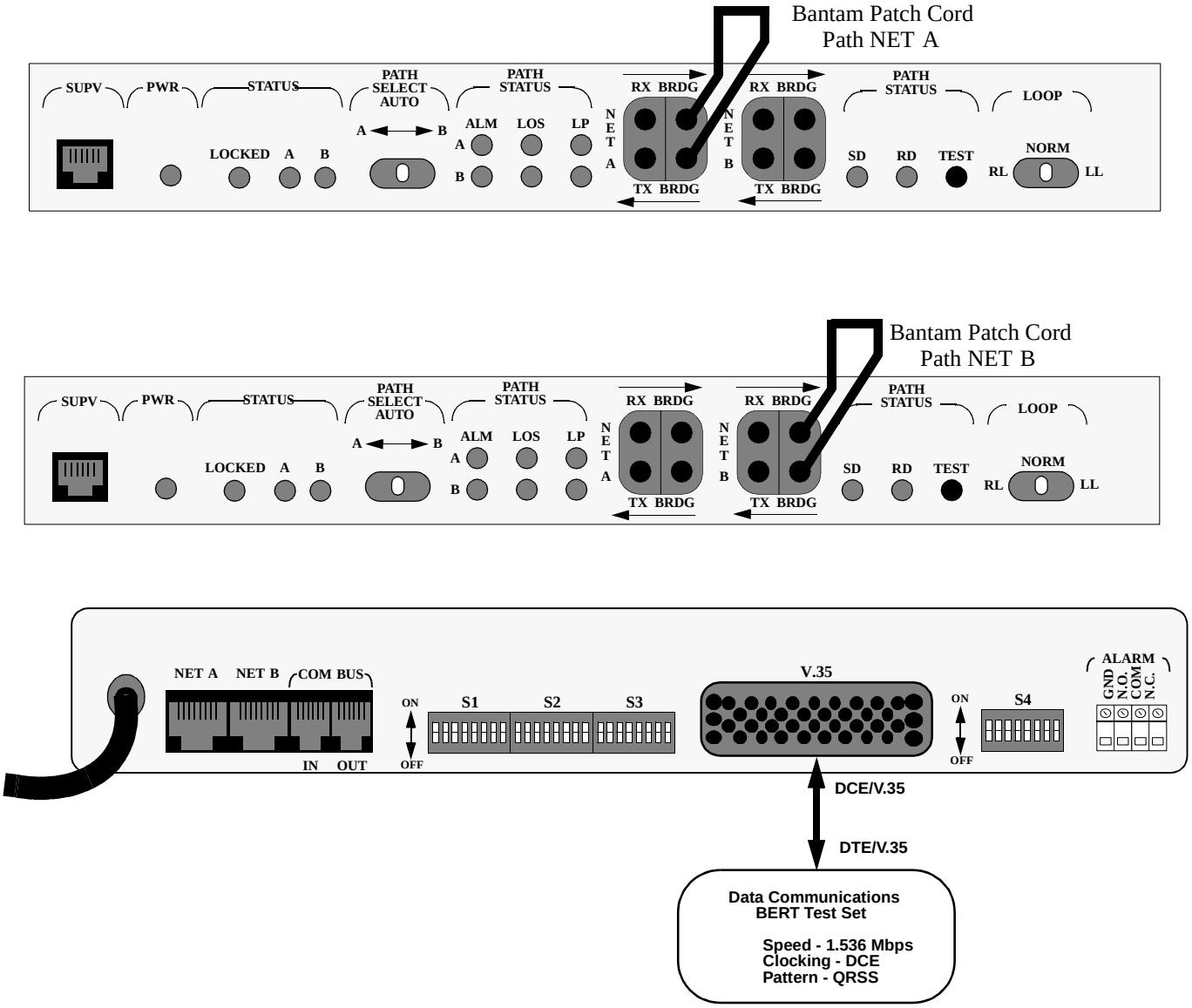
1. Attach the Path A and Path B T1 facilities to the respective NET A and NET B modular jacks at the rear of the unit (both near and far locations).
2. At both locations attach the data BERT test sets to the 1558D DTE port making sure that the speed and clocking settings match those configured in the 1558D unit.
3. Operate the Service Select switch on the 1558D to the Path A position at both the near and far 1558D units. This forces both units to use Path A as the receive signal source. Once this is done, both test sets should indicate pattern sync at both the near and far locations. Run test for a minimum of 15 minutes. The test results should be error free at both ends. If errors are detected, repeat test for another 15 minutes. If errors are still detected, a problem exists in the T1 facility. Refer problem to appropriate channels for resolution.
4. Operate the Service Select switch on the 1558D unit to the Path B position at both the near and far 1558D units. This forces both units to use Path B as the receive signal source. Run test for a minimum of 15 minutes. The test should be error free at both ends. If errors are detected, repeat test for another 15 minutes. If errors are still detected, a problem exists in the T1 facility. Refer problem to appropriate channels for resolution.

After completing the end-to-end BERT testing of both Path A and Path B facilities, verify that the remote V.54 loop operates properly by performing the following steps.

1. To verify that the loop operates, simply move the DTE manual loop switch from the AUTO to the RL (remote loop position). The unit responds by:
2. TEST LED indicator turns *On* (amber) and the 1558D internally generates a V.54 loop code to the far-end for ≥ five seconds.
3. After approximately five seconds, the TEST LED indicator will change from amber to green if the V.54 loop operated at the far-end. If the loop did not operate, the TEST LED will turn from amber to red which indicates that the far-end unit did not respond to the requested V.54 DTE loop.

The remote V.54 loop will remain active until the DTE manual loop switch is moved from the RL position back to the AUTO position. When this is done, the 1558D will generate an UNLOOP command to the far unit. After approximately ≤ five seconds the front panel TEST LED indicator will change from green to off.

This completes the end-to-end operational check for the 1558D. Remove all test equipment and verify that both units are attached to the T1 facilities (NET A and B) and verify that the DTE high speed data application is attached. After performing these checks, the 1558D unit is now ready to fully support proactive automatic protection switching and performance monitoring.



V.54 Loop Testing

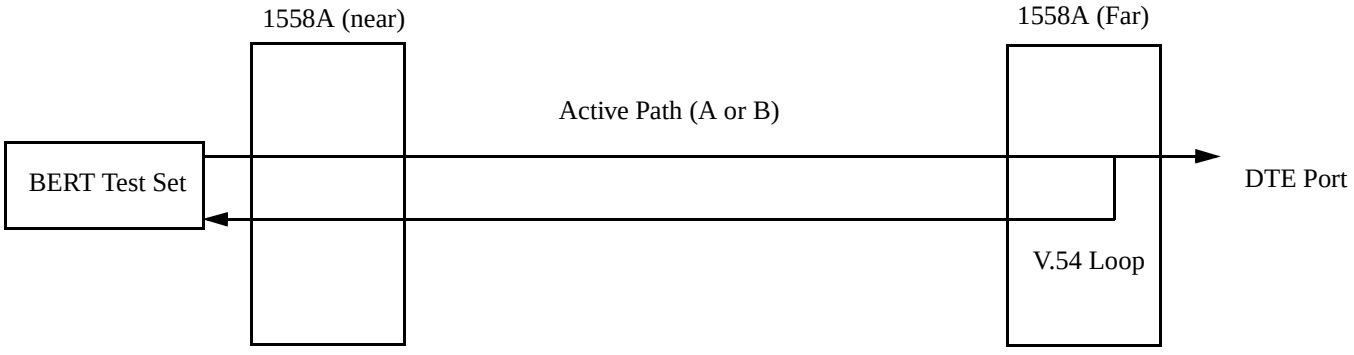


Figure 2-2 Local 1558D Test Diagram, Path A and Path B

3. Operation

The 1558D automatically switches a customer high speed data application from a “defective” T1 service to a standby facility. This capability minimizes any actual service outage to the customer. Typically, switching from the active to the standby path is transparent to the customer with minimal impact on data services. The 1558D Automatic Protection Switch (APS) equipment is compatible with AT&T TR 54017, Addendum, February, 1991. When the 1558D is configured for internal ESF CSU operation, it is fully compatible with AT&T TR 54016 ESF CSU requirements.

Applications

APS T1 protection service (per TR 54017) is either provided by a Common Carrier (AT&T or MCI, etc.) or by the customer. When a Common Carrier provides the service, APS equipment is installed in the central office and at the customer premise location(s). In the case of customer provided APS, the customer installs a 1558D at both ends of the mission-critical service. Figure 3-1 on page 3-2 depicts some of the more common APS applications.

TxPORT APS equipment must be installed in pairs (one TxPORT unit at one end of the service and another unit at the other end of the service). One unit of the pair must be configured for Master mode and the other as Slave mode.

General Operation

The 1558D constantly monitors the status and quality of the path signal (A and B) received on both the active access path and standby access path. In general, the status and quality of the signal is based on the ESF parameters described in Section 3.1 of TR 54016 and additional parameters described in this document and in TR 54017, 1991. If the performance of the active path is determined to be impaired, the protection switching equipment will automatically select the standby access path if that path is ready for service (not in an alarm or a maintenance state). The level of impairment at which a transfer is accomplished is dependent upon the alarm threshold values set in the equipment.

Following a switch, the former standby access path becomes the active path. The 1558D continues to monitor both of the incoming data streams after a switch has occurred. If both active and standby access paths exceed their specified thresholds, service will be maintained on the currently active access path.

The switch from the active to the standby path is completely independent of any external equipment. Switching from an active path to a standby path only involves the receive paths (Path A and Path B), not the transmit paths.

Revertive and Non-Revertive Switching

The default configuration of the 1558D APS provides non-revertive protection. Specifically, this means that service, when transferred to the standby path, remains on the new path until its performance degrades past the threshold settings. This is in contrast to the optional revertive mode which returns service to the default path when it has returned to a minimal level of error free performance.

Default Power-Up Path

The desire for geographically diverse routing may also result in diversity in the medium of transmission (copper, fiber, microwave, etc.). Certain media have higher intrinsic performance criteria and are therefore the service of preference. To accommodate this preference, on power up, the 1558D APS unit forces the Path A as the active path.

Loss of Signal / Loss of Frame

When a LOS (Loss Of Signal) is detected on the active path from the facility side of the APS, the 1558D will immediately switch the service to the standby facility (assuming that the standby path is not in an alarm or a maintenance state and the LOS alarm is enabled). If the standby path is in an alarm state, the service will remain on the failed path until the alarm condition clears on the standby path.

Optionally, in the event that there is a signal present but it is so impaired that it results in a LOF (Loss Of Frame), the 1558D shall immediately switch after detecting 32 consecutive framing errors (approximately 93 milliseconds) to the standby path (assuming that it is not in an alarm or a maintenance state and the LOF alarm is enabled).

Bipolar Violations

The 1558D APS units will not allow BPV (Bipolar Violations) in the DS-1 data stream unless they are used for B8ZS (Bipolar 8 Zero Substitution) encoding for clear channel capability. Where used, the B8ZS code will be employed to prevent the generation of an all zero octet.

CSU Loopbacks

Two ESF CSU loopbacks are provided in the 1558D unit (CSU Line Loop and CSU Payload Loop). These loops can be activated and deactivated by TR 54016 ESF messages, or Inband per TR 62411. To insure maximum service availability, the following special conditions shall be applied to CSU loopback actuation via the ESF data link messages:

- A CSU Line Loop or Payload can’t be activated on the active path.

- If the CSU Line Loop or Payload Loop activate signal is received by both paths simultaneously, no change of LB state shall occur, regardless of their current states.

The "one-way" protection characteristic of the APS can result in split-service operation. That is, service from the 1558D near APS to the 1558D far APS via one access path while the 1558D far APS to the 1558D near APS service is on the other access path. This is desirable to minimize service disruptions. However, normal maintenance and fault isolation techniques can't be carried out while service is being delivered in the split mode. Service to and from the APS must be forced to a common access, either manually or via maintenance message, before the standby path LB can be activated.

Forced/Locked Capability

A manual path select control is provided on the APS which selectively forces service to either Path A or Path B and effectively inhibits the other path from accepting service. The manual service select control supersedes all automatic transfers and forces the path not inhibited to carry the service, regardless of its status or condition.

APS Switching Time

Two times are of significance in specification of the APS protection switching function. The first is the latency period between the point when the switching criteria is satisfied on the active access path and the point at which restoration occurs on the standby access path. This time is less than 50 milliseconds.

The second is the duration of the switching transient event associated with physically moving service from the active to the standby access path. The 1558D APS can complete the transition from active to standby path within 1 bit time.

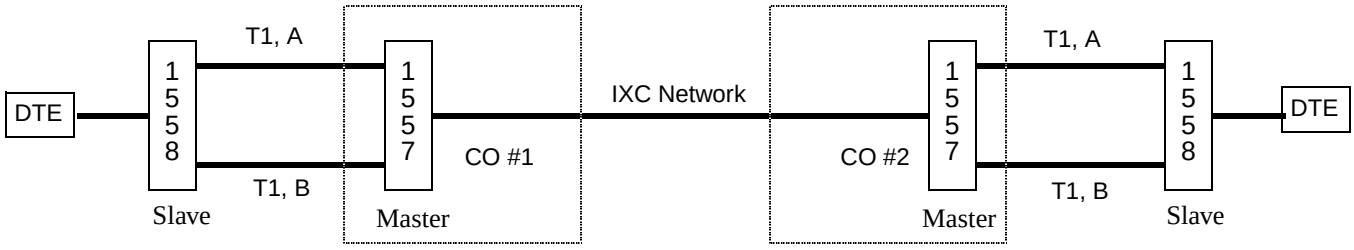
The decision to transfer service from the active path to the standby path, and vice-versa, is based on a priority system, where the highest priority condition that satisfies a transfer controls, regardless of the conditions in lower priorities.

- Priority 1 – LB Status:
  If the standby path's LB is activated, then service shall remain on the active path.
- Priority 2 – Failed Status:
  If the standby path is in a failed state then service shall remain on the active path. A failed state could be a result of excess ES, CSES, LOS, or LOF.
- Priority 3 – Error Event Threshold Criteria:
  This level of transfer is based on the occurrence of 1 second events within the current 15 minute interval as described in the TR 54017 Addendum.

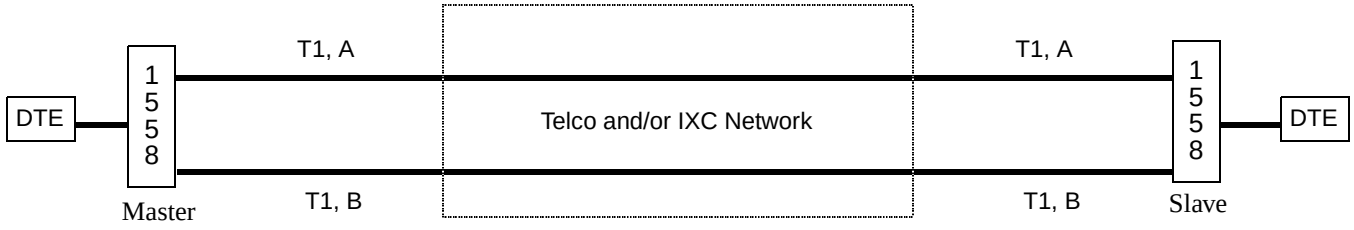
Each error event requires storage for the following values: threshold setting, current count, and a service transfer flag. The threshold setting for the events (ES and CSES) may range from 1 to 900 seconds. Transfer of service is based only on these events.

If the threshold of an event is 0, that event is inactive and is not a criterion for transfer of service. The current count tallies the total number of error event seconds within the current 15 minute interval. This count is reset at the beginning of a new 15 minute interval.

The service transfer flag is set for the event that causes a transfer of service. It allows the cause of the service transfer to be determined even after the current count has been reset at the beginning of a new interval. This flag is reset when a service transfer acknowledgment message is received, which is described in the next section.



IXC Local Loop APS application, both ends



Customer Provided end-to-end APS Application

Figure 3-1 Typical APS Applications

APS Switching Parameters

The 1558D unit switches from the active line to the standby line based upon user definable alarm parameters. The alarm performance parameters that can configured by the user are Errored Seconds, Consecutively Severely Seconds, Loss of Signal, and Loss of Framing. These alarm parameters and their definition are described below.

Errored Seconds (ES) - The user can define that the 1558D switches from the active line to the standby line when a certain number of errored seconds have been detected during the current 15 minute performance interval (900 seconds). The ES threshold can be set from 0 (setting this parameter to a zero value disables ES switching) to 900 seconds. The 1558D is configured at the factory with 20 errored seconds as the default errored second value. The definition of an ES is a second containing one or more CRC errors.

Consecutive Severely Errored Seconds (CSES) - Customers can define the 1558D switches from the active line to the standby line when a certain number of Consecutive Severely Errored Seconds have been detected during the current 15 minute performance interval (900 seconds). The CSES threshold can be set from 0 (setting this parameter to a zero value disables CSES switching) to 900 seconds. The 1558D is configured at the factory with 2 consecutive severely errored seconds as the default CSES value. The definition of a CSES is when two or more consecutive SES have been detected (note that CSES are transparent to the boundary between 15 minute intervals). A severely errored second is defined as a second containing 320 or more ESF errors.

Loss of Signal (LOS) - The user can define that the 1558D switches from the active line to the standby line when a loss of signal state has been detected. The 1558D is shipped from the factory with loss of signal parameter enabled. The definition of a loss of signal is when the receive signal from the network contains ≥175 consecutive bit intervals containing all zeros (no pulses). The condition will be cleared when one or more intervals contain a one.

Loss of Frame (LOF) - The user can define that the 1558D switches from the active line to the standby line when a loss of frame error state has been detected. The 1558D is shipped from the factory with the loss of frame parameter enabled. An LOF alarm condition occurs when 32 or more consecutive ESF frames contain frame bit errors.

When the current count of either ES or CSES is greater than or equal to the threshold setting or when a LOS or LOF (if enabled) is detected, the service shall be transferred from the active path to the standby path as long as the standby path is available (not in an alarm state or in a looped state). A requirement for the standby path to be available is that the timer circuitry, described below, is not active and a LOS or LOF condition does not exist.

Line Availability Timer

The line availability timer is used to quantify when a path is eligible to accept service.Line availability is determined by the APS by observing a defined window of time in which no active error events have occurred. The APS line availability timer can be set to any value from 0-900 seconds. This value represents the minimum amount of time, free of active error events, that must expire before this path is declared as ready to accept service. The factory default setting for the line availability timer is 60 seconds.

The line availability timer requires storage for the timer setting and the active timer count. If the timer setting is 0, the timer circuitry is disabled and the path is always available for service, assuming that there are no active alarm conditions present. If the timer setting is set to a value ranging from 1 to 900 seconds and a service transfer takes place, the standby unit initializes the active timer count to the timer setting. When the timer expires, this standby path becomes available for a service transfer. This timed period must be free of errors for all active events. If an error occurs, the active timer count is reset.

When operated in the optional revertive mode, the path availability timer serves to force restoration of service back to the default access, Path A. That is, when service is switched from Path A, it will remain on the standby path (Path B) only until Path A's availability timer expires. The factory default is Revert set to OFF.

Status and Performance Information

The current status and performance parameters are stored in the internal registers of the 1558D. Access to this information is via the 1559 APSM site manager (optional) or the LAPS (local access protection switch) PC software. The LAPS software is shipped with each 1558D unit.

The following information can be viewed by the user using either the 1559 APS Site Manager or the provided APS Local Access DOS Software.

- This path is currently carrying the service.
- This path is currently in a failed state.
- This path is currently in an inhibit state.
- The LB of this path is currently activated.
- The other path is currently in a failed state.
- The other path is currently in an inhibit state.
- The LB of the other path is activated.
- The manual locked control state.
- Current status
- Current interval Occurrences
- Current interval Duration
- Current Interval Timer

- Occurrences - Intervals, 1 through 96
- Duration - Intervals, 1 through 96
- Valid Intervals Total
- Occurrences, 24-hour value
- Duration, 24-hour total
- 30-day switch occurrence history

Configuration Modes

Any time that the 1558D unit is initialized (power removed, then reapplied), all key configuration data is read by the 1558D CPU and implemented based upon the particular boot mode options selected by the user (see Installation on page 2-1 for additional information). The four possible BOOT mode configurations are described below:

1. **Boot from Switches** - At power up, the 1558D CPU reads the values set at the rear panel option switches and configures the unit per those switch settings.
2. **Boot from Manager** - At power up the CPU sends a message to the 1559 APS manager for a download of 1558D unit configuration information. Note that this mode requires that a 1559 site manager be installed.
3. **Boot from RAM** - At power up, the 1558D CPU reads the unit configuration from the battery backed RAM data.
4. **Boot from ROM** - At power up, the 1558D CPU reads the factory firmware default values from ROM. The factory default ROM configuration option settings are:
   - Slave operation
   - Net A/B B8ZS line coding
   - Net A/B ESF framing
   - Revert mode, disabled
   - Availability timer set to 60 seconds
   - Errored seconds set to 20
   - Consecutively errored seconds set to 2
   - Loss of frame set to enabled
   - Loss of signal set to enabled

Front Panel Functions

The front panel of the APS unit contains several LED indicators, a SUPV access port, a path select switch, and several bantam test access jacks. The following paragraphs briefly describe the operation of these items (refer to Figure 3-2 and the 1558D Configuration at the end of this manual).

Supervisor Port

The front panel SUPV port allows the user to connect to the 1558D via a PC running the supplied APS LAPS (Local Access protection software) application. This user interface software allows the user to gain access to the unit configuration data, unit status, unit performance, and perform local and remote loopback testing.

Electrically, the SUPV port is RS232 and the data format is 19.2 Kb, asynchronous. The cable used to connect the PC to the SUPV port is a DB9 (female) to 6-pin modular cable. This cable is provided with the 1558D unit. The pin functions for the SUPV port are shown in the following table.

Table 3-A SUPV Pinouts

Pin	SUPV Port Wiring
1	Not Used
2	Ground
3	Data Out
4	Data In
5	Ground
6	Not Used

Power Indicators

The 1558D has a green power LED indicator located on the front panel. This indicator will be ON when the unit is connected to a nominal power source of 115 volts, AC. The 1558D draws approximately 75 milliamps. The AC power cord is approximately 6 feet long and the plug end is an industry standard 3-prong male connector.

Locked Indicator

The user can manually force and lock either the A or B T1 path as the active path by moving the PATH SELECT switch from the AUTO position to either the A or B Path Select positions. This action will force the 1558D to use the selected path. Also, the 1558D is now manually locked to this path and will not switch from it, even if the selected path is in a failed state or subsequently fails. When the 1558D has been manually forced to either the A or B PATH, the amber LOCKED LED indicator will be on. Moving the PATH SELECT switch back to the AUTO position will turn off the LOCKED LED and restore normal APS operation.

⚠ Placing the 1558D in a manually locked mode prevents the unit from performing automatic protection switching.

Status Indicators

The 1558D front panel STATUS A and B LEDs (green) indicate which of the two T1 receive paths (A or B) is presently being utilized to provide service to the CPE equipment.

Manual Path Selector Switch

The front panel manual PATH SELECT switch is used to force the 1558D to use either the A or B path as the active

line. If the user momentarily moves the switch to either the A or B position and then returns the switch to the Auto position, the 1558D will force service to the selected path (A or B). If the user leaves the switch in the manual A or B position, the 1558D will LOCK the service to this path and turn on the LOCKED LED.

> ⚠ ***Placing the 1558D in a manually locked mode prevents the unit from performing automatic protection switching.***

Path Status Alarm Indicators

The 1558D alarm circuitry is driven by the alarm parameters defined by the user at time of installation. The user definable alarm parameters are ES (errored seconds), CSES (consecutive severely errored seconds), LOS (loss of signal), LOF (consecutive ESF errored frames). When any of these alarm thresholds are met or exceeded, the ALARM LED indicator (red) will be on for the path (A or B) that has "failed".

Path Status LOS Indicators

The 1558D LOS (loss of signal) Path A and B indicators (red) will be ON when no T1 pulses are being detected on the receive signal paths from the network. The definition of loss of signal is no pulses for 175 bit times. The loss of signal state will be cleared when one or more data pulses are detected on the receive path. After the pulses are detected, the respective LOS indicator will be turned OFF.

Path Status Loop Indicators

The 1558D can respond to CSU loop/unloop commands (both inband and FDL) and local or remote APS loop/unloop commands. When a loop has been activated (Path A, B, or DTE) the respective front panel LP LED indicator (amber) will be ON. If no loop is active, the LP indicator will be OFF.

Bantam Test Access Jacks

Bantam test access jacks and bridge/monitor jacks are provided to gain physical access to the T1 Path A (NET A), and T1 Path B (NET B) facilities. The placement of the jacks is depicted in Figure 4-10 on page 4-10. The function of these jacks is described in the following table.

Table 3-B. Bantam Jack Functions

Path A/B Jacks	Function
Transmit (Tx) to T1 facility (lower left jack)	Allows the user to gain access to the transmit T1 path towards the T1 facility. Inserting a test cord into this jacks disconnects the 1558D from the T1 facility
Receive (Rx) from T1 facility (upper left jack)	Allows the user to gain access to the receive T1 path from the T1 facility. Inserting a test cord into this jacks disconnects the 1558D from the T1 facility
Transmit Bridge (BRDG) to T1 facility (lower right jack)	Allows the user to bridge/monitor the transmit T1 signal towards the T1 facility. Note, test set must be set to the bridge termination mode.
Receive Bridge (BRDG) from T1 facility (upper right jack)	Allows the user to bridge/monitor the receive T1 signal from the T1 facility. Test set must be set to the bridge termination mode.

DTE Status Indicators

Three DTE port status LED indicators provide a visual indication of the present state of the SD (send data), and RD (receive data) signals. Also, the TEST LED indicates if a manual or soft loop has been initiated by the user. A brief description of these items is described in the paragraphs below.

DTE SD LED

This LED (green) will indicate that data transitions are present on the TD lead (from the DTE equipment). The LED will be on for a mark and off for a space condition. The LED will vary in intensity depending upon the relative number of marks or spaces present at any given time.

DTE RD LED

This LED (green) will indicate that data transitions are present on the RD lead (to the DTE equipment). The LED will be on for a mark and off for a space condition. The LED will vary in intensity depending upon the relative number of marks or spaces present at any given time.

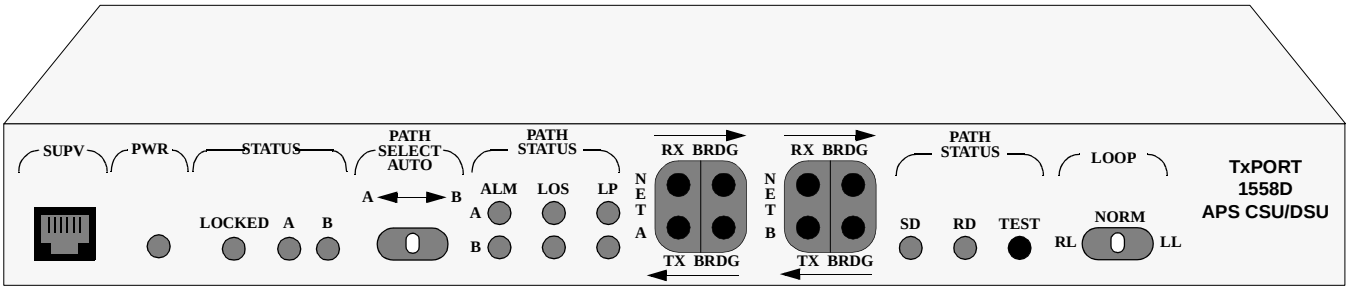


Figure 3-2 1558D Front View

TEST LED

This LED (tri-color amber, red, green) will indicate when the DSU portion of the 1558D has been placed in a TEST state either via remote loop command (V.54, Lp DTE Fac or DTE Eq) or by placing the front panel manual loop switch to either the RL or LL positions. The LED will be off when the unit is not in a test state (no active loops either locally or remotely). The LED will be ON (yellow when the manual loop switch is in the LL position). The LED will be On (yellow) when the manual loop switch is placed in the RL (remote loop) position. In ð5 seconds, the yellow LED will change to green if the far-end looped (V.54) or RED if the far-end did not loop.

Loopbacks

The 1558A unit supports several local and remote loopback diagnostic capabilities allowing the user to quickly determine both facility and equipment problems. The types of diagnostic loops that can be performed by the 1558 unit are:

- Manual Local Loop
- Manual Remote Loop
- Inband CSU Line Loop
- ESF Line Loop
- ESF Payload Loop
- V.54 Equipment Loop

The following sections will describe the operation and usage of these loops. The reader should refer to Figure 3 on page 3-13 for additional information concerning the location of these loops.

Local Manual Loop/Unloop

The 1558D unit provides a three position manual loop switch located on the front panel. This switch allows the user to initiate either a local 1558D loop or a remote loop of a far-end 1558D unit.

To initiate a local 1558 loop, simply move the loop switch from the NORM position to the LL (local loop) position. The unit responds by; (1) looping back the transmit T1 signal (Tx towards the facility) back to the receive T1 signal path (Rx from the facility) and, (2) turns on (yellow) the front panel TEST LED indicator. Note that the manual local loop forces a loop condition on both the A and B paths.

Once the loop is activated, any signals coming from the CPE equipment are looped back to the CPE equipment. If a BERT test set is attached to the 1558 DTE port, the user can BERT test and verify the operation of either the A or B path circuitry by moving the Path Select switch to either the A or B positions.

To remove the local loop condition, move the manual switch from the LL position back to the NORM position. The unit will immediately remove the loops from both the A and B paths and turn off the front panel TEST LED indicator.

Manual Remote Loop/Unloop

The near 1558D can initiate a manual remote 1558D loop of a far-end 1558D unit using an industry standard inband V.54 loop code pattern. To initiate a far 1558D equipment loop, manually operate the front panel loop switch from the normal position to the RL (remote loop) position. The unit responds by performing the following:

1. Generates a V.54 loop pattern towards the far-end unit.
2. Turns on (yellow) the front panel TEST LED indicator
3. The far unit, after detecting the V.54 code for approximately 2 seconds, will initiate a V.54 equipment loop (loops DTE port receive data back to send data plus passes receive data to CPE equipment). See Figure 3.
4. After approximately 2 seconds, the near end unit stops sending V.54 loop code and begins running a ten second BERT test.
5. After running the BERT test for several seconds, the front panel TEST LED indicator either turn GREEN if the BERT test ran error free or turn RED if the BERT pattern ran errors. Note that the errors could be caused either by facility problems or by failure of the far-end unit to loop.

To deactivate the remote loop, simply move the front panel loop switch from the RL position back to the normal position. The 1558D responds by sending the V.54 unloop pattern to the far-end for approximately 2 seconds, afterwhich the far-end unit will unloop and the both the near and far unit TEST LED will turn OFF.

> *Anytime the 1558D has been manually placed in a test state, the front panel TEST LED will be on. Also note that the TEST LED will be on when either a remote V.54 loop command has been initiated or when the unit has been commanded by the 1559 to perform a CPE Equipment loop. (V.54/CPE Equipment loop).l*

Inband CSU Loop/Unloop

The 1558D will respond to industry standard inband CSU loop/unloop codes. Operation of a CSU LLB (line loopback) results from the 1558D receiving either a framed or unframed repeating T1 pattern of (10000) for ≥5 seconds. Upon receipt of this pattern for the prescribed time, the standby path will loop the receive T1 signal (from the network) back to the transmit signal (to the network) and pass the receive signal to the CPE (see Figure 3). Note that the 1558D will not allow a CSU loop of the active path. Also note that when a loop is active on a given path, the associated front panel Loop LED indicator (yellow) will be on.

The 1558D will unloop after receiving a framed or unframed repeating T1 signal of (100) for ≥5 seconds. When the unit unloops, the front panel Loop LED indicator will go OFF.

ESF CSU Loop/Unloop

The 1558D will respond to industry standard ESF data link loop/unloop messages. There are loop messages for a payload loop/unloop and a line loop/unloop. Note that the 1558D will only respond to a data link loop command when the path is in a standby mode (not actively carrying customer T1 service). Also note that the front panel Loop indicator will be ON whenever the unit/path is in a looped state.

Local/Remote Soft Testing

Using the provided user LAPS software, the user can generate both local and remote 1558D loop/unloop commands and BERT testing commands. The various types of loops and BERT testing are discussed in detail in Chapter 4, LAPS Operation.

Rear Panel Connections

All APS unit wiring connections and option switches are located on the rear panel of the 1558D unit. The function and description of these items are discussed in the following paragraphs (refer to Figure 3-3 on page 4-7 and the 1558D Configuration Guide).

Alarm Terminal Strip

A four position screw terminal is provided to connect the 1558D unit to ground and to an external alarm device. All connections to these terminals strip should be made using 26-gauge wire, or larger. The purpose of these terminals is briefly described as follows:

Ground: This terminal is used to connect the chassis ground to an external earth ground.

Alarm Terminals (Com, NO, NC): These three terminals are used to connect the APS unit alarm relay contacts to external alarm alert equipment. The APS unit alarm relay contacts can be wired as Normally Open or Normally Closed. The contacts are rated at 2 amps @ 30 VDC. When the APS is powered, the alarm relay is in the operated state and the NO (normally open) contacts are open and the NC (normally closed) contacts are closed.

Power

The 1558D operates from 115 volts AC. The maximum current draw is ð80 milliamps. A six foot industry standard 3-pronged AC power cord is shipped with the unit.

Option Switches SW1 - SW4

The 1558D has four banks of DIP switches mounted on the rear panel (SW1 - SW4). These option switches allow the user to configure the 1558D to meet the various applications that the user may require (see Installation on page 2-1 for additional information). The following paragraphs describe these option switches.

OPTION SWITCH 1

This 8 position DIP switch will be used to configure the APS functions of the 1558D. The function of each of the DIP positions is described below. Note that the factory defaults are shown in bold type.

Position 1 - This DIP will be used to set the APS card function, Master/Slave. A unit set to Master can poll the far-end for status and can generate commands to the far unit. Slave units can only respond to commands coming from a Master unit. They cannot generate messages or obtain status from far equipment. Note that 1558 units are installed in pairs and only one of the units can be configured as a master. The factory default is SLAVE.

Positions 2, 3, - These positions will be used to set the BOOT mode for the 1558D (Switches, ROM, RAM). The factory default is boot from switches.

Position 4 - This DIP will be used to set the ARM (Alarm Relay Mode error parameters) function for the APS (ARM from ROM/RAM). The factory default is ARM from ROM. The ROM values are ES = 20, CSES = 2, LOS = Yes, and LOF = Yes.

Position 5 - This DIP will be used to set the Framing Error alarm, Enabled/Disabled. The factory default setting is LOF enabled. When enabled, the 1558D will declare an alarm condition when 32 consecutive frame errors have occurred.

Position 6 - This DIP will be used to set the Loss of Signal alarm, Enabled/Disabled. The factory default is LOS enabled. When enabled, the 1558D will declare a LOS alarm condition when a T1 receive signal contains 175 bit times of no data transitions. The LOS condition will clear when one or more data transitions have been detected.

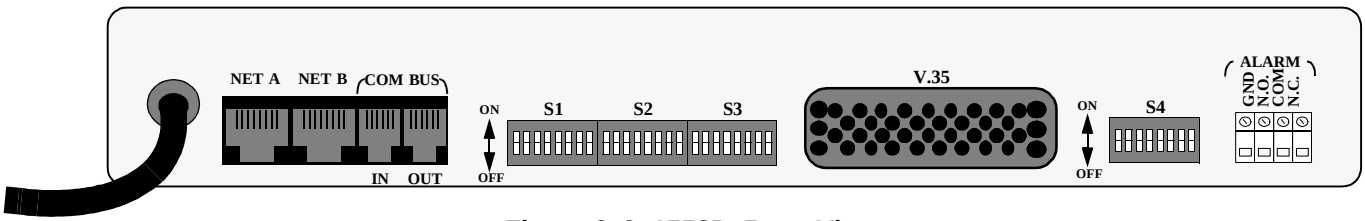


Figure 3-3 1558D Rear View

Position 7 - This DIP will be used to set the AMI/B8ZS function for NET A. The factory default setting is B8ZS. The 1558D will automatically detect and insert a B8ZS code into any block of data containing eight consecutive zeros.

Position 8 - This DIP will be used to set the AMI/B8ZS function for NET B. The factory default setting is B8ZS. The 1558D will automatically detect and insert a B8ZS code into any block of data containing eight consecutive zeros.

OPTIONS SWITCH SW2

This eight position DIP switch is used to configure the following APS functions. The function of each of the DIP positions is described below. Note that the factory defaults are shown in bold type.

Position 1 - This DIP will be used to set the CSU Enable/Disable mode. The factory default is CSU mode enable. If the unit is set to CSU mode disable, the 1558D will not respond to CSU ESF FDL commands nor will it respond to I-band CSU loop/unloop codes.

Position 2 - This DIP will be used to set the Path Revert Enable/Disable mode. The factory default is Path Revert disabled. If the unit is set for Path Revert enabled, the 1558D will always revert the service back to the A path whenever it is not in an alarm state.

Positions 3,4 - These two DIP switches configure the LBO values for Path A (0.0, 7.5, 15, or 22.5 dB). The factory default is 0 db.

Positions 5,6 - These two DIP switches configure the LBO values for Path B (0.0, 7.5, 15, or 22.5 db). The factory default is 0 db.

Positions 7,8 - These two DIPs will be used to set the 1558D timing source (Internal/Master, DTE/External, or T1/Network) of the 1558D. The 1558D has an *Auto Clock mode*. This eliminates the need for the customer to loop clocking back to the 1558D at the CPE end of the V.35 cable in those applications where the customer is required to return external clock leads to the 1558D unit.

OPTION SWITCH SW3

This eight position DIP switch is used to configure the unit (shelf/position) address of the 1558D unit.

Positions 1,2,3,4,5,6,7,8 - These eight DIP positions are used to set the unique unit address (see Installation on page 2-1). The default address is 01 (all switches in the down position).

OPTION SWITCH SW4

This 10 position DIP switch will be used to configure the DSU functions of the 1558D.

Positions 1,2,3,4,5, - These DIPs are used to set the number of DS0s used by the DTE V.35 port (FT1). The operation will be the same as the present 300 productivity unit. Note that DIPS 1 - 5 must be down and in this mode, the speed will be set to 1.344Mb or 1.536 Mb, depending upon rate multiple selected. The default is 1.536Mb.

Position 6 - This DIP will set the bit rate multiple to either 56 or 64 Kb. The default is 64Kb, clear channel.

Position 7 - This DIP will set the Contiguous or Alternate DS0 channel mode. The 1558D can assign bandwidth either in consecutive DS0 channels beginning with DS0 one or inb alternate DSO channels beginning with DS0 one. The later is sometimes required for fractional T1 service supplied by AT&T. The default is Contiguous.

Position 8 - This DIP will set the Control Flow mode to either ON or Follows. The 1558D V.35 DTE port can be optioned for control lines ON or follows. When set to ON, the 1558D sets CTS, DSR, and CD to the ON state. When set to FOLLOWS, the DSR follows T1 sync, the CTS follows RTS, and the CD follows the density status of the incoming T1 signal (>175 zeros = CD OFF). Note that the TM line goes high whenever the 1558D is placed in a test state. The default is ON.

Position 9 - This DIP will set the Data Invert mode to either No or Yes. In certain data applications, the user data may contain a high level of zeros and the user cannot operate the T1 facility using B8ZS. In this application, the 1558D can invert the data, thereby maintaining T1 density requirements. The default is NO.

Position 10 - This DIP is not used (spare)

V.35 Female Interface Connector (DCE)

The rear panel 34-pin V.35 female connector is used to interface the 1558 to the CPE equipment. The pins used in the interface and their functions are shown in Table 2-C.

Table 3-C. V.35 Female Interface Connector

Function	CCITT	Name	Direction DTE...1558	1558D V.35
Frame Ground	101	FG		A
Signal Ground	102	SG		B
Send Data	103	SD	→	P, S
Receive Data	104	RD	←	R, T
Request to Send	105	RTS	→	C
Clear to Send	106	CTS	←	D
Data Set Ready	107	DSR	→	E
Data Terminal Ready	108	DTR	→	H
Data Carrier Detect	109	DCD	←	F
Transmit Clock	113, 114	TC	←	Y, AA
Receive Clock	115	RC	←	V, X
External Clock	113	ext.TC	→	U, W
Test Mode	142	TM	←	K

DTE Control Lines

The DTE port can be optioned for control lines ON or follows. When set to ON, the 1558D sets CTS, DSR, and CD to the ON state. When set to FOLLOWS, the DSR follows T1 sync, the CTS follows RTS, and the CD follows the density status of the incoming T1 signal (>175 zeros = CD OFF). Note that the TM line goes high whenever the 1558D is placed in a test state.

COM Bus Connections

The two 6-pin modular connectors labeled COM BUS IN and COM BUS OUT on the rear panel may be used to connect to the optional 1559 APSM site manager. These ports are wired to allow daisy chaining one or more units off of the APSM (the OUT port is connected to the IN port from unit to unit). The COM BUS IN and OUT connectors are physically RJ-11, 6-pin modular jacks. The function of the 6 pins are described in the table below. For additional information concerning the site manager, consult the TxPORT 1559 manual.

Table 3-D. COM Bus Pinouts

PIN	COM BUS IN	COM BUS OUT
1	Not Used	Not Used
2	Signal Ground	Signal Ground
3	Data, output	Data, Output
4	Data, input	Not Used
5	Signal Ground	Signal Ground
6	Not Used	Not Used

Network T1 Connections

The NET A and the NET B T1 modular jacks are used to connect the 1558D to the T1 facilities using RJ-48 modular cables. Physically, the 1558D NET A and NET B connectors are RJ48, 8-pin modular connector. The usage of each of the eight pins found in the connector are described in the table below. The 1558D unit comes with two ten-foot RJ-48 cables (NET A, NET B, and DTE).

Table 3-E. T1 Connections

PIN	NET A	NET B
1	Data In (Tip)	Data In (Tip)
2	Data In (Ring)	Data In (Ring)
3,6	Not Used	Not Used
4	Data Out (Tip)	Data Out (Tip)
5	Data Out (Ring)	Data Out (Ring)
7,8	Not Used	Not Used

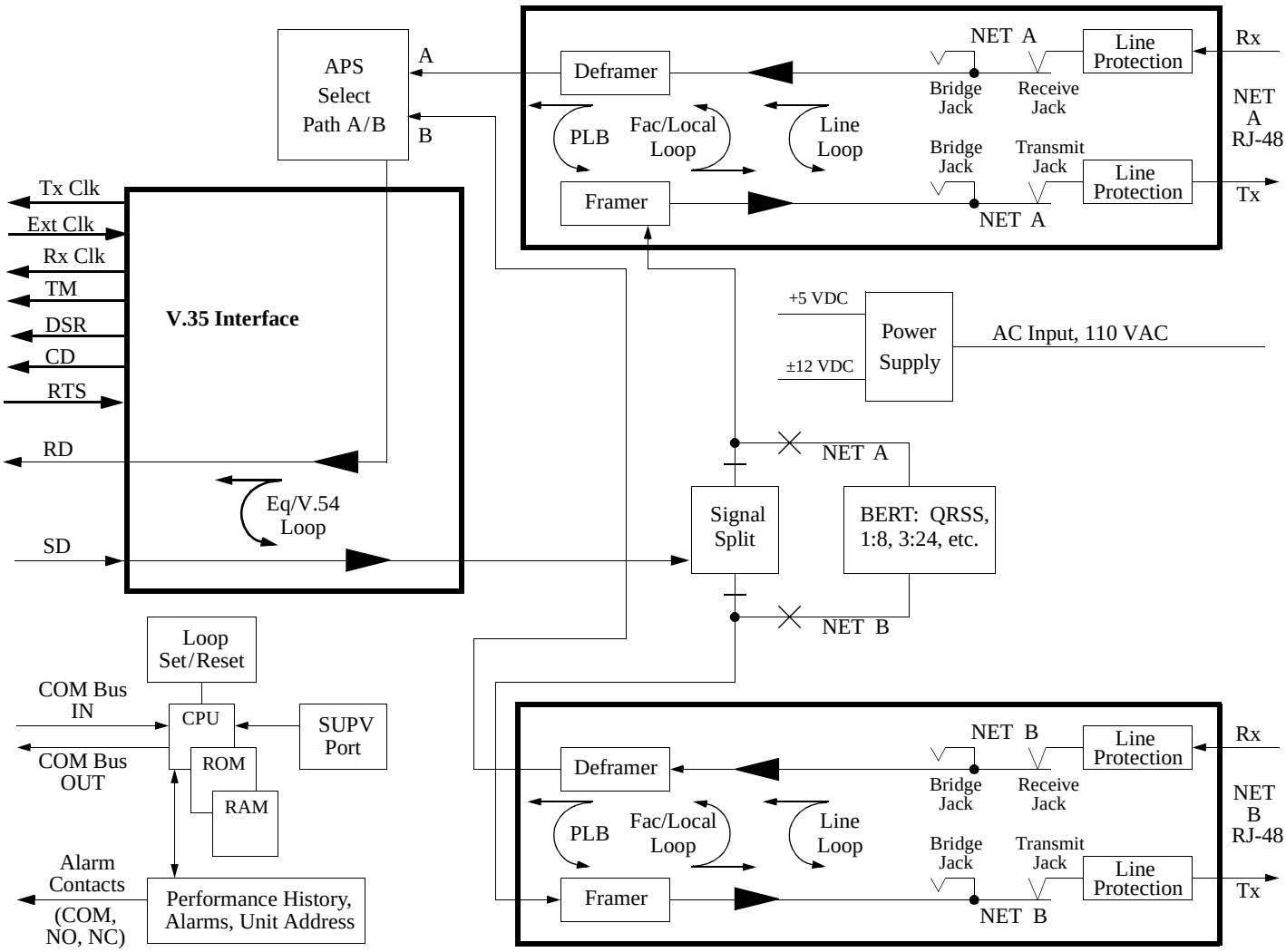


Figure 3-4 1558D APS CSU/DSU Block Diagram

4. LAPS Operation

Access to key 1558D configuration, performance, and testing functions can be locally performed by the user by installing the provided 1558D LAPS (Local Access Software) on a PC and attaching the provided PC to 1558D cable to the front panel SUPV port.

It is important that the user understand that the LAPS software provides only limited testing functionality and is solely intended to provide a basic user interface to the equipment. If more advanced access and testing is required, the user should consider using the 1559 APS manager unit.

The following sections briefly describe the features and functions of the 1558D LAPS software (Local Access Protection Switch) and how to install the software on a PC.

LAPS Installation

It is recommended that the user copy the LAPS software to a directory on the PC hard drive and then store the original disk in a safe place. The following steps will assist the user in installing the LAPS software.

1. Power up the PC to be used and insert the LAPS software into the A floppy drive. From the C drive DOS prompt enter the following command:

   C:\> **md laps**

   The PC creates a directory on the C drive named LAPS

2. At the DOS command line, enter the following:

   C:\> **cd laps**

   The PC responds by displaying `C:\LAPS`

3. From this prompt enter the following DOS command:

   C:\LAPS> copy A:*.*

4. The PC copies all files to the directory called LAPS. When the prompt indicates that all files have been copied, remove and store the original disk in a safe place.

5. After removing the disk in drive A, enter the following:

   C:\LAPS> **laps 1** (or **laps 2**)

   Entering 'LAPS 1' or 'LAPS 2' directs the program to use either COM 1 or COM 2. The computer responds by launching the LAPS application. Once the application is running, the user log on screen is displayed and the user is prompted to "Press the Enter key to begin". Once the <enter> key is pressed, the LAPS main menu is displayed.

6. Attach the provided PC/LAPS data cable from the PC COM port to the SUPV port on the 1558D.

The user should read the following LAPS user interface information before attempting to use the LAPS software.

Screens And Menus

Common Screen Elements

The LAPS user interface is a menu driven system. The available menus for the LAPS interface are shown in Figure 4-1. Each LAPS screen has several components that are common to all screens and will be discussed in this section only. The following paragraphs cover each of these components individually. Refer to the Main Menu screen (Figure 4-3 on page 4-2) which depicts these common screen elements.

Date and Time: The top right corner of the LAPS screen always displays the current date and time. The date and time can be set as described in the Utilities Screen on page 4-9.

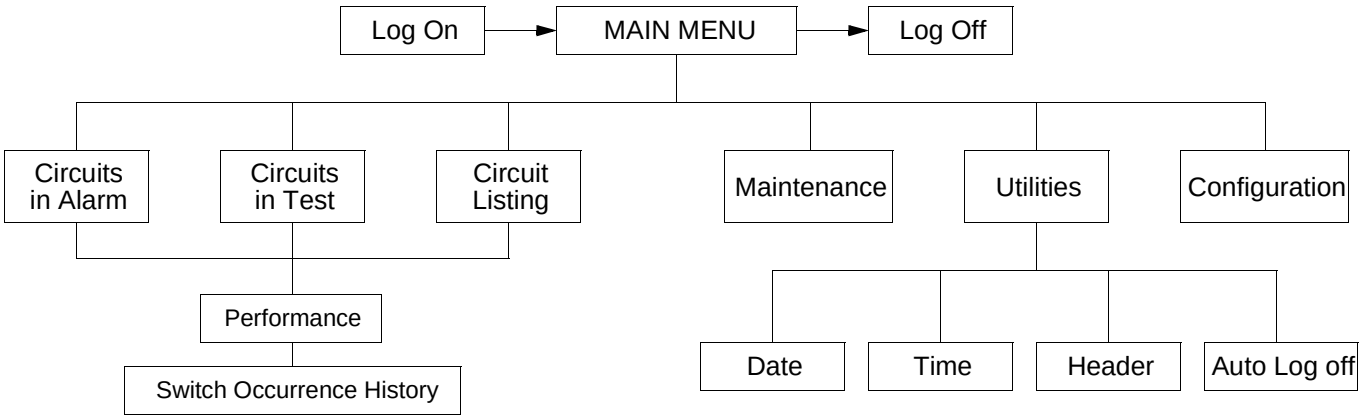


Figure 4-1 LAPS Menu Tree

Revisions: The LAPS software revision level is shown below the time. Refer to these numbers when contacting the factory with hardware or software related inquiries.

Location Header: The location name is displayed in the center of the second display line.The header can be changed under the Utilities menu.

Menu Title: The menu title (fourth line, center) denotes the general classification of the user interface that the user presently has accessed.

Messages: The message lines (bottom two) show alerts, error messages, help messages and to accept typed, user input. The use of typed input will be expanded upon in sections of this manual where it is directly applicable.

Alarms and Tests Messages: The right hand side of the message line is used to alert the user that there are active alarm or test states present in the unit. If their are active alarms or circuit test states, the message line will display "Alarms and/or Tests". If there are no circuits in alarm or in test, the Alarms/Tests message will not be displayed.

Cursor Controls

The LAPS software utilizes a highlighted cursor to make selections from menus and to select fields within screens that are to be operated upon. The cursor can be moved using the standard terminal cursor control keys, which are <backspace>, <up arrow>, <down arrow>, <left arrow>, <right arrow>, <page up>, <page down>, and <delete>.

For PC computers which do not have these particular keys or have only some of them, a set of cursor control commands are supported. Each of these commands is effected by holding down the <Ctrl> key while pressing a command key. The available commands are listed in the following table. These commands may be freely mixed with the use of the normal cursor command keys at the user's discretion.

Table 3-F Keyboard/Alternate Commands

Keyboard Command	Alternate Command
< left arrow >	< Ctrl - S >
< right arrow >	< Ctrl - D >
< up arrow >	< Ctrl - E >
< down arrow >	< Ctrl - X >
< backspace >	< Ctrl - H >
< delete >	< Ctrl - Z >
<page up>	<Ctrl - R>
<page down>	<Ctrl - C>
<update display>	<Ctrl - U>

```
Copyright 1991 TxPORT, All rights reserved


TxPORT APS Manager
Thu Jun 22 09:55:34 1995


Press Enter to begin
```

Figure 4-2 Log-on Screen

```
                          TxPORT 1559 APS Manager          Date: MM/DD/YY
                               LOCAL ACCESS                Time: HH:MM:SS
                                                           Ver. 3.XX
--------------------------------  Main Menus-----------------------------------

                          Circuits in Alarm
                          Circuits in Test
                          Circuit List
                          Maintenance
                          Configuration
                          Utilities
                          Log Off

---------------------------------- Messages-------------------------------------
                                                                        Alarms
                                                                        Tests
```

Figure 4-3 Main Menu

USER LOG ON

Once the user has booted the LAPS software and connected the PC to the SUPV port of the 1558D unit, the *Log On* screen will appear on the PC display (see Figure 4-2). To access the LAPS user menus, press the <Enter> key. The LAPS system responds by displaying the LAPS Main Menu. (see Figure 4-3).

Main Menu Screen

The Main Menu lists the main functions that the user can select and access. The primary user interfaces are shown in the Menu Tree (Figure 4-1 on page 4-1) and the *Main Menu* screen (Figure 4-3 on page 4-2). Use the terminal arrow keys or cursor control commands to highlight the desired submenu. Once a selection has been made, press <enter> to activate it. Refer to the cursor control commands detailed in Cursor Controls on page 2-2.

The Main Menu and any subsequent sub menu may be exited by pressing <esc>. If the Main Menu is exited, LAPS returns the user back to the Log On screen. This is a valid way to end a user session. If any other menu is exited, the user is returned to the previous screen. The following sections discuss the key user submenus and their uses.

Circuit List Screens

Circuits in Alarm

The Circuits in Alarm screen displays a list of all circuits which currently are in an alarm condition. Not that any 1558D units that have been placed in an Out of Service or Unused state do not report alarms. Only 1558D units that are in an In Service state and are in alarm will be posted to the Circuits in Alarm display.

Circuits in Test

The Circuits in Test screen displays a list of all circuits which currently are in test mode. A circuit is deemed to be in test mode if it has any kind of a loop established. Circuits do not have to be “In Service’ to be in test mode.

Circuit List

The Circuit List screen (Figure 4-4) lists all circuits known to the 1559 and their Near and Far operational statuses.

Circuit List Screen Manipulation

The three screens involving a circuit list (Circuits in Alarm, Circuits in Test, and Circuit List) are all displayed and manipulated in the same manner. Each circuit’s identification and status is displayed using the following fields.

Pressing the <esc> key will take the user back to the previous circuit list screen.

Pos: This field specifies the circuit’s unit address. Stand alone 1558D units are assigned address starting with shelf 1, position 1, 2, 3, etc. The factory default address setting of a 1558D is shelf 1, position 1 (1.01). Additional information concerning the unit address is discussed in the Installation sections of this manual beginning on page 2-1.

State: The current state of the circuit has the following possible definitions:

Unused: The circuit has never been installed or configured.

Out Service: The circuit has been: 1) manually taken out of active service, 2) installed but never put into service, or 3) configured but never installed.

In Service: The circuit has been installed and configured and is currently in use.

Circuit ID: The first line in this field is the circuit name assigned by the user for the NET A T1 facility. The second

```
                          TxPORT 1559 APS Manager            Date: MM/DD/YY
                               LOCAL ACCESS                  Time: HH:MM:SS
                                                             Ver. 3.XX
 -------------------------------  All Circuits-----------------------------------
Pos       State          Circuit ID                Near        Far

1.01     In Service    HICAP 1234                  Active      Active
                       HICAP 5678                  StandBy     StandBy
1.02     Unused                                  ------------
                                                 ------------
1.03     Unused                                  ------------
                                                 ------------
1.04     Unused                                  ------------
                                                 ------------
1.05     Unused                                  ------------
 ---------------------------------- Messages-----------------------------------


Shelf/Pos:
```

Figure 4-4 Circuit List

line is the circuit name assigned by the user for the NET B T1 facility. Circuit names are defined by the user with the Configuration menu (Figure 4-8 on page 4-7).

Near: This field shows the current status of a protected span's two T1 lines as viewed from the 1558D unit that you are attached to. This status is derived from error conditions, communications failures, and user activated manual and soft inhibits. The top line in the field depicts the status of T1 Line A. The second line depicts the status of T1 Line B. This field will show one of the following status indicators for each line:

(dashed line) No status is available for this circuit.

Active: The 1558D is actively using the received signal from this line and the line has no alarm conditions.

StandBy: The 1558D is not actively using this line, but it is not in an alarm condition and may be used if needed by the 1558D APS unit.

Failed: This line has an alarm condition and is therefore in a failed state. The APS may not switch to this line.

Soft Inhibit: The user has initiated a soft inhibited command to the 1558D. When in this state, this line may not be the APS equipment to provide user service.

Man. Inhibit: The user has inhibited this line from usage by placing the front panel Select Switch to either the A or B position. When in this state, this line may not be used by the APS equipment.

Reset: This line is in a reset condition. A momentary status that may appear at the time the attached APS is reset.

PL LP: This line has a payload loop active.

Line LP: This line has a line loop active.

Fac. LP: This line has a facility loop active.

Eq LP: This line has a equipment loop active.

CSU Loop: This line has a CSU loop active. This status only appears for far end units.

Far: This field shows the current status of the protected span's T1 lines as received at the far end 1558D unit. The content of this field is the same as that defined above for the "Near" field. Note that only 1558D units configured as Master will display both Near and Far status. A 1558D configured as a Slave will only display *valid* status for the Near, not the Far.

The circuits are displayed in order by the shelf number and the position within the shelf (unit address). Each Circuit List Screen shows a maximum of six circuits at one time. The next six circuits, if any, can be viewed by pressing <page down>. To show the six preceding circuits, press <page up>. An individual circuit can be specified at any time by entering the position designator at the message line prompt, Shelf/Pos: and pressing <enter>. This designator must be typed as it is displayed. For example, the APS device in position 3 of shelf 1 would be specified as '1.03' or '1.3'.

In any circuit list, a single circuit's position designator will always be selected by a highlighted cursor. The cursor control keys may be used to move this cursor from one circuit to another. If the cursor is moved down from the last position on the screen, the circuit list will scroll up, showing the next successive selection at the bottom of the screen. If the cursor is moved up from the top of the screen, the list will scroll down.

The cursor's position is used to select a specific circuit for displaying detailed performance data. Pressing <enter> while a circuit is selected will cause a Performance Screen to be displayed for that circuit. This screen is only accessi-

```
ID: HICAP 1234              TxPORT 1559 APS Manager            Date: MM/DD/YY
ID: HICAP 5678                   LOCAL ACCESS                  Time: HH:MM:SS
Shelf/Pos: 1.01                                                Ver. 3.XX
 ---------------------------------- Performance-----------------------------------
Target: [Side A, Near]          Status:  Active         24 Hr. % Error Free: 95%
Reset ESF Events:    128          SWO History:          Completed Intervals: 80
Reset Event Regs:                                     Event Free Intervals: 76

 Time  Interval     ES     CSES      LOFC      SWO     DUR     UAS     SES     BES
08:01  Current       0        0         0        0     481       0       0       0
-----  24 Hour        9        0         0        8   72001       0       9       0
10:15    [1]         1        0         0        0     899       0       9       0
15:00    [78]        0        0         0        1     476       0       0       0
14:45    [79]        5        0         0        6     435       0       5       0
14:30    [80]        3        0         0        1     888       0       3       0
 ---------------------------------- Messages ----------------------------------
                                                                          Alarms
                                                                          Tests
Shelf/Pos:
```

Figure 4-5 Performance

ble from the three types of circuit screens discussed in this section.

Performance Screen

The Performance screen (Figure 4-5) is only accessible from the Circuits in Alarm, Circuits in Test, and Circuit List screens. The Performance screen allows the user to view detailed performance data for a particular circuit.

In addition to the normal fields in the top section of the screen, the Performance Screen shows the circuit's two ID headers along with the circuit's position designator. All of these are found in the upper left corner of the display.

Pressing the <esc> key will take the user back to the previous circuit list screen.

The Performance screen contains four fields which can be altered by the user. The function of these three fields is discussed in the following paragraphs:

Target: Signifies which section of the selected circuit is presently displayed. Pressing <space bar> will change this field to the next selection. The choices are: 'Side A, Near', 'Side B, Near', 'Side A, Far', and 'Side B, Far'. Far Targets can only be accessed if the far unit is a slave 1558D.

'Near' refers to the data received by the 1558D that the user is physically attached. 'Far' refers to the data received at the 1558D unit at the remote or far end. Detailed information is displayed for each selection as described in the following paragraphs.

Reset ESF Events: This field is both a display field and a user command field. It shows the running total of ESF error events for the circuit section selected in the 'Target' field. This count accumulates until it reaches 65535 or is reset by the user. The count can be reset by moving the highlighted cursor to this field and pressing <enter>.

Reset Event Regs: This is a command field. Moving the cursor to this field and pressing <enter> will cause all interval data for the selected circuit section to be cleared.

SWO History: This command field is used to access the 30 day Switch Occurrence History screen. To access this information, move the cursor highlight to the SWO History field and press <enter>. The system responds by displaying the Occurrence History display (see Figure 4-6). This display lists the last thirty day completed periods (24 hours) and the number of switch occurrences for each of those days. The remainder of the fields in the Performance Screen are for display only. They are defined as follows:

Status: The status of the currently selected circuit section. This status is the same as that detailed for "Near/Far" on the previous page.

24 Hr.% Error Free: This is the percentage of intervals that were error free in the last 24 hours or since the event registers were last cleared.

Completed Intervals: The number of 15-minute intervals for which performance data has been collected. The maximum number is 96 (there are 96 fifteen minute intervals in a 24 hour period).

Event Free Intervals: The number of intervals that performance data has been collected without ESF error events.

(Interval Data): Per AT&T technical references 54016 and 54017, the interval data consists of Errored Seconds (ES), Consecutive Severely Errored Seconds (CSES), Loss of Frame Count (LOFC), Switch Occurrences (SWO), Duration (DUR), Unavailable Seconds (UAS), Severely Errored Seconds (SES), and Bursty Errored Seconds (BES). The value of each of these parameters is displayed for the current interval for the total of the last 24 hours, and for each valid interval in the last 24 hours.

```
ID: HICAP 1234              TxPORT 1559 APS Manager            Date: MM/DD/YY
ID: HICAP 5678                   LOCAL ACCESS                  Time: HH:MM:SS
Shelf/Pos: 1.01                                                Ver. 3.XX
------------------------------ Occurrence History ------------------------------
Net End Near

30 Day Occurrance History
     1.     8          11. -----          21. -----
     2.     0          12. -----          22. -----
     3.     0          13. -----          23. -----
     4.     4          14. -----          24. -----
     5.     0          15. -----          25. -----
     6.     1          16. -----          26. -----
     7.     0          17. -----          27. -----
     8.     2          18. -----          28. -----
     9. -----          19. -----          29. -----
    10. -----          20. -----          30. -----

---------------------------------- Messages ----------------------------------
                                                                       Alarms
                                                                       Tests
Shelf/Pos:
```

Figure 4-6 Occurrence History

The parameters shown on the Performance Screen are updated in one minute intervals. An update may be forced by pressing <Ctrl - U> on the keyboard.

The CSES field is updated once every two seconds. This is done because CSES is a self-clearing field and CSES events might not be viewed if the CSES field was updated at a slower rate.

Maintenance Screen

The Maintenance Screen (Figure 4-7) allows the user to perform test and maintenance functions on a selected circuit. Upon entering this screen, the selected circuit will be the last one chosen on any previous screen. The circuit can be changed at any time by typing a new circuit shelf/position number. It makes no difference which field is currently highlighted as long as the 'Shelf/Pos:' prompt is showing on the bottom display line. The selected circuit can also be decremented or incremented by pressing <page down> or <page up> respectively.

Maintenance testing can only be performed on circuits whose status is not "ACTIVE". It is recommended that the user place the circuit in an "OUT of Service" state to prevent the generation of alarms during testing. This is done by going to the Circuit Configuration user interface and changing the Service Status field from In Service to Out of Service. After completing maintenance testing, the unit Service Status should be changed back to In Service.

The Position, State, Circuit ID, and Status of the currently selected circuit will be displayed near the top of the Maintenance Screen. The format of this data is the same as that detailed previously in the Circuit List (page 4-3).

The highlighted cursor marks the currently selected field within the Maintenance Screen. Selections within any of the fields may be changed by pressing <space bar>. A new field may be selected with the terminal arrow keys or cursor control commands. A new selection is activated when <enter> is pressed with the cursor still positioned on that field. The actions initiated by each field are detailed below:

Clear Tests: Resets any active loopbacks, locked paths (A or B) and turns off any applied test pattern.

Clear Alarms: Resets alarms at the specified end of the circuit (Near/Far). The choices are "Near / Far".

Force: Causes the selected line (A or B) to become the active line. If the selected line was previously locked, this command will also serve to unlock it. The choices are: Side A, Near / Side B, Near / Side A, Far / Side B, Far.

Lock: Causes service to be locked to the selected line. If the selected line is currently in standBy, the APS will switch to the selected line before locking. The choices are: Side A, Near / Side B, Near / Side A, Far / Side B, Far.

Unlock: Unlocks the selected end of the protected span so that the APS is allowed to use either line. The choices are: Near / Far.

Target: Allows the user to select which T1 line that the test is to be applied to. Note that you are not allowed to apply any test conditions to the "ACTIVE"" T1 line. The choices are: Side A / Side B.

Loop: Causes the selected loop to be initiated on the line selected by 'Target'. The LAPS software does not check the

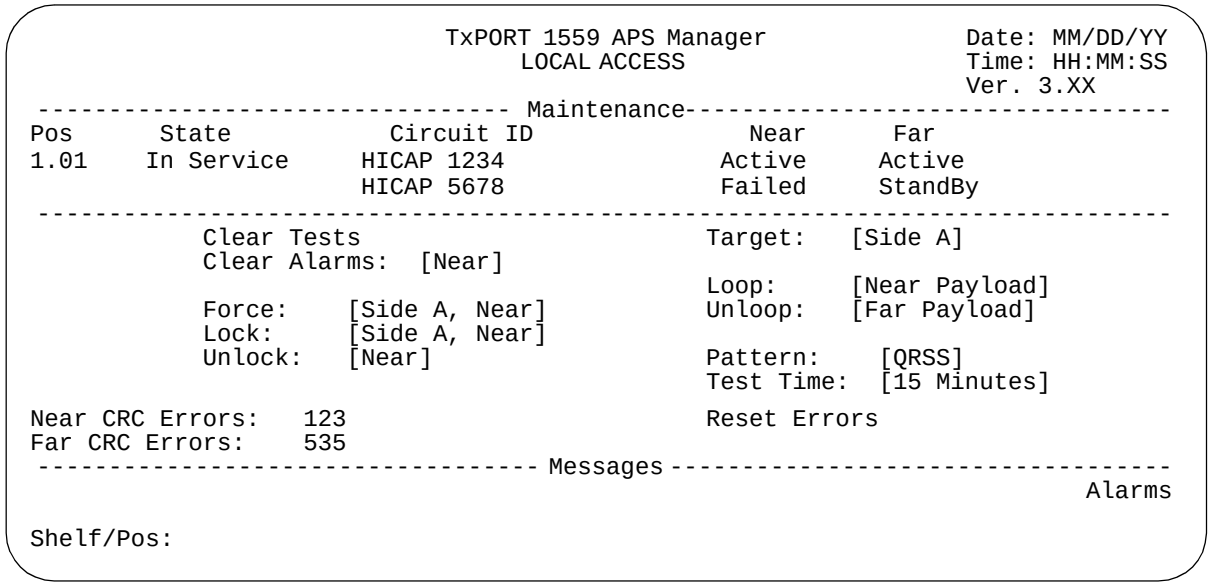


Figure 4-7 Maintenance

validity of the loop command. It is possible for the user to specify a loop that is illegal (i.e. looping the active line). No error message will be generated but the illegal action will not be executed. The choices are: Near Payload, Near Line, Near Facility, Near Equipment, Far Payload, Far Line, CSU, and Net. If the unit has been configure for "CSU Mode Disabled", the only loop available for the "Far" unit is NPC Payload. Note that Far items are only valid if unit is configured for Master operation. Loop descriptions and operation are discussed on page 4-9.

When 'Net' is chosen as the type in the Loop or Unloop field, the user has the option of specifying the 5-bit pattern to be transmitted. Using the arrow keys or cursor control commands, the user may move the cursor to the bit field. A five-bit pattern of 1s and 0s may then be typed by the user.

Unloop: Takes down the specified loop. If the loop is controlled by ESF data link commands, the response is immediate, If the command is an inband command, the response takes a minimum of 5 seconds.

Pattern: Specifies which pattern will be transmitted during test. When the 3 or 5-bit, user-defined pattern is chosen, the user may type in any pattern of ones or zeros to be transmitted. Pressing <enter> with the cursor positioned on this field will cause the pattern to be transmitted for the period of time specified in 'Test Time'. The choices are: QRSS, 1:8, 3:24, all Ones, all Zeros, user definable 3-bit, and user definable 5-bit.

Test Time: Defines the run-time of test pattern generation and error accumulation and starts the test. Pressing <enter> with the cursor positioned on this field will cause the selected pattern to be transmitted for the specified period of time. If the Maintenance menu is exited, pattern testing is halted. The choices are: 15 Minutes, 30 Minutes, 45 Minutes, 1 Hour, and Continuous.

Runtime: Shows the amount of time elapsed since a timed Pattern test began. Note that this field only appears on the screen when a test is running.

Near CRC Errors: A display-only field for viewing the number of CRC errors which are received at the Near Target receive path.

Far CRC Errors: A display-only field for viewing the number of CRC errors which are received at the Far Target receive.Far CRC Errors are only reported if the 1558D is configured as a Master. Slave 1558D units do not report Far CRC Errors.

Reset Errors: Pressing <enter> with the cursor positioned on this field causes both the Near and Far CRC accumulators to be cleared.

Configuration Screen

The Configuration Screen (Figure 4-8) allows the user to both view and set the configuration parameters for the 1558D equipment. A circuit may be configured at anytime, before or after the hardware is installed. To implement changes in the unit configuration, first place the Service State to the Out of Service or Unused state. The LAPS software will not allow a user to change the configuration of an IN SERVICE unit. Once one or more fields have been modified, the user must press <enter> or attempt to exit the screen by pressing <esc>. The user will then see the prompt "Accept changes?" (Y/N)'. If the user responds by pressing <Y>, only then will the configuration changes take effect. A response of <N> will cause LAPS to ignore all requested changes and to restore the original unit configuration param-

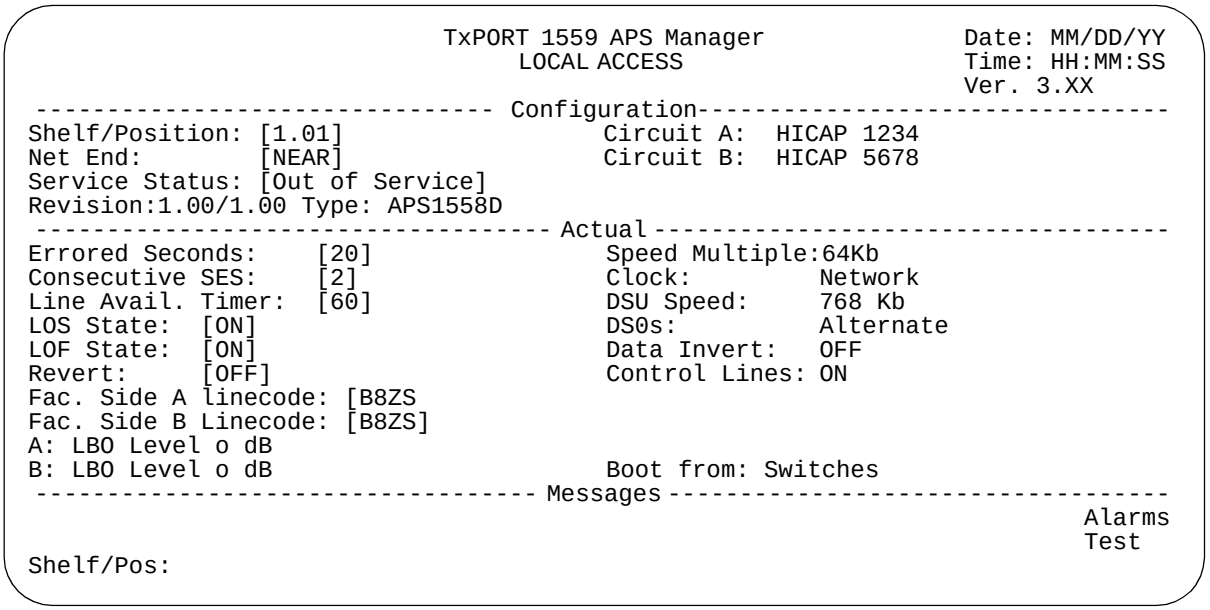


Figure 4-8 Configuration

eters. If the screen is exited with a <N> response, reentering the Configuration Screen will show that all fields have been returned to their previous values.

Configuration Screen fields have the following functions:

Shelf/Position: Defines the circuit that is being configured. This field may be changed by typing a new value or by incrementing or decremented it with the <page down> and <page up> keys, respectively. The unit is configured at the factory for as address "Shelf 1.0".

Net End: Defines which end of the circuit is being configured or viewed. The choices are: Near / Far (Far only available if 1558D is configured as a Master)

Service Status: Indicates the service status of the circuit. This field also determines if the remainder of the fields in this screen can be changed or only viewed. The following selections may be made for this field:

In Service: The circuit is currently in service and all alarm and Call on Alarm features are functional. No configuration parameters can be altered for a circuit that is in service.

Out Service: The circuit is not currently in service. Alarms will function but the LAPS will not show the circuit on the Circuits In Alarm display. Also, if the optional 1559 site manager is installed, the 1559 will not initiate a Call on Alarm. All other fields may be altered as described in the following paragraphs.

Unused: No circuit has been defined for this Shelf/Position.

Revision: This field displays the actual hardware and software revision for this unit and the unit type (1558A, 1558D, etc.).

Circuit A: This field displays the descriptive name/ID of Line A of the pair of T1 lines connected to the 1558D.

Circuit B: This field displays the descriptive name/ID of Line B of the pair of T1 lines connected to the APS.

Actual/Database: This display only field indicates to the user when the configuration data is being obtained from the card (actual) and when the information is not being obtained from the card but from stored information in either the APS manager or from the LAPS user interface (database).

Errored Seconds: This field is used to define the Errored Seconds threshold for an APS service (as specified in AT&T TR54017). The value may be set from 0 to 900. The factory default value is 20 errored seconds.

Consecutive SES: This field is used to define the Consecutive Severely Errored Seconds threshold for an APS service (as specified in AT&T TR54017). The value may be set from to 0 to 900. The factory default value is 2 consecutive errored seconds.

Line Avail. Timer: This field sets the time interval for which each path's Line Activity Timer remains active. The value can be set from 60 to 900 seconds. The factory default is 60 seconds.

LOS State: This field determines if the circuit's APS will alarm on Loss of Signal error state. If On is selected, the 1558D will alarm immediately on LOS. The choices are: Off / On. The factory default is ON.

LOF State: This field determines if the circuit's APS will alarm on Loss of Frame error state. If On is selected, the 1558D will alarm immediately on LOF. The choices are: Off / On. The factory default is ON.

Revert: If this field is set to On, the 1558D will always restore the APS service back to the NET A path when the NET A path meets the following criteria; (1) no alarm conditions are active on the NET A path, and (2) the Line Availability timer setting has expired (0 to 900 seconds, user definable). The REVERT field can be set to either ON or OFF. The factory default is OFF.

Fac. Side A Line code: Sets the facility side line coding for Line A. The choices are: AMI / B8ZS. The factory default is B8ZS.

Fac. Side B Line code: Sets the facility side line coding for Line B. The choices are: AMI / B8ZS. The choices are: AMI / B8ZS. The factory default is B8ZS.

LBO Level, A: Displays the option setting of the LBO level select switch for network Line A. This field is a read only field and may only be manually changed by the user (see Installation on page 2-1). The factory default setting is 0 dB.

LBO Level, B: Displays the setting of the LBO level select switch for network Line B. This field is a read only field and may only be manually changed by the user (see Installation on page 2-1). The factory default setting is 0 dB.

Speed Multiple: Displays the actual option switch setting of the DSU speed multiple (56 or 64 Kb). The factory default is 64 Kb multiples. This field is a read only field and may only be manually changed by the user (see Installation on page 2-1). The factory default setting is 1536 Kb.

Clock: This field display the DSU clocking mode has been manually optioned (Internal, External or Network) by the user. The factory default is NETWORK.

DS0s: This field displays whether the unit has been configured for Alternate or Contiguous DS0 channel assignment. The factory default is Contiguous.

Data Invert: This field displays whether the data invert mode is ON or OFF. The factory default is OFF.

Control Lines: This field display whether or not the data control lines are configured in the ON or OFF mode. The factory default is OFF.

Boot from: Displays the current setting of the APS switches which determine the source of boot-time configuration mode. The choices are: Switches / ROM / RAM / APSM. The factory default is SWITCHES.

Utilities Screen

The Utilities Screen (Figure 4-9) allows the user to set the Date, Time, Location Header, and the Auto Log Off interval. The following paragraphs describe these items.

Date: Selecting this field causes 'Date' to be prompted on the bottom display line. The user may enter a new date in the form MM/DD/YY. Pressing <enter> completes the change.

Time: Selecting this field causes 'Time:' to be prompted on the bottom display line. The user may enter a new time in the form HH:MM:SS. Pressing <enter> completes the change.

Location Header: Not used in LAPS software applications (1559 Manager only).

Auto Log Off: This field sets the time period for the Auto Log Off feature, which logs the current user off the system if there are no keys pressed for the period specified in this field. When Auto Log Off occurs, the effect is the same as selecting 'Log Off' or pressing <esc> while in the main menu. The choices are: Never / 15 Minutes / 30 Minutes / 45 Minutes / 1 Hour. The factory default mode is NEVER.

Loopback Operations

The 1558D has several loops that can be initiated by the user to assist in trouble shooting T1 transmission path problems (see the Block Diagram in Figure 4-10). It is important to note that the types of loops that a 1558D unit can send or respond too is dependent upon the manual unit option settings (master/slave). It is also important to note that APS service must be installed in pairs, one configured as the master and the other as the slave. In addition, each APS pair must be configured to operate in either the normal mode or in the transparent mode. The normal mode allows the slave unit to respond to CSU loop commands and 54016 commands. The transparent mode disables all CSU response functions of the slave unit.

In most applications, APS service is provided by an IXC. In these applications, the APS equipment located in the central office will always be configured for Master/Normal and the APS equipment located at the customer's premise will be configured for Slave/Normal. The 1558 unit is shipped from the factory configured for Slave/Normal operation.

The loop types that LAPS can initiate from the front panel SUPV port of a unit configured as a Master are:

- Near Payload Loop
- Near Line Loop
- Near Facility Loop
- Near Equipment Loop
- NPC Payload Loop (Transparent mode only)
- Far Payload
- Far Line
- CSU Loop
- NET Loop (Telco network interface)

The loop types that LAPS can initiate from the front panel SUPV port of a unit configured as a Slave are:

- Local Facility Loop
- Local Equipment Loop

Before performing loops and unloops, it is important to understand that the user must carefully set up and select the desired loopback. It is recommended that the user follow the steps listed below when setting up a loopback.

1. From the Main Menu, select the Maintenance screen

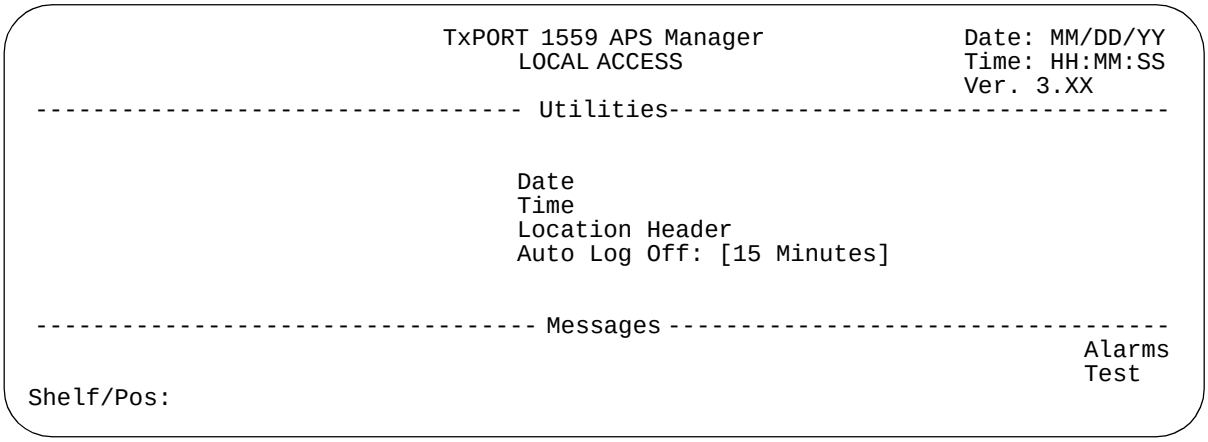


Figure 4-9 Utilities

2. From the Maintenance screen, decide which Path is to be looped (A or B path).

3. If necessary, force the 1558D to use the Path (A or B) that is not to be looped.

4. Lock this Path (A or B). This prevents the 1558D from switching the active path to the test path during testing.

> ⚠ ***The LAPS software and 1558D hardware will not allow a user to loop an active line or apply a BERT pattern to an active line. Only a line shown in the StandBy mode or Inhibited mode can be looped or BERT tested.***

5. Initiate the desired local/remote loop.

The following sections describe in detail how to perform loops and unloops of the 1558D equipment. Note that all loops and unloops are performed at the Maintenance screen.

The location of the various loops is depicted in the 1558D Block Diagram shown in Figure 4-10. The remainder of this chapter discusses these loops. The user should refer to the block diagram mentioned earlier for a clearer understanding of the loop that is being described by this material discussed in the following paragraphs.

Near Payload Loop

Target the path (A or B) that you want to test by moving the cursor highlight to the Target field and then, using the space bar, toggle the field until it displays the SIDE that you want to loop (Side A or Side B). After you have selected either the A or B side as the target for testing, move the cursor highlight to the Loop field and toggle the field, using the space bar, until the field displays Near Payload. Then, momentarily depress the <enter> key. The LAPS will initiate a payload loop of the selected target. After a few moments, notice that the NEAR status field has changed from Soft Inhibit or StandBy to PL LP. Also note that the near 1558D front panel Loop LED indicator is on.

A payload loopback loops the incoming T1 signal back to the network. The T1 signal is regenerated (both CRC and signal level). In addition to looping the signal back to the network, the signal is also passed to the 1558D DTE port.

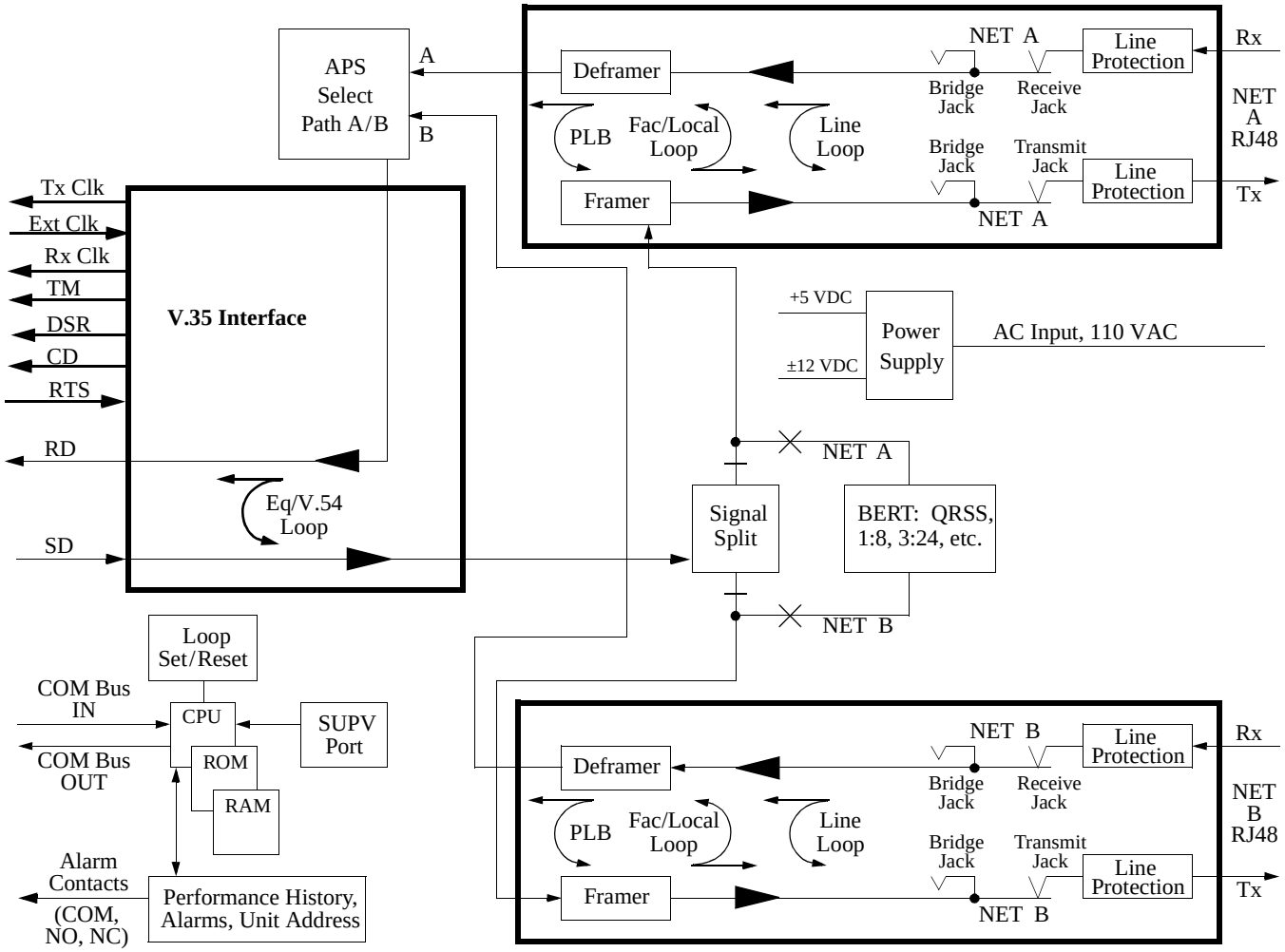


Figure 4-10 1558D Block Diagram

To unloop the unit, move the cursor highlight to the Unloop field and toggle the field, using the space bar, until Near Payload is displayed. Then depress the <enter> key. The LAPS will issue a payload unloop command. After a few moments note that the NEAR status field changes from PL LB to Soft Inhibit or StandBy. Also note that the LP LED indicator on the 1558D turns off. The Payload loop is now off.

Near Line Loop

Target the path (A or B) that you want to test by moving the cursor highlight to the Target field and then, using the space bar, toggle the field until it displays the to side that you want to loop (Side A or Side B). After you have selected either the A or B side as the target for testing, move the cursor highlight to the Loop field and toggle the field, using the space bar, until the field displays Near Line. Then momentarily depress the <enter> key. The LAPS will initiate a Near Line loop of the selected target. After a few moments, notice that the NEAR status field has changed from Soft Inhibit to Line LP. Also note that the 1558D front panel Loop LED indicator is on.

A Line loopback loops the incoming T1 signal from the facility back to the network. Only the T1 signal level is regenerated, not the CRC. In addition to looping the signal back to the network, the signal is also passed to the 1558D DTE port.

To unloop the unit, simply move the cursor highlight to the Unloop field and toggle the field, using the space bar, until Near Line is displayed. Then depress the <enter> key. The LAPS will issue a line unloop command. After a few moments note that the NEAR status field changes from Ln Lp to Soft Inhibit or StandBy. Also note that the LP LED indicator on the 1558D turns off. The Line loop is now off.

Near Facility Loop

Target the path (A or B) that you want to test by moving the cursor highlight to the Target: field and then, using the spacebar, toggle the field until it displays the to side that you want to loop (Side A or Side B). After you have selected either the A or B side as the target for testing, move the cursor highlight to the Loop field and toggle the field, using the space bar, until the field displays Near Facility. Then momentarily depress the <enter> key. The LAPS will initiate a Near Facility loop of the selected target. After a few moments, notice that the NEAR status field has changed from Soft Inhibit or StandBy to Fac LP. Also note that the 1558D front panel Loop LED indicator is on.

A facility loopback loops the outgoing T1 signal back to the 1558D receive. The T1 signal level is regenerated and, depending on the user option (regenerate CRC yes/no), the CRC will or will not be regenerated. In addition to looping the signal back to the 1558D receive, the signal is also transmitted to the network (see the block diagram in Figure 4-10).

To unloop the unit, simply move the cursor highlight to the Unloop field and toggle the field, using the space bar, until Near Facility is displayed. Then depress the <enter> key. The LAPS will issue a line unloop command. After a few moments note that the NEAR status field changes from Fac Lp to Soft Inhibit or Standby. Also note that the LP indicator on the unit turns off. The Line loop is now off.

Near Equipment Loop

A DTE equipment loopback loops the incoming T1 signal coming into the DTE (Tx) port back to the DTE port (Rx). Only the T1 signal level is regenerated, not the CRC. In addition to looping the signal back to the DTE port, the signal is also transmitted to the network.

To initiate a CO Equipment Loop, first target the path (A or B) that you want to test by moving the cursor highlight to the Target: field and then, using the spacebar, toggle the field until it displays the side that you want to loop (Side A or Side B). After you have selected either the A or B side as the target for testing, move the cursor highlight to the Loop field and toggle the field, using the space bar, until the field displays Near Equipment. Then momentarily depress the <enter> key. The LAPS will respond by sending the following message to the user, ***"Warning! This loop disrupts active service. Perform Loop? (Y/N)."*** If the user enters y (yes), the system will initiate a DTE Equipment loop. After a few moments, notice that the NEAR status fields for both the A and B circuits has changed from Soft Inhibit or StandBy to Eq Lp. Also note that the 1558D front panel DTE Loop LED indicator is on. If the user enters N (no) when prompted with the warning message, the LAPS system ignores the equipment loop command.

To unloop the unit, simply move the cursor highlight to the Unloop field and toggle the field, using the space bar, until Near Equipment is displayed. Then depress the <enter> key. The LAPS will issue an Equipment unloop command. After a few moments note that the NEAR status field changes from Eq Lp to Soft Inhibit or StandBy. Also note that the LP LED indicator on the 1558D turns off. The Equipment loop is now off.

Far Payload

A Far Payload loopback is used to loop the far slave 1558D unit from the master unit. At the far slave unit, the Payload loopback loops the incoming T1 signal (RX) coming from the network (NET A or NET B) port back to the network (TX, NET A or NET B). Both the signal and CRC are regenerated. In addition to looping the signal back to the network, the signal is also transmitted to the DTE port.

To initiate a Far Payload loop, first target the path (A or B) that you want to test by moving the cursor highlight to the Target: field and then, using the spacebar, toggle the field until it displays the side that you want to loop (Side A or Side B). After you have selected either the A or B side as

the target for testing, move the cursor highlight to the Loop field and toggle the field, using the space bar, until the field displays Far Payload. Then momentarily depress the <enter> key. The LAPS will respond by sending the appropriate loop command to the far slave unit. After a few moments, notice that the FAR status field has changed from Soft Inhibit or StandBy to PL LP. Also note that the 1558D far slave 1558D Loop LED indicator is on.

To unloop the unit, simply move the cursor highlight to the Unloop field and toggle the field, using the space bar, until Far Payload is displayed. Then depress the <enter> key. The LAPS will issue an unloop command. After a few moments note that the FAR status field changes from PL LP to Soft Inhibit or StandBy. Also note that the Loop LED indicator on the far slave 1558D turns off. The Payload loop is now off.

Far Line

A Far Line loopback is used to loop the far end slave 1558D unit from the master unit. At the far end slave unit, the Far Line loopback loops the incoming T1 signal (RX) coming from the network (NET A or NET B) port back to the network (TX, NET A or NET B). Only the signal is regenerated by a Far Line loop. In addition to looping the signal back to the network, the signal is also transmitted to the DTE port.

To initiate a Far Line loop, first target the path (A or B) that you want to test by moving the cursor highlight to the Target: field and then, using the spacebar, toggle the field until it displays the side that you want to loop (Side A or Side B). After you have selected either the A or B side as the target for testing, move the cursor highlight to the Loop field and toggle the field, using the space bar, until the field displays Far Line. Then momentarily depress the <enter> key. The LAPS will respond by sending the appropriate loop command to the far end slave unit. After a few moments, notice that the FAR status field has changed from Soft Inhibit or StandBy to Loop. Also note that the far slave 1558D Loop LED indicator is on.

To unloop the unit, simply move the cursor highlight to the Unloop field and toggle the field, using the space bar, until Far Line is displayed. Then depress the <enter> key. The LAPS will issue an unloop command. After a few moments note that the FAR status field changes from Loop back to Soft Inhibit or StandBy. Also note that the Loop LED indicator on the far slave 1558D turns off. The Line loop is now off.

CSU Loop

The 1558D, when configured as a Slave unit with the CSU mode Enabled, will respond to industry standard CSU loop and unloop commands. A CSU loopback loops the incoming T1 signal (RX) coming from the network (NET A or NET B) back to the network (TX). Only the signal is regenerated by a CSU loop. In addition to looping the signal back to the network, the signal is also transmitted to the DTE port.

To initiate a CSU loop, first target the path (A or B) that you want to test by moving the cursor highlight to the Target: field and then, using the spacebar, toggle the field until it displays the side that you want to loop (Side A or Side B). After you have selected either the A or B side as the target for testing, move the cursor highlight to the Loop field and toggle the field, using the space bar, until the field displays CSU. Then momentarily depress the <enter> key. The LAPS will respond by sending the appropriate loop command to the far end slave unit. After several seconds, notice that the FAR status field has changed from Soft Inhibit or StandBy to Loop. Also note that the far end slave 1558D front panel Loop LED indicator is on.

To unloop the unit, simply move the cursor highlight to the Unloop field and toggle the field, using the space bar, until CSU is displayed. Then depress the <enter> key. The LAPS will issue an unloop command. After several seconds, note that the FAR status field changes from Loop to Soft Inhibit or StandBy. Also note that the Loop LED indicator on the far slave 1558D turns off. The CSU loop is now off.

NET Loop

The NET loop command is used to generate 5-bit patterns towards the far end equipment. These patterns may be used to loop a network interface device or a CSU. To initiate a 5-bit NET pattern, first target the path (A or B) that you want to test by moving the cursor highlight to the Target: field and then, using the spacebar, toggle the field until it displays the side that you want to loop (Side A or Side B). After you have selected either the A or B side as the target for testing, move the cursor highlight to the Loop field and toggle the field, using the space bar, until the field displays NET. Note that when the NET command is selected, a user definable 5-bit code field is also displayed [10000]. This 5-bit field can be set to any combination of ones and zeros by moving the cursor highlight to this field and then entering the desired combination of ones and zeros at the message prompt.

The most common network interface loop up 5-bit pattern is [11000]. The most common unloop 5-bit pattern for network interface devices is [11100]. After selecting the 5-bit pattern, move the cursor back to the Loop field and press the <enter> key. The LAPS responds by sending the selected NET 5-bit code to the far end equipment for 5 seconds or more.

To unloop the network interface device, simply move the cursor to the Unloop field and toggle it with the spacebar, until NET is displayed. Note that when the NET command is selected, a user definable 5-bit code is displayed [11100]. This field may be set to any combination of ones and zeros by entering the desired combination. The most common network interface unloop command is [11100]. After pressing <enter>, the LAPS will issue a NET unloop command for 5

seconds or more, after which, the NET device should be unlooped.

NPC Payload Loop

The NPC Payload loopback is used to loop a far end slave unit that is configured to operate in the transparent mode (CSU Disabled option). In this mode the far end slave card will not respond to any ESF CSU commands. Normally, this application is used only by an IXC internal network protection applications. Note that a NPC Payload loop is functionally the same type as a Far Payload loopback.

A NPC Payload loopback is used to loop the slave 1558D unit from the master unit. At the far end slave unit, the NPC Payload loopback loops the incoming T1 signal (RX) coming from the network (NET A or NET B) port and loops this signal back to the network (TX). Both the signal and CRC is regenerated. In addition to looping the signal back to the network, the signal is also transmitted to the DTE port.

To initiate a NPC Payload loop, first target the path (A or B) that you want to test by moving the cursor highlight to the Target: field and then, using the spacebar, toggle the field until it displays the side that you want to loop (Side A or Side B). After you have selected either the A or B side as the target for testing, move the cursor highlight to the Loop field and toggle the field, using the space bar, until the field displays NPC Payload. Then momentarily depress the <enter> key. The LAPS will respond by sending the appropriate loop command to the far slave unit. After a few moments, notice that the FAR status field has changed from Soft Inhibit or StandBy to PL LP. Also note that the far end 1558D front panel Loop LED indicator is on.

To unloop the unit, simply move the cursor highlight to the Unloop field and toggle the field, using the space bar, until NPC Payload is displayed. Then depress the <enter> key. The LAPS will issue an unloop command. After a few moments note that the FAR status field changes from PL LP to Soft Inhibit or StandBy. Also note that the Loop LED indicator on the far slave 1558D turns off. The NPC Payload loop is now off.

BERT Testing

The user can perform BERT testing from a Master unit by accessing the Maintenance screen. In the lower right hand and left hand portions of the display are the command/toggle/information fields that are used for BERT testing. These fields and their use are discussed below.

Pattern: Specifies which pattern will be transmitted during test. When the 3 or 5-bit, user-defined pattern is chosen, the user may type in any pattern of 1s and/or 0s to be transmitted. Pressing <enter> with the cursor positioned on this field will cause the pattern to be transmitted for the period of time specified in 'Test Time'. The choices are: QRSS, 1:8, 3:24, all Ones, all Zeros, user definable 3-bit, and user definable 5-bit.

> *If the 1558D DTE is configured for AMI operation, the test sets must be set to generate either a 511, 2047, or 1:7 pattern. If the 1558D is configured for B8ZS operation, any pattern may be used (511, 2047, 1:7, QRSS, 3:24, etc.). When sending a 1:7 pattern, though, some T1 test sets inherently cause generation of a yellow alarm condition.*

Test Time: Defines the run-time of test pattern generation and error accumulation and starts the test. Pressing <enter> with the cursor positioned on this field will cause the selected pattern to be transmitted for the specified period of time. If the Maintenance menu is exited, pattern testing is halted. The choices are: 15 Minutes, 30 Minutes, 45 Minutes, 1 Hour, and Continuous.

Runtime: Shows the amount of time elapsed since a timed Pattern test began. Note that this field only appears on the screen when a test is running.

Near CRC Errors: A display-only field for viewing the number of CRC errors which are received at the Near Target receive path.

Far CRC Errors: A display-only field for viewing the number of CRC errors which are received at the Far Target receive.Far CRC Errors are only reported if the 1558D is configured as a Master. Slave 1558D units do not report Far CRC Errors.

Reset Errors: Pressing <enter> with the cursor positioned on this field causes both the Near and Far CRC accumulators to be cleared (only if Master 1558D).

It is important to understand that the 1558D does not allow testing (loop or BERT) on the active path. To perform testing on a given path the user must first configure the path to the StandBy mode, Soft Inhibit mode or Manual Inhibit mode. Once the path to be tested is in one of these modes, the LAPS will allow the user to perform testing.

BERT testing can be performed either to loopbacks or straight away to the far end. To perform a BERT test, the user should follow the steps discussed below.

1. Select the path to be tested using the TARGET toggle field.

2. Move the cursor highlight to the Pattern field and then, using the spacebar, toggle the field until the desired user pattern is display. The available patterns are; QRSS, 1:8, 3:24, all Ones, all Zeros, user definable 3-bit, and user definable 5-bit.

3. Next, move the cursor highlight to the Test Time field and then, using the spacebar, toggle the field to the

desired test time. The choices are 15 minutes, 30 minutes, 1 Hour, 24 Hours, and Continuous.

4. After performing Steps 1 - 3, move the cursor highlight to either the Test Time or Pattern field and then momentarily depress the <enter> key. The system will immediately begin to generate the selected pattern on the selected path for the selected time interval. Observing the Near and Far end CRC errors counters will assist the user in determining if the error problem is occurring in the transmit or receive path.

   The LAPS system cannot generate loops while a BERT test is in process. Also, if the user exits the 'Maintenance' screen while a BERT is running, the BERT stops.

While running the test, the user may reset the CRC error counters by moving the cursor highlight to the Reset Errors field and momentarily depress the <enter> key. This will reset the Near and Far CRC error counters to zero. Performing an error reset does not stop the BERT test in progress.

The user may stop the BERT test at any time by simply moving the cursor highlight to either the Pattern or Test Time command fields and then depress the <enter> key. The system responds by turning off the Runtime clock display. To restart the test, simply depress the <enter> key again. The system responds by applying the selected BERT pattern and restarting the Runtime clock display.

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