Lucent Technologies
Bell Labs Innovations

AnyMedia® Access System

(24 Channel)
Feature Supplement—
MDS2 Shelf Configurations

Issue 4
March 2002
363-211-106

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1 Introduction

3 Product Description

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About This Document

Overview

Purpose

This document, *Feature Supplement—MDS2 Shelf Configurations* (hereinafter referred to as the MDS2 feature supplement), provides the following information for the MDS2 Shelf (hereinafter known as the MDS2 feature):

- An overview of the MDS2 shelf configurations
- Specific information about the features, benefits, applications, and operation of the shelf configurations
- Configuration and engineering information for planning purposes.

Intended audience

Customers who use this MDS2 feature supplement include the following:

- Standardization groups
- Product evaluators
- Network planners
- Engineers.

Issue

This is Issue 4 of the AnyMedia® Access System (24 channel), *Feature Supplement—MDS2 Shelf Configurations*.

Reason for reissue

The MDS2 feature supplement has been issued to include the following feature:

- The FiberReach and MDS2 Block product has been discontinued.
- Power supplies and ringing supplies can be obtained from outside vendors.

- Cabinets can be obtained from outside vendors.

Content

This issue of the MDS2 feature supplement contains the following:

- An overview of the *MDS2 feature*
- A description of the MDS2 feature and its components
- Applications, services and interfaces of the MDS2 feature
- Operations of the MDS2 feature
- Planning and engineering information for the MDS2 feature
- Table of contents, acronym list, glossary, and index for the document, which help the reader find desired information quickly and easily
- A comment form so readers can give feedback to improve the next revision of the document.

For ordering information for the system, see the AnyMedia® Access System, *Ordering Guide*, code 363-211-125.

Document organization

This document has the following organization:

- *About this Document*
  Defines the purpose of the document and the intended audience. Also includes topics about the conventions used in the document, related documentation, how to order documents, and how to comment on this document.

  Chapter 1, *Introduction*
  Describes the MDS2 features and the benefits of the MDS2 feature.

  Describes the types of applications for which the MDS2 feature is uniquely suited. Lists the types of traditional digital loop carrier (DLC) nonswitched and switched services.

- Chapter 2, *System Configurations*
  Describes the various MDS2 feature configurations for use in central offices, remote terminals, cabinets, and single shelf applications options.
- Chapter 3, *Product Description*
  Describes the components of the MDS2 shelf and the various circuit packs and channel units available.
- Chapter 4, *Traditional DLC Interfaces*
  Defines the interfaces of the MDS2 shelf including the TL1 system interface (TL1SI), personal computer (PC) graphical system interface (GSI), and testing interfaces for traditional DLC services.

- Chapter 5, *OAM&P for Traditional DLC Services*
  Describes the methods used to perform configuration management, which includes memory administration, provisioning and inventory; fault management, which includes maintenance and testing; performance management; and security management of the special services of the MDS2 feature.
- Chapter 6, *System Planning and Engineering for Traditional DLC Services*
  Describes the techniques used to incorporate the MDS2 feature into a telecommunications network, which includes capacities, traffic engineering and management, synchronization, system powering, and circuit testing for special services.
- *List of Acronyms*
  Lists the acronyms used to replace the longer expressions the acronyms represent.
- *Glossary*
  Defines terms that may be unfamiliar to the user.
- *Index*
  Lists in alphabetical order the specific subject information in the document.

Conventions Used in This Document

Terms used

The following are terms used in this MDS2 feature supplement that may have a different meaning than the general or common use of the term.

- In the *AnyMedia* Access System, the term *access* means that the system provides the primary service interface for the customer to enter the network.
- Traditional DLC services refer to traditional telephony services, which include plain old telephone service (POTS), ISDN, and two-wire locally switched, nonswitched, and nonlocally switched services.
- Special services refer to two-wire and four-wire switched, nonswitched, and nonlocally switched special services.
- MDS2 feature refers to the MDS2 shelf.
- VF growth refers to the growth or addition of traditional DLC services (as defined above) or special services to an existing DLC system.

Apparatus code followed by empty parentheses

An apparatus code followed by empty parentheses “( )” includes the letter-suffixed versions of the circuit pack. For example, PTU BDJ200( ) represents the PTU BDJ200 circuit pack and/or the PTU BDJ200B circuit pack.

Acronyms and abbreviations

In the first chapter, acronyms are spelled out in lower case letters the first time they are used. Acronyms are also expanded if the section topic is specifically about the acronym. All acronyms may be found in the Acronym list located in the back of the document.

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Document list, packaging, and formats

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Available on the Web

- ***AnyMedia* Access System Documents**
  - — 363-211-125, AnyMedia® Access System, *Ordering Guide* http://www.lucent8.com/library/AnyMediaOrderingGuide.pdf
  - — Other *AnyMedia* Access System documents, including System Release Descriptions (SRDs) and the Navis™ *AnyMedia* Element Management System (EMS), can be found by going to http://www.lucent8.com, selecting “Documents”, then selecting “Product Line: AnyMedia” and “Search Now”

    An SRD is issued per release and describes the functionality of the system at the time of release.

Available on CD-ROM

363-211-103, AnyMedia® Access System, *Documentation*, which is a CD-ROM that contains the following documents in various formats:

- ***AnyMedia* Access System Documents**
  - — AnyMedia® Access System, *Applications, Planning, and Ordering Guide* (APOG) (in PDF format)
  - — AnyMedia® Access System, *Feature Supplement—MDS2 Shelf Configurations* (in PDF format)
  - — AnyMedia® Access System, *Feature Supplement—Integrated Access Terminal* (in PDF format)
  - — AnyMedia® Access System, *Feature Supplement—Central Office Terminal* (in PDF format)
  - — AnyMedia® Access System, *Ordering Guide* (in PDF format)
  - — AnyMedia® Access System, *Installation Manual* (in PDF format)
  - — AnyMedia® Access System, *Commands and Procedures* (363-211-100, in HTML format, also includes PDFs of selected procedures)
  - — AnyMedia® Access System, *ConnectReach™ Terminal User’s Guide* (in PDF format)
  - — AnyMedia® Access System, *ConnectReach Plus™ Terminal User’s Guide* (in PDF format)
- **Cabinet Documents**
  - — AnyMedia® Access System, *82-Type Outdoor Electronics Cabinets* (in PDF format)
  - — AnyMedia® Access System, *52B and 52E Outdoor Electronics Cabinets* (in PDF format)

— AnyMedia® Access System, *92-Type Indoor Electronics Cabinets Description, Installation, and Operations* (to be supplied at a later date in PDF format)

- ***SLC* Documents**

— *SLC* Series 5 Carrier System J1C182BC-1 Remote Terminal Ring Shelf, *User Manual* (in PDF format)

NOTE:
An *Adobe Acrobat* Reader is provided to view all PDF files.
For documents in HTML format, users need and must supply their own Web browser to view them. The documentation has been verified using the following Web browsers: *Netscape Navigator* 4.0 and *Internet Explorer* 5.0 or later.

The *AnyMedia* Access System Management Interface, which includes the graphical system interface (GSI) and the Network Maintenance Manager, is available on CD-ROM.

Available in Print (hard copy)

- ***AnyMedia* Access System Documents**

— 363-211-101, AnyMedia® Access System, *Applications, Planning, and Ordering Guide* (APOG)

— 363-211-106, AnyMedia® Access System, *Feature Supplement—MDS2 Shelf Configurations*

— 363-211-127, AnyMedia® Access System, *Feature Supplement—Integrated Access Terminal*

— 363-211-128, AnyMedia® Access System, *Feature Supplement—Central Office Terminal*

— 363-211-125, AnyMedia® Access System, *Ordering Guide*

— 363-211-102, AnyMedia® Access System, *Installation Manual*

— 363-211-129, AnyMedia® Access System, *ConnectReach™ Terminal User's Guide*

— 363-211-130, AnyMedia® Access System, *ConnectReach Plus™ Terminal User's Guide*

— 363-211-300, AnyMedia® Access System, *ADSL Element Manager System Administrator's Guide*

— 363-211-301, AnyMedia® Access System, *ADSL Element Manager System User's Guide*

— 363-211-302, AnyMedia® Access System, *AEM-BB Software Release Description for Release 1.2*

— 363-211-401, AnyMedia® Access System, Element Manager for Narrowband Services Release 1.0, *Functional Description*

— 363-211-402, AnyMedia® Access System, Element Manager for Narrowband Services Release 1.0, *User Service Manual*

- **Cabinet Documents**

— 631-600-290, AnyMedia® Access System, *82-Type Outdoor Electronics Cabinets*

— 631-600-293, AnyMedia® Access System, *52B and 52E Outdoor Electronics Cabinets*

— 640-250-307, AnyMedia® Access System, *92-Type Indoor Electronics Cabinets Description, Installation, and Operations* (orderable at a later date)

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1 Introduction

Overview

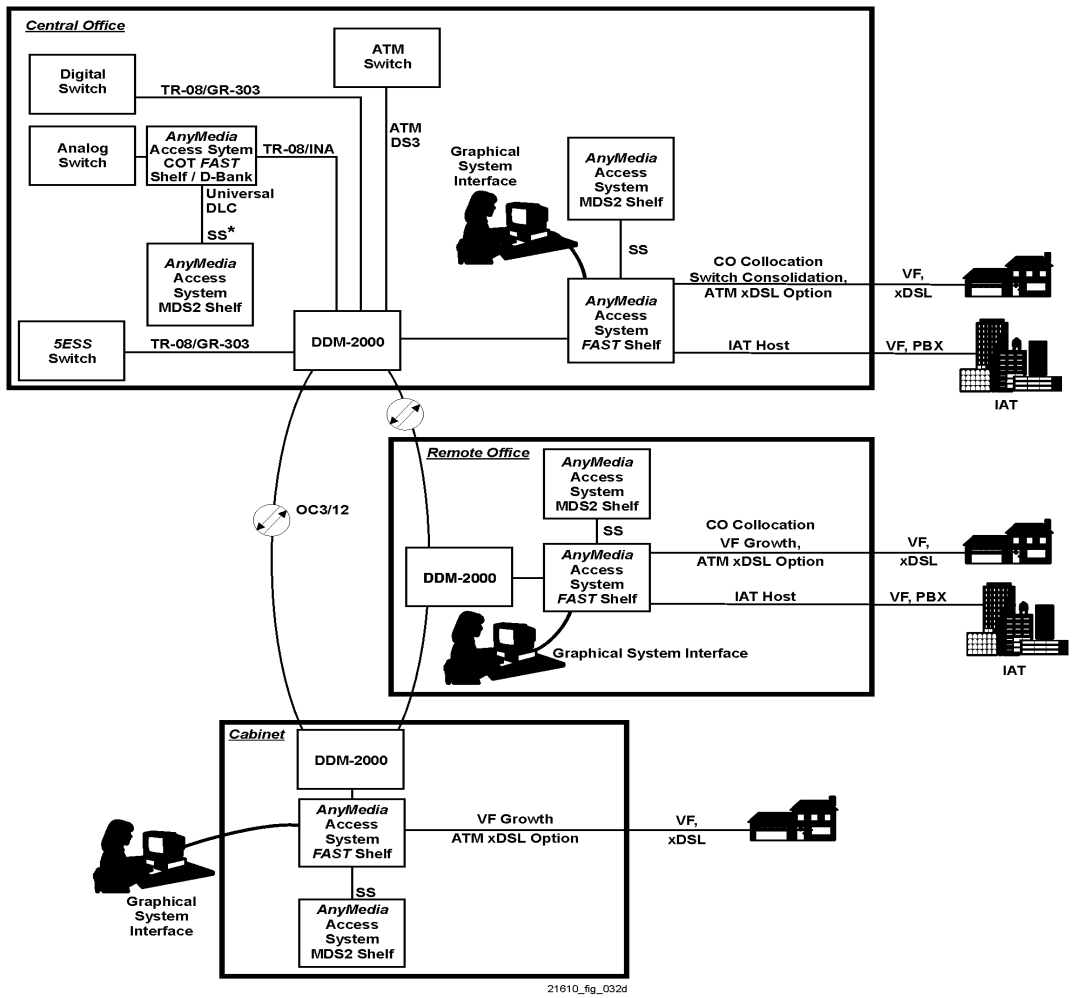
The MDS2 feature supplement describes the MDS2 shelf configurations available to customers who have the *AnyMedia* Access System FAST™ shelf. The AnyMedia® Access System, *Applications, Planning, and Ordering Guide* describes in detail how the MDS2 shelf configurations are supported by the *AnyMedia* Access System.

Features and benefits

The *AnyMedia* Access System *FAST* shelf supports volume services (such as plain old telephone service [POTS], coin, and two-wire specials), and the MDS2 extension shelf supports most other special services. It is designed for use with the *AnyMedia FAST* shelf and uniquely supports the following:

- TR-08 Mode 1 universal configuration via an *AnyMedia* Access System central office terminal (COT) MDS2 shelf.
- Services such as enhanced business service (EBS), two-wire and four-wire special services, narrowband data (e.g., digital data system [DDS]), and DC test and alarm services.
- Simplified operations via the Management Interface, which includes the graphical system interface (GSI) and the Network Maintenance Manager.

The applications supported by the *AnyMedia* Access System are shown in Figure 1-1 on page 1-2.



* SS - Special Services supported by MDS2 shelf

Figure 1-1. *AnyMedia* Access System Applications

Applications

The MDS2 shelf configurations (like the *FAST* shelf) are supported in the following applications:

- Central office (CO) collocation
- Switch consolidation
- Voice frequency (VF) growth*.

System Configurations

The MDS2 shelf and its associated *FAST* shelf are available in system configurations as follows:

- Flush mount
- RT mount
- Miscellaneous mount
- Cabinet mount.

Main components for MDS2 feature

To support special services, the MDS2 feature requires the following main components:

- **MDSU packs** (reside on the *FAST* shelf)—Each pack provides an interface to half the channel unit slots supported at the MDS2 shelf. Two MDSUs are required to serve 96 customers with full testing functionality from the MDS2 shelf. When two MDSUs are installed, they must be in adjacent slots.
- **MDS2 shelf**—an extension shelf to the RT *FAST* shelf and/or the COT *FAST* shelf that provides a broad range of special services using the *SLC*-2000 and *SLC* Series 5 channel units.
  - **Power and test unit (PTU)**—This pack provides power to the MDS2 extension shelf.
  - **MSC (metallic shelf unit)**—This pack performs the control functions for the MDS2 shelf.

* Throughout this document, the term VF growth is used generically to define the growth or addition of POTS, two-wire and four-wire special services, ISDN, narrowband data (e.g., DDS), enhanced business services (EBS) P-Phone, and DC test and alarm circuits to an existing DLC system.

— **Channel units (CUs)**—*SLC* Series 5 and *SLC*-2000 channel units support a broad range of special services including EBS (P-Phone), two-wire and four-wire special services, narrowband data (e.g., DDS), and DC test and alarm circuits. Table 1-1 shows the CUs available on the MDS2 shelf.

Table 1-1. MDS2 Channel Units

Code	COT End	RT End	Description	Data Sheet
Nonprovisionable				
SPQ®328	3		Enhanced Business Service (EBS)	TLGD-328C
*SPQ*429		3	Quad EBS (P-Phone)	TLGD-429R
Manually Provisionable				
AUA45B	3	3	Dual Ringing Repeater (Manual Ring)	363-005-123
AUA75( )	3	3	Private Line Automatic Ring (PLAR)	363-005-132
AUA200		3	Two-Wire Switched 56-kbps DPX	363-005-313
AUA232		3	Data Services Unit Dataport (DSU DP)	363-005-312
MCU-5205	3	3	Metallic Channel Unit (*Tollgrade*[a])	TLGD-5205
MCU-5405	3	3	Digital Bypass Pair (*Tollgrade*)	TLGD-5405
Teltrend AUA293I2	3	3	ISDN BRITE	AUA293I2
ADTRAN 1433105		3	ADTRAN *Total Reach* DDS Dataport (DDS-DP)	61433105L1-5D
Electronically Provisionable				
*SPQ*442	3	3	E *SPOTS* Current Sink	363-005-382
*SPQ*443	3		Two-Wire Current Feed	363-005-383
*SPQ*444	3	3	Four-Wire CS (FXO/TDM)	363-005-385
*SPQ*452	3	3	Dual OCU Dataport	363-005-341
*SPQ*334	3		Dual DS0 DP	363-005-332
*SPQ*454	3	3	Four-Wire E&M/PLR	363-005-386
AUA41(B)	3	3	Four-Wire CF (FXS/ETO/DX)	363-005-105

System benefits

The MDS2 feature offers additional system benefits to the *AnyMedia* Access System.

Low cost deployment

MDS2 shelf configurations provide for an extremely competitive cost structure.

- The MDS2 extension shelf supports a wide range of two-wire and four-wire special services utilizing existing SLC®-2000 and *SLC* Series 5 channel units (CUs). The ability to incorporate the legacy systems with the *AnyMedia FAST* shelf's design saves space,
- When special services are needed, the optional MDS2 extension shelf is simple to install and turn up. The turn-up procedure is easy to follow, which allows for quick service to subscribers.
- The MDS2 shelf configurations are designed to reside with the *FAST* shelf and take advantage of configuration options for central office (CO), remote terminal (RT) bay, cabinet and single system arrangements.

Simplified operations

An extremely important requirement of an access system is its operations capability. Therefore, Lucent Technologies has focused on simplifying the operations of the *AnyMedia* Access System as it interfaces with the MDS2 shelf configurations.

- The MDS2 shelf configurations are managed through a convenient Management Interface, which includes a GSI used for managing traditional DLC services.
- The *AnyMedia* Access System's operations interfaces for the MDS2 shelf configurations are fully message based.
- The system does its own internal alarm correlation and filtering so that the alarm messages identify the root cause of a problem in the detailed alarm information delivered to the operating systems.
- The *AnyMedia* Access System provides a CD-ROM for online access to all documentation required to plan, engineer, install, turn-up, activate, diagnose, recover, and maintain the system.

Applications and services

The services supported by the MDS2 shelf configurations include switched services, nonswitched services, and digital data services. For a complete list of the services in an RT or COT configuration, see Table 3-6 on page 3-22.

Switched services

Locally switched and nonlocally switched services are supported by several *SLC*-2000 or *SLC* Series 5 compatible channel units (CUs) on the MDS2 shelf configurations, including the following:

- DID PBX-CO trunks (DPT interface via the *SPQ*442 E *SPOTS* CU and SPO interface via the *SPQ*443 CU)
- Four-wire FX lines and trunks (FXS/FXO/TDM interfaces via the AUA41B and *SPQ*444 CUs)
- Switched digital services (*Datapath* [two-wire] or *ACCUNET* [four-wire] interfaces via the AUA200, *SPQ*452 CUs, and ADTRAN *Total Reach* DDS Dataport (DDS-DP), respectively)
- Enhanced business service (EBS) (P-Phone) (via the *SPQ*429 CU and/or *SPQ*328 CU).

Nonlocally switched service

Nonlocally switched ISDN BRITE service is supported by the Teltrend AUA293I2 CU on the MDS2 shelf.

- ISDN BRITE (Teltrend AUA293I2 CU)

Nonswitched services

Nonswitched services are supported by several *SLC*-2000 and *SLC* Series 5 compatible CUs on the MDS2 shelf configurations, including the following:

- PBX off-premises stations (two-wire FXO interface via the *SPQ*442 CU, FXS with *SPQ*443, and four-wire FXS/FXO/TDM interfaces via the AUA41B and *SPQ*444 CUs)
- PBX tie trunks (four-wire E&M/PLR/DX/TO interfaces via the *SPQ*454 and AUA41B CUs)
- Four-wire private line data (TO interfaces via the AUA41B CU)
- Voice private line (TO/RD/PLAR interfaces via the *SPQ*442, AUA41B, AUA45B, and AUA75( ) CUs)
- Digital data (DDS service via the *SPQ*334, *SPQ*452, AUA232 [EIA232 interface] dataports)
- DC/AC alarms (*Tollgrade MCU*-5205 CU)
- DC test path (for remote metallic testing of loop carrier drops via the *Tollgrade MCU*-5405 CU)
- Two-wire private-line manual ring service (AUA45B ringing repeater CU)
- Two-wire PLAR service (AUA75( ) PLAR CU)
- E&M tandem interface with other transmission equipment (*SPQ*454 four-wire E&M CU).

Digital data services

The *SPQ*452 dual OCU dataport is primarily used in an end-link of a DDS private line data service. The end-link is the part of the service between a customer and the local central office. It may also be used to provide local data service. This

OCU dataport supplies the proper sealing current to the T/R and T1/R1 leads when the external load is less than 5400 ohms. The OCU dataport provides a high fault tolerance if a power line accidentally comes in contact with the metallic leads of the channel unit. The *SPQ*334 is a COT-only counterpart to the *SPQ*452 to support DDS.

The digital services include the following:

- Selectable customer data rates of 2.4, 4.8, 9.6, 19.2, 38.4, 56, or 64 kbps
- Error correction of majority vote, 19.2 single timeslot, or channel error correction
- All-zero-code is allowed
- Secondary channel (a low-speed telemetry channel added to the customer data bits)
- Sealing current.

Integrated services digital network

Integrated services digital network (ISDN) service is supported on the MDS2 shelf by the *ANSI* U-interface Teltrend AUA293I2 BRITE CU.

The Teltrend AUA293I2 BRITE CU provides ANSI standard U-interface ISDN service. It supports one subscriber interface via a slot of the MDS2 shelf. The CU uses three DS0 timeslots to provide ISDN service in universal TR-08 only, TR-08 virtual remote terminals, and INA virtual banks. The Teltrend AUA293I2 is compliant with both Telcordia Technologies, Inc. TR-NWT-000397 and TR-TSY-00829 carrier-side interfaces.

NOTE:
The Teltrend AUA293I2 is a BRITE, used only in universal mode, and cannot be used directly in integrated TR-303 or TR-08.

System Configurations

2

Overview

The applications and services of the *AnyMedia* Access System are supported by several configurations. This chapter details the configuration options for traditional DLC as they pertain to the MDS2 shelf configurations.

Configuration Options

Overview

Configuration options of the *AnyMedia* Access System in support of optional MDS2 shelf for traditional DLC and special services include the following:

- Central office (CO) bay arrangement
- Remote terminal (RT) bay arrangement
- Cabinet arrangement
- Single system arrangements.

This section discusses these configuration options and how they can be used to support the following applications:

- Collocation for competitive access
- Switch or wire center consolidation
- VF growth.

CO bay arrangement

The CO bay arrangement of the *AnyMedia* Access System is used for applications that will require the *AnyMedia* Access System RT equipment placed in bays in a CO environment. This arrangement provides a solution for competitive access applications where a network service provider establishes a switching center at a convenient location and transports integrated GR-303 or TR-08 facilities from the network service provider's digital switch to the *AnyMedia* Access System in an existing local exchange carrier CO. Connections are made to the customer loops at the existing MDF. This CO bay arrangement provides a solution for switch or wire center consolidation applications as well. Bay-mounted equipment in the CO best suits the needs of consolidation for service upgrades of switch integrated services.

Typical installations in COs require installation of equipment in bays that have access from both the front and rear of the bay. Specific bay and shelf arrangements for the CO for the MDS2 shelf are described in *Central Office Bay Arrangements* on page 2-5.

Both flush mount and RT-bay type arrangements are available.

RT bay arrangement

The RT bay arrangement of the *AnyMedia* Access System is used for applications which will require the *AnyMedia* Access System RT equipment to be placed in bays in an RT environment. The RT bay arrangement provides a solution for traditional use of a DLC system in a local exchange carrier environment. Typically, the RT bay arrangement is used in VF growth applications where feeder relief of POTS and special services is necessary. The *FAST* shelf with optional MDS2 shelf is placed in a bay in an indoor environment such as a hut, a CEV, or in a subscriber's equipment room. For feeder relief or service growth, the most demand for services is expected to be POTS or *SPOTS* service. If there is also demand for special services, these are supported by the MDS2 shelf. Some special services will require the MDS2 shelf.

These applications usually mount the bays against walls or in back-to-back arrangements to conserve space with front-only access of the bays. Line connections are through outside plant protector blocks to local distribution frames or cross-connect fields. Specific bay and shelf arrangements for the RT, including pre-engineered, orderable configurations and other possible configurations, are described in *Remote Terminal Bay Configurations* on page 2-7.

Cabinet arrangement

Cabinets can be placed in remote locations where customers need to be served.

The MDS2 shelf configurations can be ordered for the following Avaya cabinets:

- 82A
- 52B
- 52E
- 92C.

The features of all the cabinets are detailed in *Cabinet Arrangements* on page 2-10.

82A cabinets

A large line size (maximum capacity is 1536 all POTS lines) 82A-type cabinet is used for pad installation situations. This cabinet is equipped to support the enclosed shelves with all the equipment necessary to perform the system's service functions. Applications of DLC for feeder relief or service growth and integrated ADSL also make use of outside plant cabinets.

If there is demand for special services, the MDS2 shelf may be installed in a cabinet, preferably located near its serving *FAST* shelf, and usually directly above the serving shelf. This increases the capacity of the cabinet to 1568 lines.

When an MDS2 shelf is needed in a cabinet, it must be ordered as a specific group for the cabinet. It cannot be installed in an operating cabinet not equipped for an MDS2 shelf.

52B cabinets

These cabinets house a single *AnyMedia* Access System for outside plant applications. The single *FAST* shelf supports up to 512 lines (or up to 256 ISDN lines, or up to 60 ADSL lines). An optional MDS2 shelf supports up to 96 special service circuits, which makes the total capacity of the cabinet 544 lines.

52E cabinets

These cabinets house up to two *FAST* shelves for outside plant application. Two *FAST* shelves support up to 1024 lines (or up to 512 ISDN lines, or up to 60 ADSL lines). An optional MDS2 shelf supports up to 96 special service circuits, which makes the total capacity of a cabinet 1056 lines.

92C cabinets

These cabinets are for indoor customer premises applications. The cabinet houses one *FAST* shelf and supporting equipment. The *FAST* shelf supports up to 512 lines (or up to 256 ISDN lines, or up to 60 ADSL lines). If an optional MDS2 shelf is equipped, the total capacity of the cabinet is 544 lines.

Single system arrangements

The single system arrangement is used where a complete bay of *AnyMedia* Access Systems is not immediately required. This provides a solution for applications that may require fewer than 512 lines or when growth is slow and it is preferable to install a single shelf at a time. If there is demand for special services, an MDS2 shelf may be installed with an associated *FAST* shelf. Single system arrangements are described in *Single System Arrangements* on page 2-12.

Central Office Bay Arrangements

Overview

The *AnyMedia* Access System can be mounted in a front and rear access bay, which is typically used in a central office (CO) environment. Also, a flush-mounted system is available for use in a CO where flush-mounted frames are already available.

This section describes the following:

- Possible configurations
- CO flush mount arrangements
- How to determine which bay thermal design to use.

For the CO environment, the *AnyMedia* Access System can be mounted in a seismic 7-foot RT bay (ED8C800 type). The bays are 26 inches wide with 23-inch spacing of mounting centers, and up to four *FAST* shelves can be installed in a single bay.

NOTE:
All equipment described in this section are specified in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide*. These are separately orderable items listed in the AnyMedia® Access System, *Ordering Guide*.

Possible configurations

The *FAST* shelf configurations are detailed in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide*.

Alternate bay arrangement

Another possible bay arrangement could be equipped with up to three *FAST* shelves with the second position left open for the installation of an additional *FAST* shelf for the VF growth applications or for the installation of an MDS2 shelf to satisfy special services demand.

This possible bay arrangement consists of the following orderable components:

- An MDS2 shelf can be substituted for a *FAST* shelf in any *FAST* shelf position in the bay. Typically, an MDS2 shelf will be mounted directly above its hosting *FAST* shelf.
- This bay is front and rear access and may require fans for forced convection cooling.
- The second shelf position from the bottom is vacant to allow for future growth: a *FAST* shelf, an MDS2 shelf, or other features.

- All cable connections to the bay are connectorized and available in various lengths to provide a flexible connection plan.

Central office flush mount bay

The CO flush mount bay can be used similarly to the RT mount CO bay described in the *Possible configurations* on page 2-5. The flush mount bay would be used to conform with other equipment in a CO that is flush-mounted. Details about the flush mount bay with the *FAST* shelf can be found in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide*.

MDS2 shelf cabling

If an MDS2 shelf is installed in position 2 of a typical bay arrangement, two front access MDS2 server dangler cables will be supplied with the MDS2 shelf for connection to the MDSU circuit packs in the *FAST* shelf (the MDSU circuit packs can go in any two adjacent slots). The VF cables for the two AP slot positions to be occupied by the MDSU circuit packs at the *FAST* shelf will be removed from the cable trough and tied off in the cable duct.

Typically, the MDS2 shelf receives power and ringing inputs from the *FAST* shelf. The MDS2 VF cables are routed up the cable duct between bays for appropriate office, CEV, hut or customer premises termination. Earlier versions of the MDS2 shelf receive power and ringing inputs from independent sources.

Cables are required to support the E&M leads needed for some special services, and connection to TAPs A and B is necessary to support special service testing.

Associated equipment

The following equipment is generally required to be connected to the system to support its complete operation for the MDS2 shelf configurations. More equipment is detailed in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide.*

- Transport equipment and facilities—A choice of products can be offered including a fiber mux like *SLC*-2000 ARM, T1 carrier office repeater bays, or other DS1 level transport equipment. The *FAST* shelf DS1 transport interface is based on the T1.102 standard so that a large selection of transport systems are compatible with the system.

Remote Terminal Bay Configurations

Overview

The *AnyMedia* Access System can be placed in bays, huts, CEVs, subscriber premises, or anywhere that traditional DLC is deployed. Details regarding the *FAST* shelf configurations are in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide.*

This section describes the following for the MDS2 shelf configurations:

- Possible configurations
- Optional special services and transport
- Additional equipment required for RT applications.

Possible configurations

In addition to one or more *FAST* shelves in a bay, the following equipment may also be assembled in the bay as long as size and thermal constraints are considered:

- MDS2 shelves
- SONET multiplexer
- DSX panel
- Power and ringing supplies
- Remote test units (RTUs)
- Fans and baffles
- Batteries
- Lightguide cross connect panel
- Power distribution panel
- T1 extension shelf.

Alternate bay arrangement

Another possible bay arrangement could be equipped with up to three *FAST* shelves with the second position left open for the installation of an additional *FAST* shelf for the VF growth applications. The typical RT bay arrangement with appropriate convection equipment is the same as the CO bay arrangement.

Details on orderable components are in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide*

- Danglers, which are short cables with connectors to bring rear-connector access to the front of the shelf, are used for front access for bay connections. Fixed length danglers are provided with each bay. Custom cables may be ordered separately in varying lengths.

Optional special services and transport

The MDS2 shelf can support up to 96 special services using *SLC* type channel units. The probability of encountering at least one special service circuit in an RT site is high, so many customers will install at least one MDS2 shelf in each RT site. It is recommended that an MDS2 shelf be installed with each new *AnyMedia* Access System application. However, since some customers may choose to defer the cost of the MDS2 shelf, it is possible to install the MDS2 shelf in a bay with an in-service *AnyMedia FAST* shelf without service impact. It is also possible to install the MDS2 shelf in an adjacent bay to the host shelf, although the absolute cable distance between the *FAST* shelf and the MDS2 shelf limits the available positions in the second bay.

Only one MDS2 shelf will be supported by an *AnyMedia* Access System *FAST* shelf.

The information in *Possible configurations* for CO bay arrangements on page 2-5 is also applicable to the bay with an MDS2 shelf included.

Additional equipment required for RT applications

Details about the equipment for the *FAST* shelf are in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide.* For the MDS2 shelf configurations, the RT applications include the following:

- VF cables
- Power cables
- Test access cables
- Miscellaneous alarm cables
- Ringing cables
- Ringing filter assembly
- CO output alarm cables.

VF cables

Each VF cable supports 32 tip/ring pairs per AP, 1 cable per AP, 16 cables per shelf, installed for all 4 *AnyMedia* Access System *FAST* shelves at bay installation time. The other end of each cable is terminated at an MDF or at a local cross connect depending on the application.

When the bay is equipped with an MDS2 shelf, the *FAST* VF cables will not be installed in the bay position where the MDS2 shelf is installed. The MDS2 shelf must be cabled (three 32-pair cables) separately to the MDF or local cross-connect.

The VF cables associated with the AP slots occupied by the MDSU circuit pack in the *FAST* shelf serving the MDS2 shelf will be removed from the trough and placed in the adjacent cable duct.

Power cables

The MDS2 shelf receives power directly from its associated *FAST* shelf or from an independent source. Appropriate grounding (single-point or mesh) is also specified for the bay.

Test access cables (test access and control)

Cabling is provided for test access ports and test control leads to a metallic bypass pair. A test access can also be provided using a *Micro-Bank* test system, a *Tau-Tron NGRTH* test system, or a *4TEL* remote measurement unit (RMU). When equipped with an MDS2 shelf, they are included in the *FAST* shelf daisy-chain for test access.

Miscellaneous alarm cables

Miscellaneous discrete input alarms require cables that come from a connector on the backplane of the *AnyMedia* Access System shelf. For front-only access in RT applications, the cables are accessed from a connection to a dangler cable. Two connectors (J111, J111A) are used for miscellaneous alarm inputs, such as the cabinet door alarm. These are connected to the CTU slot on the *FAST* shelf.

Ringing cables

Cables provide a –20 Hz ring connection and return to the *FAST* shelf from the office supply. Ringing supplies for the MDS2 shelf are provided through a cable from the associated *FAST* shelf or directly from the office supply depending on the code of *FAST* shelf.

Ringing filter assembly

An optional ringing filter assembly is available to protect the ringing lines from lightning. This protection is only required when the ringing supply is located remotely from the *AnyMedia* Access System.

CO output alarm cables

Alarm signals output from an office alarms cable via a J110 dangler on the backplane. Alarm signals from the connector are routed to the CTU slot on the *FAST* shelf.

Cabinet Arrangements

Overview

The *AnyMedia* Access System can be installed in outside plant and indoor cabinets when access requirements warrant cabinet deployment. This section briefly describes the cabinet applications and necessary equipment as it applies to the MDS2 shelf configurations. Detailed information is in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide*. The following types of cabinets are available:

- An Avaya 82A-type outside plant cabinet supporting three *AnyMedia FAST* shelves and an optional MDS2 shelf
- An Avaya 52B-type outside plant cabinet supporting one *AnyMedia FAST* shelf and an optional MDS2 shelf
- An Avaya 52E-type outside plant cabinet supporting two *AnyMedia FAST* shelves and an optional MDS2 shelf
- An Avaya 92C-type indoor cabinet supporting one *AnyMedia FAST* shelf and an optional MDS2 shelf.

82A-type cabinet

The Avaya 82A-type cabinet houses the *AnyMedia* Access System for outside plant applications. The cabinet is equipped with a heat exchanger.

The cabinet can support a single MDS2 shelf. The MDS2 shelf can provide up to 96 special service lines, which supports a total capacity of 1568 lines for a fully equipped cabinet with three *FAST* shelves and one MDS2 shelf. Equipping the cabinet with an MDS2 shelf requires ordering a specific group number.

52B-type cabinet

The Avaya 52B-type cabinet houses a single *AnyMedia* Access System for outside plant application.

The cabinet can include an optional MDS2 shelf supporting up to 96 special service circuits.

52E-type cabinet applications

The Avaya 52E-type cabinet houses up to two *FAST* shelves for outside plant application.

The cabinet can include an optional MDS2 shelf supporting up to 96 special service circuits.

92C-type cabinet

The Avaya 92C-type cabinet is available for indoor customer premises applications. This cabinet provides a complete application solution that includes telecommunications electronics based on the *AnyMedia* Access System and its supporting electronics, power and ringing plant, battery backup, and fiber and copper cabling.

The cabinet can include an optional single MDS2 shelf or optional DDM-Plus shelf (only one). If a single MDS2 shelf is equipped, the total capacity of the cabinet is 544 lines.

Single System Arrangements

Overview

For applications that need less than a complete bay of equipment, such as those listed below, the customer could consider a single system arrangement:

- Small applications that require fewer than 512 lines
- Slow growth applications.

The following single system arrangements can be miscellaneously mounted:

- *AnyMedia FAST* shelf
- *FAST* shelf and its associated MDS2 shelf.

Information pertaining specifically to the MDS2 shelf configurations is supplied here. More *FAST* shelf information is in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide*.

Small or slow growth applications requiring MDS2 shelf

The previously discussed applications may require that special services also be provided. The addition of an MDS2 shelf to a miscellaneously mounted *FAST* shelf for the small or slow growth applications satisfies this need.

For these cases, the MDS2 shelf and its baffle should be mounted above its associated *FAST* shelf (with fan shelf or baffle). Approximately 31 inches of vacant bay height is required to mount a *FAST* shelf, an MDS2 shelf, and their required baffles and fans. See the mounting and installation details in the AnyMedia® Access System, *Installation Manual, Chapter 2*.

Product Description

3

Overview

This chapter provides detailed descriptions of the components of the MDS2 shelf. Each component is described in terms of the component features and functionality, physical features such as size and faceplate characteristics, and specifications.

AnyMedia MDS2 Shelf Description

Overview

The *AnyMedia* MDS2 shelf is a six-inch high shelf supporting up to 24 legacy *SLC* Series 5 and *SLC*-2000 CUs with a 96-line capacity (see Table 1-1 on page 1-4). It is an extension shelf designed to work in conjunction with an *AnyMedia FAST* shelf, supporting a variety of *SLC*-2000 and *SLC* Series 5 compatible special services CUs. Typically, the MDS2 shelf will be mounted directly above its host *FAST* shelf, and it can be miscellaneously mounted within 15 cable feet of the host shelf. The available shelf mounts and their applications for the MDS2 shelf are as follows:

Mounting

- RT mount
  - — Front and rear access (J1C286AA-1, L3)
  - — Front-only access (J1C286AA-1, L4).
- Flush mount
  - — Front and rear access (J1C286AA-1, L3).

Applications

- CO applications
  - — RT Front and rear access (J1C286AA-1, L3)
  - — Front and rear access (J1C286AA-1, L3).
- RT applications
  - — RT mount front and rear access (J1C286AA-1, L3)
  - — Front-only access (J1C286AA-1, L4).

MDS2 shelf features and functions

The MDS2 shelf, shown in Figure 3-1, assembly consists of a connectorized multilayer backplane, diecast and sheet metal cage, and a fuse module providing a dual power interface along with test access capabilities. It is designed to be RT mounted into a standard RT frame or flush mounted in a CO bay. The equipment arrangements will include ordering codes for RT and CO applications, with and without cable danglers, respectively.

The MDS2 shelf is intended to be installed with an *AnyMedia* Access System in the desired application, whether it be an RT frame, CO bay, CEV, or 80-type cabinets. The preferred location would be directly above the first *AnyMedia FAST* shelf installed in a frame.

The MDS2 shelf interfaces with the *AnyMedia* Access System through MDSU circuit packs that take the place of two AP packs (the MDSU packs may be located in any two adjacent slots in the *FAST* shelf), with the default slots being slots 14 and 15, as shown in Figure 3-2 on page 3-5. Cabling connects the rear of the MDS2 to faceplate connectors on the MDSU packs. A minimum of one MDSU with cabling is required for service along with one MSC pack and one PTU pack located in the MDS2 shelf.

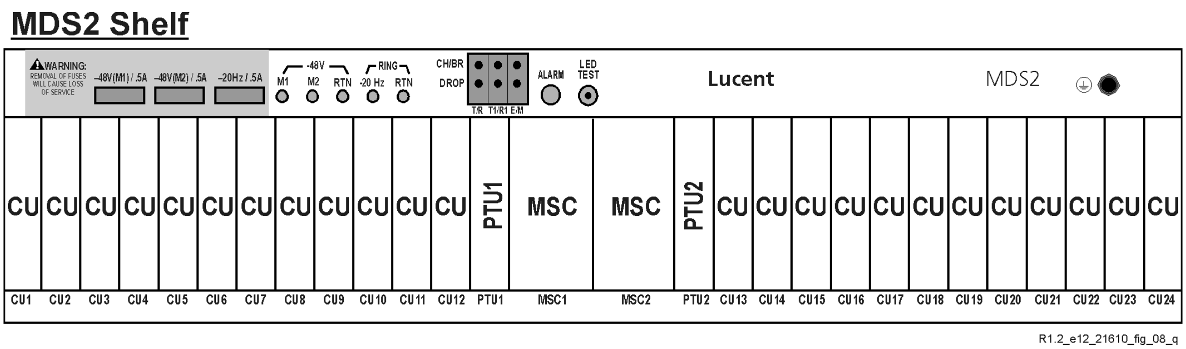


Figure 3-1. MDS2 Shelf

The MDS2 functions as two independent sections, each section supporting a maximum of 12 CUs, or 48 lines, with dedicated power to each section.

When the MDS2 is configured for CO applications, where rear access is available, the VF cable dangler will not be needed.

Some MDS2 cables (E&M, composite clock, test access, and ringing) cannot be exposed to lightning. They must be installed within the same building.

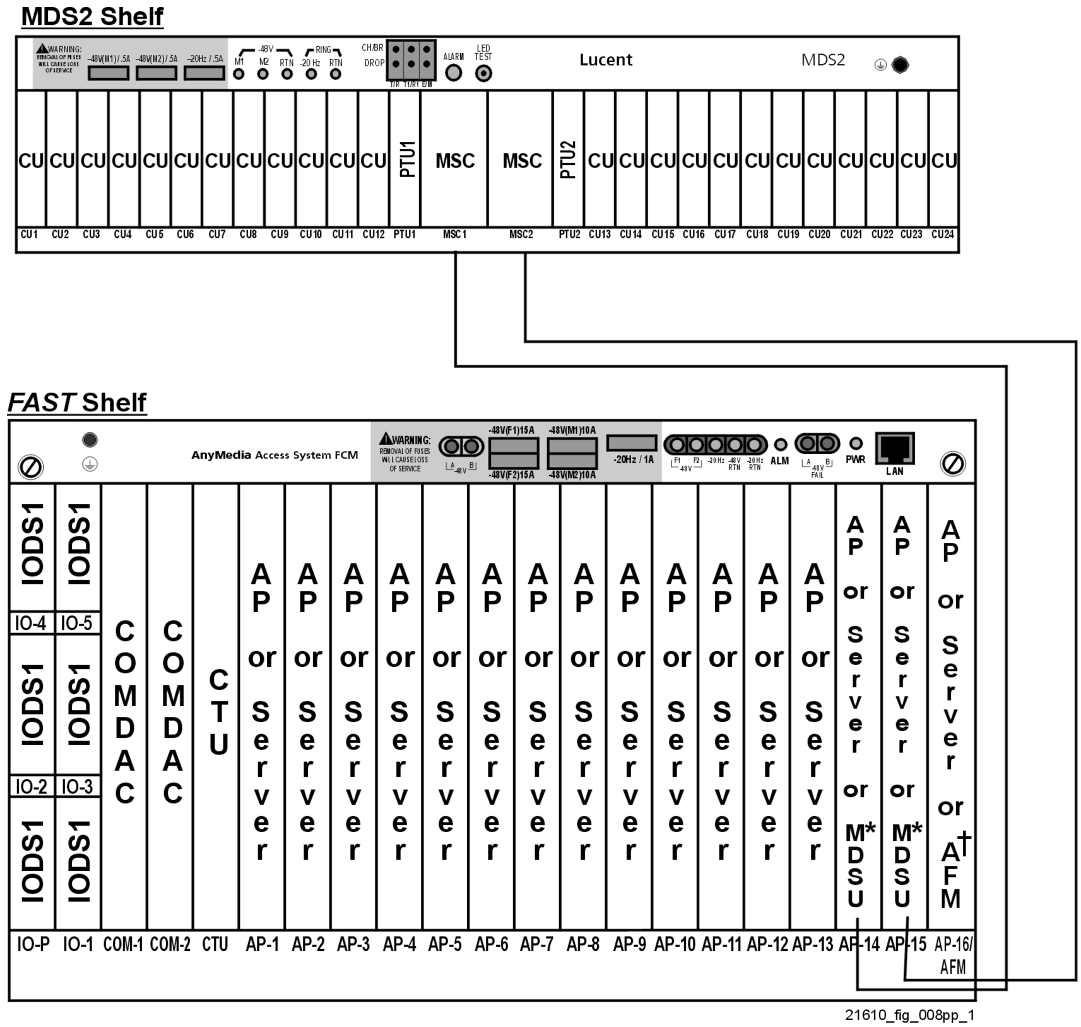
Physical description

The MDS2 shelf is composed of the following:

- Shelf assembly
- Multilayer backplane
- Cable danglers for front access
- MDS2 connection cables.

The remainder of the shelf is constructed of sheet metal with a single door on the front, hinged at the bottom and latched at the top. A rear cover provides EMC protection. EMI screens are attached top and bottom to contain emissions, as well as provide air flow through the shelf to dissipate heat from the packs.

Designation strips provide slot marking for common packs and CUs. Keying is provided to prevent improper installation of the common packs.



*** If two (2) MDSU packs are installed, they must be in adjacent slots.**

† The AFM circuit pack and the xDSL APs are supported at the RT *FAST* shelf only.

Figure 3-2. MDS2 Shelf Interface with the *FAST* Shelf MDSU

Physical dimensions The MDS2 shelf dimensions are shown in Table 3-1 on page 3-6.

Table 3-1. *AnyMedia* MDS2 Shelf Dimensions

AnyMedia Access System MDS2 Shelf	Height		Width		Depth	
	inch	centi-meter	inch	centi-meter	inch	centi-meter
With Cables	6	15.3	21.4	54.8	13.5	34.6
Without Cables	6	15.3	21.4	54.8	13.5	34.6

Shelf arrangement

One section of the MDS2 shelf shown in Figure 3-1 is arranged to accommodate 12 CUs, a PTU, and an MSC pack. The left section is a mirror image of the right section.

Circuit pack dimensions

The dimensions of the circuit packs are shown in Table 3-2.

Table 3-2. Circuit Pack Dimensions

Circuit Pack	Shelf Location	Height		Width		Depth	
		inch	centi-meter	inch	centi-meter	inch	centi-meter
MDSU	FAST	13.0	33.0	1.0	2.5	7.5	19.6
MSC	MDS2	3.5	8.9	1.4	3.6	9.6	24.4
PTU	MDS2	3.5	8.9	0.7	1.8	9.6	24.4

Power, ringing, and test access

The MDS2 shelf has two independent –48V power feeders and one –20 Hz ringing voltage feeder. The power feeders are fused at 5 amps and the ringing feeder is fused at 0.5 amp.

Five test points are available for the power and ringing inputs as follows:

- Two test points for each power feed
- One test point for the power return
- One test point for the –20 Hz ringing input

- One test point for the ringing return. Additional test jacks are available for performing test access functions.

Cable danglers

Cable danglers are provided to bring interconnectivity to the front of the shelf for RT applications where rear access is not available. Danglers for PCM, tip/ring, and TAP connections are routed over the top of the backplane and brought forward. Danglers routed along either side of the shelf allow limit blocking air flow through the shelf.

VF and E&M cables

Connectorized cables are required to connect to VF and E&M pairs exiting the shelf to be connected to an MDF, a cross-connect field, or protector blocks. These cables are orderable in different lengths to suit each application. See the AnyMedia® Access System, *Ordering Guide* for details on cable type and length choices for both VF and E&M cables.

The E&M leads are available for CO applications where both front and rear access is available.

Composite office clock cable

The system may be optionally synchronized to an external 64 kHz composite office clock signal. A composite office clock connection is provided to the MDS2 shelf by a dedicated cable that carries two composite clock signals. One of the composite clock signals supplies the active timing signal, while the second provides a redundant signal if the active input fails. The MSC circuit pack selects the active input and distributes the derived clocks to the channel units of the MDS2 shelf. If composite clock signals are connected to the MDS2 shelf, the signals must also be connected to the host *FAST* shelf, and the system must be provisioned for the external composite clock synchronization mode.

MDS2 server cables

The MDS2 server extension cables will be provided as separately orderable items if extra length is needed. The placement of the MDS2 shelf with respect to the *AnyMedia FAST* shelf will determine the proper length cable needed. If the unit is directly above the *FAST* shelf, the 6-foot dangler length will be adequate. The cable must extend from a faceplate connection on the MDSU within the *AnyMedia* Access System to the backplane of the MDS2. If the MDS2 is positioned elsewhere in the frame, then the 5-foot or 9-foot extension cables connected to the 6-foot dangler cable will be required. The MDS2 must be within a maximum of 15 feet cable length from the host *AnyMedia* Access System.

Functional block diagram

Figure 3-3 shows an *AnyMedia* Access System functional block diagram when the MDS2 shelf is used in conjunction with a *FAST* shelf. This figure shows the relationships of the circuit packs and APs described in the rest of this section.

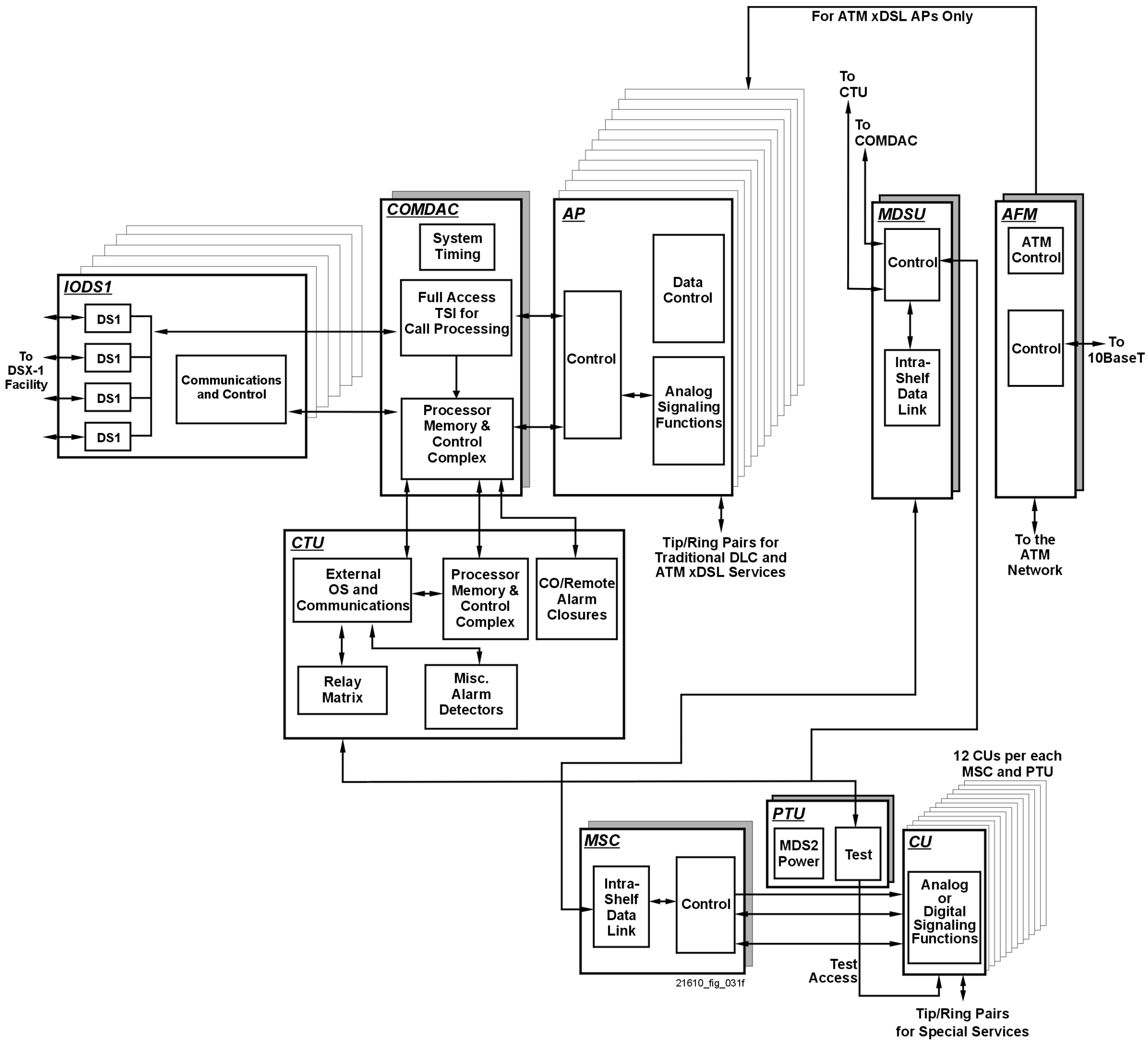


Figure 3-3. *AnyMedia* Access System *FAST* and MDS2 Shelf Functional Block Diagram

Functional block diagram

Figure 3-3 on page 3-8 shows an *AnyMedia* Access System functional block diagram when the MDS2 shelf is used in conjunction with a *FAST* shelf. This figure shows the relationships of the circuit packs and APs described in the rest of this section.

Equipment Application Description

Overview

AnyMedia Access System has a number of equipment combinations to satisfy all customer applications. See the AnyMedia® Access System, *Applications, Planning, and Order Guide* for summaries of the application choices that must be made to select the correct equipment. More details on the final codes required are contained in the AnyMedia® Access System, *Ordering Guide*.

Circuit Pack Common Functions and Characteristics

Overview

All the circuit packs, which includes APs, designed and manufactured for the MDS2 shelf of the *AnyMedia* Access System have certain common functional and physical characteristics. Existing *SLC*-2000 and *SLC* Series 5 CUs used in the MDS2 shelf may or may not have common functionality characteristics depending on the vintage.

Functionality

All *AnyMedia* Access System circuit packs have the following common functionality:

- Include built-in self-test and fault diagnostics, as applicable
- Provide status LED and buttons (where applicable)
- Inventory information (*CLEI* code, date of manufacture, etc.)
- *UL* recognized.

Physical characteristics

The circuit packs have the following common physical characteristics:

- A unique keying design to prevent erroneous insertion in shelf
- A standard labeling and bar code identification
- Appearance coordinated with other Lucent Technologies *AnyMedia* products.

AnyMedia Access System Apparatus Codes

Overview

The function codes for the packs used exclusively for MDS2 shelf services are listed below. Each function code has an associated apparatus code. The complete list of apparatus codes supported at the RT and COT *FAST* shelves are listed in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide*. Consult the AnyMedia® Access System, *Ordering Guide* for the correct apparatus code when ordering a pack.

Function Code	Apparatus Code
MDSU	MSU100
MSC	MSC100
PTU	BDJ200 and BDJ200B

Circuit Pack—MDSU MSU100

Overview

The MDSU MSU100 is the server interface between the MDS2 shelf and the *FAST* shelf. When using two MDSUs to serve a full MDS2 shelf, the MDSUs may go in any two adjacent slots on the *FAST* shelf, with the default slots being slots 14 and 15. Figure 3-4 shows the functional block diagram of the MDSU MSU100, Figure 3-5 shows the circuit pack faceplate, and Table 3-3 lists the functions and colors for LED indicators.

Features and functions

The MDSU MSU100 supports the following features and functions:

- Multiplexes/demultiplexes one 8 MHz data link to the MDS2 shelf
- Produces and supplies the 8 MHz clock for the MDS2 shelf
- Monitors/directs *FAST* shelf/MDS2 shelf control traffic.

Functional block diagram

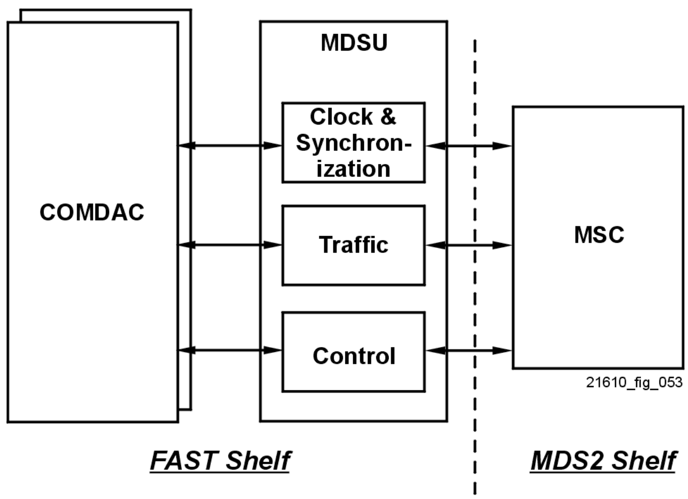


Figure 3-4. MDSU MSU100 Functional Block Diagram

Equipment description

Circuit pack faceplate

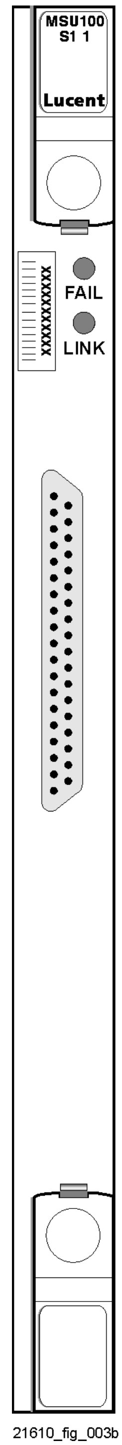


Figure 3-5. MDSU MSU100 Faceplate

Circuit pack LED indicators

Table 3-3. MDSU MSU100 Faceplate LEDs

LED	Function	Color
FAIL	Lit when the circuit pack fails.	Red
LINK	Lit when loss of clock/sync signal is detected. Flashes at a rate of approximately 1Hz when incorrect MDSU/MDS2 side association is detected.	Yellow

Circuit Pack—MSC MSC100

Overview

The MSC MSC100 is the controller interface between the CUs on the MDS2 and the MDSU installed on the *AnyMedia* Access System shelf. Figure 3-6 shows the functional block diagram of the MSC MSC100, Figure 3-7 shows the circuit pack faceplate, and Table 3-4 lists the functions and colors for LED indicators.

Features and functions

The MSC MSC100 supports the following features and functions:

- Supports 12 *SPQ*/AUA channel units on the MDS2 shelf
- Terminates an optional CO composite clock input
- Provides synchronization signals for the MDS2 shelf CUs
- Multiplexes and demultiplexes traffic links between the MDSU on the *FAST* shelf and the MDS2 shelf CUs
- Supports a control link from the COMDAC to the MDS2 shelf and CUs
- Monitors the health of the MDS2 shelf and CUs
- Provides fault isolation and fault reporting.

Functional block diagram

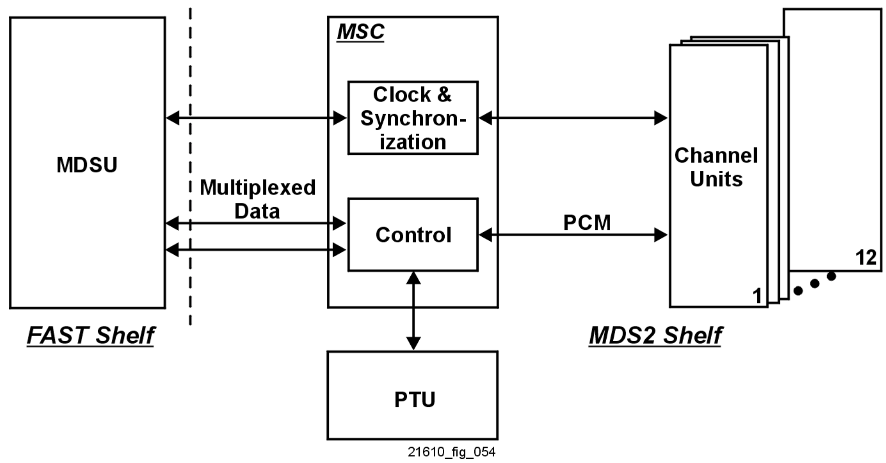


Figure 3-6. MSC MSC100 Functional Block Diagram

Equipment description

Circuit pack faceplate

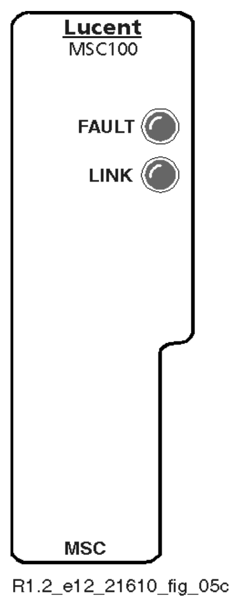


Figure 3-7. MSC MSC100 Faceplate

Circuit pack LED indicators

Table 3-4. MSC MSC100 Faceplate LEDs

LED	Function	Color
FAULT	Lit when the circuit pack fails.	Red
LINK	Lit when loss of clock/sync signal is detected. Flashes at a rate of approximately 1Hz when incorrect MDSU/MDS2 side association is detected.	Yellow

Circuit Pack—PTU BDJ200( )

Overview

The PTU BDJ200 and PTU BDJ200B supply DC power and ringing voltage to the common units and power and ringing CUs on the MDS2 shelf. There are two PTUs per MDS2 shelf; each PTU is the power source for one-half of the shelf. The PTU BDJ200( ) supports a variety of interchangeable CUs.

Figure 3-8 shows the functional block diagram of the PTU BDJ200( ). Following is a list of the functional differences between the PTU BDJ200 and the PTU BDJ200B:

- The PTU BDJ200 is used for accessing TAP B on the MDS2 extension shelf.
- The PTU BDJ200B is used to access TAP A and TAP B on the MDS2 extension shelf.
- The PTU BDJ200 cannot connect to the AUA232.
- The PTU BDJ200B can connect to all CUs on the MDS2 shelf configurations.

Figure 3-9 shows the circuit pack faceplate, and Table 3-5 lists the functions and colors for LED indicators and the function of the reset switch.

Features and functions

Each PTU BDJ200( ) on the MDS2 shelf supports the following features and functions:

- Supplies +5V and –5V for a shelf half
- Monitors the other PTU on the same shelf for loss of +5V and reports failures to the MSC
- Monitors the other PTU on the same shelf for loss of –48V and reports failures to the MSC
- Receives all test instructions from the MSC
- Monitors for loss of ringing
- Provides test access per GR-834
- Provides CU tip/ring and customer drop tip/ring access for testing
- Provides metallic bypass pair or equivalent DC test pair terminations and detectors for TR-465 (PGTC) compatible circuit testing (applies to universal configurations only) (PTU BDJ200)
- Provides PGTC terminations and detectors for CU testing per TR-TSY-000465 (PTU BDJ200B)

- Provides terminations and detectors for CU testing per TR-TSY-000303.

Functional block diagram

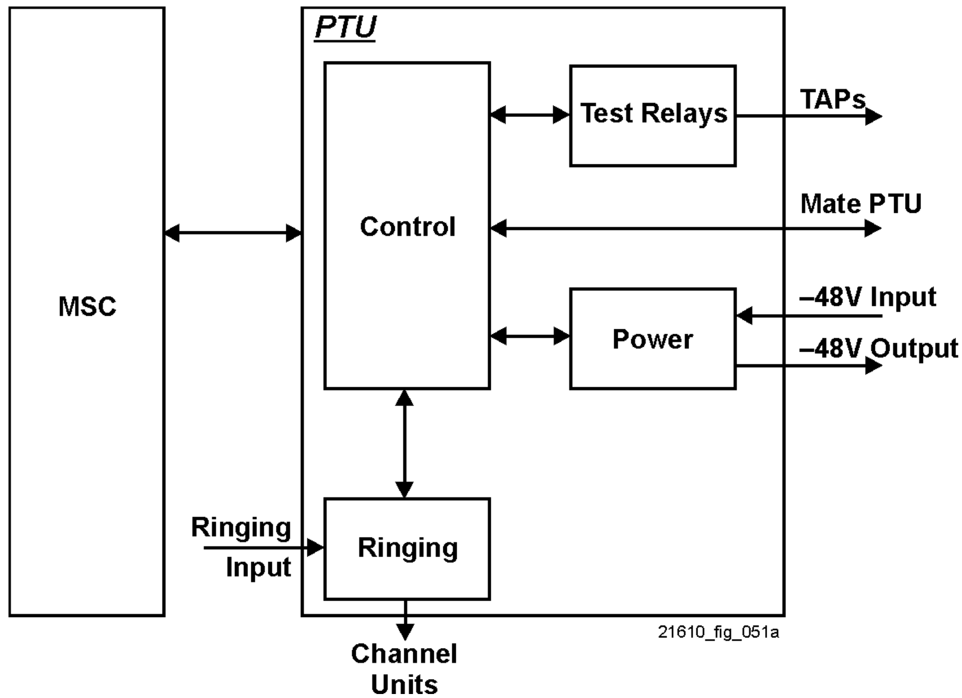


Figure 3-8. PTU BDJ200( ) Functional Block Diagram

Equipment description

Circuit pack faceplate

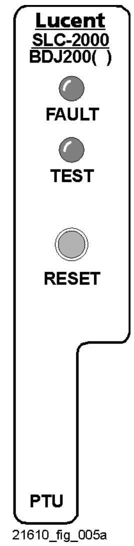


Figure 3-9. PTU BDJ200( ) Faceplate

Circuit pack indicators

Table 3-5. PTU BDJ200( ) Faceplate LED Indicators and Button

LED	Function	Color
FAULT LED	Lit when a fault is detected on the circuit pack It is normal for this LED to light momentarily during system reset and during power-up.	Red
TEST LED	Lit when a channel served by the PTU is under test.	Green

Button	Function
RESET	The PTU can be reset by depressing this momentary push button. It will release the test access pairs and free the stuck test access relays.

Compatibility Matrix for *AnyMedia* Access System COT and RT Shelves

The COT (*FAST* and MDS2) and RT (*FAST* and MDS2) CU/AP pairs listed in Table 3-6 are interoperable.

Table 3-6. COT (*FAST* & MDS2) and RT (*FAST* & MDS2) CU/AP Pairs

COT		RT	
CU/AP	**GSFN**	**CU/AP**	**GSFN**
*SPQ*334	DS01, DS02[a]	AUA232 (RS-232)	DATA
	DS01	ADTRAN 1433105 (*Total Reach* OCU-DP)	OCU1, OCU2, OCU3
		*SPQ*452	OCU1, OCU2, OCU3
	DS02		OCU2, OCU3
	SW56		SW56
		AUA200	DATA
*SPQ*452	OCU1	*SPQ*452	OCU1
	OCU2		OCU2
	OCU3		OCU3
*SPQ*328 CS	EBS	*SPQ*429 CF	EBS
AUA45B	AC	AUA45B	AC
AUA75( )	LR	AUA75( )	LR
Teltrend AUA293I2	BRI	Teltrend AUA293I2	BRI
MCU-5205	NO1	*MCU*-5205	NO1
MCU-5405	NO2	*MCU*-5405	NO2
*SPQ*442	TO	*SPQ*442	TO
*SPQ*443	FXS		FXO
	DPO		DPT
	TO		TO

Table 3-6. COT (*FAST* & MDS2) and RT (*FAST* & MDS2) CU/AP Pairs

COT		RT	
CU/AP	**GSFN**	**CU/AP**	**GSFN**
AUA41B	TO4 / ETO4	AUA41B	TO4
	TO4 / ETO4		ETO4
	DX4[N,R]		DX4[N,R]
*SPQ*442	FXO		FX[S,T][1,2,3,5]
*SPQ*454	EM4[C,H]		DX4[N,R]
	PLR[1,2]		
	EM4[C,H] PLR[1,2]	*SPQ*454	EM4[C,H] PLR[1,2]
*SPQ*443	FXS	*SPQ*444	FXO[1,2,3,5]
			TDS[A,B]
*SPQ*442	FXO		TDO[A,B]
	DPT		TD[O,S][C,D]
*SPQ*444	TDO[A,B]	*SPQ*442	FXO
		*SPQ*444	FXO[1,2,3,5]
	TDS[A,B]	PROG2W LPA380	2FX, 2FXLS
	TD[O,S][C,D]	*SPQ*442	DPT
		PROG2W LPA380	2RVO
		AUA41B	DX4[N,R]
		*SPQ*454	EM4[C,H], PLR[1,2]
	FXO[1,2,3,5]	PROG2W LPA380	2FX, 2FXLS
*SPQ*454	EM4[C,H], PLR[1,2]	*SPQ*442	DPT
		PROG2W LPA380	2RVO
*SPQ*442	DPT	PROG2W LPA380, PRCOIN LPA350	2RVO
*SPQ*442	FXO	PROG2W LPA380, PRCOIN LPA350	2FX, 2FXLS
PROG2W LPA380	2RVO	DPT32CS LPA356	2RVT
		*SPQ*442	DPT, 2RVT
PRCOIN LPA350	2RVO	DPT32CS LPA356	2RVT
		*SPQ*442	DPT, 2RVT
PRCOIN LPA350, PROG2W LPA380	2NOS	PRCOIN LPA350, PROG2W LPA380	2NOS

Table 3-6. COT (*FAST* & MDS2) and RT (*FAST* & MDS2) CU/AP Pairs

COT		RT	
CU/AP	**GSFN**	**CU/AP**	**GSFN**
PRCOINCS LPA150	DFLT2, 2LO	POTS LPA300	2LS, DFLT
	DFLT2	PRCOIN LPA350	2LS, 2GS, DFLT
	2LO		2LS, DFLT
	COIN2		COIN
	DFLT2	PROG2W LPA380	2LS, 2GS, DFLT
	2LO		2LS, DFLT

a. The following combinations are invalid because of incompatible T0 cross-connect bandwidth required for each CU:
SPQ-334: GSFN=DS02; RATE= 19.2, 96., 4.8, 2.4; EC=Yes; TS=2
AUA232: GSFN=DATA; RATE= 19.2, 96., 4.8, 2.4; EC=Yes; TS=1

MDS2 Shelf—AUA45B Ringing Repeater Channel Unit

Private line manual ring

The AUA45B dual ringing repeater CU provides two-wire private-line point-to-point manual ring service. The AUA45B CU provides two channels of service and can be used in the MDS2 shelf with compatible equipment in the CO. The CU can detect and originate AC ringing on its tip and ring interface and provides a VF transmission channel. In a typical manual ringing application, pushing a button at the calling station applies an AC ringing voltage to the calling CU. The CU at the called end sends ringing to the called station.

The far-end termination can be any of the following CUs:

- *SLC* Series 5 carrier system AUA45B CU
- D4 2RD/PLAR CU (J98726SN*)
- D4 4RD/PLAR CU (J98726SP)
- D3 2RD CU (J98718SL)
- D3 4RD CU (J98718SM).

The AUA45B CU is compatible with D3/D4 two- or four-wire RD/PLAR CUs when used in the *repeat input timing* ring mode. The AUA45B CU can be used in certain types of alarm service—those services that use transmission-only supervision and that use VF signals within the passband of the CU.

Features and functions

The AUA45B CU provides the following features and functions:

- Manual ringing service—repeat input timing mode
- VF transmission-only service
- Supported in a universal TR-08 or an INA configuration
- Faceplate test jack access to tip and ring of each channel.

The option switches for the AUA45B CU are physical switches located on the printed wiring board and must be set manually—they cannot be set electronically using the GSI.

Details for the AUA45B CU are described in the 363-005-123 data sheet; Chapter 5, Configuration Management—Ringing Repeater provides guidelines for selecting option settings for the AUA45B CU, describes the applications of the unit, and provides CU compatibility information.

* J codes are equipment codes.

The AUA45B CU does not have test access relays and therefore is NOT compatible with MLT or a remote test head.

Equipment description

Channel unit faceplate and option switches

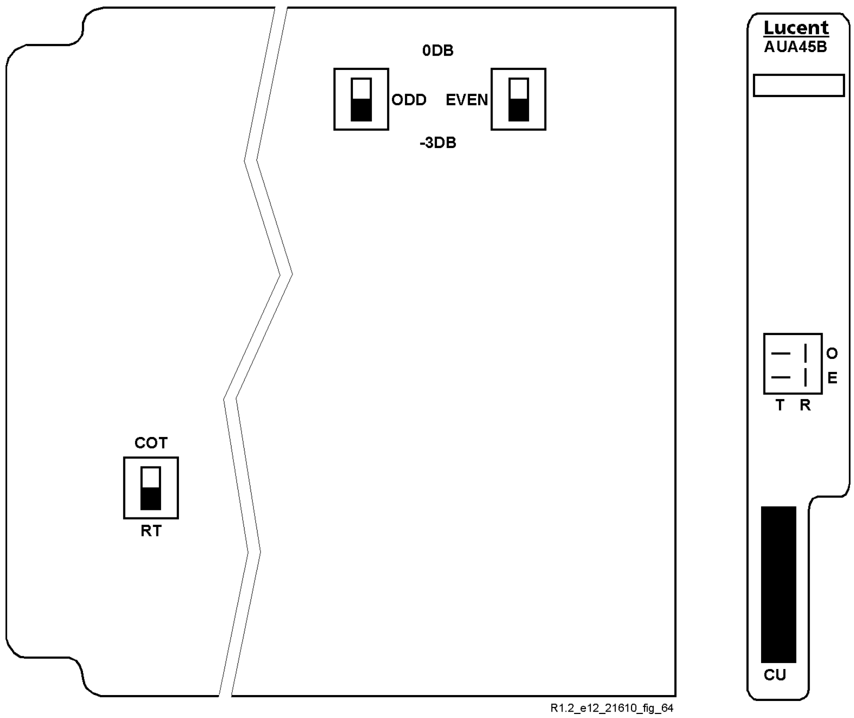


Figure 3-10. AUA45B Ringing Repeater Channel Unit Faceplate

MDS2 Shelf—AUA75( ) Private Line Automatic Ring Channel Unit

PLAR

The AUA75( ) PLAR CU provides two-wire private-line point-to-point automatic ring service. The AUA75( ) CU provides two channels of service and can be used in the MDS2 shelf with compatible equipment in the central office. This CU provides a current feed interface to the customer loop. In a typical automatic ring application, signaling begins when the calling station goes off-hook, which automatically causes ringing at the called station. The called station rings at 2 seconds on and 4 seconds off until it is taken off-hook (answered). When the called party answers, ringing is tripped and a talk path is established between the two stations.

The far-end termination can be any of the following CUs:

- *SLC* Series 5 carrier AUA75( ) CU
- D4 2RD/PLAR CU (J98726SN*)
- D4 4RD/PLAR CU (J98726SP)
- D3 2WPLAR CU (J98718SN)
- D3 4WPLAR CU (J98718SP).

Features and functions

The AUA75( ) CU provides the following features and functions:

- Private line automatic ring service
- Supported in a universal TR-08 or an INA configuration
- Faceplate test jack access to tip and ring of each channel
- Faceplate BUSY indicators.

The option switches for the AUA75( ) CU are physical switches located on the printed wiring board and must be set manually—they cannot be set electronically using the GSI.

Details for the AUA75( ) CU are described in the 363-005-132 data sheet; Chapter 5, Configuration Management—Private Line Auto Ring provides guidelines for selecting option settings for the AUA75( ) CU, describes the applications of the unit, and provides CU compatibility information.

The AUA75( ) CU is NOT compatible with MLT or the Teradyne *4TEL* system.

* J codes are equipment codes.

Equipment description

Channel unit faceplate and option switches

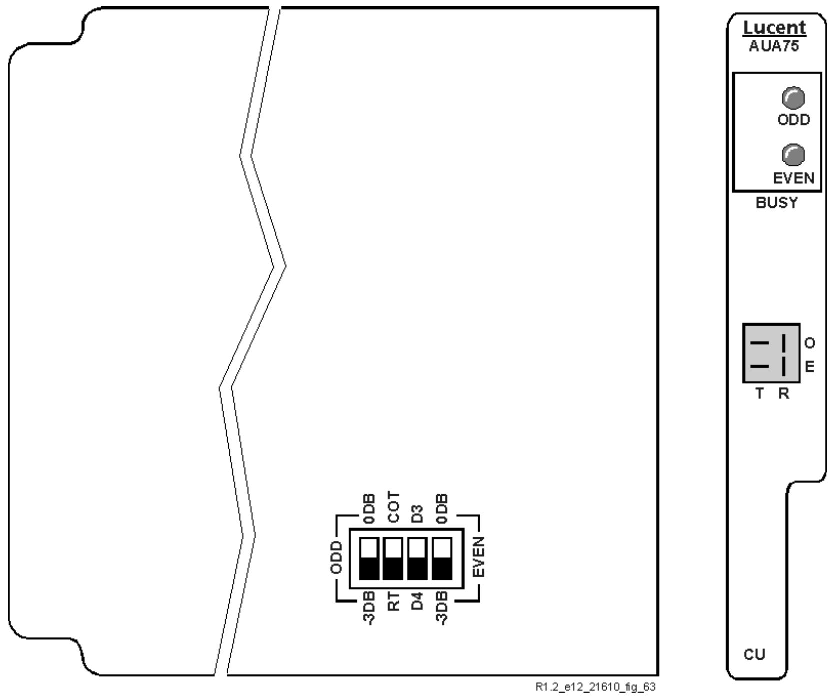


Figure 3-11. AUA75( ) Private Line Automatic Ring Channel Unit Faceplate and Option Switches

Channel unit LED indicators

Table 3-7. AUA75( ) Private Line Automatic Ring Channel Unit Faceplate LEDs

LED	Function	Color
ODD BUSY	Lit when the odd channel is busy.	Red
EVEN BUSY	Lit when the even channel is busy.	Red

MDS2 Shelf—*SPQ*442 Two-Wire Current Sink Channel Unit

Two-wire VF special services

The *SPQ*442 current sink CU is used primarily in two-wire nonlocally switched loop- and ground-start special services, two-wire nonswitched private lines, and DID trunks.

The *SPQ*442 CU may interface with a switching machine, other transmission equipment, or cable. The connecting wire or cable must conform to the CSA design rules.

The *SPQ*442 CU provides four channels of service. Each channel can be used independently of the others to provide any of the following functions:

- Foreign exchange - office end (FXO)—The FXO function is used for a nonlocally or locally switched loop- or ground-start application. Typically, nonlocally switched applications are foreign exchange trunks and lines and off-premises PBX station lines.
- Dial pulse terminating (DPT)—The DPT function is used for a DID application only, with either dial pulse or multi-frequency addressing.
- Transmission only (TO)—The TO function is used for a private line application, with no DC signaling.
- Toll diversion—The *SPQ*442 supports toll diversion in INA VBs with ESF signalling. The *SPQ*442 in the MDS2 shelf must have a compatible AUA41B CU in the COT.

THE *SPQ*442 is end-to-end compatible with any of the following CUs:

- WP42 *SPOTS* DPO
- D4 DPO
- *SLC* Series 5 AUA36( ) (only in a *SLC*-2000 COT)
- *SLC*-2000 *SPQ*336.

The *SPQ*442 CU has transmission and signaling options that must be set before service can be provided. The CU does not have physical switches; instead, option information is written into memory registers located on the CU. All transmission and signaling options and the function type (FXO, DPT, or TO) for each channel are set by entering commands via local or remote provisioning.

The *SPQ*442 CU stores in nonvolatile memory an inventory record (including its ten-character *CLEI* code) available for reading by a compatible OSS.

Features and functions

The *SPQ*442 CU provides the following features and functions:

- Two-wire special services

- — Loop- or ground-start, local or FX
- — Loop reverse battery (DPT)
- — Private line, voice or data (TO).

- Provisionable transmission treatment
- OHT, full-time or caller ID only
- Support for *CLASS* services
- Support for line side answer supervision
- Can be used in a GR-303 (default settings only) TR-08, or an INA configuration
- Inventory information (*CLEI* code, date of manufacture, etc.)
- Faceplate test jack access to tip and ring of each channel
- Faceplate BUSY indicators.

Details for the *SPQ*442 CU are described in the 363-005-382 data sheet. The guidelines given in Chapter 5, Configuration Management—Two-Wire Special Services Provisioning (SPQ442) for selecting option setting, applications, and compatibility for the AUA42 CU should be used for the *SPQ*442 CU.

Equipment description

Channel unit faceplate

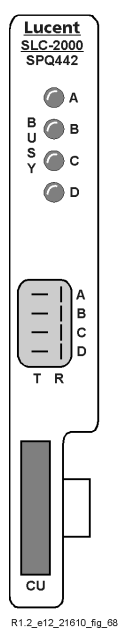


Figure 3-12. *SPQ*442 Two-Wire Current Sink Channel Unit Faceplate

Channel unit LED indicators

Table 3-8. *SPQ*442 Two-Wire Current Sink Channel Unit Faceplate LEDs

LED	Function	Color
A	Lit when channel is busy.	Red
B	Lit when channel is busy.	Red
C	Lit when channel is busy.	Red
D	Lit when channel is busy.	Red

MDS2 Shelf—*SPQ*443 Two-Wire Current Feed Channel Unit

Two-wire VF special services

The *SPQ*443 current feed (CF) CU is used primarily in two-wire nonlocally switched loop- and ground-start special services, two-wire nonswitched private lines, and DID trunks.

The *SPQ*443 CU may interface with a switching machine, other transmission equipment, or cable. The connecting wire or cable must conform to the CSA design rules.

The *SPQ*443 CU provides four channels of service. Each channel can be used independently of the others to provide any of the following functions:

- Foreign exchange - subscriber end (FXS)—The FXS function is used for a nonlocally or locally switched loop- or ground-start application. Typically, nonlocally switched applications are foreign exchange trunks and lines and off-premises PBX station lines.
- Dial pulse originating (DPO)—The DPO function is used for a DID application only, with either dial pulse or multi-frequency addressing.
- Transmission only (TO)—The TO function is used for a private line application, with no DC signaling. The unit provides sealing current.

The *SPQ*443 is end-to-end compatible with any of the following CUs:

- *SLC*-2000 *SPQ*442
- *SLC*-2000 *SPQ*444.

The *SPQ*443 CU has transmission and signaling options that must be set before service can be provided. The CU does not have physical switches; instead, option information is written into memory registers located on the CU. All transmission and signaling options and the function type (FXS, DPO, or TO) for each channel are set by entering commands via local or remote provisioning.

The *SPQ*443 CU stores in nonvolatile memory an inventory record (including its ten-character *CLEI* code) available for reading by a compatible OSS.

Features and functions

The *SPQ*443 CU provides the following features and functions:

- Two-wire special services
  - — Loop- or ground-start, local or FX
  - — Loop reverse battery (DPO)
  - — Private line, voice or data (TO).
- Provisionable transmission treatment

- OHT, full-time or caller ID only
- Support for *CLASS* services
- Support for line side answer supervision
- Can be used in a TR-08 or an INA configuration
- Inventory information (*CLEI* code, date of manufacture, etc.)
- Faceplate test jack access to tip and ring of each channel
- Faceplate BUSY indicators.

Details for the *SPQ*443 CU are described in the 363-005-383 data sheet. The guidelines given in Chapter 5, *Configuration Management— Two-Wire Special Services Provisioning (SPQ443)* on page 5-46 are for selecting option setting and applications for the *SPQ*443 CU.

Equipment description

Channel unit faceplate

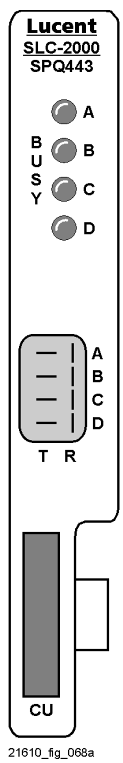


Figure 3-13. *SPQ*443 Two-Wire Current Feed Channel Unit Faceplate

Channel unit LED indicators

Table 3-9. *SPQ*443 Two-Wire Current Sink Channel Unit Faceplate LEDs

LED	Function	Color
A	Lit when channel is busy.	Red
B	Lit when channel is busy.	Red
C	Lit when channel is busy	Red
D	Lit when channel is busy	Red

MDS2 Shelf—*MCU*-5205 Metallic Channel Unit

Features and functions

The *MCU*-5205* synchronous CU enables a variety of DC and AC alarm and telemetry services to be transported over the *AnyMedia* Access System. The *MCU*-5205 CU can be used in the COT or MDS2 shelf. The *MCU*-5205 is end-to-end compatible with another *MCU*-5205 CU for universal *SLC*-2000 system applications. It is also end-to-end compatible with the *MCU*-4200, Issue 2 CU, which can be used in a *SLC*-96 carrier channel bank or D4 channel bank. The alarm circuit can be extended to a distant CO by a back-to-back carrier arrangement using a pair of DS0 DP CUs.

The *MCU*-5205 CU enables provisioning of virtually all general purpose alarm and telemetry types of circuits (including those designated by the following local exchange carrier common language service codes: BA, BL, BS, CI, CP, NT, PA, PM, PR, PV, RT, SG, TC, ZA, ZM, ZQ, ZS, and ZT). In addition, it is compatible with service observing circuits, telephone answering circuits, and concentrator/ identifier circuits.

The *MCU*-5205 CU provides a single circuit that uses one DS0 time slot and provides an ADPCM voice channel as well as the alarm channel over the same time slot. Since the *MCU*-5205 CU is a synchronous unit, where back-to-back DS0-DPs are used to extend the alarm circuit across the central office, both central office channel banks must be externally timed via a composite clock signal.

The *MCU*-5205 CU is designed, manufactured, and marketed by Tollgrade Communications, Inc. Circuit application and option setting information can be found in the *Tollgrade* data sheet TLGD-5205.

* Can be ordered from Tollgrade Communications; see AnyMedia® Access System, *Ordering Guide*.

MDS2 Shelf—*MCU*-5405 Metallic Channel Unit

Features and functions

The *MCU*-5405 CU provides an MLT-compatible digital bypass pair for applications where a metallic bypass pair is not available for subscriber loop testing. The *MCU*-5405 CU allows a full range of MLT tests to be performed with the speed and accuracy typical of a good metallic bypass pair. However, the MLT operating range using a pair of *MCU*-5405 CUs is 3000 ohms from the RT to the customer location, whereas use of a metallic bypass pair reduces the RT-to-CPE test reach by the resistance of the test pair. Also, a digital by-pass pair is not affected by inductive interference, ground potential problems, or various other environmental conditions.

The *MCU*-5405 CU can be used in the COT and MDS2 shelf. The *MCU*-5405 is end-to-end compatible with the following CUs:

- Another *MCU*-5405 CU for universal *SLC*-2000 system applications
- *MCU*-4496 or *MCU*-4496ER (extended range) CU, which can be used in a *SLC*-96 carrier channel bank or D4 channel bank.

The *MCU*-5405 CU provides a single circuit that uses two consecutive channels (DS0 time slots) and provides an ADPCM voice channel as well as the bypass pair function.

The *MCU*-5405 CU is designed, manufactured, and marketed by Tollgrade Communications, Inc. Circuit application and option setting information can be found in the *Tollgrade* data sheet TLGD-5405.

MDS2 Shelf—AUA41B Four-Wire Current Feed Channel Unit

Four-wire VF special services

The AUA41B CU is a current feed unit used in nonlocally switched loop- and ground-start special services, nonswitched private lines, and PBX tie trunks. For any of the function modes and depending upon application, the AUA41B CU may be used in the MDS2 shelf or a *SLC*-2000 COT. It may interface with a switching machine, other transmission equipment, data equipment, or cable.

The AUA41B CU, when used in a *SLC*-2000 COT or MDS2 shelf, has provisionable sealing current (current or no current) in the TO and ETO modes. The AUA41B CU has one switch that is used to turn this sealing current on or off.

The AUA41B CU is end-to-end compatible with the following CUs:

- AUA44( ) four-wire CU; loop-start/ground-start applications in Feature Package C (FPC), including the LSAS feature. If the distant terminal is a *SLC*-2000 COT or RT, the compatible four-wire CU is *SPQ*444 (does not support LSAS).
- AUA41( ), AUA141 CUs; tie trunk and private line (TO) applications.
- AUA42( ), AUA142, *SPQ*442 two-wire CUs; loop-start/ground-start and private line (TO) applications.
- AUA43( ), *SPQ*443 two-wire CUs; private line (TO) applications.
- AUA54( ) CU; tie trunk applications (*SPQ*454 if distant terminal is *SLC*-2000 COT or RT).

Where RT is operating in the INA-RT mode, the AUA41( ) is also end-to-end compatible with D4-type CUs with FXO, DX, E&M, and TO functions. This compatibility extends to the LSAS service feature, provided the D-bank CU is a D5 with FXO signaling and provisioned for Toll Diversion (e.g., AEK24 CU is provisioned for FXP( ) function code) in order to signal battery reversal.

Features and functions

The AUA41B CU provides the following features and functions:

- Four-wire special services
  - — Loop-start or ground-start signaling
  - — DX signaling
  - — TO/ETO.
- Provisionable transmission treatment
- Can be used in an INA configuration
- Optional sealing current in TO and ETO modes

- Faceplate test access to tip and ring and tip1 and ring1
- Inventory information (*CLEI* code, date of manufacture, etc.).

The AUA41B CU provides one channel of service and can function in any of the following modes:

- Foreign exchange-station end (4FXS)—The 4FXS function is used in nonlocally switched loop- or ground-start applications. Typical applications are foreign exchange trunks and lines and off-premises PBX stations. These applications are generally two-wire at each end. Therefore, when the AUA41B CU is used in the circuit, additional equipment must be used for the four- to two-wire conversion at the circuit ends.
- Duplex (4DX)—The primary application of the 4DX function is in PBX tie trunks where the RT faces cable. (Additional equipment at the customer location converts the DX signaling to E&M.) If the RT is at the customer location, the *SPQ*454 four-wire CU, which provides an E&M interface, should be used instead.
- Transmission only (4TO) or equalized transmission only (4ETO)—Both the 4TO and 4ETO functions are used in private lines (voice or data). The 4ETO function is used when equalization of cable transmission characteristics is required. Otherwise, the 4TO function is used.
- Toll diversion—The AUA41B supports toll diversion in INA VBs with ESF signalling. The AUA41B in the MDS2 shelf must have one of the following compatible CUs in the COT: *SPQ*442 or *SPQ*444.

For the 4FXS, 4DX, and 4ETO functions, the AUA41B CU may be used with up to 15 dB of nonloaded or loaded cable. The AUA41B CU has transmission and signaling options that must be set before service can be provided. The CU has one physical option switch that is used to enable or disable the sealing current and must be set manually. The remaining option information is written into memory registers located on the CU. These transmission and signaling options are set by entering commands via local or remote provisioning.

Details for the AUA41B CU are described in data sheet 363-005-105. Chapter 5, Configuration Management—Four-Wire VF Special Services on page 5-55 provides guidelines for selecting option settings for the AUA41B CU, describes the various applications of this unit, and provides CU compatibility information.

Equipment description

Channel unit faceplate and option switch

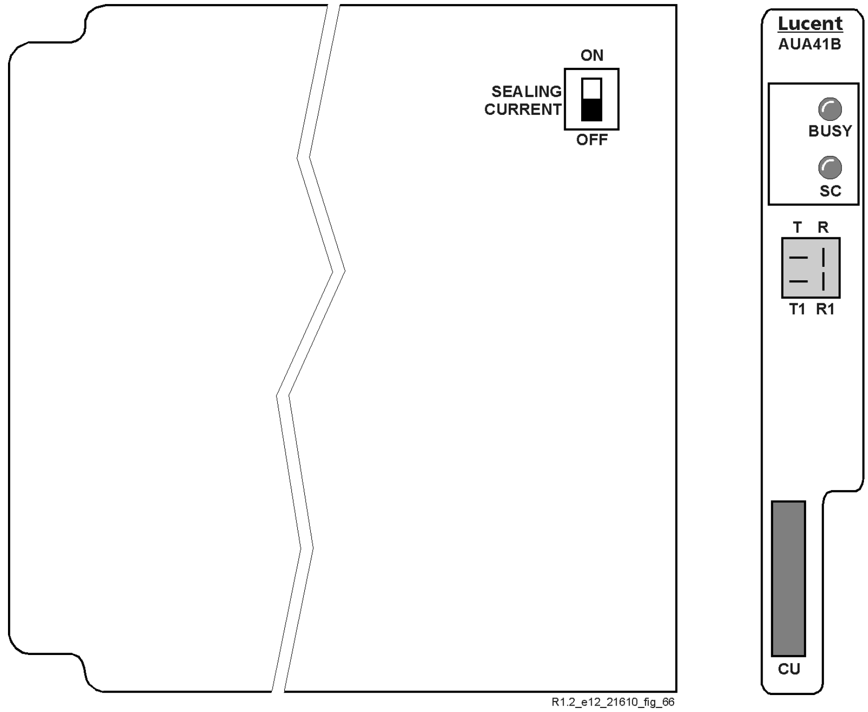


Figure 3-14. AUA41B Four-Wire Current Feed Channel Unit Faceplate

NOTE:
The AUA41B has an on/off sealing current switch that takes effect only when the TO4 or ETO4 function code is selected. The switch must be set manually.

Channel unit LED indicators

Table 3-10. AUA41B Four-Wire Current Feed Channel Unit Faceplate LEDs

LED	Function	Color
BUSY	Lit when service is active, during a LED test command, and on power-up.	Red
SC	Lit indicates that sealing-current is flowing. This SC LED will also be lit during a LED test command and on power-up.	Red

MDS2 Shelf—*SPQ*444 Four-Wire Current Sink Channel Unit

Four-wire current sink *SPQ*444 CU

The *SPQ*444 four-wire current sink CU is used in nonlocally switched loop- and ground-start special services. Applications include metallic range extensions to a customer location and back-to-back connections to a D4 4FXS or 4TDM CU.

The *SPQ*444 CU can function in one of the following modes:

- Foreign exchange - office end (4FXO)—For off-premises station applications, the unit is at the PBX end of the circuit. This application is generally two-wire at each end. Therefore, when the *SPQ*444 CU is used in the circuit, additional equipment must be used for the four- to two-wire conversion at the PBX. The *SPQ*444 CU will pass distinctive ringing in the 4FXO mode. For the 4FXO function, the *SPQ*444 CU may be used with up to 15 dB of nonloaded or loaded cable.
- Tandem (4TDM)—The TDM function is used in providing a back-to-back carrier interface for loop- or ground-start circuits. In this application, the *SPQ*444 CU cannot face the outside plant.
- Toll diversion—The *SPQ*444 supports toll diversion in INA VBs with ESF signalling. The *SPQ*444 in the MDS2 shelf must have a compatible AUA41B CU in the COT.

The *SPQ*444 CU is end-to-end compatible in an *SLC*-2000 system equipped with Release 3.2 (or later) with the following CUs:

- AUA41( ), AUA141, AUA43( ), and *SPQ*443 for loop-start/ground-start applications without LSAS feature
- *SPQ*443 for FX applications with LSAS
- AUA36, AUA41( ), AUA141, AUA42( ), AUA142, AUA43( ), AUA45( ), AUA56, AUA75( ), *SPQ*442, *SPQ*443, *SPQ*444, and *SPQ*454, when the *SPQ*444 is provisioned for 4TDM.

Where the RT is providing integrated network facility access, the *SPQ*444 is also end-to-end compatible with D4-type CUs with FXS functions, in the 4FXO mode, and with CUs with FX( ), DX, TO, RD, PLAR, and E&M functions, in the 4TDM mode.

The *SPQ*444 CU stores in nonvolatile memory an inventory record (including its ten-character *CLEI* code) available for reading by a compatible OSS.

The *SPQ*444 CU has transmission and signaling options that must be set before service can be provided. The CU does not have physical switches; instead, option information is written into memory registers located on the CU. All transmission and signaling options and the function type (FXO and TDM) are set by entering commands via local or remote provisioning.

Features and functions

The *SPQ*444 CU provides the following features and functions:

- Four-wire special services
  - — Loop- or ground-start signaling
  - — Tandem signaling.
- Provisionable transmission treatment
- Can be used in an INA configuration
- Inventory information (for example, *CLEI* code, date of manufacture, etc.).

The *SPQ*444 CU is functionally equivalent to the AUA44B CU.

Details for the *SPQ*444 CU are described in data sheet 363-005-385. The guidelines given in Chapter 5, Configuration Management—Four-Wire VF Special Services for selecting option setting, applications, and compatibility for the AUA44 CU should be used for the *SPQ*444 CU.

Equipment description

Channel unit faceplate

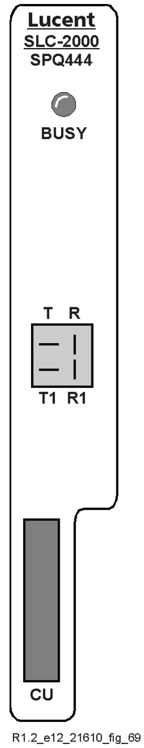


Figure 3-15. *SPQ*444 Four-Wire Current Sink Channel Unit Faceplate

Channel unit LED indicators

Table 3-11. *SPQ444* Four-Wire Current Sink Channel Unit Faceplate LEDs

LED	Function	Color
BUSY	Lit when service is active, during an LED test command, and on power-up.	Red

MDS2 Shelf—*SPQ*454 Four-Wire E&M Channel Unit

Four-wire *SPQ*454 CU

The *SPQ*454 four-wire CU is used in PBX tie trunks and can interface with a PBX or other transmission equipment.

The *SPQ*454 four-wire CU can be used in circuits requiring E&M or PLR type signaling to provide a tie trunk interface to a PBX or a back-to-back carrier arrangement with an interexchange carrier. In tie trunk applications, the E&M function provides the normal tie trunk interface. The PLR function provides the inverted E&M signaling interface required by certain terminal equipment as specified by Part 68 of the FCC Rules. The signaling leads can be connected over a single lead (Type I) or with a looped connection (Type II).

The *SPQ*454 CU may interface with a PBX, ACD, or other transmission or signaling equipment located in the same building.

The *SPQ*454 CU is end-to-end compatible with the AUA41( ) four-wire CU for PBX tie trunk applications. The *SPQ*454 can also be used in the local CO back-to-back with a D-bank 4E&M (J98726BC) or PLR (J98726BN) CU in applications where signaling is two-state, such as direct-inward-dial PBX trunk from a foreign CO.

Features and functions

The *SPQ*454 CU provides the following functions:

- E&M—The E&M function is used in PBX tie trunks to provide the E&M signaling interface. It converts the DC signal from the PBX M lead into PCM signaling pulses for the digital line. Similar pulses from the digital line are converted into a DC signal and sent to the PBX over the E lead.
- PLR—The primary application of the PLR function is also in PBX tie trunks either facing the PBX or in a back-to-back carrier interface. The PLR function provides the E&M signaling interface with inverted polarity. The CU converts the DC signal from the PBX E lead into PCM signaling pulses for the digital line. Similar pulses from the digital line are converted into a DC signal and sent to the PBX over the M lead.

The *SPQ*454 CU has transmission and signaling options that must be set before service can be provided. The CU does not have physical switches. Instead, option information is written into memory registers located on the CU. All transmission and signaling options and the function type (E&M or PLR) on the CU are set by entering commands via local or remote provisioning.

The *SPQ*454 CU stores in nonvolatile memory an inventory record (including its ten-character *CLEI* code) available for reading by a compatible OSS.

The *SPQ*454 CU provides the following features and functions:

- Four-wire special services
  - — PBX tie trunk interface with E&M or PLR signaling
  - — Interexchange carrier interface with E&M or PLR signaling.
- Provisionable transmission treatment
- Can be used in a universal TR-08 or an INA configuration
- Inventory information (for example, *CLEI* code, date of manufacture, etc.).

Details for the *SPQ*454 CU are described in the 363-205-386 data sheet. The guidelines given in Chapter 5, Configuration Management—Four-Wire VF Special Services for selecting option setting, applications, and compatibility for the AUA54B CU should be used for the *SPQ*454 CU.

Equipment description

Channel unit faceplate

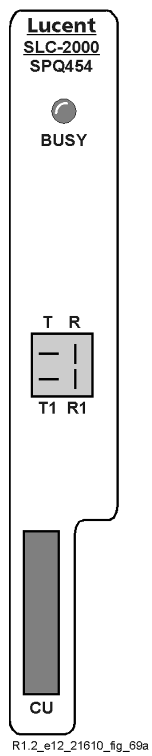


Figure 3-16. *SPQ*454 Four-Wire E&M Channel Unit Faceplate

Channel unit LED indicators

Table 3-12. *SPQ*454 Four-Wire E&M Channel Unit Faceplate LEDs

LED	Function	Color
BUSY	Lit when channel is busy.	Red

MDS2 Shelf—Digital Data Services, *SPQ*452 Dual OCU DP

Overview

The *SPQ*452 dual OCU DP CU is primarily used in an end-link of a DDS private line data service. The end-link is the part of the service between a customer and the local central office. It may also be used to provide local data service.

The *SPQ*452 CU stores in nonvolatile memory an inventory record available for reading by a compatible OSS. This inventory record includes its 10-character *COMMON LANGUAGE CLEI* code.

The *SPQ*452 dual OCU DP is end-to-end compatible with the following CUs:

- Another *SPQ*452 dual OCU DP
- AUA252( ) OCU DP
- AUS52( )/AUA152 OCU DP
- *SPQ*334/AUA34( ) DS0 DP
- D4 DP CUs in a *SLC*-96 COT or D4 bank.

Features and functions

The *SPQ*452 CU provides the following features and functions:

- Selectable customer data rates of 2.4, 4.8, 9.6, 19.2, 38.4, 56, or 64 kbps
- Error correction (majority vote, 19.2 single time slot, or second channel error correction)
- All-zero-code allowed
- Secondary channel (a low-speed telemetry channel added to the customer data bits)
- Sealing current
- Higher fault tolerance if a power line accidentally comes in contact with the metallic leads of the CU
- Compatible with universal TR-08 or INA configuration
- Faceplate indicator operates by flashing when loopback is activated
- Faceplate-controlled local loopback occurring at the PCM bit stream
- Four-wire bridging access faceplate jack that is compatible with CSU and DSU operation
- Two OCU DP channels

- Four-wire switched 56 kbps (4W SW56) service option compatible with the following AT&T and *US Sprint* SW56 service:
  - — Standard 4W SW56 service option compatible with AT&T *ACCUNET* Switched 56 and Sprint 56 of US Sprint SW56 service
  - — Enhanced SW56 (ESW56) service option compatible with *US Sprint* SW56 as specified in US Sprint Technical Specification TS-0046
  - — 4W SW56 A/B signaling option for frame-aligned SW56 configurations.
- Quality monitoring of the customer loop.

This OCU DP provides two channels of service and serves as the interface between full-duplex synchronous digital data (bipolar return-to-zero format) on a four-wire customer loop and the digital line PCM bit stream. The customer digital data rate may be 2.4, 4.8, 9.6, and 19.2 kbps subrates, and 38.4, 56, and 64 kbps full rates.

The *SPQ*452 OCU DP transmits and receives a bipolar return-to-zero signal on the four-wire loop. The maximum cable loss is 45 dB measured at a frequency equal to one-half of the primary data rate.

The line drivers and receivers present a balanced 135 ohm impedance across the signal frequency range.

The *SPQ*452 offers the following options:

- Error Correction Methods—Following are the error correction methods:
  - — Majority vote (MVEC)
  - — 19.2 kbps single timeslot (19.2 EC)
  - — Second channel (SCEC).

  The appropriate method depends on the customer data rate provided. All error correction methods ensure a 10^{-8} (DDS service standard) error-rate performance for a 10^{-3} error-rate facility.
- ZC—It provides an all-zero-code option to guarantee a sufficient ones density on the DS1 facility.
- Secondary Channel Option—When selected, this option provides to the subscriber a low-speed telemetry channel. This option is available with all data rates except 64 kbps.

- SW56 Service Option—This includes an enhanced SW56 service option, an A/B signaling option for frame-aligned SW56 configurations, and a quality monitoring option for the customer’s loop. For SW56 applications, it provides SW56 operation that can be used by a local exchange carrier to offer dedicated digital access to IXC and SW56 digital data services such as AT&T *ACCUNET* Switched 56 and Sprint 56 of US Sprint. In SW56 applications, the OCU allows dialing by the four-wire digital data circuit using CMI signaling in accordance with AT&T PUB42458. The unit decodes signaling from the network and passes this to the loop as either CMI (idle) or DATA mode (call active). The signaling between the OCU and the network is wink-start, A-bit signaling (an in-bank signaling technique that is the default method of decoding signaling from the network). In-band signaling allows SW56 service over circuit configurations that contain tandemed DS0 DPs. The OCU also provides an AB signaling option for circuit configurations not supporting clear channel nor tandemed DS0 DPs (this signaling option is also referred to as hardware signaling).

When this OCU is used in an *AnyMedia* Access System, you enter all functions through local or remote provisioning.

For details of this CU, see the 363-005-341 data sheet. Chapter 5, Configuration Management—Digital Data Services provides guidelines for selecting option settings for the CU, describes the various applications of this unit, and provides CU compatibility information.

Equipment description

Channel unit faceplate

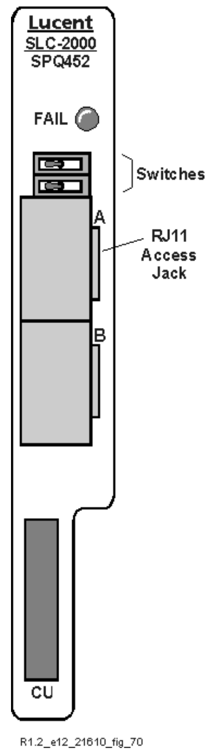


Figure 3-17. *SPQ*452 Dual OCU DP Channel Unit Faceplate

Channel unit indicators

Table 3-13. *SPQ*452 Dual OCU DP Channel Unit Faceplate LEDs, Jacks, and Switches

LED	Function	Color
FAIL	When lit, indicates either power up of the CU or a FAIL condition of either DP on the channel unit. The LED also flashes when a flashing loopback is established.	Red

Jack and Switches	Function
RJ11 jack	Provides bridging access to the T&R (Transmit) and T1&R1 (Receive) pairs of the *SPQ*452 dual OCU DP circuit. Using an adapter cord, this jack is compatible with the Telepath Industries TPI-95 Digital Loop Analyzer Test Set and other industry standard CSUs/DSUs.
Switches	Activates manual loopbacks (one for each DP circuit).

MDS2 Shelf—Digital Data Services, *SPQ*334 Dual DS0 DP

Overview

The *SPQ*334 dual DS0 DP CU is primarily used in an end-link of a DDS private line data service, but is also used in switched 56 kbps (SW56) applications. The end-link is the part of the service between a customer and the local central office. It may also be used to provide local data service. The *SPQ*334 is always located in the MDS2 COT.

The *SPQ*334 DS0 DP provides two channels of service and serves as the interface between full-duplex synchronous digital data (bipolar return-to-zero format) on a four-wire tip/ring side and the digital line PCM bit stream. The digital data rate may be 2.4, 4.8, 9.6, and 19.2 kbps subrates, and 38.4, 56, and 64 kbps full rates. All customer data, even when less than 64 kbps, are embedded in the 64 kbps bit stream. The unit transmits and receives a bipolar return-to-zero signal on the four-wire loop.

The line drivers and receivers present a balanced 135 ohm impedance across the signal frequency range.

The *SPQ*334 CU stores in nonvolatile memory an inventory record available for reading by a compatible OSS. This inventory record includes its 10-character *COMMON LANGUAGE CLEI* code.

The *SPQ*334 dual DS0 DP is end-to-end compatible with following CUs:

- *SPQ*452 dual OCU DP
- AUA232 DSU DP
- AUA200.

Features and functions

The *SPQ*334 CU provides the following features and functions:

- Selectable customer data rates of 2.4, 4.8, 9.6, 19.2, 38.4, 56, or 64 kbps
- Error correction (majority vote, 19.2 single time slot, or second channel error correction)
- Zero code suppression
- Secondary channel (a low-speed telemetry channel added to the customer data bits)
- Higher fault tolerance if a power line accidentally comes in contact with the metallic leads of the CU
- Compatible with universal TR-08 or INA configuration
- Faceplate indicator operates by flashing when loopback is activated
- Faceplate-controlled local loopback occurring at the PCM bit stream

- Four-wire bridging access faceplate jack
- Two DS0 DP channels.

The *SPQ*334 offers the following options:

- Error Correction Methods—Following are the error correction methods:
  - — Majority vote (MVEC)
  - — 19.2 kbps single timeslot (19.2 EC)
  - — Second channel (SCEC).

  The appropriate method depends on the customer data rate provided. All error correction methods ensure a 10^{-8} (DDS service standard) error-rate performance for a 10^{-3} error-rate facility.
- ZC—It provides an all-zero-code option to guarantee a sufficient ones density on the DS1 facility.
- Secondary Channel Option—When selected, this option provides to the subscriber a low-speed telemetry channel. This option is available with all data rates except 64 kbps.
- SW56 Service Option—This includes A/B signaling option for frame-aligned SW56 configurations. For SW56 applications, it provides SW56 operation that can be used by a local exchange carrier to offer dedicated digital access to IXC and SW56 digital data services such as AT&T *ACCUNET* Switched 56 and Sprint 56 of US Sprint. The functions needed in the DS0 DP located in the COT are dependent on the Switched 56 operating mode provisioned in the OCU DP located at the RT. The DS0 also provides an AB signaling option for circuit configurations not supporting clear channel nor tandemed DS0 DPs (this signaling option is also referred to as hardware signaling).

When this DS0 is used in an *AnyMedia* Access System, you enter all functions through local or remote provisioning.

For more details, see the 363-005-332 data sheet. Chapter 5, Configuration Management—Digital Data Services, on page 5-149 provides guidelines for selecting option settings for the CU, describes the various applications of this unit, and provides CU compatibility information.

Equipment description

Channel unit faceplate

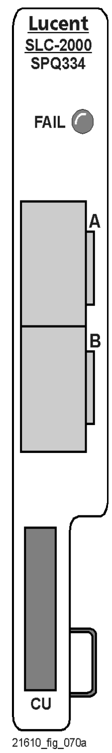


Figure 3-18. *SPQ*334 Four-Wire Channel Unit Faceplate

Channel unit indicators

Table 3-14. *SPQ*334 Dual DS0 DP Channel Unit Faceplate LEDs, Jacks, and Switches

LED	Function	Color
FAIL	When lit, indicates either power up of the CU or a FAIL condition of either DP on the CU. When flashing, indicates a flashing loopback is established.	Red

Jack and Switches	Function
RJ45 jack	Provides bridging access to the T&R (Transmit) and T1&R1 (Receive) pairs of the *SPQ*334 dual DS0 DP circuit. Using an adapter cord, this jack is compatible with the Telepath Industries TPI-95 Digital Loop Analyzer Test Set.

MDS2 Shelf—Digital Data Services, AUA200 Channel Unit

Overview

The AUA200 DPX CU is primarily used in a two-wire end-link of a switched 56 kbps digital data service. An end-link is the part of the service between a customer and the local central office.

The AUA200 DPX is end-to-end compatible with the following CUs:

- AUA34( ) DS0 DP located at the *SLC*-2000 COT
- D4 DS0 DP in a *SLC*-96 COT or D4 channel bank.

Features and functions

The AUA200 DPX provides the following features and functions:

- Switched 56 kbps data operation over a single pair of wires
- Extends *Datapath* services from a Nortel Networks *DMS*-100 or *DMS*-10 central office switch
- Support for network connectivity to non-*Datapath* four-wire switched 56 kbps services
- Integrated *DMS* switch maintenance control
- Support for DDS alternating and latching loopbacks
- Can be used in a universal TR-08 or an INA configuration
- Faceplate mounted status and test indicator
- Faceplate mounted self-test push button.

The AUA200 DPX CU provides an extension of the Nortel Networks *Datapath* switched 56 kbps PSDN service offering. This service of AUA200 CU also supports various rates less than 56 kpbs. The loop interface and data protocols are compatible with the "*Datapath* Network Access Interface Specifications" as described in Telcordia Technologies, Inc. TR-EOP-000277*.

The AUA200 DPX CU is network compatible with the Nortel Networks *Datapath* service and digitally compatible with four-wire switched 56 kbps data services such as the AT&T *ACCUNET* digital service. The DS0 interface to the facility is similar to the 56 kbps DDS format except that the eighth bit (data/control) is used for call supervision. The unit provides a single subscriber circuit interface between the customer's *Datapath* DU and the DS0 digital bit stream. The AUA200 DPX CU

* Telcordia Technologies, Inc. Technical Reference TR-EOP-000277, Issue 1, September 1985, *Datapath Network Access Interface Specifications, Switched Network Compatibility and Performance Specifications for Two-Wire Connection to the Public Switched Digital Network*.

communicates with the customer-located DU via a two-wire nonloaded loop interface.

The AUA200 DPX CU contains many options that are selected using switches on the CU.

NOTE:
There is no GSI access to the AUA200 CU.

Details for the AUA200 CU are described in the 363-005-313 data sheet. The data sheet provides guidelines for selecting option settings, describes the various applications for the CU, and provides CU compatibility information.

Equipment description

Channel unit faceplate and option switches

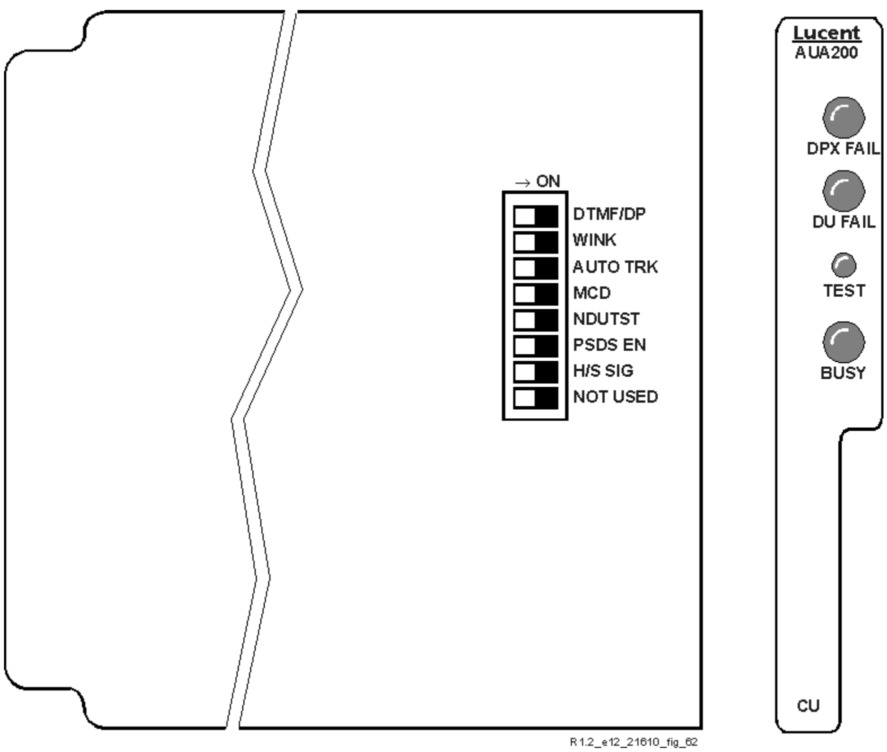


Figure 3-19. AUA200 Channel Unit Faceplate and Option Switches

Channel unit indicators

Table 3-15. AUA200 Channel Unit Faceplate LEDs

LED	Function	Color
DPX FAIL	When lit steadily, indicates failure of the AUA200; when flashing, indicates an incorrect signal pattern received from the switch.	Red
DU FAIL	When lit, indicates the attempt to test the local DU has failed.	Red
BUSY	When lit steadily, indicates circuit is busy; when flashing, indicates DDS loopback or IBERT testing in progress.	Red

Button	Function
DU test	Initiates a self-test when pressed. Once the switch is pressed, the unit will suspend data transmission to the DTE and perform a DSU loopback test on the far-end unit.

MDS2 Shelf—Digital Data Services, AUA232 DSU DP

DDS private line data service

The AUA232 DSU DP is primarily used in an end-link of a DDS private line data service. An end-link is the part of the service between a customer and the local central office. The AUA232 DSU DP may also be used to provide local data service. For DDS applications, the AUA232 DSU DP-equipped MDS2 shelf is always located on the customer's premises. For local data applications, the AUA232 CU may also be used in the COT.

The AUA232 DSU DP is end-to-end compatible with the following CUs:

- Another AUA232 CU
- AUA34( ) DS0 DP
- *SPQ*334 DS0 DP
- AUA52( ) OCU DP
- AUA252( ) OCU DP
- *SPQ*452 OCU DP
- D4 DP CUs in a *SLC*-96 COT or D4 channel bank.

Features and functions

The AUA232 DSU DP has the following features and functions:

- Asynchronous and synchronous data operation
- 1.2 (asynchronous only); 2.4, 4.8, 9.6, 19.2, and 56 kbps (synchronous only) data rates
- Error correction, anti-streaming, RTS options
- RS-232 DTE faceplate interface RJ48 modular jack
- Can be used in a universal TR-08 or an INA configuration
- Faceplate push button for local test activation
- Faceplate test result/loopback indicator.

The AUA232 DSU DP combines the function of an OCU-DP and a DSU/CSU. The DSU DP allows a DTE device access to the DDS network at rates up to 56 kbps. It responds to network loopback commands received from the network for fault isolation or verification of T1 circuits. It has test capability for local use and a status LED for test/loopback information. Error correction is optional for all service rates. Asynchronous data operation is supported up to 19.2 k baud. Synchronous data operation is supported from 2.4 to 56 kbps.

The AUA232( ) DSU DP presents a DDS interface to the network and an eight-wire EIA RS-232 interface to the customer. The AUA232 CU provides a single subscriber circuit interface between DTE and the digital bit stream.

The AUA232 CU contains many options that are selected using switches on the circuit pack.

The AUA232 CU cannot be used in single-point ground environment schemes.

NOTE:
There is no GSI access to the AUA232 CU.

Details for the AUA232 DSU DP are described in the 363-005-312 data sheet. The data sheet provides guidelines for selecting option settings, describes the various applications for the CU, and provides CU compatibility information.

Equipment description

Channel unit faceplate and option switches

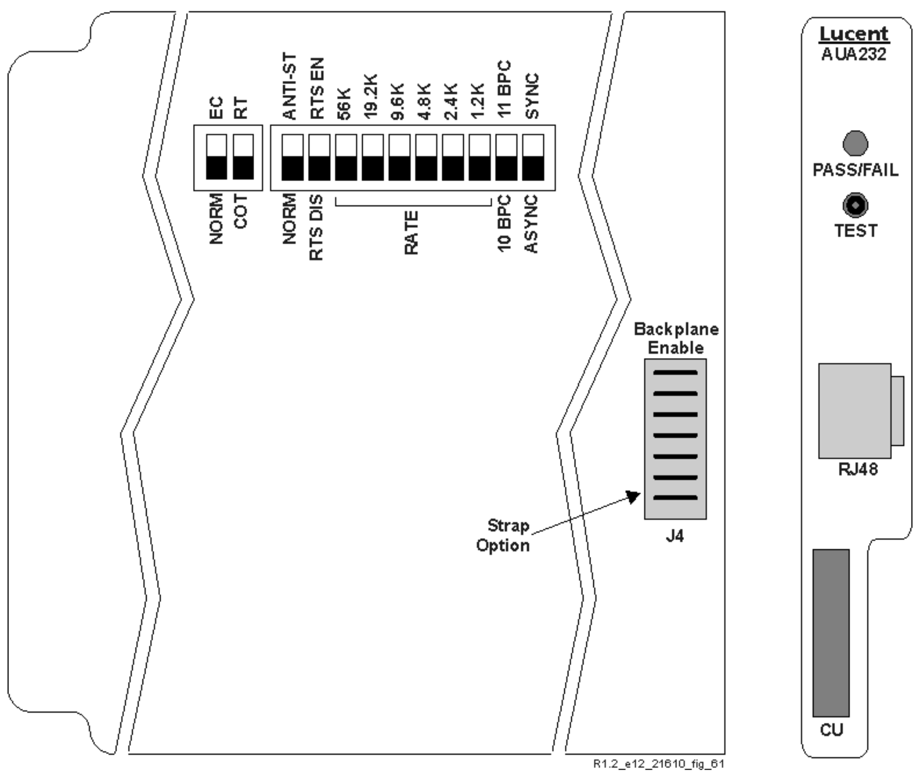


Figure 3-20. AUA232 DSU DP Channel Unit Faceplate

Channel unit indicators

Table 3-16. AUA232 DSU DP Channel Unit Faceplate LED, Button, Jack, and Strap

LED	Function	Color
PASS/FAIL	The 511 pattern contains errors.	Red
	The pattern is error free.	Green
	An error was previously detected, but the pattern is presently error free.	Yellow

Button, Jack, Strap	Function
Test button	When lit, indicates that the 511 pattern contains errors.
	When lit, indicates that the pattern is error-free.
	When lit, indicates if an error was previously detected, but the pattern is presently error-free.
RJ48 modular jack	Located on the faceplate or using the tip/ring metallic interface on the backplane.
Strap option (J4)	Provided on the circuit pack to enable access of the eight wires using the tip/ring backplane interface.

MDS2 Shelf—Teltrend AUA293I2 ISDN BRITE

Overview

The Teltrend AUA293I2 ISDN BRITE CU provides one *ANSI* standard U-DSL over a nonloaded two-wire loop.

The Teltrend AUA293I2 CU uses the U-interface 2B1Q signal to provide a four-level line code at a data rate of 160 kbps (80k baud), comprising two B channels and one D channel, plus overhead. The D channel is used for signaling and low-speed packet data. The B channels may be used for circuit-switched voice, circuit-switched data, or packet data. The unit complies with the *ANSI* standard for a U-interface digital subscriber line.

The carrier side Teltrend AUA293I2 CU interfaces to another AUA293I2 CU.

The Teltrend AUA293I2 CU is supported in universal TR-08 or INA configuration. The AUA293I2 CU can be used in the MDS2 shelf with no CU slot restrictions.

Features and functions

The Teltrend AUA293I2 CU provides the following features and functions:

- Option settings—When the Teltrend AUA293I2 CU is installed in an RT MDS2 shelf, the line unit switch must be set to RT. The CU provides one channel of service in the LULT mode. When the AUA293I2 CU is installed in a COT, the line unit switch must be set to COT. The AUA293I2 CU provides the LUNT function.
- Supports nonloaded loops up to 18 kft in length (26 awg)
- Supports timing from the system clock
- Supports service provisioning using the `ENT-T0` command from the GSI and manual switch settings
- Supports local loopback test operations via faceplate buttons.

When the CU is provisioned for 2 or 3 timeslots, a bundled T0 cross-connection is necessary to allocate the needed bandwidth on the network interface. See Figure 5-2 on page 5-12 for an example.

Applications and prescription setting (provisioning) for the Teltrend AUA293I2 BRITE CU are described in Teltrend’s Installation Guide.

Equipment description

Channel unit faceplate

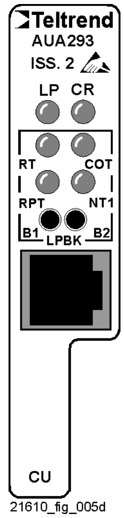


Figure 3-21. Teltrend AUA293I2 ISDN BRITE Channel Unit Faceplate

Channel unit LED indicators

Table 3-17. Teltrend AUA293I2 ISDN BRITE Channel Unit LEDS

LED	Function	Color
LP	Lit when transmission status of loop is not in sync.	RED
CR	Lit when transmission status of carrier is not in sync.	RED
RT	Flashes when there is a burst of CRC errors at the RT end. Steady light when there are long term CRC errors at RT end.	YELLOW
COT	Flashes when there is a burst of CRC errors at COT end. Steady light when there are long term CRC errors at COT end.	YELLOW
RPT	Initial slow flash when loopback operation is on first repeater. Initial quick flash when loopback operation is on second repeater.	YELLOW
NT1	Lit when loopback operation is on NT1.	YELLOW

MDS2 Shelf—*SPQ*328 Enhanced Business Service Channel Unit

Overview

The *SPQ*328 Quad enhanced business service (EBS) CU is a Centrex-CO feature offered to customers served by a *DMS*-100 switch. It is frequently referred to as P-Phone service. This service uses a pair of CUs to provide enhanced local service using a proprietary protocol of Nortel. The CUs are installed at the following locations:

- MDS2 Central Office Terminal (COT): *SPQ*328 Quad EBS CU
- MDS2 Remote Terminal: *SPQ*429 Quad EBS CU.

The *SPQ*328 CU is end-to-end compatible with the *SPQ*429 CU. The *SPQ*328 CU must be located at the COT and the *SPQ*429 must be located at the RT.

The *SPQ*328 CU provides four channels of service, acting as the current sink interface between the digital facility and a Nortel *DMS*-100 switch.

The *SPQ*328 CU stores in nonvolatile memory an inventory record available for reading by a compatible OSS. This inventory record includes its ten-character *CLEI* code.

Features and functions

The *SPQ*328 CU provides the following features and functions:

- Four channels of enhanced business service
- No option switches
- Faceplate test jack access to tip and ring of each channel
- Inventory information.

The *SPQ*328 CU is supported in universal TR-08 or INA configurations. The DS1 line coding must be provisioned to B8ZS. The CU will not work on a DS1 using ZCS line code.

For more details, see *Tollgrade* TLGD-328C data sheet.

Equipment description

Channel unit faceplate

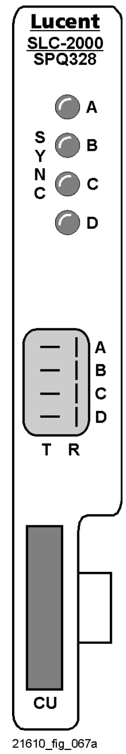


Figure 3-22. *SPQ*328 Quad EBS Channel Unit Faceplate

NOTE:
No user options or settings are on the *SPQ*328.

Channel unit LED indicators

Table 3-18. *SPQ*328 Quad EBS Channel Unit Faceplate LEDs

LED	Function	Color
A (B, C, D) SYNC	When lit, indicates that end-to-end communication (Channel 1) is lost between the units.	Red

MDS2 Shelf—*SPQ*429 Enhanced Business Service Channel Unit

Overview

The SPQ429 enhanced business service (EBS) CU is a Centrex-CO feature offered to customers served by a *DMS*-100 switch. It is frequently referred to as P-Phone service. This service uses a pair of CUs to provide enhanced local service using a proprietary protocol of Nortel. The CUs are installed at the following locations:

- SLC-2000 Central Office Terminal: *SPQ*328 Quad EBS CU
- MDS2 Remote Terminal: *SPQ*429 Quad EBS CU
- MDS2 Central Office Terminal: *SPQ*328 Quad EBS CU.

The *SPQ*429 CU is end-to-end compatible with an *SPQ*328 CU. The *SPQ*429 must be placed at the MDS2 RT end.

The *SPQ*429 CU provides four channels of service, acting as the current feed interface between the digital facility and a Nortel EBS (P-Phone) station set.

The *SPQ*429 CU stores in nonvolatile memory an inventory record available for reading by a compatible OSS. This inventory record includes its ten-character *CLEI* code.

Features and functions

This CU provides the following features and functions:

- Four channels of enhanced business service
- No option switches
- Faceplate test jack access to tip and ring of each channel
- Inventory information.

The *SPQ*429 CU is supported in universal TR-08 or INA configurations. The DS1 line coding must be provisioned to B8ZS. The CU will not work on a DS1 using ZCS line code.

For more details, see *Tollgrade* TLGD-429R data sheet.

Equipment description

Channel unit faceplate

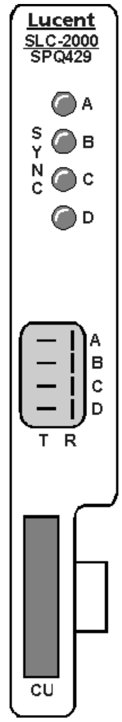


Figure 3-23. *SPQ*429 Quad EBS Channel Unit Faceplate

NOTE:
No user options or settings are on the *SPQ*429.

Channel unit LED indicators

Table 3-19. *SPQ*429 Quad EBS Channel Unit Faceplate LEDs

LED	Function	Color
A (B, C, D) SYNC	When lit, indicates that end-to-end communication (Channel 1) is lost between the units.	Red

MDS2 Shelf—ADTRAN *Total Reach* DDS Dataport (DDS-DP) Channel Unit

Features and Functions

The ADTRAN *Total Reach* DDS-DP CU provides the interface between a DS0 timeslot and the two-wire metallic loop extending to the customer premises. The *Total Reach* DDS-DP CU may interoperate with another *Total Reach* DDS-DP, OCU-DP, DS0-DP, I/O DCS or switch. The *Total Reach* DDS-DP CU must be located in the *AnyMedia* Access System MDS2 shelf.

The features of this CU include the following:

- Two-wire deployment
- Repeaterless operations
- Bridged tap tolerance
- Span power for remote *Total Reach* DDS termination unit (TRDDS-R)
- Loop quality monitor and A/B signaling options
- Bidirectional OCU loopback capability.

The *Total Reach* DDS-DP CU is provisioned using the hardware option switch settings and the GSI or TL1SI provisioning tools.

Refer to the *ADTRAN Total Reach® All Rate DDS Dataport Installation and Maintenance* data sheet, section 61433105L1-5D for option switch settings and operations.

Refer to the *ADTRAN Total Reach® All Rate DDS Termination Unit Installation and Maintenance* data sheet, section 6129102L2-5D1-5D for information on the TRDDS-R termination unit.

Traditional DLC Interfaces

4

Overview

This chapter discusses the traditional DLC transmission, OAM&P, testing, and alarm interfaces of the *MDS2* option.

Virtual Remote Terminals

Overview

The *AnyMedia* Access System can be configured to be logically divided into a number of separate virtual terminals that provide three types of traditional DLC service node interfaces. Twenty DS1s can be equipped and configured on the shelf to provide the following terminal interfaces:

- One GR-303 VRT
- Up to 20 Mode 1 TR-08 VRTs
- Up to 20 INA VBs.

All three terminal types can be configured to exist at the same time, depending on the allocation of the 20 DS1s available in the shelf.

Detailed information about VFRs can be found in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide.*

System capacity (subscriber lines)

An *AnyMedia* Access System application provides multiple VRT and INA access service. The maximum number of subscriber lines per *FAST* shelf arrangement is determined by the number of DS1s equipped in a *FAST* shelf, the interface selected, and one of the following arrangements:

- The number of telephony APs in the *FAST* shelf
- The number of telephony APs in the *FAST* shelf and the number of CUs in the MDS2 shelf.

Example: *FAST* shelf only with GR-303 interface

When the maximum of 16 APs is installed in the *FAST* shelf and all the APs are 32 POTS lines APs, the shelf can provide up to 512 lines of POTS service

16 APs x 32 POTS lines/AP = 512 POTS lines

Example: *FAST* shelf and MDS2 shelf with GR-303 interface

When the *FAST* shelf is equipped with 14 32-line POTS APs and two MDSU circuit packs, which serves 96 channels at the MDS2 shelf (24 CUs with 4 channels each), the *FAST* shelf can provide up to 544 lines of service

(14 APs x 32 POTS lines/AP) + (24 CUs x 4 lines/CU) = 544 lines

Management Interface

Overview

The *AnyMedia* Access System has a convenient Management Interface, which is used for managing traditional DLC services and ATM xDSL services.

The Management Interface allows the technician to provision a single NE at a time through its GSI, while simultaneously monitoring alarms of multiple NEs through its Network Maintenance Manager.

GSI

The GSI for the *AnyMedia* Access System is a software tool that provides a graphical interface to support the OAM&P functions of the system. When the GSI is connected to the CTU or LAN for telephony services or the AFM LAN for ATM xDSL services, the GSI provides a graphical view of the *AnyMedia FAST* shelf view of the following:

- *AnyMedia FAST* shelf and MDS2 shelf, as shown in Figure 4-1 on page 4-4

Specifically, the GSI accesses the *AnyMedia* Access System in the following ways:

- A cable connects from the PC serial port(s) to the *AnyMedia* Access System CIT 9-pin EIA-232E/574 connector, which is located on the front of the CTU circuit pack on the *FAST* shelf.
- A connection via an Ethernet LAN card to the system’s network TCP/IP connection for either local or remote access.

Network Maintenance Manager

The Network Maintenance Manager is used to monitor alarms over multiple NEs. The Network Maintenance Manager allows a technician to choose which NEs to monitor, to filter viewed alarms, and to manage the display of these alarms. Figure 4-2 on page 4-5 shows the options in Network Maintenance Manager window.

The Network Maintenance Manager is accessed remotely by choosing it through the Management Interface, or through a button or pull-down menu on the GSI. In this way, a technician may go back and forth from multiple to single NEs as needed to check and administer to the alarms.

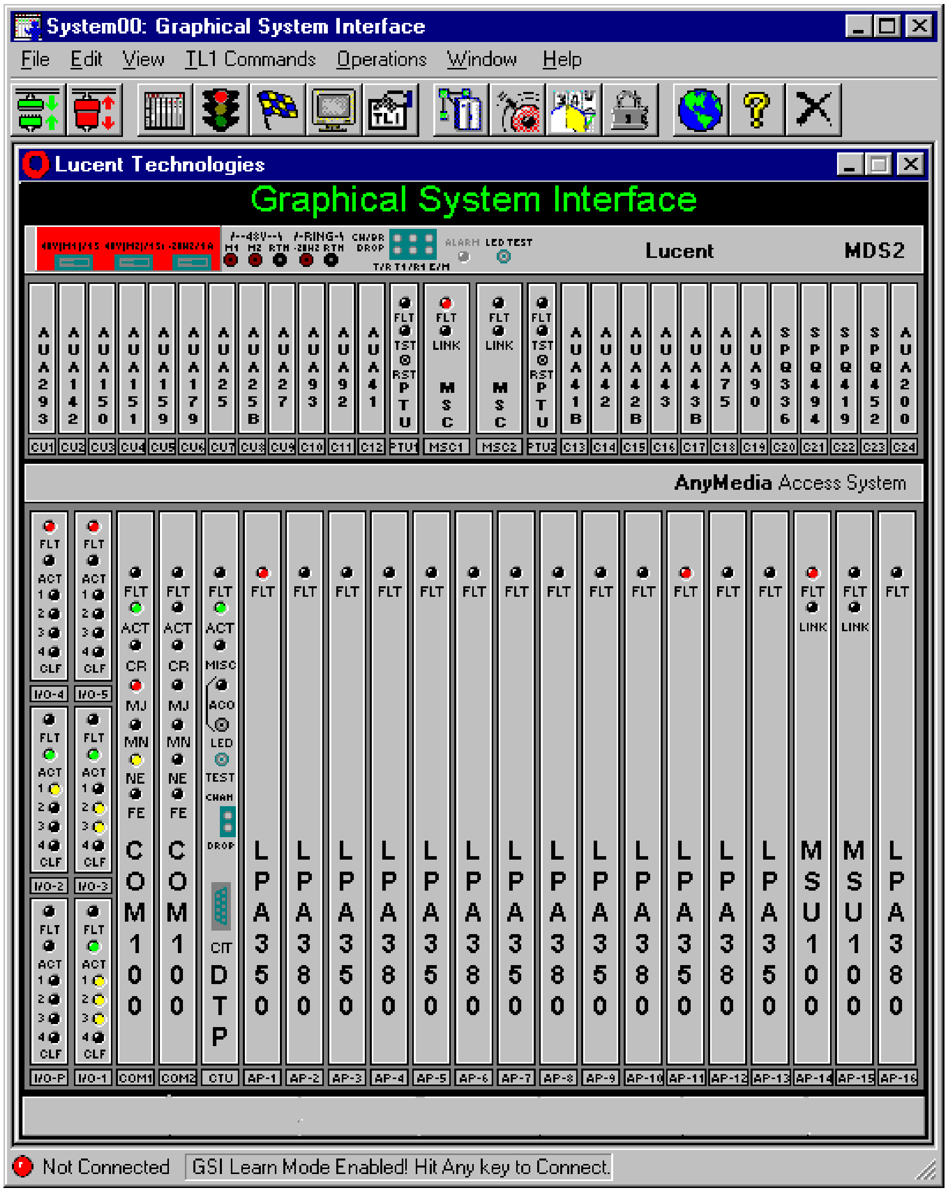


Figure 4-1. GSI Representation of *AnyMedia* Access System *FAST* Shelf and MDS2 Shelf

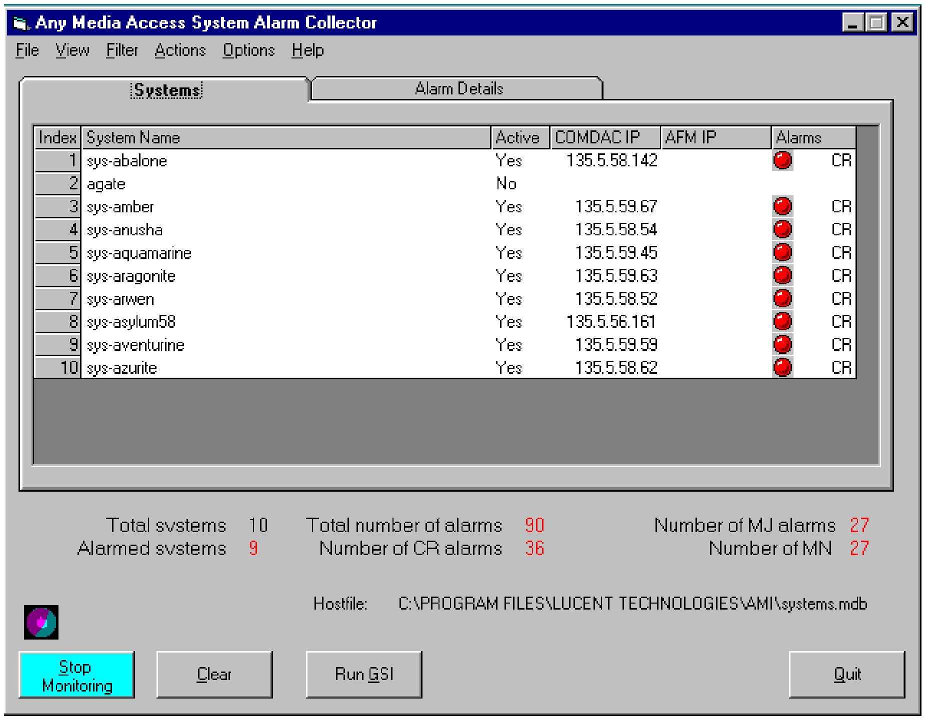


Figure 4-2. Network Maintenance Manager Interface

GSI description

Whether accessing the system remotely or locally, a technician using the GSI sees a graphical representation of the *FAST* shelf and MDS2 shelf as Figure 4-1 shows. The GSI has buttons and pull-down menus, which are used to monitor and manage the equipment, as Figure 4-3 shows. The technician can select a specific operation and run any of the TL1 commands for it with simple button clicks. The technician can also launch a TL1SI view window through the GSI and enter command-line messages.

GSI operations interfaces

The serial port on the PC is used for local access to the CTU CIT port. TL1 commands are used for all OAM&P functions (listed in Chapter 5, *OAM&P for Traditional DLC Services*). If the PC is equipped with a LAN card, the GSI software can also be used to access the system locally or remotely via the LAN interface.

GSI selections

The technician performs the system operations through the GSI by selecting an operation in a pull-down menu, as Figure 4-3 shows. This action can also be performed by selecting the **TL1 Cmds** button on the GSI, which launches a list of all the TL1 commands as buttons, as Figure 4-4 shows. The technician is then able to click on the TL1 command necessary to perform the operation.

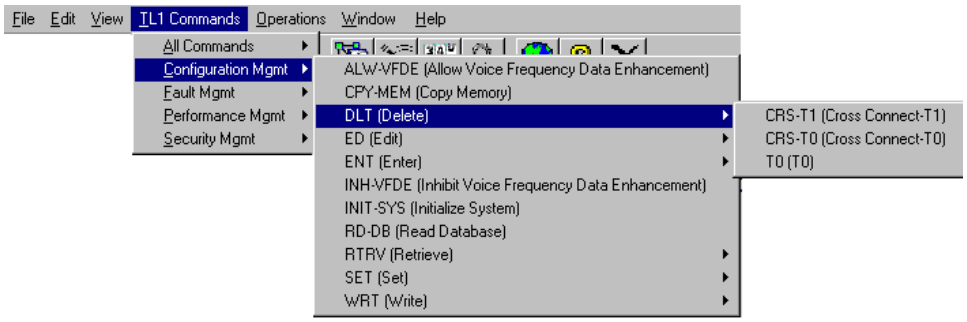


Figure 4-3. Pull-Down Menu for Selecting GSI Operations

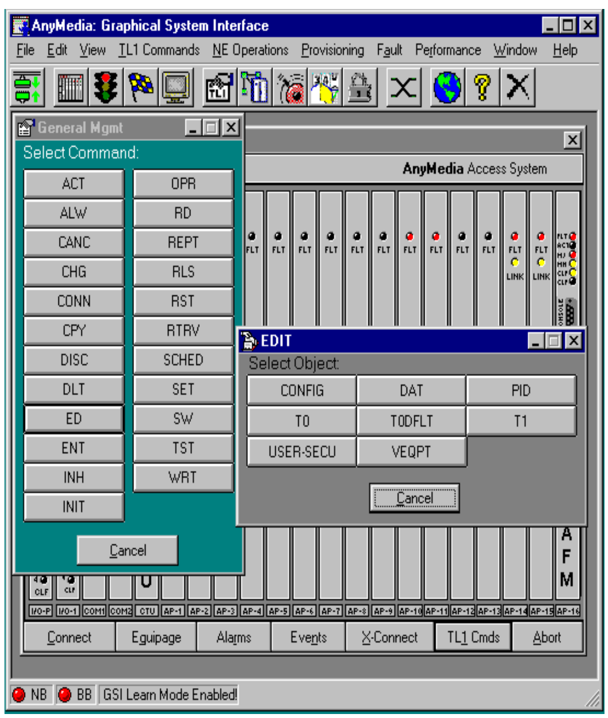


Figure 4-4. TL1 Commands Window

GSI operation areas

The GSI supports the operations that manage the *AnyMedia* Access System functional areas by allowing a technician to select an operation and its associated TL1 commands in the following areas:

- All Commands—provides all the TL1 commands for the operations (Configuration Management, Fault Management, Performance Management, Security Management) in one list.
- Configuration Management—operations that control and provision the system, which includes memory management, software management, service provisioning, inventory management, and initialization.
- Fault Management—operations that maintain the system, which includes fault detection, fault isolation, correction of abnormal operations, protection switching, alarm reporting, and testing. Alarm conditions appear on the status bar along with an audible beep. After an alarm is detected, a message that explains how to proceed appears in a pop-up message box.
- Performance Management—operations to evaluate and report on the performance of the system and the system's components.
- Security Management—operations that protect the system from unauthorized access, which includes security administration, password maintenance and changes, and access status reports.

In the GSI, autonomous messages generated by the system notify the user about system events as the events occur. Autonomous messages include alarm notifications, database changes, threshold crossings, and other system events.

Network Maintenance Manager description

The Network Maintenance Manager is selected as an option when a technician selects the Management Interface icon, or through the GSI via a pull-down menu or a button. The Network Maintenance Manager is invoked when the technician wants to monitor many NE systems instead of just one, but the technician also has the option to return to a single system to address alarms.

Network Maintenance Manager operations

When using the Network Maintenance Manager, it accesses the NEs through a connection on the rear of the backplane via an Ethernet LAN card to the system's network TCP/IP connection for remote access.

Network Maintenance Manager selections

When using the Network Maintenance Manager, the technician performs the system operations by selecting the tabs or pull-down selections needed to see the system alarms by severity or alarm status. A technician can choose options that show the alarms displayed by system and/or severity and the alarm status. The Network Maintenance Manager also gives the technician the option to see alarms that are on the COMDAC and/or AFM. The technician can start and stop monitoring the alarms at any time.

Figure 4-5 on page 4-8 shows a sample of the alarms captured using the Network Maintenance Manager.

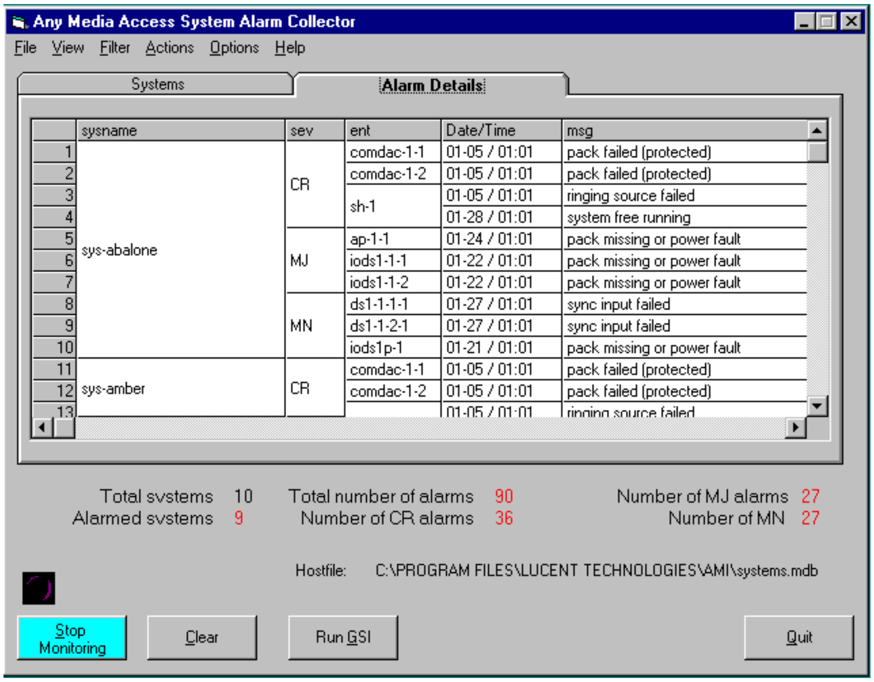


Figure 4-5. A Graphical Representation of the Alarms Collected Using the Network Maintenance Manager

External Interfaces for Circuit Testing

Overview

The *AnyMedia* Access System provides the following external interfaces for circuit testing:

- Local access for manual testing is provided via test access jacks on the front of the CTU (two-wire circuits) or on the MDS2 FCM (two-, four- or six-wire circuits).
- Connections to the TAP-B used for TR-465 (i.e., PGTC–compatible) testing are made via two connectorized dangler cables. Similarly, connections to the TAP-A used for GR-834-compatible testing are made via a TAP dangler cable.
- If an external RTU located at the *AnyMedia* Access System site (designation RTU-2) is used, the RTU-2 is normally connected to the tip/ring leads from two port circuits at either the protector block assembly or an *AnyMedia* Access System-site distribution frame. One VF or DDS port circuit is used by the RTU-2 as a data communication channel, and another VF port circuit is used as a talk/monitor channel, as described in the RTU-2 vendor's installation instructions.
- RTU port for GR-834 TL1 messages.

TAP

A TAP is a metallic test bus in an *AnyMedia* Access System that allows full-split access to subscriber drops terminated on APs or CUs that are installed in the system. Two TAPs (TAP-A and TAP-B) are provided in an *AnyMedia* Access System. TAP-A is normally used for special service testing. TAP-B is used for locally switched service testing. TAP-A is not available until the PTU BDJ200B circuit pack has been installed at the MDS2 shelf in the PTU-1 slot. TAP-B is not available until the PTU BDJ200B circuit pack has been installed at the MDS2 shelf in the PTU-2 slot.

CO/Remote Alarm Output Closures and Alarm Cutoff

Overview

The *AnyMedia* Access System provides the following three alarm output closures to indicate each of the severe alarm states (critical, major, or minor) in the system:

- Local alarm
  - — One set for visual alarm indications
  - — One set for audible alarm indications.
- Remote telemetry system
  - — One set for output to the remote telemetry system.

Local alarm output closures

The system provides two sets of local alarm output closures for three output closures for each as follows:

- One set for visual alarm indications
- One set for audible alarm indications.

Each set of alarm closures on the CTU is used to indicate the most severe alarm state (critical, major, or minor) in the system, including the MDS2 shelf if equipped. The CO alarm output closures are located at the CTU.

Remote alarm output closures

The system provides one set of alarm closures for output to the remote telemetry system to indicate the most severe alarm state (critical, major, or minor) in the system, including the MDS2 shelf if equipped, as well as identification of the system. The remote alarm output closures are located at the CTU.

Alarm cutoff

The system supports an alarm cutoff (ACO) function that, when activated, retires the audible CO and remote alarm output closures. The ACO function does not retire the visual CO and system ID for remote alarm output closures.

The ACO function can be activated via the **ACO** button on the CTU faceplate, an `Operate-Alarm Cutoff` TL1 command, or a RACO input signal from the remote telemetry system.

The ACO indicator on the CTU is illuminated when the ACO function is activated. The ACO function is terminated and the ACO indicator is extinguished when either of the following occur:

- All alarms are retired

- A new alarm (with higher severity) occurs.

In the latter case, the audible CO and remote alarm closures are reactivated.

Alarm closure behavior on power loss

The CO and remote alarm output closures are fail-safe to handle loss of power condition. In the powered-down state, the following alarm output closures are automatically activated by hardware:

- CR (audible CO)
- CR (visual CO)
- CR (remote)
- SID (remote).

OAM&P for Traditional DLC Services

5

Overview

This chapter discusses the OAM&P operations of the *AnyMedia* Access System for traditional DLC services.

Configuration Management

Overview

Configuration Management is the system activity for operations that control and provision the system, including the following:

- Memory administration—used to manage the NVDS of the *AnyMedia* Access System
- Software management—used to manage the NVPS of the system
- Service provisioning—process of preparing a CU port circuit for service by defining the CU's function and setting its parameters
- Inventory management—system activity of collecting, updating, and reporting data on system equipage and system status
- Synchronization provisioning—controls the synchronization mode of the *AnyMedia* Access System and its synchronization reference sources.

Configuration Management— Memory Administration

Overview

Memory administration is used to manage the NVDS of the *AnyMedia* Access System.

Data storage

The system has the following types of data storage:

- Volatile data storage, which is in the RAM
- NVDS, which is implemented using a FLASH memory device on the COMDAC circuit pack.

The system periodically audits the NVDS. If the system is in a simplex configuration, it checks the self-consistency of the NVDS. If the system is in a duplex configuration, it checks self-consistency and mutual-consistency of both copies of the NVDS.

Data backup and restore

The system supports backups of the NVDS data in case of catastrophic multiple failures of the NVDS. Backups of the NVDS data are done through the NVDS database upload from the NVDS to an OS or a GSI interface. NVDS backup will not occur automatically; an OS or a GSI must be used to initiate this action.

The system also supports restoration of previous NVDS data from a previous release in the event of a *backout* of a new software release. The restoration of previous NVDS data is done through the NVDS database download from an OS or GSI.

Configuration Management—Service Activation

Overview

Service activation is the process of preparing the *AnyMedia* Access System for service by configuring the cross-connections between its bandwidth management entities (e.g., feeder resources, VRTs, and VBs) and setting any required options.

For more details, refer to AnyMedia® Access System, *Applications, Planning, and Ordering Guide.*

Configuration Management—Provisioning

Overview

The following services provided by the *AnyMedia* Access System are described in this chapter:

- Line termination provisioning
- Channel unit provisioning
- Two-wire special services provisioning
- Two-wire special service prescription setting for *SPQ*442 channel unit
- Private line auto ring
- Ringing repeater
- Enhanced business service (P-Phone)
- Four-wire VF special services
- Digital data services
- Nonlocally switched ISDN basic access (BRITE channel unit)
- DC/AC alarm service and test pair
- Channel unit parameters
- MDS2 channel unit option switch selectable parameters
- MDS2 channel unit provisionable parameters.

Configuration Management—Line Termination Provisioning

Overview

Line termination provisioning is the process of preparing a subscriber port circuit for service by defining its function and setting any required options. This section deals with MDS2 specific provisioning.

Service provisioning considerations

Traditional DLC services include POTS, coin, two-wire locally switched, nonswitched, and nonlocally switched services, and basic access ISDN service. The subscriber interfaces for these services are supported via several APs on the *FAST* shelf and CUs on the MDS2 shelf. The APs contain no physical option switches; instead, their function is controlled by electronic service provisioning information which is stored nonvolatilely in the *AnyMedia* Access System. Software in the *AnyMedia* Access System compares this stored service provisioning information with the equipped APs and, if they are compatible, the software conditions the AP hardware to provide the desired service. A similar process occurs for CUs on the MDS2 shelf; however, some of the CUs also require that some options be configured with switches.

The following significant pieces of information are required to provision service on any interface:

- The physical subscriber port must be assigned to a logical line on an in-service VRT or to a logical DS0 on an INA VB. This assignment is represented by a T0 cross-connection.
- Transmission and signaling parameters for the desired service must be provided. The information is represented by a T0 provisioning record.

  For lines served by TR-08 VRTs, the information must be entered via a TL1 provisioning command. The information can be entered by an OS, or it can be entered manually through a local or remote TL1SI/GSI.

  For lines served by GR-303 VRTs, the information can be entered via a TL1 command from an OS or TL1SI/GSI. Alternatively, a compatible CO switch can provide the necessary information via its GR-303 EOC. The Lucent *5ESS* switch, the Nortel *DMS*-100 switch, and the Siemens *EWSD* support either EOC or OS provisioning.

  For some of the CUs, additional option switches must also be set manually.

The *AnyMedia* Access System associates the transmission and signaling parameters (the T0 records) with the *logical* lines of the system. The logical line-to-physical port assignment information (the T0 cross-connections) permits the system software to transfer these parameters to the correct AP or CU hardware.

Physical-to-logical port provisioning

To establish service on a subscriber port of the *AnyMedia* Access System, the physical subscriber port must be assigned to a logical line on a VRT or INA VB within the system. The *AnyMedia* Access System may contain 1 GR-303 VRT, and/or up to 20 TR-08 VRTs and INA VBs in any combination, subject to the limit imposed by the 20 available DS1 network interfaces. A physical subscriber port may be assigned to only 1 logical line on 1 VRT or INA VB; similarly, a logical line can be assigned to only 1 physical subscriber port.

The single GR-303 VRT can support any number of physical lines up to the full 512-line maximum capacity of the fully populated *FAST* shelf or 544-line maximum capacity for a fully loaded *FAST* shelf and MDS2 shelf. The logical lines of the GR-303 VRT are identified by CRVs, which may be any of 512 (544) integer values from 1 to 2048. A physical subscriber port in the system can be assigned to any CRV of the GR-303 VRT.

A TR-08 VRT supports 96 logical lines and a maximum of 96 physical lines. The logical lines are identified by LLNs, which are integer values ranging from 1 to 96. A physical subscriber port may be assigned to any LLN within any TR-08 VRT.

An INA VB supports 24 logical DS0 timeslots and a maximum of 24 physical lines. The logical DS0 timeslots are numbered from 1 to 24. A physical subscriber port may be assigned to any logical DS0 within any INA VB.

The association between logical lines and physical lines can be changed by deleting a cross-connection and entering a new cross-connection. This permits the physical appearance of a logical line to be easily moved from one physical port to another physical port without changing the serving switch’s database or the matching COT CU.

Transmission and signaling parameter provisioning

Transmission and signaling information must be provided for each subscriber port prior to service availability (i.e., the *AnyMedia* Access System provides no default provisioning). However, as described in the *Configuration Management—Service Activation* section, the *AnyMedia* Access System provides specialized TL1 commands that can preprovision all lines of the system at turn-up time. This preprovisioning capability is sufficient to establish service for an all-POTS system without further per-line provisioning.

The per-line provisioning information may be entered via TL1 commands from a remote OS or a TL1SI. Alternatively, the information for POTS/*SPOTS,* coin, and ISDN applications can be provisioned via the GR-303 EOC by digital switches that implement this functionality. The TL1 and EOC interfaces act on a single instance of the *AnyMedia* Access System's nonvolatile data store so that absolute provisioning information integrity is maintained within the system, regardless of the source of a provisioning data change. Changes to the provisioning information made via the GR-303 EOC may be viewed via the TL1 interface, and vice versa. However, not all provisioning features are available via the EOC interface. The choice of TL1 versus EOC provisioning for GR-303 applications, or some hybrid of the two provisioning types, will be dictated by the operations plan of the local exchange carrier and by the capabilities of the LDS.

The TL1 provisioning information is aligned with Telcordia Technologies, Inc. GR-199. The per-subscriber information consists of a *CLEI* code, a generic signaling function (GSFN) code which specifies the circuit's signaling protocol, and a variable number of additional parameters specific to each GSFN code.

The *CLEI* code information is not required to provide service. The field may be used if desired to indicate the intended AP or CU type for a service. However, the system software will not deny service to a subscriber port because the provisioned *CLEI* code does not match the equipped *CLEI* code of an AP or CU. The *CLEI* field may remain empty without affecting the service capability of a subscriber port.

The GSFN codes supported in the *AnyMedia* Access System via CUs in the MDS2 shelf are as follows:

- AC—manual ringdown
- DATA—manually provisioned digital data services
- EBS—enhanced business service (P-Phone)
- LR—private line automatic ringdown
- BRI—basic rate transmission extension (3 DS0 ISDN BRITE)
- DPT—dial pulse terminate
- FXO—foreign exchange office
- TO—transmission only, sealing current
- DX4[N,R]—four-wire Duplex Signaling
- ETO4—four-wire equalized transmission only
- FX[S,T][1,2,3,5]—four-wire Foreign Exchange
- TO4—four-wire transmission only
- EM4[C,H]—four-wire E&M
- PLR[1,2]—four-wire pulse link repeater
- FX[O,P][1,2,3,5]—four-wire foreign exchange office
- TD[O,S][A,B,C,D]—four-wire tandem
- OCU[1,2,3]—office channel unit dataport

- SW56—switched 56 kbps DDS service
- NO1 and NO2—DC services
- DS0[1,2]—DDS service
- DPO—dial pulse originate.

Additional transmission and signaling parameters may be required depending upon the GSFN code of the circuit being provisioned.

The system software compares the transmission and signaling information for each logical line with the associated AP and CU hardware. If the hardware is compatible with the provisioned GSFN code and the associated parameters, then the appropriate information is transferred to the hardware registers and the line is placed in service.

Provisioning service activation

Service activation for traditional DLC services requires that feeder and subscriber ports be associated with a VRT/VB through T1 and T0 cross-connections, respectively, and that T0 provisioning data be entered for the desired service. Finally, the required physical circuit packs must be equipped. Figure 5-1 represents the composite provisioning data required to bring a single subscriber line into service on a TR-08 VRT, with examples of the associated TL1 commands..

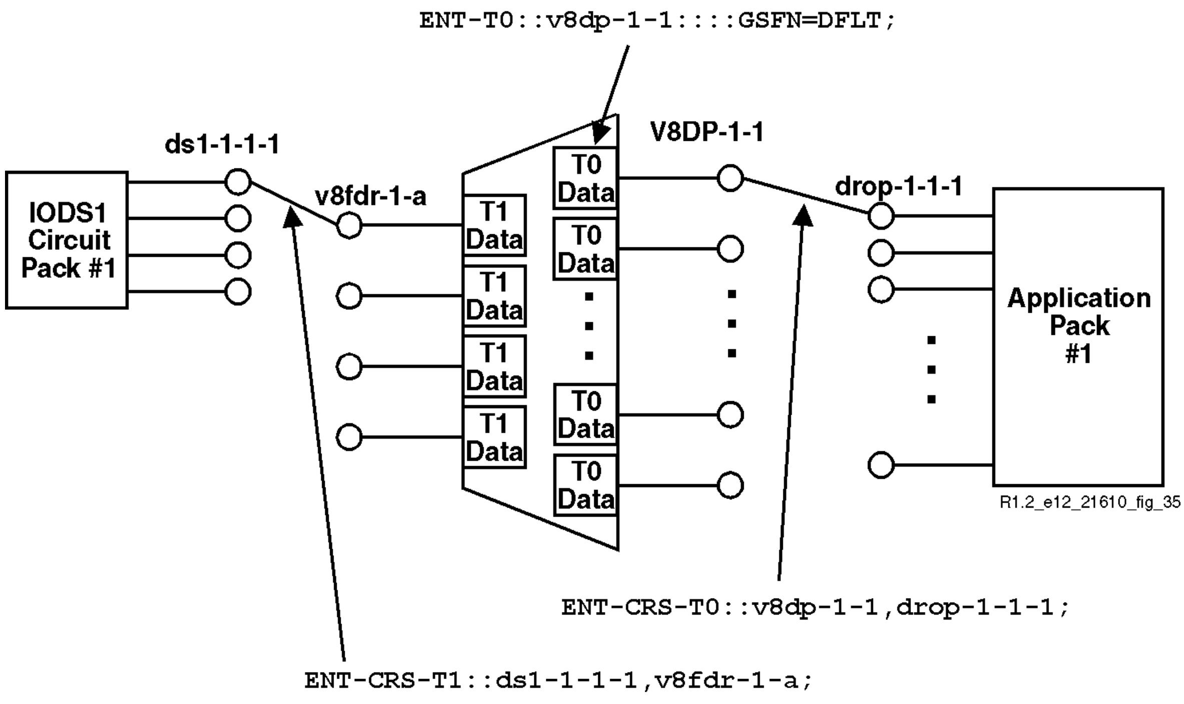


Figure 5-1. Provisioning Data for a TR-08 POTS Subscriber Line

A GR-303 VRT supports DS0 concentration (i.e., it can support more physical subscriber lines than trunk timeslots). The subscriber lines will be dynamically assigned to available trunk timeslots as required, under control of the GR-303 switch.

TR-08 VRTs are not concentrated; they can support from 1 to 4 DS1 inputs and from 1 to 96 subscriber lines. A sufficient set of DS1 inputs must be provided in a TR-08 VRT to support the set of subscriber lines assigned to the VRT.

The *AnyMedia* Access System imposes few restrictions on line termination provisioning. Therefore, it is possible to define some unusual combinations of VRTs/VBs and services (e.g., a coin line may be provisioned in an INA VB, although such a configuration may have no practical application).

The *AnyMedia* Access System has limited provisioning memory capacity that can accommodate provisioning records for up to 672 subscriber lines. This is greater than the maximum number of physical lines that can be supported by the system. This permits two provisioning records to be created for a limited number of lines during load balancing or service rollover operations.

Example

If a switch module that supports a TR-08 VRT is too heavily loaded, a new TR-08 VRT can be created within the *AnyMedia* Access System to move some subscribers to a less-heavily loaded switch module. This would be done as follows (all provisioning actions in the *AnyMedia* Access System can be performed remotely):

1. Create a new TR-08 VRT within the *AnyMedia* Access System, provision the necessary DS1 feeder cross-connections, and build the supporting information in the new switch module’s database view.
2. Create new T0 records in the new VRT for the lines that are to be moved.
3. As each line is moved in the switch’s database, delete the line’s existing T0 cross-connection record in the *AnyMedia* Access System and enter a new T0 cross-connection to the new VRT.
4. When all lines have been moved to the new VRT, delete the old T0 records in the unloaded VRT.

The T0 records for retired lines should always be deleted so that the provisioning resources of the *AnyMedia* Access System will not be exhausted.

Bundled T0 cross-connections

Several special services require more than one facility DS0 timeslot. Examples are:

- Dataport service with second-channel error correction (EC=SCEC or EC=YES)
- ISDN basic access service via BRITE channel units

- DC bypass circuits for remote drop testing.

When these services are supported on a TR-08 VRT or on an INA VB, they must be associated with more than one feeder timeslot. These multiple-DS0 associations are referred to as *bundled T0 cross-connections*. Bundled T0 cross-connections are administered by the same TL1 commands as are single T0 cross-connections. An example of the provisioning data for a BRITE service via an INA VB, including a 3-timeslot bundled T0 cross-connection, is shown in Figure 5-2. Note that only the first logical line (T0 object) associated with the service is provisioned.

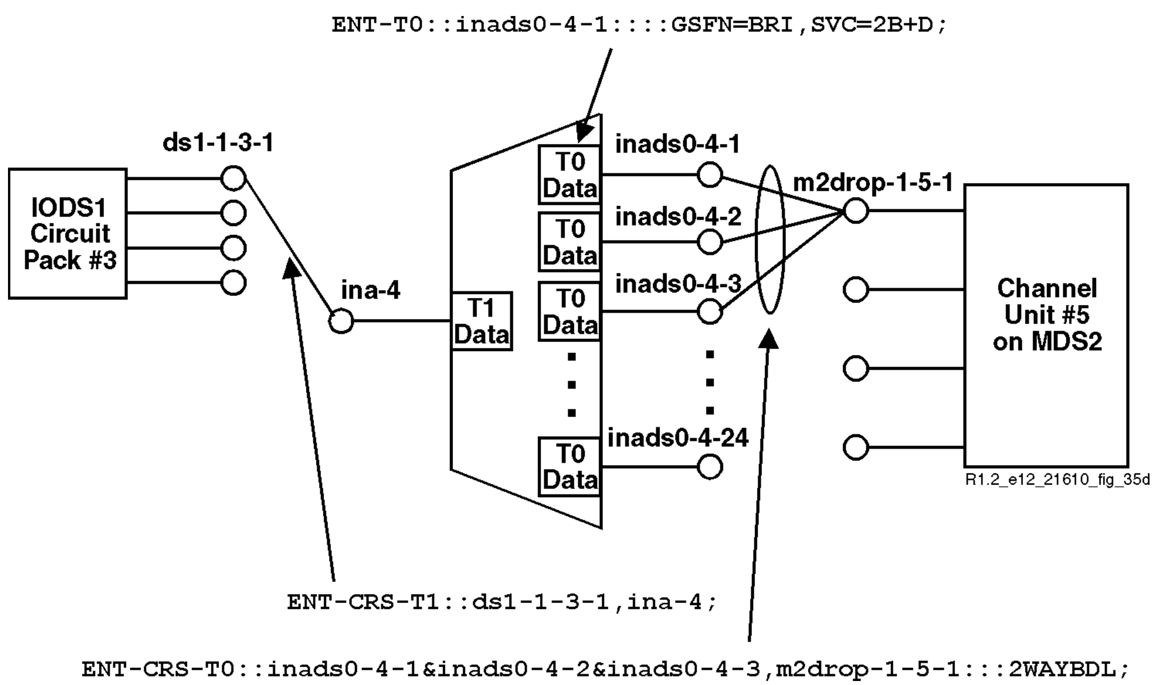


Figure 5-2. Provisioning Data for a BRITE Service in an INA VB

Configuration Management —Channel Unit Provisioning

Overview

The logical lines of VRTs/VBs in the *AnyMedia* Access System must be provisioned with appropriate T0 data to activate subscriber service. The system provides no default T0 provisioning data. However, the system can be preprovisioned for 512 POTS interfaces using the `ED-VEQPT` TL1 command during turn-up.

The T0 data are stored in nonvolatile data memory on the COMDAC circuit pack and transferred to the associated AP or CU as needed. The T0 data can be entered and modified via the `ENT-T0`, `ED-T0`, `RTRV-T0`, and `DLT-T0` TL1 commands. Alternatively, for the GR-303 VRT, the data can be created and modified by the GR-303 LDS via its EOC. The TL1 and EOC interfaces act on the same nonvolatile data memory, so that consistent data are maintained regardless which interface performs the provisioning. The current memory contents can be retrieved by either interface.

Channel unit replacement

When CU is replaced by a compatible pack, the new pack will be provisioned automatically with the current T0 data.

T0 parameters

The T0 data for a logical line defines the service function of the associated subscriber line. The key parameter in the T0 record is the GSFN.

The GSFN codes available via the MDS2 shelf are as follows:

- AC—is applicable to the AUA45B dual ringing repeater CU. Lines that are provisioned with the AC GSFN provide two-wire private line point-to-point manual ring service. These lines can be created via the TL1 commands.
- DATA—is applicable to the AUA200 Datapath Extension DPX and AUA232 DSU dataport CUs. Lines that are provisioned with the DATA GSFN and use the AUA200 CU provide two-wire manually provisioned switched 56 kbps digital data services. Lines that are provisioned with the DATA GSFN and use the AUA232 DSU dataport CU provide four-wire (three-wire across the RS232 interface) manually provisioned digital data services at rates up to 56-kbps. These lines can be created via the TL1 commands.
- EBS—is applicable to the *SPQ*328 (P-Phone) current sink CU and the *SPQ*429 EBS (P-Phone) current feed CU. Lines that are provisioned with the EBS GSFN provide two-wire voice services. These lines can be created via the TL1 commands. The *SPQ*328 CU must be located at a COT and the *SPQ*429 at the RT.

- DS0[1,2]—is applicable to the *SPQ*334 dual four-wire DS0 dataport CU. Lines that are provisioned with the DS0 GSFN provide private line data service. The rates may be 2.4, 4.8, 9.6, or 19.2 kbps (called subrates) or 38.4, 56 or 64 kbps (called fullrates). These lines can be created via the TL1 commands.
- DPO—is applicable to the *SPQ*443 two-wire current feed CU. Lines that are provisioned with the DPO GSFN provide two-wire DID trunk service, with either dial pulse or multifrequency addressing. These lines can be created via the TL1 commands.
- NO1—is applicable to the *MCU*-5205 metallic CU. Lines that are provisioned with the NO1 GSFN and use the *MCU*-5205 CU provide a synchronous channel for a variety of DC and AC alarm and telemetry services. These lines can be created via the TL1 commands.
- NO2—is applicable to the *MCU*-5405 metallic CU. Lines that are provisioned with the NO2 GSFN and use the *MCU*-5405 CU provide an MLT compatible digital bypass pair for applications where a metallic bypass pair is not available. These lines can be created via the TL1 commands.
- LR—is applicable to the AUA75( ) PLAR CU. Lines that are provisioned with the LR GSFN provide two-wire private line point-to-point automatic ring service. These lines can be created via the TL1 commands.
- BRI—is applicable to the Teltrend AUA293I2 ISDN BRITE CU. Lines that are provisioned with the BRI GSFN provide 2B+D, B1+D, B2+D, or D-only service. These lines can be created via the TL1 commands. Lines with BRI code are only compatible with a TR-08 VRT or an INA VB.
- TO—is applicable to the *SPQ*442 two-wire current sink CU and the *SPQ*443 two-wire current feed CU. Lines that are provisioned with the TO GSFN provide two-wire private line transmission-only service. The *SPQ*443 provides sealing current applied to the tip/ring pair. The *SPQ*442 does not provide sealing current. These lines can be created via the TL1 commands.
- DPT—is applicable to the *SPQ*442 two-wire current sink CU. Lines that are provisioned with the DPT GSFN provide two-wire nonlocally switched DID service, with either dial pulse or multifrequency addressing. These lines can be created via the TL1 commands. DPT is used for nonlocally switched service.
- DX4[N,R]—is applicable to the AUA41B four-wire current feed CU. Lines that are provisioned with the DX4[N,R] GSFN provide four-wire special services duplex signaling, with either normal or reversed signaling leads. The primary application is in PBX tie-trunks where the MDS2 faces cable. Additional equipment at the customer location provides the DX to E&M conversion. The AUA41B CU has transmission and signaling options that must be set before service can be provided. These lines can be created via the TL1 commands.

- FX[O,P][1,2,3,5]—is applicable to the *SPQ*444 four-wire current sink CU. Lines that are provisioned with the FX[O,P][1,2,3,5] GSFN provide foreign exchange—office end, four-wire loop-start or ground-start signaling, with normal or reversed signaling leads, and with or without toll diversion. The *SPQ*444 CU has transmission and signaling options that must be set before service can be provided. These lines can be created via the TL1 commands.
- FX[S,T][1,2,3,5]—is applicable to the AUA41B four-wire current feed CU. Lines that are provisioned with the FX[S,T][1,2,3,5] GSFN provide foreign exchange—subscriber end, four-wire loop-start, ground-start signaling, with normal or reversed signaling leads, and with or without toll diversion. The AUA41B CU has transmission and signaling options that must be set before service can be provided. These lines can be created via the TL1 commands.
- FXS—is applicable to the *SPQ*443 two-wire current feed CU. Lines that are provisioned with the FXS GSFN provide local or foreign exchange-subscriber end, two-wire loop-start or ground-start signaling. The *SPQ*443 CU has transmission options that must be set before service can be provided. These lines can be created via the TL1 commands.
- EM4[C,H]—is applicable to the *SPQ*454 four-wire E&M special services CU. Lines that are provisioned with the EM4[C,H] GSFN provide E&M signaling, Type 1 or Type 2. The unit converts the DC signal on the M lead from the PBX into a signal carried by the digital network. A similar signal from the digital facility is converted into the DC signal sent to the equipment over the E lead. Both Type I and II signaling connections are supported. The *SPQ*454 CU has transmission and signaling options that must be set before service can be provided. These lines can be created via the TL1 commands.
- PLR[1,2]—is applicable to the *SPQ*454 four-wire E&M special services CU. Lines that are provisioned with the PLR[1,2] GSFN provide PLR signaling (the complement of E&M signaling). The PLR function provides the E&M with inverted polarity signaling interface. The unit converts DC signal on the E lead from the interfacing equipment into a signal carried by the digital facility. Similar signals from the digital facility are converted into DC signal sent to the equipment over the M lead. Both Type I and II signaling connections are supported. The *SPQ*454 CU has transmission and signaling options that must be set before service can be provided. These lines can be created via the TL1 commands.
- ETO4—is applicable to the AUA41B four-wire current feed CU. Lines that are provisioned with the ETO4 GSFN provide four-wire private line equalized transmission-only service with no sealing current applied to the tip/ring pair. The ETO4 function is used in private lines (voice or data). The ETO4 function is used when equalization of cable transmission characteristics is required. Otherwise, the TO4 function is used. The AUA41B CU has transmission and signaling options that must be set before service can be provided. These lines can be created via the TL1 commands.

- FXO—is applicable to the *SPQ*442 two-wire current sink CU. Lines that are provisioned with the FXO GSFN provide foreign exchange—office end, two-wire loop-start or ground-start service. These lines can be created via the TL1 commands.
- OCU[1,2,3]—is applicable to the *SPQ*452 dual four-wire OCU dataport CU and the ADTRAN 1433105 two-wire *Total Reach* digital data system dataport (DDS-DP) CU. Lines that are provisioned with the OCU GSFN provide private line data service. The rates may be 2.4, 4.8, 9.6, or 19.2 kbps (called subrates) or 38.4, 56 or 64 kbps (called fullrates). These lines can be created via the TL1 commands.
- SW56—is applicable to the *SPQ*334 and *SPQ*452 dual four-wire DS0 and OCU, respectively, dataport CUs. Lines that are provisioned with the SW56 GSFN provide switched 56 kbps digital service. These lines can be created via the TL1 commands.
- TD[O,S][A,B,C,D]—is applicable to the *SPQ*444 four-wire current sink CU. Lines that are provisioned with the TD[O,S][A,B,C,D] GSFN provide four-wire tandem, office or subscriber end, 4-state or 2-state signaling, looped or nonlooped signaling leads. The *SPQ*444 CU has transmission and signaling options that must be set before service can be provided. These lines can be created via the TL1 commands.
- TO4—is applicable to the AUA41B four-wire current feed CU. Lines that are provisioned with the TO4 GSFN provide four-wire private line transmission-only service with no sealing current applied to the tip/ring pair. The TO4 function is used in private lines (voice or data). The AUA41B CU has transmission and signaling options that must be set before service can be provided. These lines can be created via the TL1 commands.
- 2RVT—is applicable to the DPT32CS AP and the *SPQ*442 CU (both are two-wire current sink). Lines that are provisioned with the 2RVT GSFN provide locally switched two-wire DID service, with either dial pulse or multifrequency addressing. These lines can be created via the TL1 commands. 2RVT is not used at the COT.

The mapping of GSFN codes to CUs is summarized in Table 5-1.

Depending on the GSFN code selected for a T0 record, a number of additional parameters can be provisioned for the affected subscriber line. These parameters are summarized in Figure 5-3, Figure 5-4, and Figure 5-5. Default values are provided for all parameters. The additional parameters are as follows:

- TYPE—is the *CLEI* code for the CU. This parameter is optional for all lines.

Table 5-1. Mapping of GSFN Codes to CUs

Generic Signal Function	Channel Units	Switch Selectable Parameters	CIT Selectable Parameters
AC	AUA45B	Table 5-44 on page 5-170	Table 5-47
DATA	AUA200, AUA232	Table 5-44 on page 5-170	Table 5-49
EBS	*SPQ*429, *SPQ*328	– – –	Table 5-52
LR	AUA75( )	Table 5-44 on page 5-170	Table 5-58
BRI	Teltrend AUA293I2	Table 5-44	Table 5-48
DPT, 2RVT	*SPQ*442	– – –	Table 5-50
FXO	*SPQ*442	– – –	Table 5-55 on page 5-178
TO	*SPQ*442, *SPQ*443	– – –	Table 5-67 on page 5-182
DX4[N,R]	AUA41B	– – –	Table 5-51 on page 5-176
ETO4	AUA41B	– – –	Table 5-54 on page 5-177
2RVT	DPT32CS and *SPQ*442	– – –	Table 5-73 on page 5-187
FX[S,T][1,2,3,5]	AUA41B	– – –	Table 5-57 on page 5-179
TO4	AUA41B	– – –	Table 5-68 on page 5-183
EM4[C,H]	*SPQ*454	– – –	Table 5-53 on page 5-177
PLR[1,2]	*SPQ*454	– – –	Table 5-63 on page 5-181
FX[O,P][1,2,3,5]	*SPQ*444	– – –	Table 5-56 on page 5-178
TD[O,S][A,B,C,D]	*SPQ*444	– – –	Table 5-65 on page 5-182 and Table 5-66 on page 5-182

Table 5-1. Mapping of GSFN Codes to CUs (Continued)

Generic Signal Function	Channel Units	Switch Selectable Parameters	CIT Selectable Parameters
OCU1 OCU2 OCU3	*SPQ*452	– – –	Table 5-60 on page 5-180, Table 5-61 on page 5-180, and Table 5-62 on page 5-181
OCU1 OCU2 OCU3	ADTRAN 1433105	Table 5-46 on page 5-174	Table 5-74 on page 5-187, Table 5-75 on page 5-188, and Table 5-76 on page 5-188
SW56	*SPQ*452, *SPQ*334	– – –	Table 5-64 on page 5-182
NO1	*MCU*-5205	Table 5-44 on page 5-170	Table 5-59 on page 5-180
NO2	*MCU*-5405	Table 5-44 on page 5-170	Table 5-59 on page 5-180
FXS	*SPQ*443	– – –	Table 5-72 on page 5-186
DPO	SPQ443	– – –	Table 5-71 on page 5-186
DS01	*SPQ*334	– – –	Table 5-69 on page 5-184
DS02	*SPQ*334	– – –	Table 5-70 on page 5-185

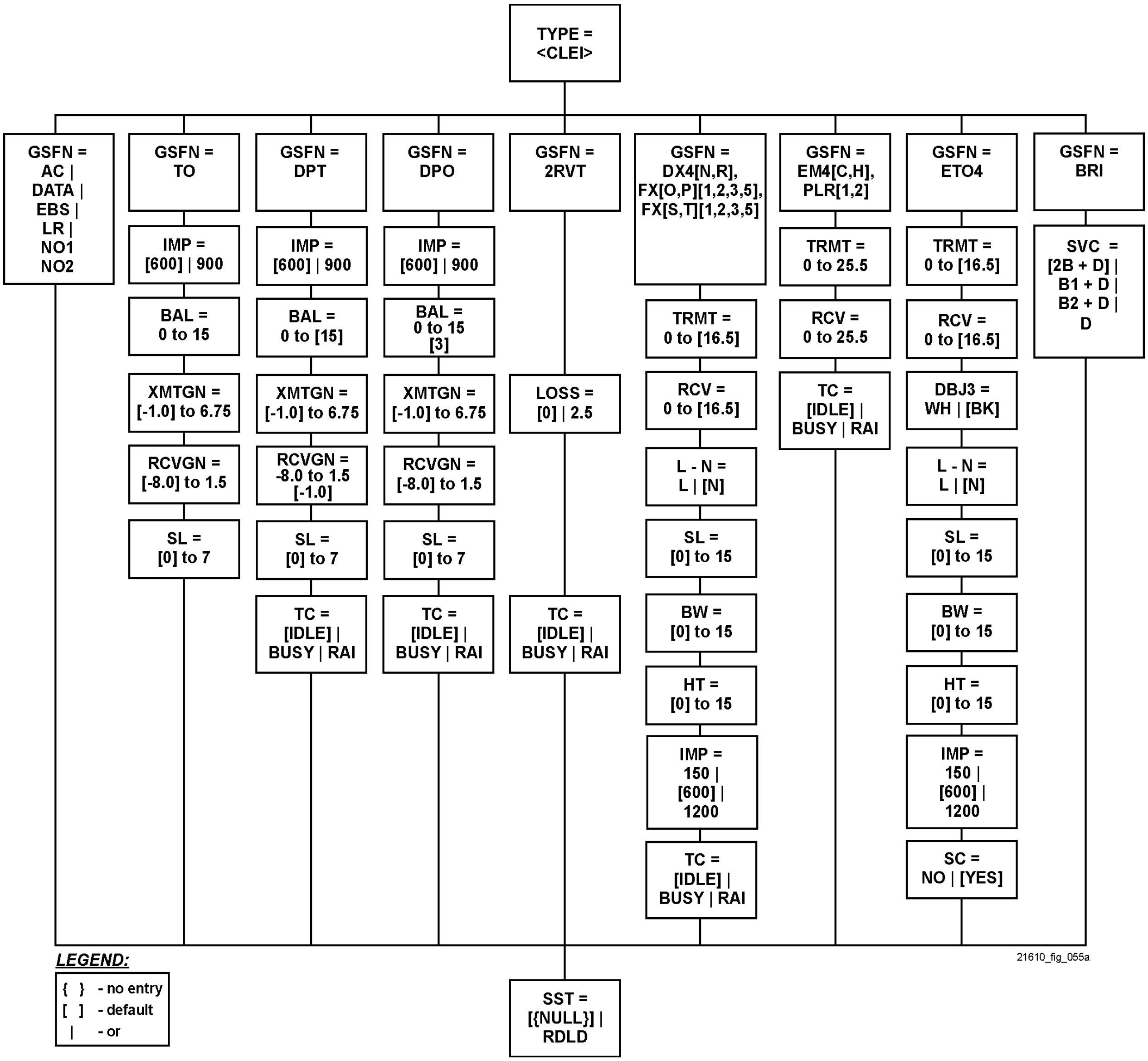


Figure 5-3. TL1 Provisioning Parameters for T0 Objects—MDS2 Shelf

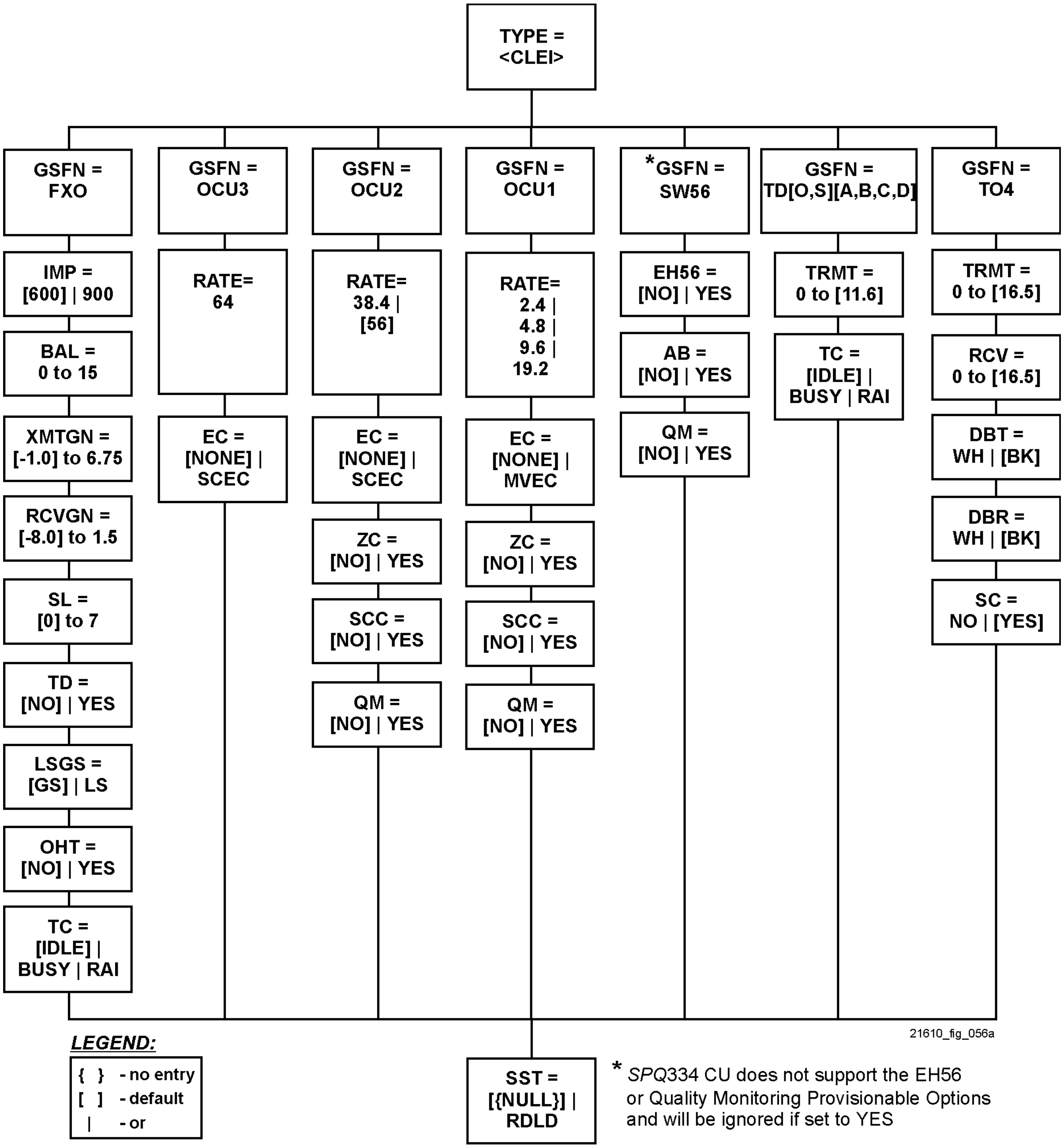


Figure 5-4. TL1 Provisioning Parameters for T0 Objects—MDS2 Shelf (Continued)

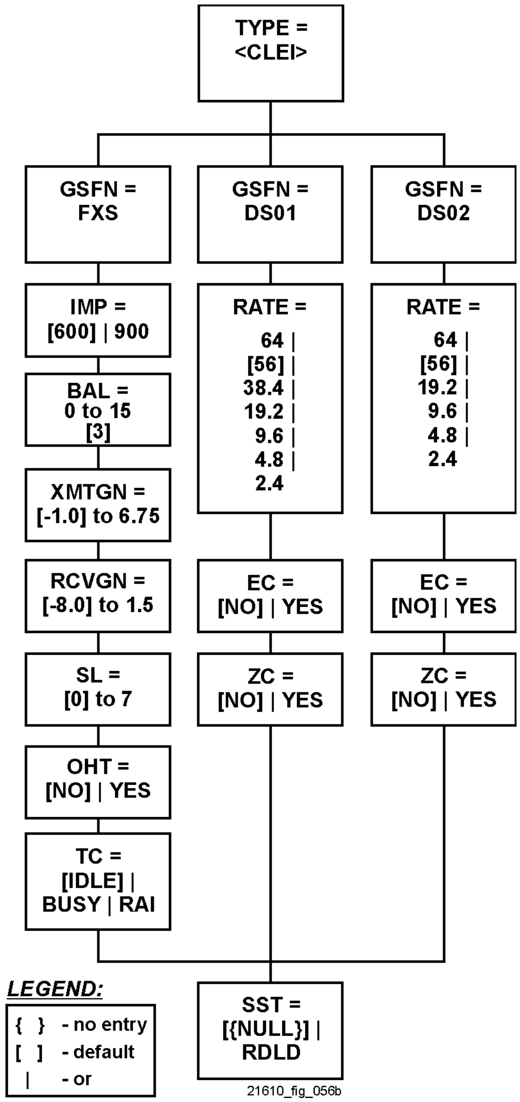


Figure 5-5. TL1 Provisioning Parameters for T0 Objects—MDS2 Shelf (Continued)

Configuration Management—Two-Wire Special Services Provisioning (*SPQ*442)

Overview

This section describes two-wire traditional DLC special services supported by the *SPQ*442 CU for the *AnyMedia* Access System, and their provisioning. The *SPQ*442 CU provides transmission treatment for two-wire special service circuits over loops within and beyond the CSA.

Assigned special services

Several services within the CSA range can typically be provided through circuit assignment, without loop engineering. These services include the following:

- PBX-CO trunk
- WATS line (to Class 5 CO)
- WATS trunk (to Class 5 CO)
- Off-premises extension line
- Secretarial line
- CO centrex
- DID Trunks, DPT interface only. (The *SPQ*442 CU is used in the MDS2-COT.)

These services are supported by *SPOTS* and DID (DPT) CU technology. The *SPQ*442 CU are fully compatible with *SLC* Series 5 and *SLC*-2000 system *SPOTS* current sink and DID (DPO) channel units, respectively, for universal DLC arrangements; and with integrated applications via the TR-08 and GR-303 switch interfaces.

The *SPQ*442 CU provides the DPT interface between the *AnyMedia* MDS2 shelf and the DID trunk circuit of a PBX.

For both POTS and *SPOTS* CU applications in integrated TR-08 arrangements and in universal DLC arrangements, the PRCOIN and PROG2W APs should be provisioned with the DFLT generic signaling function. When this provisioning option is selected, the PRCOIN and PROG2W APs detect the signaling codes sourced by the TR-08 switch (or the CO CU) and automatically configure for loop-start or ground-start operation and for the correct transmission loss. The *SPQ*442 CU needs to be provisioned for the DPT GSFN.

In integrated GR-303 arrangements, the local digital switch automatically configures the APs for loop-start or ground-start operation via its EOC. Although traditionally used in designed special services, the *SPQ*442 CU can be provisioned for the DPT function, default values of which are suitable for an assigned locally switched special service circuit.

Designed two-wire special services

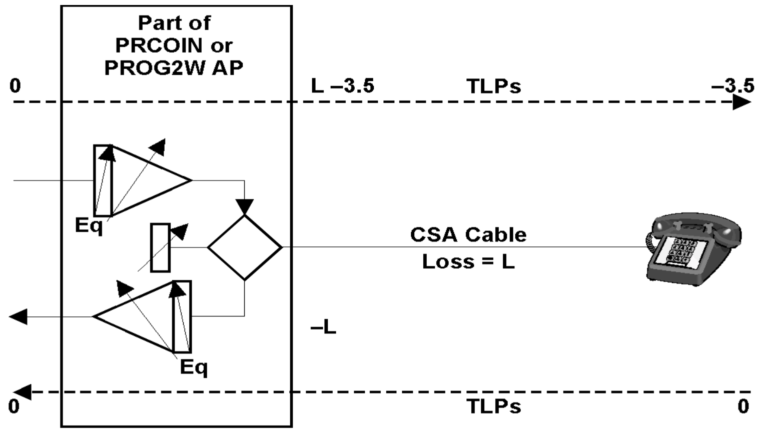
Nonswitched and nonlocally switched services require prescription setting of transmission and signaling parameters. This includes the following types of two-wire special services supported by the PRCOIN and PROG2W APs:

- FX lines or WATS lines (2FXLS signaling)
- FX trunks or WATS trunks (2FX signaling)
- Off-premises station lines, station end only (2FXLS signaling)
- 2RVO (two-wire loop reverse battery signaling, office interface) signaling E911 service primary application
- Voiceband private lines (2NOS [two-wire transmission only, no signaling, with sealing current] signaling).

Additional two-wire special services supported by the *SPQ*442 CU on the MDS2 shelf include the following:

- FX or WATS lines and trunks (FXO signaling)
- Off premises station lines, PBX-end only (FXO signaling)
- DID trunks (DPT signaling)
- Voiceband private lines (T0 signaling, without sealing current).

The end-links of these services via the *AnyMedia* Access System are illustrated in Figure 5-6 through Figure 5-15. All services are designed to yield a DS1 bitstream level of 0 TLP, except for voice band data where the bitstream level is defined as +7 TLP. Signaling is in accordance with *ANSI* T1.403-1995, Annex C for all usage except that of the AUA75( ) PLAR and AUA45B Ringing Repeater CUs. Signaling of the AUA75( ) and AUA45B CUs is consistent with AT&T PUB43801.



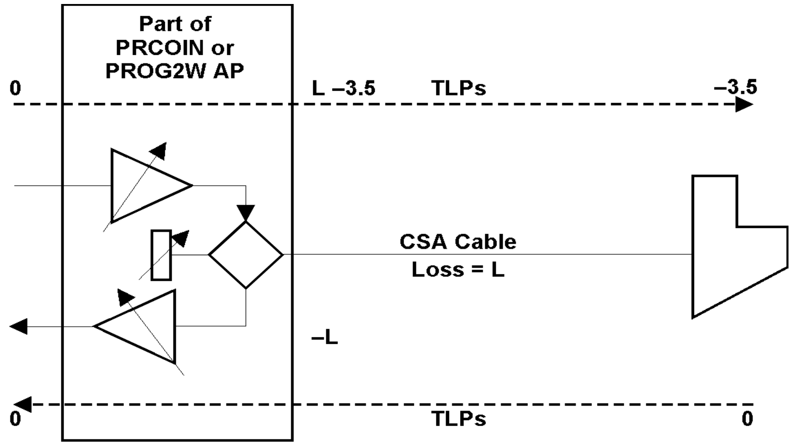
PRCOIN / PROG2W Provisioning

Parameter	Value	Parameter	Value
GSFN	2FXLS	BAL1	FIXED
LOSS	FIXED	BAL2	Prescription[a]
RTLP	L -3.5[b]	EQLZ1	Prescription[a]
TTLP	-L[b]	TC	IDLE
Z	600	EFTT	Y

a The Balance and Equalization values depend on the cable makeup.
b TTLP and RTLP are rounded to the nearest 0 25 dB

21610_fig_042

Figure 5-6. FX Line or WATS Line



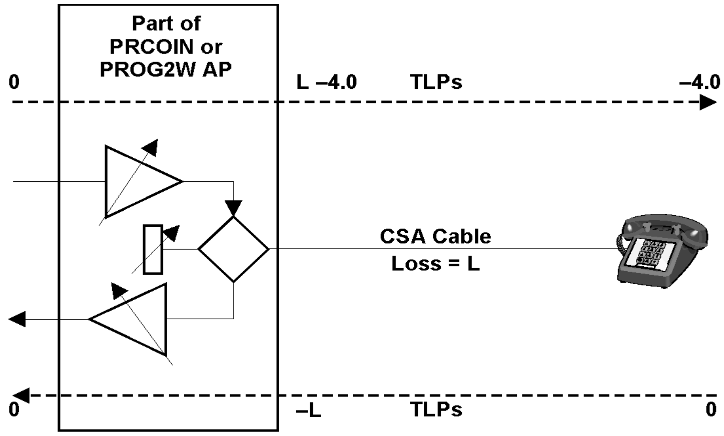
PRCOIN / PROG2W Provisioning

Parameter	Value	Parameter	Value
GSFN	2FX	BAL1	FIXED
LOSS	FIXED	BAL2	Prescription[a]
RTLP	L -3.5[b]	EQLZ1	Prescription[a]
TTLP	-L[b]	TC	IDLE or BUSY
Z	600	EFTT	Y

a. The Balance and Equalization values depend on the cable makeup.
b. TTLP and RTLP are rounded to the nearest 0.25 dB.

21610_fig_043

Figure 5-7. FX Trunk or WATS Trunk



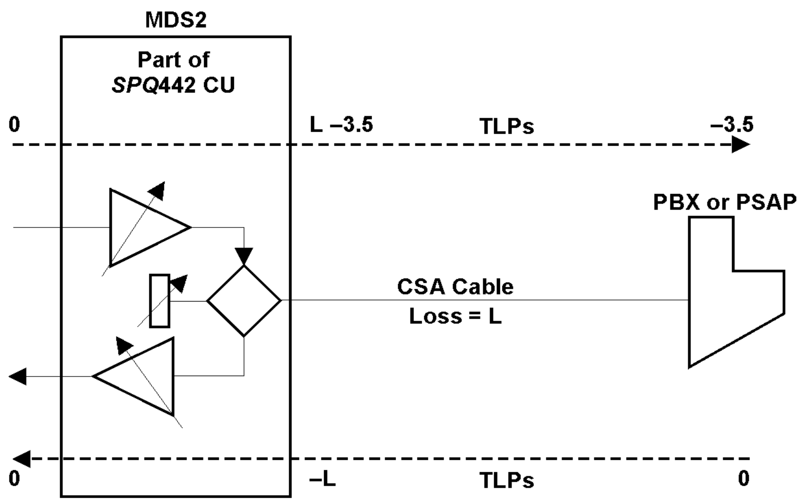
PRCOIN / PROG2W Provisioning

Parameter	Value	Parameter	Value
GSFN	2FXLS	BAL1	FIXED
LOSS	FIXED	BAL2	Prescription[a]
RTLP	L -4.0[b]	EQLZ1	Prescription[a]
TTLP	-L[b]	TC	IDLE
Z	600	EFTT	N

a. The Balance and Equalization values depend on the cable makeup.
b. TTLP and RTLP are rounded to the nearest 0.25 dB.

21610_fig_044

Figure 5-8. Off-Premises Station Line (Station End)



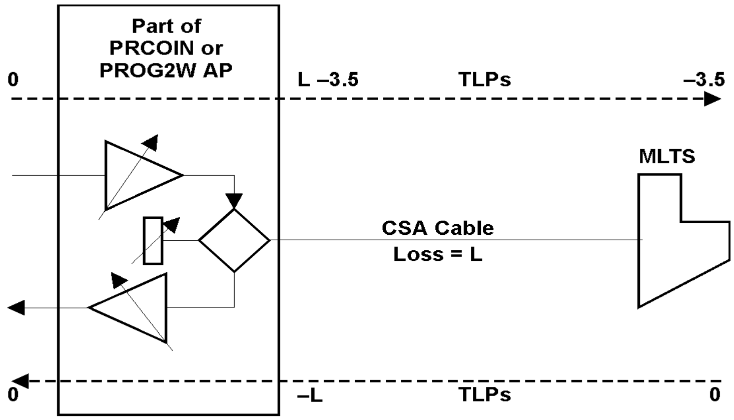
SPQ442 CU Provisioning

Parameter	Value	Parameter	Value
GSFN	DPT	BAL	Prescription[a]
IMP	600	SL	Prescription[a]
XMTGN	L[b]		
RCVGN	L -3.5[b]		
TC	Idle or Busy		

a. The Balance and Equalization (SL) values depend on the cable makeup.
b. The XMTGN and RCVGN are rounded to the nearest 0.25 dB.

21610_fig_043c

Figure 5-9. DID or Enhanced 911 Trunk (DPT End)



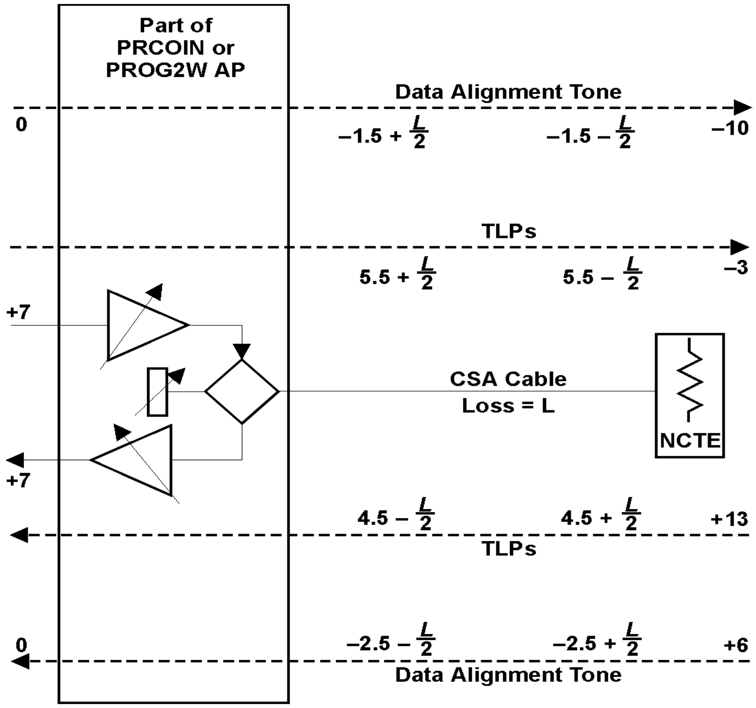
PRCOIN / PROG2W Provisioning

Parameter	Value	Parameter	Value
GSFN	2RVO	BAL1	FIXED
LOSS	FIXED	BAL2	Prescription[a]
RTLP	L -3.5[b]	EQLZ1	Prescription[a]
TTLP	-L[b]	TC	IDLE or BUSY
Z	900		

a. The Balance and Equalization values depend on the cable makeup.
b. TTLP and RTLP are rounded to the nearest 0.25 dB.

21610_fig_045

Figure 5-10. Enhanced 911 Trunk (DPO End)



[x] **The TLP levels at the customer location shown in this example are from TR-NWT-000965, Issue 2, Section 5.3.7, for NCI Code 02NO2. TR-NWT-000335 lists a variety of TLPs for NCI Code 02NO2.**

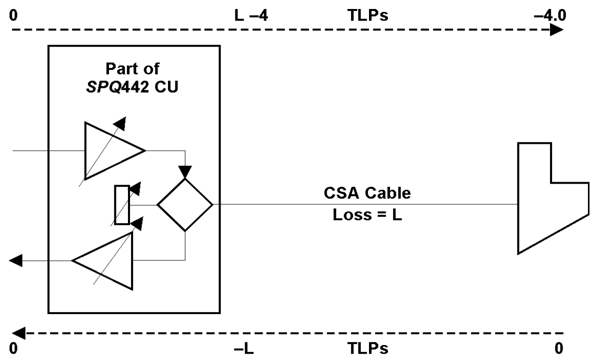
PRCOIN / PROG2W Provisioning

Parameter	Value	Parameter	Value
GSFN	2NOS	BAL1	FIXED
LOSS	FIXED	BAL2	Prescription[a]
RTLP	$-1.5 + \frac{L}{2}$ [b]	EQLZ1	Prescription[a]
TTLP	$-2.5 - \frac{L}{2}$ [b]		
Z	600		

a. The Balance and Equalization values depend on the cable makeup.
b. TTLP and RTLP are rounded to the nearest 0.25 dB.

21610_fig_046

Figure 5-11. Voiceband Private Line Data



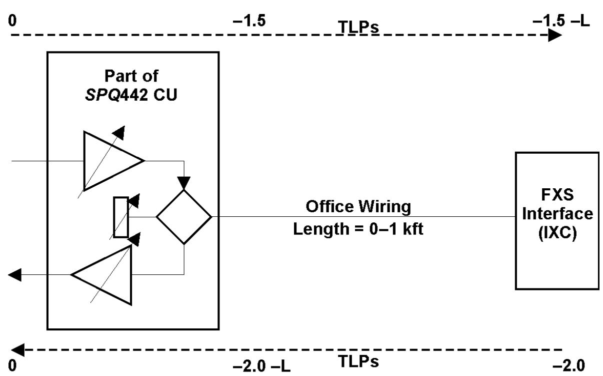
SPQ442 CU Provisioning

Parameter	Value	Parameter	Value
GSFN	FXO	SL	Prescription[a]
XMTGN	L[b]	LSGS	LS
RCVGN	L[b] – 4	TD	N
IMP	600	TC	Idle
BAL	Prescription[a]		

a. The Slope and Balance values depend on the cable makeup.
b. XMTGN and RCVGN are rounded to the nearest 0.25 dB.

21610_fig_043x

Figure 5-12. Off-Premises Station Line, PBX-End (FXO)



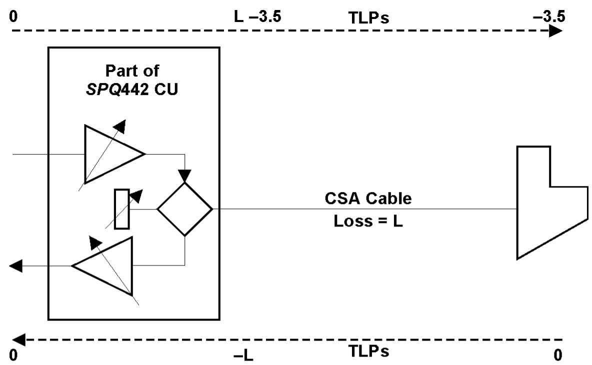
SPQ442 CU Provisioning

Parameter	Value	Parameter	Value
GSFN	FXO	SL	0
XMTGN	2.0 + L[a]	LSGS	GS
RCVGN	–1.5	TD	N
IMP	900	TC	Idle
BAL	0, 1, or 2[b]		

a. XMTGN is rounded to the nearest 0.25 dB.
b. The Balance value depends on the length of the office wiring.

21610_fig_043w

Figure 5-13. FX Trunk, Office End (FXO) Interface to IXC Carrier Equipment



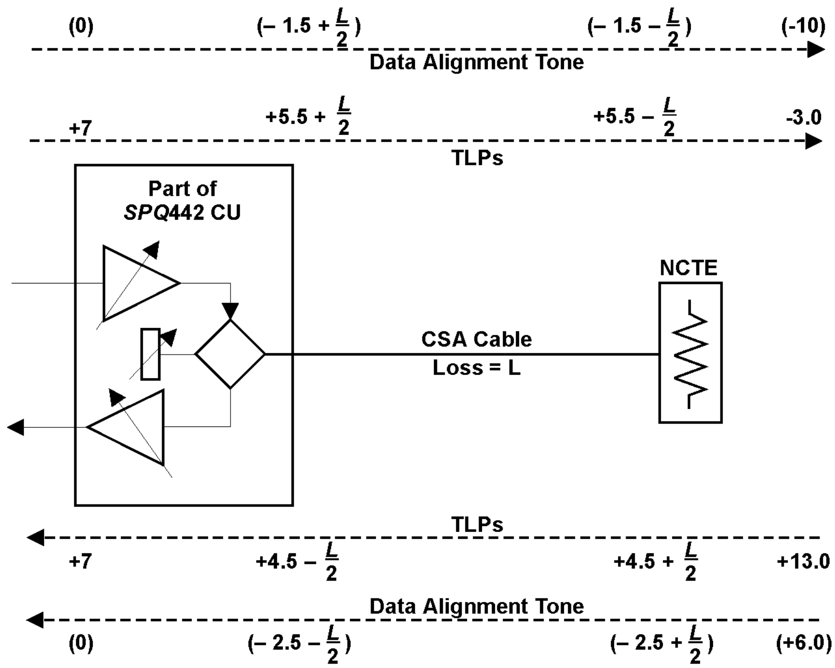
SPQ442 CU Provisioning

Parameter	Value	Parameter	Value
GSFN	DPT	BAL	Prescription[b]
XMTGN	L[a]	SL	Prescription[b]
RCVGN	L[a] – 3.5	TC	Idle
IMP	600		

a. The XMTGN and RCVGN are rounded to the nearest 0.25 dB.
b. The Balance and Equalization (SL) values depend on the cable makeup.

21610_fig_043u

Figure 5-14. DID Trunk, PBX-End (DPT)



***SPQ*442 CU Provisioning**

Parameter	Value	Parameter	Value
GSFN	TO	IMP	600
XMTGN	$2.5 + \frac{L}{2}$ [a]	BAL	Prescription[b]
RCVGV	$-1.5 + \frac{L}{2}$ [a]	SL	Prescription[b]

a. XMTGN and RCVGN are rounded to the nearest 0.25 dB.
b. The Slope and Balance values depend on the cable makeup.

21610_fig_043v

Figure 5-15. Two-Wire Voiceband Private Line (TO)

Configuration Management—Two-Wire Special Service Prescription Setting for *SPQ*442 Channel Unit

Overview

This section provides prescription setting guidelines for the *SPQ*442 CU in the MDS2 shelf. The prescription settings are determined by the cable makeup data, the far-end termination, and the structural impedance of the CU. These guidelines are needed to configure the following service interfaces:

- Two-wire FXO interfaces
- Two-wire DPT interfaces
- Two-wire TO interfaces with no sealing current.

Note that DPT interfaces for locally-switched services can also be provisioned automatically by a compatible GR-303 local digital switch via its embedded operations channel. Also, two-wire TO interfaces *with* sealing current can be provided by the and application packs.

Channel unit impedance selection

There are two choices of the structural impedance for the *SPQ*442 CU: 600 ohms in series with 2.16 microfarads or 900 ohms in series with 2.16 microfarads. The following is a summary of the selection guidelines:

1. Select the 600-ohm structural impedance (IMP=600) for the CU if it faces a loop or an interoffice trunk cable.
2. Select the 900-ohm structural impedance (IMP=900) for the CU if it faces the switch or other transmission devices through office wiring or is used back-to-back with MFT or a 900-ohm D( ) CU.

Channel unit gain calculation

The gain settings for the transmit path, XMTGN, and for the receive path, RCVGN, are determined by a three-step operation:

1. Determine the precise values of TLP at the CU's tip/ring pair $(TLP)_t$ and $(TLP)_r$.
2. Determine the ideal gain settings:

   $XMTGN = -(TLP)_t$
   $RCVGN = (TLP)_r$.
3. Round XMTGN and RCVGN to the nearest 0.25 dB.

The precise values of the TLPs at the CU's tip/ring pair are determined by the loss of the cable pair and the TLP assigned for the network interface (NI) end of the cable. They are given by the following two equations:

$(TLP)_t = (TLP\ NI)_t – L$

$(TLP)_r = (TLP\ NI)_r + L$

where:
$(TLP)_t$ = the CU input level on T, R leads
$(TLP)_r$ = the CU output level on T, R leads
L = loss of cable pairs
$(TLP\ NI)_t$ = prescribed TLP at the network interface, in the transmit direction
$(TLP\ NI)_r$ = prescribed TLP at the network interface, in the receive direction.

When the CU faces cable, the input and output levels are calculated from the 1 kHz cable loss. The values obtained from these equations must be rounded off to the nearest 0.25 dB for inclusion in an Engineering Work Order Document.

NOTE:
The signal level in the bitstream, $(TLP)_b$, is zero in all voice circuits.

Balance and equalization on single-gauge CSA cable

Two tables provide hybrid balance settings:

- Table 5-2 for the *SPQ*442 CU with structural impedance of 600 ohms
- Table 5-3 for applications facing transmission devices through office wiring.

Use Table 5-2 as follows:

1. Determine the distant termination and use the appropriate 600-ohm or 900-ohm column.
2. Locate the length nearest the facility length.
3. Read across to the proper gauge column and find the balance setting.

Table 5-2. Hybrid Balance Settings (BAL) for the *SPQ*442 CU with Structural Impedance of 600 Ohms

Major Gauge Equivalent Length (kft)	Cable Gauge and Far End Termination							
	26		24		22		19	
	600 ohms	900 ohms	600 ohms	900 ohms	600 ohms	900 ohms	600 ohms	900 ohms
0.0	3	0	3	0	3	0	3	0
0.5	2	2	2	2	2	2	3	2
1.0	2	10	2	6	2	6	2	6
1.5	2	10	2	10	2	10	2	6
2.0	6	10	6	10	2	10	2	10
2.5	6	10	6	10	6	10	6	10
3.0	6	10	6	10	6	10	6	10
3.5	6	10	6	10	6	10	6	10
4.0	10	10	6	10	6	10	6	15
4.5	10	10	6	10	6	10	6	15
5.0	10	10	6	10	6	9	6	15
5.5	10	10	15	9	7	13	7	13
6.0	10	10	15	9	7	13	7	13
6.5	10	10	7	13	7	13	5	8
7.0	10	9	7	11	7	11	5	8
7.5	9	9	7	11	7	11	5	8
8.0	9	9	7	11	7	11	5	14
8.5	9	9	7	11	8	12	5	14
9.0	9	9	7	11	8	12	5	14
9.5	9	9	7	12	8	12	5	14
10.0	9	11	7	12	8	12	5	14
10.5	NA	NA	8	12	5	14	4	14
11.0	NA	NA	8	12	5	14	4	14
11.5	NA	NA	8	12	5	14	4	4
12.0	NA	NA	8	12	5	14	4	4

When the CU faces an electronically-derived channel at the CO, balance settings depend on the length of the office wiring, as shown in Table 5-3.

Table 5-3. Hybrid Balance Settings for the *SPQ*442 (900-ohm Structural Impedance) Facing Central Office Equipment

Office Wire Length (kft)	Setting Number
0.00	0
0.25	1
0.50	2
0.75	2
1.00	2

A few special cases for balance settings of the *SPQ*442 CU are as follows:

- BAL = 0, 1, or 2 depending on the length of office wiring where the CU faces a switch or a CU
- BAL = 3 for the CU when it faces a PBX and the CU is at the customer location
- BAL = 15 when the CU is provisioned automatically by the GR-303 switch for a locally switched DID trunk.

Equalizer setting calculation

The prescription settings listed in Table 5-4 are for the CU equalizer on single-gauge facilities with 600- or 900-ohm terminations. Use Table 5-4 as follows:

1. Determine the distant termination and use the appropriate 600- or 900-ohm column.
2. Locate the length nearest to the facility length.
3. Read across to the proper gauge column and find the equalizer setting.

A few special cases for equalizer settings of the *SPQ*442 CU are as follows:

- SL = 0 for the CU when it faces a switch or a CU through office wiring
- SL = 0 for the CU when it is on customer premises.

Table 5-4. Equalizer Prescription Settings for Cable Gauge and Termination

Cable Length (kft)	26-Gauge EQLZ1		24-Gauge EQLZ1		22-Gauge EQLZ1		19-Gauge EQLZ1	
	600 ohms	900 ohms	600 ohms	900 ohms	600 ohms	900 ohms	600 ohms	900 ohms
0-3	0	0	0	0	0	0	0	0
3.5	0	0	0	0	0	0	0	0
4.0	0	1	0	0	0	0	0	0
4.5	0	1	0	1	0	1	0	1
5.0	1	1	1	1	0	1	0	1
5.5	1	1	1	1	1	1	1	1
6.0	1	1	1	1	1	1	1	1
6.5	1	2	1	1	1	1	1	1
7.0	1	2	1	2	1	2	1	1
7.5	2	2	1	2	1	2	1	2
8.0	2	3	2	3	1	2	1	2
8.5	2	3	2	3	2	3	2	2
9.0	3	4	2	3	2	3	2	3
9.5	3	4	3	4	2	3	2	3
10.0	4	5	3	4	3	4	2	3
10.5	4	5	3	5	3	4	3	4
11.0	5	6	4	5	3	4	3	4
11.5	5	6	4	5	4	5	3	4
12.0	6	7	5	6	4	5	4	5
12.5	6	7	5	7	4	6	4	5
13.0	7	7	6	7	5	6	4	6
13.5	7	7	6	7	5	6	5	6
14.0	7	7	6	7	5	7	5	6
14.5	7	NA	7	7	6	7	5	6
15.0	7	NA	7	7	6	7	5	7
15.5	7	NA	7	7	6	7	6	7
16.0	7	NA	7	NA	7	7	6	7

Table 5-4. Equalizer Prescription Settings for Cable Gauge and Termination (Continued)

Cable Length (kft)	26-Gauge EQLZ1		24-Gauge EQLZ1		22-Gauge EQLZ1		19-Gauge EQLZ1	
	600 ohms	900 ohms	600 ohms	900 ohms	600 ohms	900 ohms	600 ohms	900 ohms
16.5	NA	NA	7	NA	7	7	6	7
17.0	NA	NA	7	NA	7	NA	6	7
17.5	NA	NA	7	NA	7	NA	7	NA
18.0	NA	NA	NA	NA	7	NA	7	NA

Balance and equalization: 2-gauge CSA cable (with or without bridged taps)

Cable conversion

When the facility has more than one gauge of cable or contains cable with bridged taps, it must be converted to an equivalent-length single-gauge facility for calculating balance and equalizer settings. The longest length of cable is selected as the major gauge; the remaining length (minor gauge) is converted to the equivalent length of major gauge cable. Conversion factors for equivalent length vary with the structural impedance and far-end termination. Two tables provide the conversion factors for 600-ohm structural impedance: Table 5-5 for 600-ohm terminations, and Table 5-6 for 900-ohm terminations.

Table 5-5. Constant for Conversion to Equivalent Gauge (600 to 600 ohms)

Major Gauge	Minor Gauge			
	19	22	24	26
19	1.00	1.07	1.13	1.22
22	0.97	1.00	1.09	1.17
24	0.89	0.91	1.00	1.08
26	0.81	0.84	0.92	1.00

Facilities using MAT cable

Any 25-gauge Metropolitan Area T-carrier (MAT) cable segment must first be converted to an equivalent length of 26-gauge (high-capacitance) cable before determining major and minor gauges. Multiply the MAT cable length by 0.77 to get the equivalent 26-gauge cable length. This length is used to determine major and minor gauges; it is also used in the procedures for converting 2-gauge cable to an equivalent single-gauge facility.

Table 5-6. Constant for Conversion to Equivalent Gauge (900 to 600 ohms)

Major Gauge	Minor Gauge			
	19	**22**	**24**	**26**
19	1.00	1.01	1.10	1.11
22	0.99	1.00	1.09	1.10
24	0.91	0.92	1.00	1.05
26	0.90	0.91	0.95	1.00

2-gauge cable

Procedures for calculating balance and equalizer settings for 2-gauge cables are as follows:

1. Determine the impedance on the distant end of the cable sections (600 or 900 ohms).
2. Use the appropriate constant (K) from Table 5-5 (600 ohms) or Table 5-6 (900 ohms).
3. Convert the minor gauge to the equivalent length of major gauge:

   EL = L(minor) x K

   where:
   EL = the major gauge equivalent length
   L(minor) = the length of the gauge being converted
   K = the constant from Table 5-4 or Table 5-5.
4. Add the equivalent length to the length of the major gauge. The resulting length is the equivalent length of single-gauge cable.
5. Follow the single-gauge cable procedures using the equivalent length of single-gauge in place of the facility length to find entry points for Table 5-3 for balance settings and Table 5-4 for equalizer settings.

Bridged taps

Bridged taps on the cable can be converted to an equivalent length of cable using Table 5-7. The bridged tap should be converted based on one of the following:

- The gauge of cable to which the bridged tap is connected

- The gauge of the longest length of cable when the bridged tap is connected between two different gauges or when the location of the bridged tap is unknown.

Table 5-7. Bridged Tap Equivalent Lengths (kft) for Two-Wire Designs

See the Note below the table.

Bridged Tap Length (kft)	Gauge			
	26	24	22	19
0.5	0.3	0.4	0.5	0.5
1.0	0.7	0.8	0.9	1.0
1.5	1.1	1.3	1.4	1.5
2.0	1.6	1.7	1.9	2.0
2.5	2.1	2.2	2.4	2.5

Note: For balance and equalization, not losses.

Procedures for calculating balance and equalizer settings for cable with bridged taps are as follows:

1. Find the bridged tap length in Table 5-7 that is nearest to the actual length of the bridged tap.
2. Find the gauge of cable selected for bridged tap conversion in Table 5-7 and read the equivalent length from the column.
3. Add the equivalent length from Table 5-7 to the cable facility used for the conversion.
4. Follow the single-gauge or 2-gauge cable procedures to find balance and equalizer settings.

1 kHz cable loss

Nonloaded cable

The 1 kHz loss of nonloaded cable may be determined from Table 5-8 for single-gauge facilities, or from Figure 5-16 or Figure 5-17. To use Figure 5-16 or Figure 5-17, the facility length and DC resistance must be known. For nonloaded facilities terminated in 600 ohms on each end, use Figure 5-16. For a facility terminated in 900 ohms on one end and 600 ohms on the other end, use Figure 5-17.

The following method of using Figure 5-16 and Figure 5-17 provides accurate results that are temperature-independent as long as the proper value of temperature-dependent cable resistance is used.

1. Determine the total length of the facility: CU to termination. Add the length of any bridged taps to the total.
2. Determine the total DC resistance using the constants in Table 5-9. Do not include bridged tap resistance in total.
3. Read across the appropriate figure to the total length value. Read up to the DC resistance value. The 1 kHz loss may be read at the intersecting point.

Table 5-8. Nonloaded Cable Without Bridged Taps

Cable Length (kft)	1 kHz Cable Transducer Loss (dB) (600 to 600 ohms at 68°F)			
	19-GA	**22-GA**	**24-GA**	**26-GA**
1	0.1	0.2	0.4	0.6
2	0.3	0.5	0.7	1.2
3	0.4	0.7	1.1	1.7
4	0.5	1.0	1.5	2.2
5	0.7	1.2	1.8	2.7
6	0.8	1.5	2.2	3.2
7	1.0	1.7	2.5	3.7
8	1.2	2.0	2.9	4.2
9	1.3	2.2	3.2	4.7
10	1.5	2.5	3.6	5.1
11	1.7	2.8	4.0	5.6
12	1.9	3.1	4.3	6.1
13	2.1	3.4	4.7	6.6
14	2.3	3.6	5.1	7.1
15	2.5	3.9	5.5	7.6
16	2.7	4.2	5.9	8.1
17	2.9	4.6	6.3	8.6
18	3.1	4.9	6.7	9.1
19	3.4	5.2	7.5	9.7
20	3.6	5.5	7.5	10.2
21	3.8	5.8	7.9	10.7
22	4.1	6.1	8.4	11.3

Table 5-8. Nonloaded Cable Without Bridged Taps (Continued)

Cable Length (kft)	1 kHz Cable Transducer Loss (dB) (600 to 600 ohms at 68°F)			
	19-GA	22-GA	24-GA	26-GA
23	4.3	6.5	8.8	11.8
24	4.5	6.8	9.2	12.4
25	4.8	7.1	9.6	12.9
26	5.0	7.5	NA	NA
27	5.3	7.8	NA	NA
28	5.5	8.2	NA	NA
29	6.0	8.5	NA	NA
30	0.7	NA	NA	NA
31	6.3	NA	NA	NA
32	6.5	NA	NA	NA
33	6.8	NA	NA	NA
34	7.0	NA	NA	NA
35	7.3	NA	NA	NA
36	7.6	NA	NA	NA
37	7.8	NA	NA	NA
38	8.1	NA	NA	NA
39	8.3	NA	NA	NA
40	8.5	NA	NA	NA

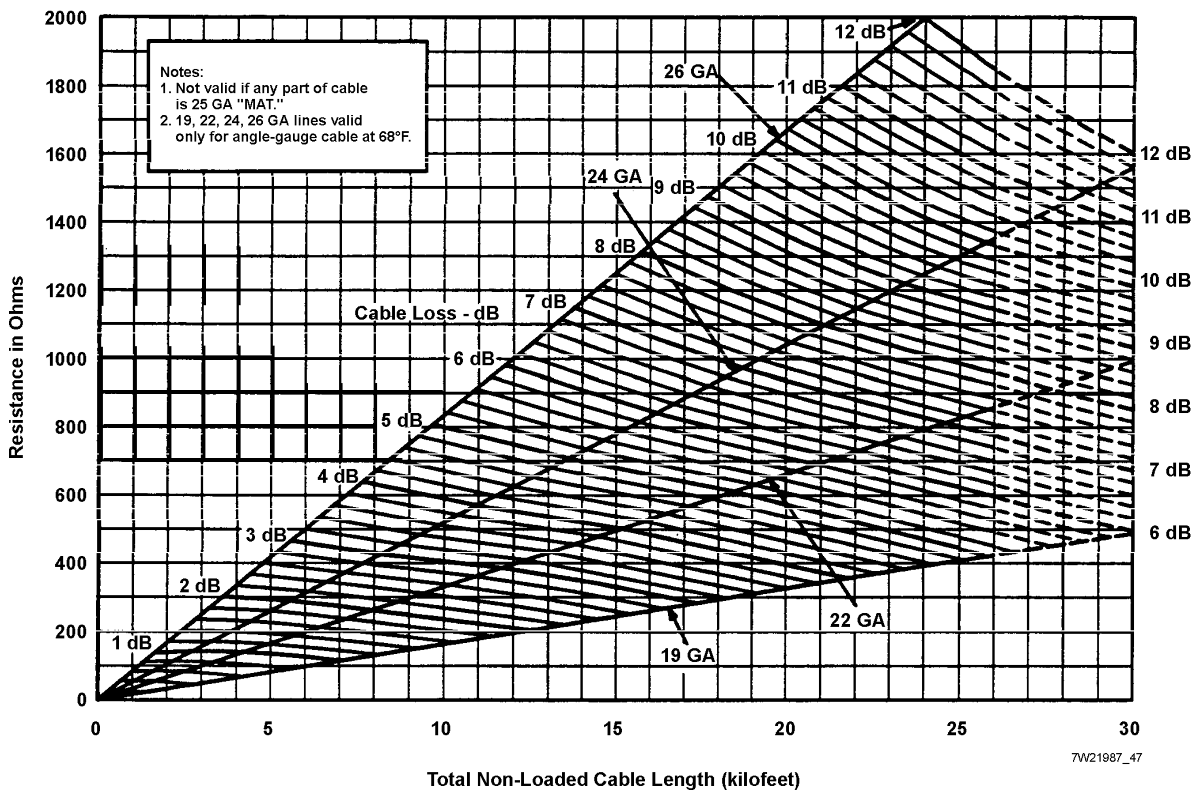


Figure 5-16. 1 kHz Cable Loss, Nonloaded Cable, Between 600 Ohm and 600 Ohm Terminations

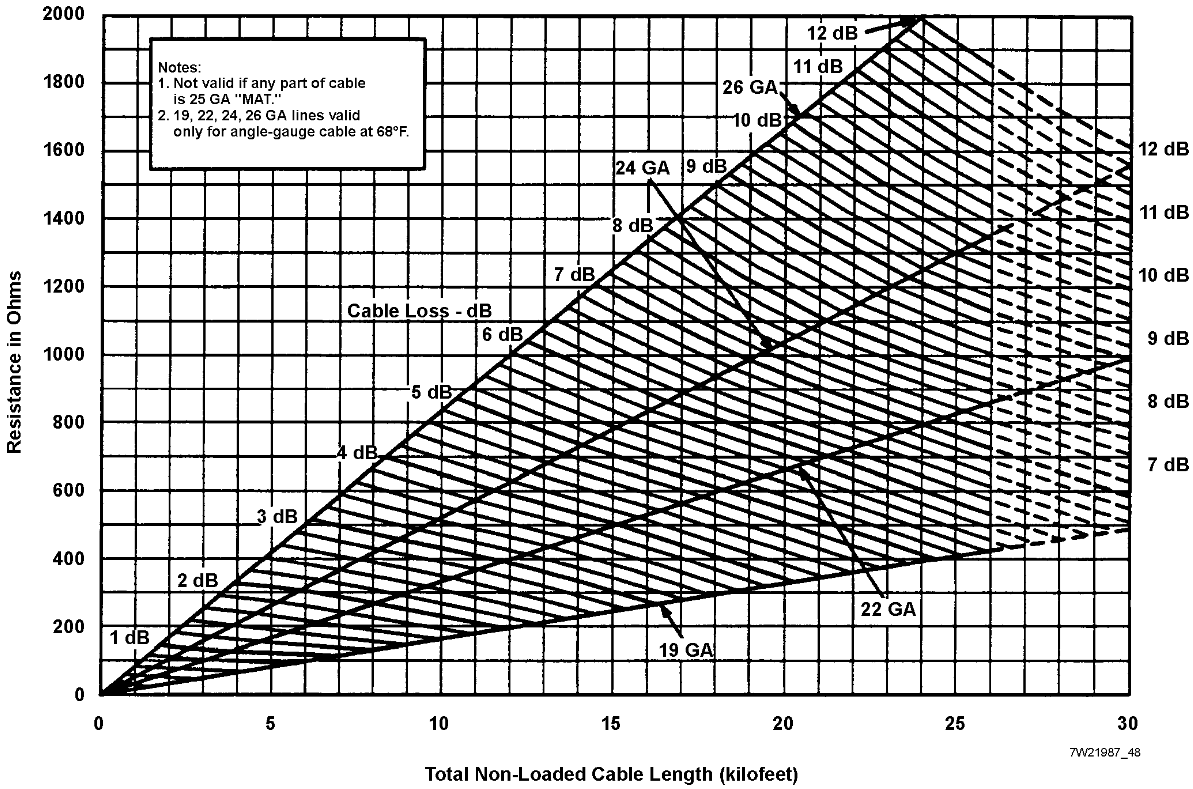


Figure 5-17. 1 kHz Cable Loss, Nonloaded Cable, Between 900 Ohm and 600 Ohm Terminations

Table 5-9. DC Resistance Constants for Nonloaded and Loaded Cable

See the Notes below the table.

Gauge	**68°F**		**100°F**	
	Nonloaded	**H88 Loaded**	**Nonloaded**	**H88 Loaded**
19	16.3	17.8	17.4	19.1
22	32.8	34.3	35.1	36.7
24	51.9	53.4	55.6	57.2
25-gauge MAT cable	65.5	67.0	70.1	71.7
26	83.3	84.8	89.2	90.8

Notes:
1. Values shown are in ohms/kft
2. For other temperatures, use the following:
   $R_T = R_{68} [1 + 0.0022(T-68)]$

Configuration Management— Two-Wire Special Services Provisioning (*SPQ*443)

Overview

This section describes two-wire traditional DLC special services supported by the *SPQ*443 CU for the *AnyMedia* Access System, and their provisioning. The *SPQ*443 CU provides transmission treatment for two-wire special service circuits over loops within and beyond the CSA.

Assigned special services

Several services within the CSA range can typically be provided through circuit assignment, without loop engineering. These services include the following:

- WATS line (to Class 5 CO)
- WATS trunk (to Class 5 CO)
- Off-premises PBX station lines
- DID Trunks, DPO interface only. (Using *SPQ*443 CU in MDS2 COT.)

These services are supported by *SPOTS* and DID (DPO) CU technology. The *SPQ*443 CU are fully compatible with *SLC* Series 5 and *SLC*-2000 system *SPOTS* current sink and DID (DPT) channel units, respectively, for universal DLC arrangements.

The *SPQ*443 CU provides the DPO interface between the *AnyMedia* MDS2 shelf and the DID trunk circuit.

Although traditionally used in designed special services, the *SPQ*443 CU can be provisioned for the DPO function, default values of which are suitable for an assigned locally switched special service circuit.

Configuration Management— Private Line Auto Ring

Overview

This section describes the two-wire point-to-point private line auto ring (PLAR) service supported by the AUA75( ) CU for the *AnyMedia* Access System and its provisioning. The AUA75( ) CU is not limited to CSA design rules. The cable loss for an end-to-end circuit should not exceed 9 dB, split between the two end cable links. The design objective for *overall* end-to-end loss is recommended to be –9 dB. The resistance of cable at either end of the circuit cannot exceed 1300 ohms, assuming 450 ohms for the station equipment.

Designed special services

The end-link of this service via the *AnyMedia* Access System MDS2-RT is illustrated in Figure 5-18. Several access configurations are available, including the following:

- The RT is configured as an INA bank, and the PLAR circuits are directly routed to a D-bank.
- The RT can be configured as a TR-08 or GR-303 RT with the PLAR circuits routed to a D-bank via a hairpin or nail-up connection at the LDS.

The CU at the D-bank can either feed a loop to the terminating station set or face another CU for transport to a distant CO. The D-bank type terminal can also consist of a *SLC*-2000 COT operating in INA mode. The terminating TLP shown in Figure 5-18 is –9.0 dB. This value is Lucent Technologies' recommendation, not an industry standard. The most relevant industry standard, Telcordia Technologies, Inc.'s TR-NWT-000965, specifies only that the terminating TLP must not be less than -10 dB (end-to-end loss not greater than 10 dB). Other standards, such as TR-57, also do not list a target TLP. This objective of –9 dB for terminating TLP is consistent with grade-of-service studies for POTS service, skewed on the low side to reflect the occasional need for added loss when used in a multipoint circuit. Since commonly deployed two-wire PLAR channel units do not provide transmission treatment that would allow *gain transfer* from one end of the four-wire network to the other, the network will generally be required to introduce at least 1 dB of loss to assure circuit stability. To achieve the end-to-end circuit loss objective, then, the sum of the losses of both end-link cable pairs and the serving channel units must be about 8 dB.

Because the AUA75( ) CU does not provide gain between the tip/ring interface and the bitstream, it is generally not possible to design the overall circuit with zero TLPs in the bitstream. The best that can be done is to design so that the TLP in the cable is not excessively low, to minimize crosstalk. For example, assume that the far-end CU terminating the circuit of Figure 5-18 is an AT&T D4 2RD/PLAR unit (which has a large attenuation range controlled in 0.1 dB steps). This D4 unit can be adjusted to overcome the 3 dB granularity in the AUA75( ) CU, allowing the circuit design to maintain the end-to-end design loss objective of 9 dB (provided the loss of both loops is less than 8 dB). For a loop loss of 3 dB or greater, the AUA75( )'s loss might be set to zero (e.g., if the loop loss is 8 dB, the downstream desired bitstream TLP becomes –1 dB and the actual upstream TLP is –8 dB). For a loop loss of less than 3 dB the AUA75( )'s loss might be set to 3 dB. If, for example, the loop loss were zero the desired bitstream TLP would be -6 dB in the downstream direction and actual upstream TLP becomes –3 dB. Where the far end CU is another AUA75( ) PLAR unit, with 3 dB granularity, not only will the bitstream TLP be non-zero but the terminating TLPs cannot, in general, be very close to the 9 dB objective. However, the range of the terminating TLPs *can* be maintained between 6.0 and 10.0 dB, unless the total loss of both cables is greater than 9 dB.

The resistance range of the AUA75( ) CU is 1750 ohms. Assuming a station set with 450 ohms of off-hook resistance, the cable range is 1300 ohms.

The AUA75( ) CU should be provisioned with the LR value as the generic signaling function. The AUA75( ) CU has four option switches:

- CU location (COT or RT)
- Signaling compatibility for both channels (D3 or D4)
- Transmit and receive channel loss, a switch for each channel (0 or 3 dB).

The option switches for the AUA75( ) are physically located on the printed wiring board of the CU and must be set manually; they cannot be set electronically using the GSI.

NOTE:
RT should be selected when the AUA75( ) CU is located in the *AnyMedia* MDS2-RT. D4 signaling compatibility should always be selected unless the far-end CU serving each of the AUA75( ) unit's channels uses D3 signaling.

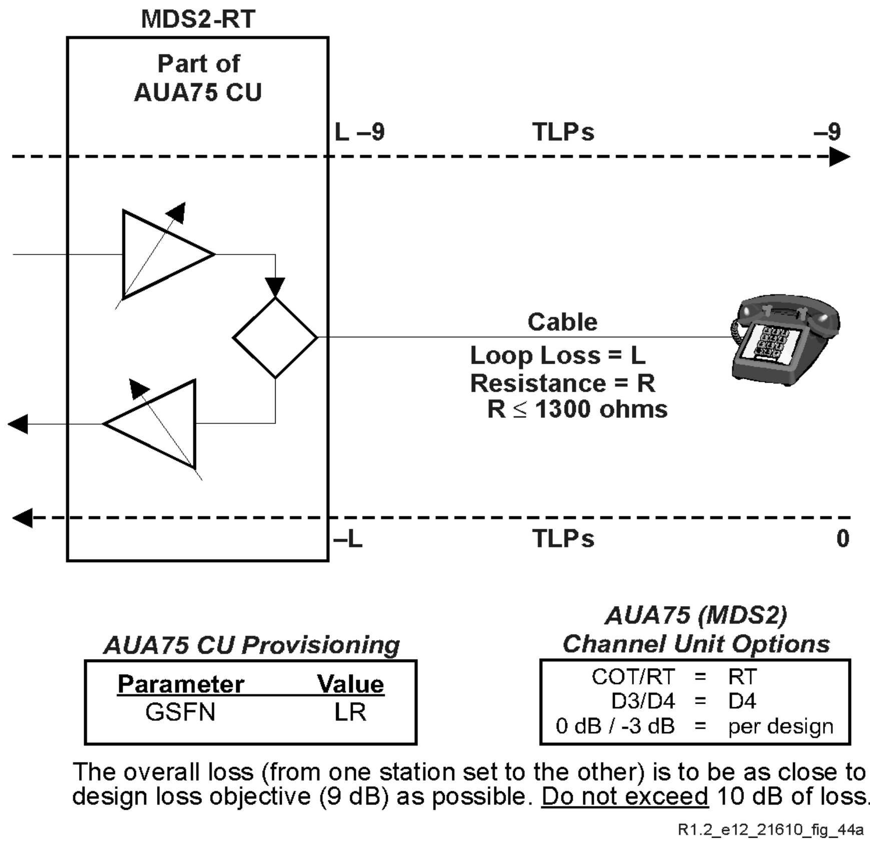


Figure 5-18. Point-To-Point Private Line Automatic Ring

Configuration Management—Ringing Repeater

Overview

This section describes the two-wire point-to-point private line manual ring service supported by the AUA45B CU for the *AnyMedia* Access System and its provisioning. The AUA45B CU is not limited to CSA design rules. The cable loss for an end-to-end circuit should not exceed 9 dB, split in any proportion between the two end cable links. The design objective for *overall* end-to-end loss is recommended to be –9 dB.

Designed special services

The end-link of this manual ring service via the *AnyMedia* Access System MDS2-RT is illustrated in Figure 5-19. Several access configurations are available, including the following:

- The RT is configured as an INA bank, and the manual ring circuits are directly routed to a D-bank.
- The RT can be configured as a TR-08 or GR-303 RT with the manual ring circuits routed to a D-bank via a hairpin or nail-up connection at the LDS.

The CU at the D-bank can either feed a loop to the terminating station set or face another CU for transport to a distant CO. The D-bank type terminal can also consist of a *SLC*-2000 COT operating in INA mode. The terminating TLP shown in Figure 5-19 is –9.0 dB. This value is Lucent Technologies' recommendation, not an industry standard. The most relevant industry standard, Telcordia Technologies, Inc.'s TR-NWT-000965, specifies only that the terminating TLP must not be less than –10 dB (end-to-end loss not greater than 10 dB). Other standards, such as TR-57, also do not list a target TLP. This objective of –9 dB for terminating TLP is consistent with grade-of-service studies for POTS service, skewed on the low side to reflect the occasional need for added loss when used in a multipoint circuit. Since commonly deployed two-wire *ringdown* CUs do not provide transmission treatment that would allow *gain transfer* from one end of the four-wire network to the other, the network will generally be required to introduce at least 1 dB of loss to assure circuit stability. To achieve the end-to-end circuit loss objective, where the network adds 1 dB of loss, the sum of the losses of both end-link cable pairs and the serving CUs must be 8 dB.

Because the AUA45B CU does not provide gain between the tip/ring interface and the bitstream, it is generally not possible to design the overall circuit with zero TLPs in the bitstream. The best that can be done is to design so that the TLP in the cable is not excessively low, to minimize crosstalk. For example, assume that the far-end CU terminating the circuit of Figure 5-19 is an AT&T D4 2RD/PLAR unit (which has a large attenuation range controlled in 0.1 dB steps). This D4 unit can be adjusted to overcome the 3 dB granularity in the AUA45B CU, allowing the circuit design to maintain the end-to-end design loss objective of 9 dB (provided the loss of both loops is less than 8 dB). For a loop loss of 3 dB or greater, the AUA45B's loss might be set to zero (e.g., if the loop loss is 8 dB, the downstream desired bitstream TLP becomes –1 dB and the actual upstream TLP is –8 dB). For a loop loss of less than 3 dB, the AUA45B's loss might be set to 3 dB. If, for example, the loop loss were zero, the desired bitstream TLP would be –6 dB in the downstream direction and actual upstream TLP becomes –3 dB. Where the far end CU is another AUA45(_) manual ring unit, with 3 dB granularity, not only will the bitstream TLP be non-zero, but the terminating TLPs cannot, in general, be very close to the 9 dB objective. However, the range of the terminating TLPs *can* be maintained between 6.0 and 10.0 dB, unless the total loss of both cables is greater than 9 dB.

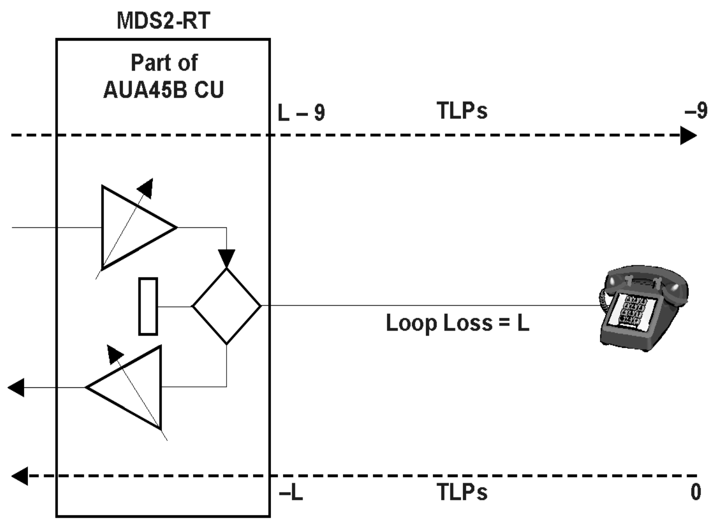
The cable resistance range of the AUA45B CU is 1500 ohms for outgoing ringing into 4 REN, but the range for incoming ringing depends on the ring generator of the station set. The sensitivity of the CU is 40V across tip and ring, and its input impedance is about 3.7 kilohms, essentially capacitive.

The AUA45B CU should be provisioned with the AC value as the generic signaling function. The AUA45B CU has three option switches:

- CU location (COT or RT)
- Transmit and receive channel loss, a switch for each channel (0 or 3 dB).

The option switches for the AUA45B are physically located on the printed wiring board of the CU and must be set manually; they cannot be set electronically using the GSI.

NOTE:
RT should be selected when the AUA45B CU is located in the *AnyMedia* MDS2-RT.



AUA45B CU Provisioning

Parameter	Value
GSFN	AC

AUA45B (MDS2) Channel Unit Options

COT/RT = RT
0 dB / -3 dB = per design

R1.2_e12_21610_fig_44b

Maximum loss should not exceed 9 dB, split in any proportion between the two end cable links.

The overall loss (from one station set to the other) is to be as close to design loss objective (9 dB) as possible. Do not exceed 10 dB of overall loss.

NOTE: When only one of the channels on the AUA45B is placed in service, the loss switches for the unterminated channel at both ends must be set to the -3 dB position (that is, 6 dB end-to-end loss). This will prevent the other channel from singing. All unterminated AUA45B channels must be set for an end-to-end loss of 6 dB.

Figure 5-19. Two-Wire Point-To-Point Private Line Manual Ring

Configuration Management— Enhanced Business Service (P-Phone)

Overview

The two-wire P-Phone service is supported by the *SPQ*429 battery feed and *SPQ*328 EBS current sink CU for the *AnyMedia* Access System and its provisioning. The *SPQ*429 and *SPQ*328 CU are used in P-Phone applications, where P-Phone refers to the Nortel's line of EBS telephone sets. The *SPQ*429 is limited to CSA design rules. The *SPQ*328 EBS current sink CU must be used in the *AnyMedia* MDS2-COT or *SLC*-2000 TR-08 or INA bank to terminate the COT end of the channel. The *SPQ*429 CU is located in the *AnyMedia* MDS2-RT. Not including the cable, the CU combination has a symmetric loss of 2 dB +/–1 dB end-to-end.

Special services

The end-link of the EBS service via the *AnyMedia* MDS2-RT is illustrated in Figure 5-20. The end-link of the EBS service via the *AnyMedia* MDS2-COT is illustrated in Figure 5-21. These configurations should be used when the RT is configured as an INA bank or the EBS circuits are routed via switch nailup or hairpin.

The *SPQ*429 and *SPQ*328 CUs should be provisioned with the EBS generic signaling function. No user options or settings are on either CU.

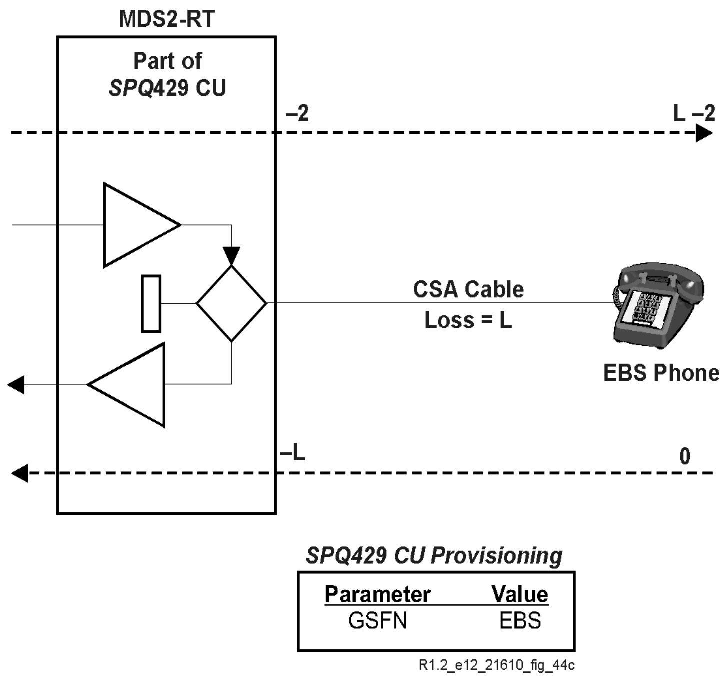


Figure 5-20. Two-Wire Enhanced Business Service (P-Phone) via MDS2 RT

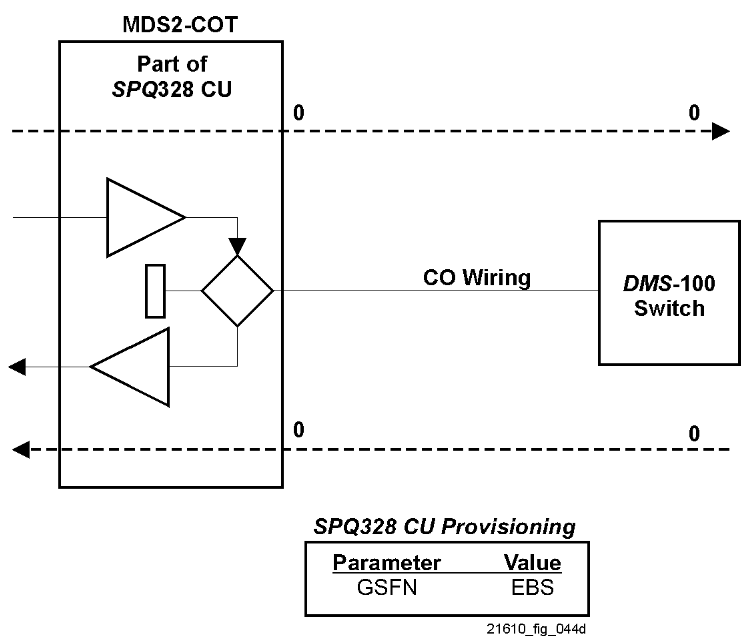


Figure 5-21. Two-Wire Enhanced Business Service (P-Phone) via MDS2 COT

Configuration Management—Four-Wire VF Special Services

Overview

The *AnyMedia* Access System provides four-wire VF special services via three CU codes which are supported on the MDS2 shelf. This section describes the services supported by the AUA41B, *SPQ*444, and *SPQ*454 CUs and their provisioning.

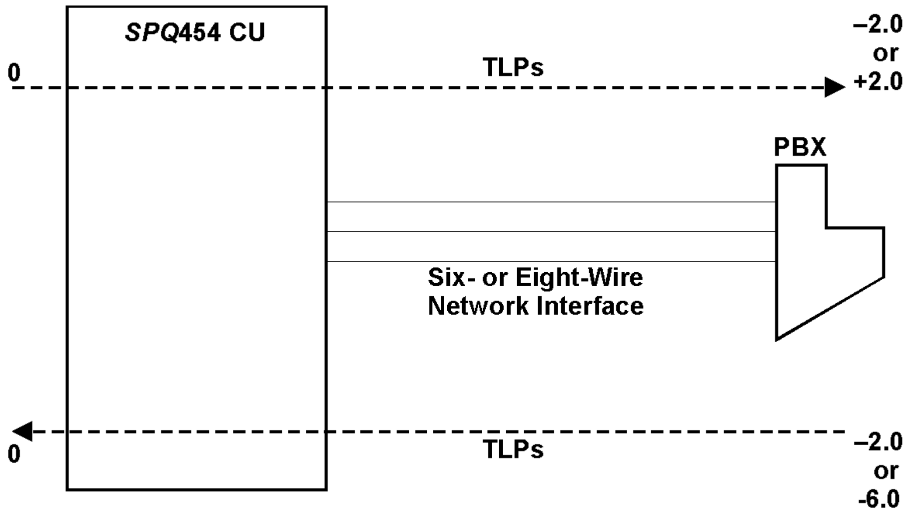
Four-wire VF services

Circuit applications for these three four-wire VF CUs can be grouped into three categories:

- Tie trunks using E&M/PLR/DX signaling (*SPQ*454 and AUA41B CUs)
- Circuits with loop-start/ground-start signaling (AUA41B and *SPQ*444 CUs)
- Private line data circuits without signaling (AUA41B CU).

Tie trunks

Tie trunks interconnect PBXs. Figure 5-22 shows the end-link of a four-wire tie trunk that uses E&M signaling. The circuit is implemented using the *SPQ*454 CU provisioned for either the E&M or PLR GSFN, as appropriate. E&M is selected when the customer equipment originates on the M lead. PLR is selected when the customer equipment originates on the E lead. Since the *SPQ*454 CU is not rated for outside plant voltage exposure, this circuit design is applicable only for direct interfaces to customer equipment.



SPQ454 Provisioning

Parameter	Value	Parameter	Value
GSFN	EM4 (C,H) or PLR (1,2)	RCV	10.5 or 6.5
TRMT	15.5 or 11.5	TC	BUSY

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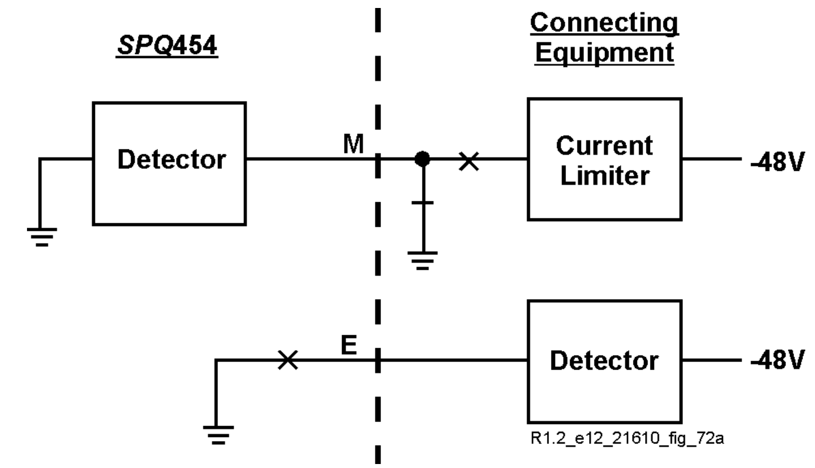
Figure 5-22. Four-Wire PBX Tie Trunk with E&M or PLR Signaling

Figure 5-23 shows the functionality of the E&M circuits of the *SPQ*454 CU and the connecting equipment.

Figure 5-24 shows the functionality of the *SPQ*454 CU provisioning for the PLR (1,2) generic signaling function.

A. Type 1 E&M interface. EM4C function code (Connecting equipment originates on M lead.)



B. Type II E&M interface. EM4H function code (Connecting equipment originates on M lead.)

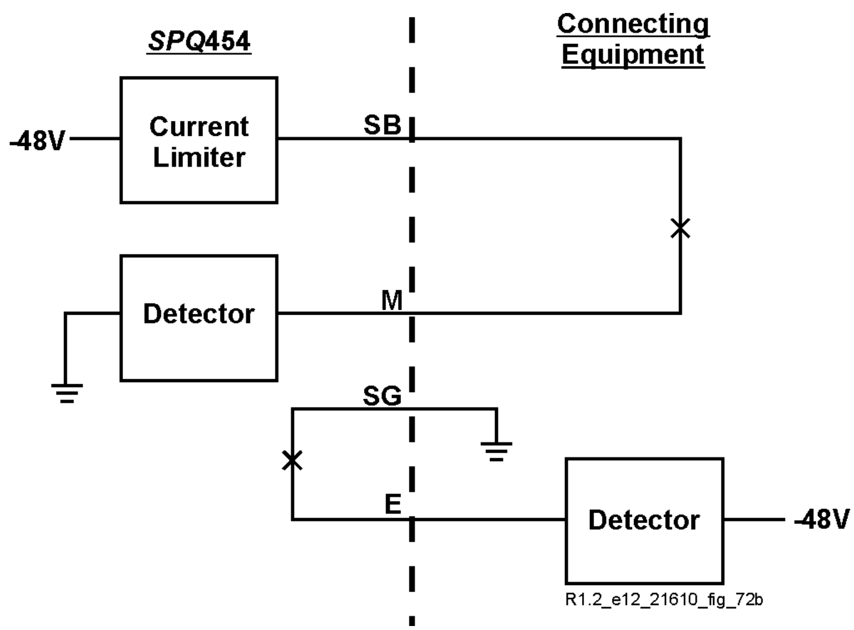
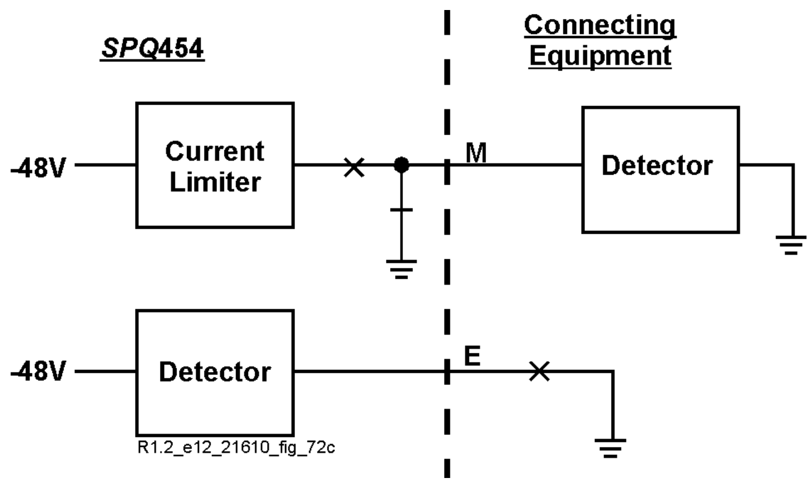


Figure 5-23. E&M Interface

A. Type 1 E&M interface. PLR1 function code (Connecting equipment originates on E lead.)



B. Type II E&M interface. PLR2 function code (Connecting equipment originates on E lead.)

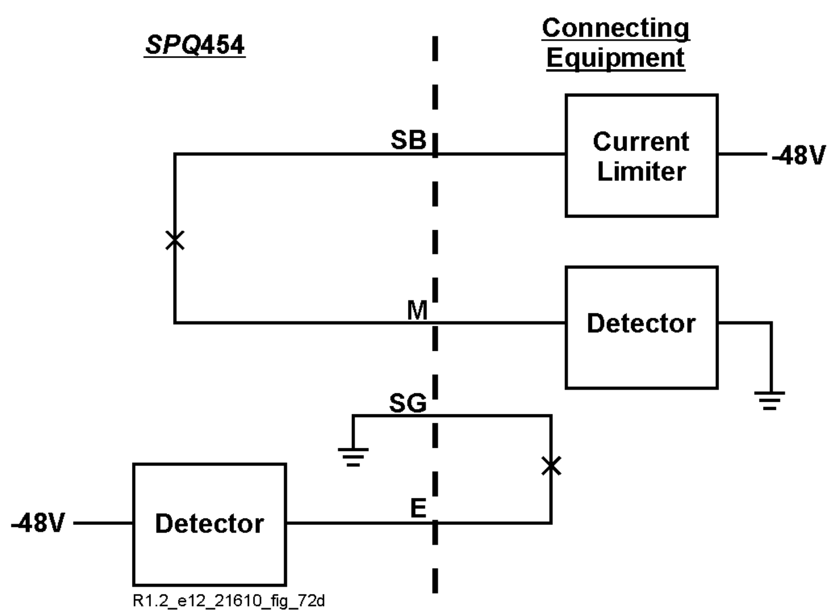
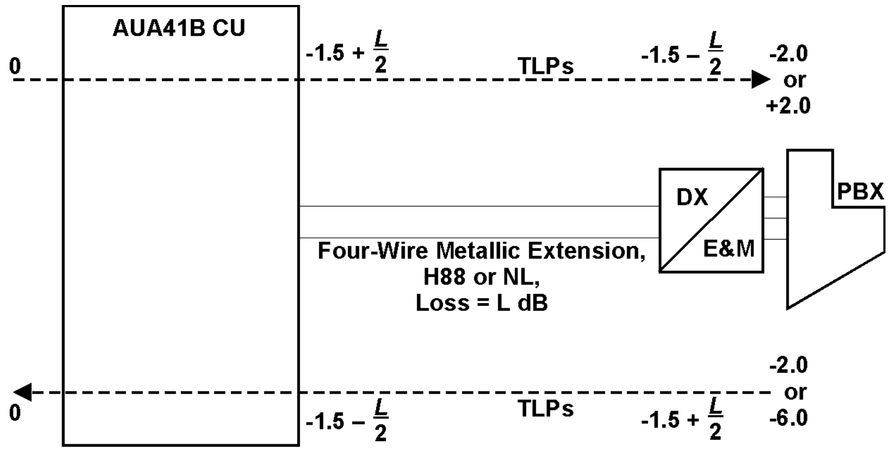


Figure 5-24. PLR Interface

Figure 5-25 shows the end-link of a four-wire tie trunk that includes a metallic cable extension with less than 15 dB of 1 kHz loss. This circuit uses the AUA41B CU to provide a DX signaling interface. It requires network terminating equipment at the subscriber premises to convert from DX to E&M signaling.



AUA41B Provisioning

Parameter	Value	Parameter	Value
GSFN	DX4 (N,R)	SL	Prescription-Set
IMP	600 or 1200	BW	Prescription-Set
TRMT	Prescription-Set	HT	Prescription-Set
RCV	Prescription-Set	TC	BUSY
L-N	Prescription-Set		

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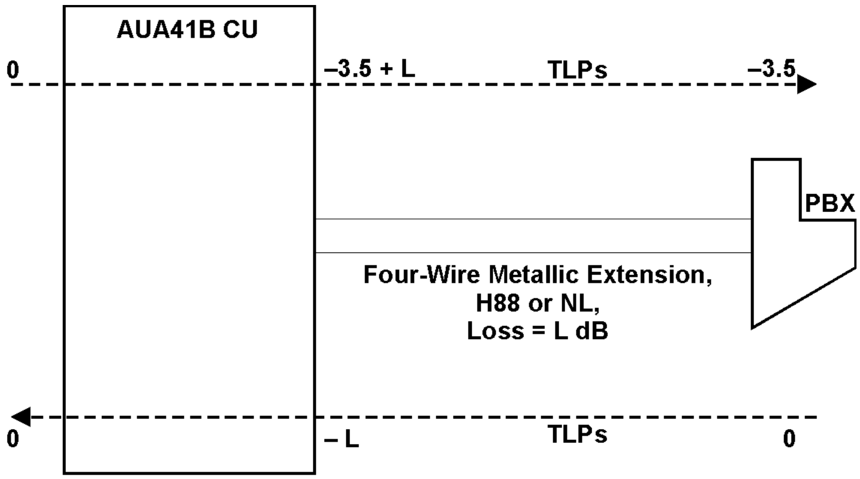
Figure 5-25. Four-Wire PBX Tie Trunk with DX Signaling

Loop-start/ground-start

Four-wire loop-start and ground-start applications include foreign exchange lines and trunks, off-premises stations, and PBX-CO trunks. Figure 5-26 shows the end link of a four-wire PBX-CO trunk that uses the AUA41B CU to provide a ground-start current-feed interface. For crosstalk compatibility, this particular circuit design must be limited to 9.5 dB of nonloaded cable loss at 1 kHz to prevent the transmit level at the CU from exceeding +6 TLP. The range can be extended by providing NCTE at the customer location and allocating the total cable conditioning between the NCTE and the CU. The NCTE might also present a two-wire interface to the PBX.



AUA41B Provisioning

Parameter	Value	Parameter	Value
GSFN	FXS (3,5)	SL	Prescription-Set
IMP	600 or 1200	BW	Prescription-Set
TRMT	Prescription-Set	HT	Prescription-Set
RCV	Prescription-Set	TC	BUSY
L-N	Prescription-Set		

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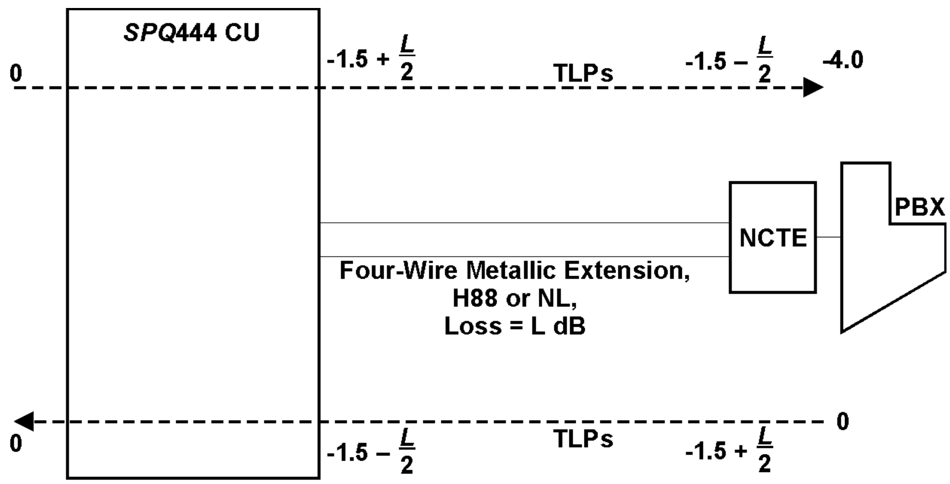
Figure 5-26. Four-Wire PBX-CO Trunk with Ground-Start Signaling

Figure 5-27 shows the PBX-end link of a four-wire off-premises station circuit. This circuit uses the *SPQ*444 CU to provide the current-sink loop-start interface toward the PBX. NCTE is provided at the customer location to provide a two-wire to four-wire conversion.



SPQ444 Provisioning

Parameter	Value	Parameter	Value
GSFN	FXO (1,2)	SL	Prescription-Set
IMP	600 or 1200	BW	Prescription-Set
TRMT	Prescription-Set	HT	Prescription-Set
RCV	Prescription-Set	TC	BUSY
L-N	Prescription-Set		

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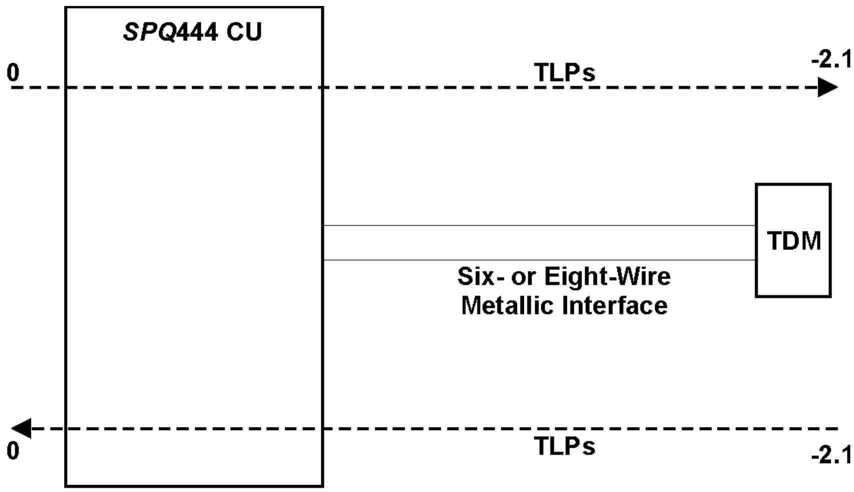
Figure 5-27. Four-Wire Off-Premises Station with Loop-Start Signaling

Figure 5-28 illustrates a tandem signaling interface to an interexchange carrier via the *SPQ*444 CU. This configuration can be used in carrier-to-carrier interfaces for a variety of services, including a foreign exchange line or trunk as shown in the figure.



SPQ444 Provisioning

Parameter	Value	Parameter	Value
GSFN	TD (O,S)(A,B)	TC	IDLE
TRMT	1.5		

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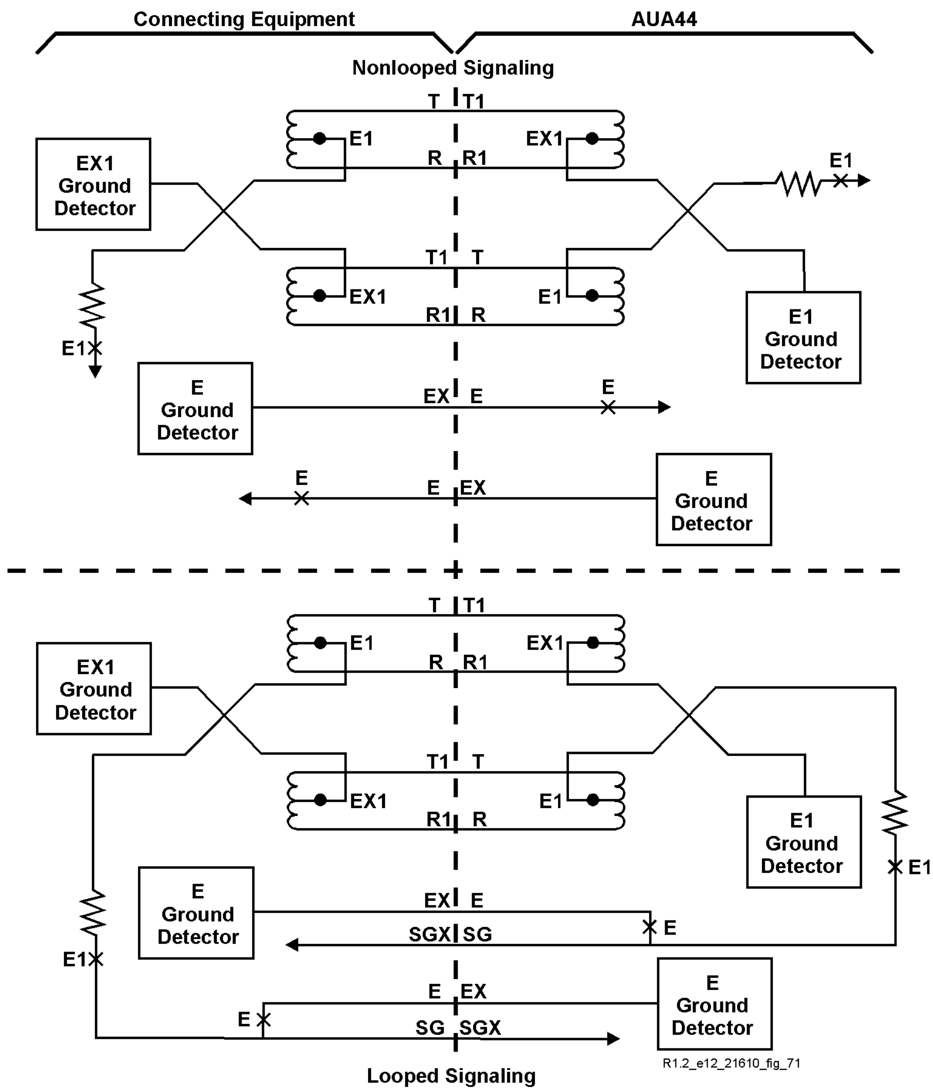
Figure 5-28. Foreign Exchange Trunk or Line Interface to Interexchange Carrier with Tandem Signaling

The MDS2 shelf E&M signaling leads are also used to implement the tandem interface to another carrier terminal used by an interexchange carrier. Figure 5-29 shows how the two signaling paths in each direction are implemented with a tandem interface.



DS1 SIGNALING

Detector	Sig. Channels
E GND	A-C
E1 GND	B-D

Sig. Channels	Metallic Action
A-C	E Grounded
B-D	E1 Grounded

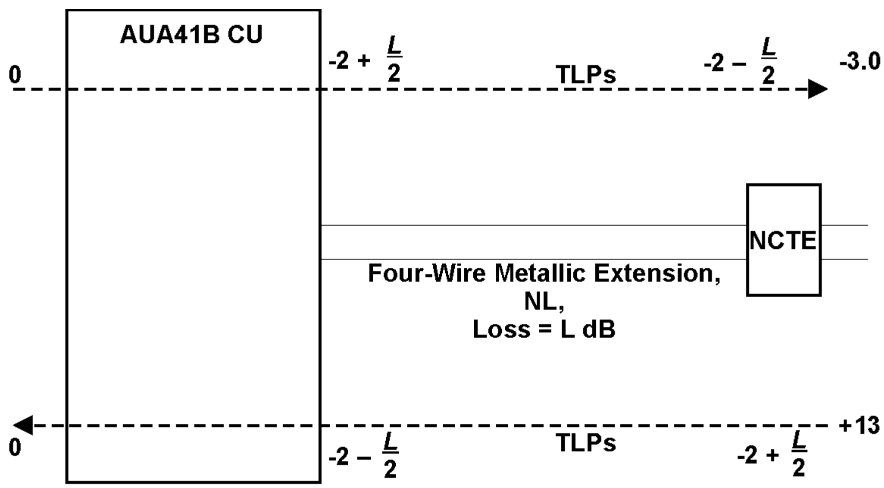
*** Polarity of DS1 signals depends on CU function code.**

Figure 5-29. Signaling Paths Implemented with a Tandem Interface

Private line data

Most private line data circuits are designed four-wire throughout. TO CUs are used in carrier-to-carrier interfaces; the ETO CUs are used for most metallic extensions. Figure 5-30 shows the end link of a private line data circuit that uses the AUA41B CU to interface a metallic extension. The CU is provisioned for the ETO4 generic signaling function. The maximum loop loss for this configuration is limited to 14 dB because standard design of data circuits recommends +5 dB for the maximum TLP entering the cable (instead of the +6 dB crosstalk limit for VF circuits).

A carrier-to-carrier interface can also be implemented with the AUA41B CU; it would be provisioned using the TO4 generic signaling function.



AUA41B Provisioning

Parameter	Value	Parameter	Value
GSFN	ETO	L-N	Prescription-Set
IMP	600	SL	Prescription-Set
TRMT	Prescription-Set	BW	Prescription-Set
RCV	Prescription-Set	HT	Prescription-Set
DBJ3	BK	SC	YES or NO

R1.2_e12_21610_fig_43k

Figure 5-30. Four-Wire Private Line Data

Circuit design considerations

Back-to-back carrier arrangements

When it is impractical to use CUs with E&M or tandem signaling (such as when the interface is exposed to outside plant voltages, or the connecting terminal does not provide E&M interfaces), special back-to-back arrangements are available. E&M signaling may be replaced by DX signaling, and tandem connections may be replaced by a pair of four-wire CUs with the FXO/FXS functions.

Signaling range at customer location

Connections between the *SPQ*454 CU and the PBX or other customer terminal cannot be exposed to the outside plant environment. Within this constraint, however, the MDS2 and the customer terminal can be separated by several kilofeet of inside wiring. The signaling range is limited by the *SPQ*454 CU to 250 ohms for Type I signaling and to 500 ohms loop resistance for Type II signaling. However, the actual limit may depend on the customer terminal.

Simplex connections

The guidelines for selecting simplex connections (normal or reversed) for four-wire VF CUs apply to both duplex and loop-start/ground-start signaling applications. If the terminal at the other end of the four-wire metallic extension is a D( ) channel bank, a *SLC* Series 5 system, a *SLC*-2000 system, or an *AnyMedia* Access System MDS2 shelf, one of the CUs must be optioned as normal and the other as reversed. If the distant terminal is MFT, CPFT, or Omniport NCTE, both the CU and the distant repeater are optioned the same (both normal or both reversed).

Mismatch equalization

When the NCTE does not have active equalization, the four-wire CU facing the cable can be pre- and post-equalized by selecting 150 ohms impedance. Selection of 150/600 ohm impedance results in a loss/frequency characteristic which complements nonloaded cable and is equivalent to a fixed value of slope equalization. The range of cable lengths which can be equalized this way is somewhat limited, but can be increased by also using mismatch equalization at the NCTE. Table 5-10,Table 5-11, Table 5-12, Table 5-13, and Table 5-14 give the ranges of cable lengths which can be equalized by this method.

Sealing current treatment for data circuits

The AUA41B CU provides Transmission Only service for private line data applications. This CU, in the TO4 and ETO4 function codes, optionally applies -48 V battery and ground to the transmission lead simplexes to establish a source of sealing current. The sealing current source can be enabled or disabled by circuit provisioning.

Four-wire VF CU prescription setting

CU impedance selection

Guidelines for selecting impedance of four-wire CUs are these:

- Nonloaded cable with electronic equalization—600 ohms

- Nonloaded cable with impedance mismatch equalization—150 ohms
- Loaded cable—1200 ohms.

CU attenuation (gain) calculation without equalization

This section contains the equations for determining the transmit and receive attenuation for the CUs in applications not requiring equalization. The equations require that the switching machine or customer equipment transmission level points, the cable loss, and the CU insertion losses (Table 5-15) be known. For actual cable measurement refer to AT&T 363-205-110, *SLC* Series 5 Carrier System, Cable Measurement Method for Determining Provisioning Setting for Special Service CU, Loop Transmission System.

Transmit path calculations

$$ATT(t) = 8.5 + G(t) - TLP(t)$$

where:

ATT(t) = transmit attenuation

G(t) = transmit insertion gain or loss from Table 5-15

TLP(t) = signal level received on T and R leads.

Receive path calculations

$$ATT(r) = 4.0 + G(r) - TLP(r)$$

where:

ATT(r) = receive attenuation

G(r) = receive insertion gain or loss from Table 5-15

TLP(r) = signal level received on T1, R1 leads.

CU equalization other than 150-ohm mismatch equalization

This section contains directions for selecting slope (SL), height (HT), and bandwidth (BW) settings for the CUs for applications using active equalization.

Nonloaded cable applications—single gauge

For single-gauge facilities, the prescription equalizer settings may be taken directly from Table 5-16 (19-gauge), Table 5-17 (22-gauge), Table 5-18 (24-gauge), Table 5-19 (25-gauge MAT cable), and Table 5-20 (26-gauge cable). The proper table is selected according to the gauge of the cable. Use the tables as follows:

1. Round the facility length to the nearest whole number in kft to obtain the table entry point.
2. From the table, record the BW, HT, SL, and equalizer gain (EQL GN).
3. Determine cable loss (see *1 kHz cable loss* on page 5-40).

Correct the cable loss to one-tenth of a dB (0.1 dB) accuracy. This can be done by interpolating from the cable loss given in Table 5-16, Table 5-17, Table 5-18, Table 5-19 and Table 5-20 or by calculating the total resistance and referring to Figure 5-16 or Figure 5-17 in the *Configuration Management—Two-Wire Special Services Provisioning (SPQ442)* section. The cable loss value is used to calculate the attenuator settings.

Example: Given 14.6 kft of 26-gauge cable:

a. Round off to 15 kft to get table entry point.
b. From Table 5-20, 15 kft of 26-gauge cable has the following settings: BW=13, HT=6, SL=3, and equalizer gain (EQL GN) = 1.6 dB (used to calculate attenuator settings later).
c. In Table 5-20, 15 kft has 7.6 dB of loss; 14 kft has 7.1 dB of loss. By interpolation, 14.6 kft of 26-gauge cable has 1 kHz loss L = 7.4 dB.

Or use Figure 5-16 to determine cable loss:

1. Calculate total resistance = cable length x cable resistance from Table 5-9 where cable length = 14.6 kft
2. Cable resistance for 26-gauge nonloaded cable from Table 5-9 = 83.3 ohms/kft at 68<deg>F
3. Therefore, resistance = 14.6 x 83.3 = 1216 ohms.
4. From Figure 5-16, 1-kHz loss L = 7.4 dB.

Nonloaded cable applications—two gauges

When the facility has two different gauges of nonloaded cable, prescription settings may be obtained as follows: use Table 5-21 for 24- and 22-gauge combinations, Table 5-22 for 26- and 22-gauge combinations, and Table 5-23 for 26- and 24-gauge combinations. The proper table is selected according to the gauge of the cable. Facilities with 19-gauge cable combinations are reduced to an equivalent single-gauge facility to get prescription settings. (See procedure for mixed 19-gauge cable). To find equalizer settings for 2-gauge cable section, proceed as follows:

1. Determine the table entry point by adding the length of the two gauges together and rounding to the nearest kft for the working length. Enter the table at WL and round the finer gauge to the nearest whole number.
2. Obtain BW, HT, SL, and EQL GN from the table.
3. Obtain the cable loss using Figure 5-16.

Example: Given a facility composed of 10.4 kft of 24-gauge cable and 8.2 kft of 26-gauge cable:

1. Determine table points by finding WL (working length):

   10.4 kft 24-gauge + 8.2 kft 26-gauge = 18.6 kft or rounding,

   WL = 19 kft.

   Round the finer gauge (26) to the nearest kft (8.2 = 8.0). The table entry points are as follows:

   WL = 19 kft, 8 kft of 26-gauge and 11 kft of 24-gauge.

2. From Table 5-23:

   BW=14, HT=8, SL=2, and EQL GN = 1.6 dB (will be used to calculate attenuator settings).

3. Use Figure 5-16 to determine the cable loss of 8.2 kft of 26-gauge and 10.4 kft of 24-gauge as follows:

   Total length = 10.4 + 8.25 = 18.6 kft.

   Total resistance = 8.2 (83.3) + 10.4 (51.9) = 1223 ohms (Table 5-9 gives cable resistance/kft).

   From Figure 5-16, cable loss = 8.1 dB.

Nonloaded cable applications—more than two gauges

To determine prescription equalizer settings for facilities composed of more than two gauges, the facility must be converted to an equivalent 2-gauge facility. The two longest segments are designated the major gauges and the remaining segments of cable are minor gauges.The minor segments are then converted to major gauge equivalent lengths using Table 5-24. The proper table is selected by the two resulting major gauges. The two major gauge equivalent lengths are used to select the proper table and table entry points. The rules for conversion of a minor gauge to the equivalent major gauge are as follows:

1. Convert a minor gauge to the major gauge that is in closest physical proximity in the actual makeup of the cable.
2. Convert the minor gauges to the major gauge that is nearest in gauge size.

Facilities using MAT cable

Any 25-gauge MAT cable segment must first be converted to an equivalent length of 26-gauge (high-capacitance) cable before determining major and minor gauges. Multiply the MAT cable length by 0.77 to get the equivalent 26-gauge cable length.This length is used to determine major and minor gauges and to convert minor gauge to major gauge. However, the actual length of MAT cable is used to determine cable loss from Figure 5-16 or Figure 5-17.

Equalizer settings

To determine the equalizer settings for facilities composed of more than two gauges as follows:

1. Select the two longest sections of cable as the major gauges. The remaining sections are minor gauges.
2. Convert a minor gauge to a major gauge.
   a. Select the proper constant from Table 5-24.
   b. Multiply the length of the minor gauge by the constant.
   c. Add the results to the length of the major gauge.
3. Repeat (2) for all minor gauges.
4. Use the results of (3) to enter the tables for 2-gauge facilities (Table 5-21**,** Table 5-22**,** or Table 5-23).
5. Obtain BW, HT, SL, and EQL GN from the table.
6. Compute the cable loss using Figure 5-16 and the actual cable gauges and lengths as entry points, not the converted gauges and lengths obtained in (2) and (3) or from converting MAT cable.

Example: Given a cable facility composed of the following:

1. 8.8 kft of 22-gauge
2. 3.6 kft of 24-gauge
3. 6.6 kft of MAT cable
4. 7.6 kft of 26-gauge

Perform the following steps:

a. Convert 25-gauge MAT cable segment to equivalent length of 26-gauge:

   6.6 kft 25-gauge MAT cable x 0.77 = 5.1 kft equivalent length of 26-gauge.
b. Select 22- and 26-gauge segments as the major gauges.
c. Convert 24-gauge to 22-gauge:

   3.6 kft 24-gauge x 1.17 (24 to 22 conversion constant) = 4.2 kft equivalent length of 22-gauge.

   8.2 kft 22-gauge + 4.2 kft 22-gauge equivalent = 12.4 kft 22-gauge table entry.
d. Add the 25-gauge MAT cable equivalent length to the 26-gauge segment length:

   7.6 kft 26-gauge + 5.1 kft 25-gauge MAT cable equivalent = 12.7 kft 26-gauge table entry.

e. From (c) and (d) above, WL equals:

12.4 kft 22-gauge + 12.7 kft 26-gauge = 25.1 kft or WL = 25 kft.

Round the finer gauge (26) to the nearest whole number:

12.7 kft = 13 kft 26-gauge.

Table 5-22 entry points are:

WL = 25 kft

26-gauge = 13 kft and 22-gauge = 12 kft (rounded to the nearest whole number).

f. From Table 5-22:

BW=14, HT=8, SL=6, and EQL GN = 3.5 dB.

g. Calculate the parameters for determining 1-kHz cable loss from Figure 5-16:

3.6 kft 24-gauge + 8.2 kft 22-gauge + 7.6 kft 26-gauge + 5.1 kft 25-gauge MAT cable equivalent = 24.5 kft total length.

187 ohms 24-gauge + 269 ohms 22-gauge + 633 ohms 26-gauge + 432 ohms 25-gauge MAT cable actual resistance of 6.6 kft (not converted length) = 1521 ohms total resistance.

From Figure 5-16, cable loss equals 10.5 dB.

Nonloaded cable applications—bridged taps (BT)

The procedure for determining equalizer settings for nonloaded cable with BT requires that the BT be converted to an equivalent length of cable (Table 5-25). The gauge of the BT does not matter since loss and amplitude distortion are caused primarily by cable capacitance. The four gauges of cable (19, 22, 24, 26) considered in this BT section have essentially the same capacitance (0.083 µF) per mile. The BT should be converted to an equivalent length as follows:

1. If the BT is connected at the junction of two gauges, convert to the equivalent length of the longer gauge.
2. If not, convert the BT to an equivalent length of gauge to which it connects.
3. If the location of the BT is unknown, convert to the gauge which makes up the largest part of the facility.
4. **Example:** Given a cable facility composed of 12 kft of 26-gauge cable with a 3.6 kft BT:

a. Convert the BT to an equivalent length of 26-gauge cable from Table 5-25. For this BT length, the equivalent 26-gauge length would be approximately 2.4 kft.

b. Add the facility length to the equivalent length of BT:

   12 kft facility length + 2.4 kft = 14.4 kft total facility length 26-gauge.

c. From the appropriate single-gauge table, determine the equalizer settings. Use Table 5-20 with an entry point of 14 kft:

   BW=13, HT=6, SL=2, and EQL GN = 1.1 dB.

d. Determine the cable loss from Figure 5-16:

   Total resistance 12 kft 26-gauge = 1000 ohms.

   Total length 12 kft 26-gauge + 3.6 kft BT = 15.6 kft.

   From Figure 5-16, cable loss = 6.6 dB.

Nonloaded and loaded cable - mixed 19-gauge

Since only small quantities of 19-gauge cable exist in outside plant, it is not included in the 2-gauge tables. When 2-gauge facilities containing 19-gauge cable are encountered, the facility should be reduced to an equivalent single gauge as follows:

1. Select the longer of the two gauges as the major gauge and the shorter as the minor gauge.
2. Obtain the constant from Table 5-24 to convert the minor gauge to the major gauge.
3. Multiply the length of the minor gauge by the constant to obtain the equivalent length of major gauge.
4. Use the result of (3) to enter the appropriate single-gauge table to obtain BW, HT, SL, and EQL GN settings.
5. Determine cable loss (Figure 5-16 or Table 5-26).

Example: Given a cable facility composed of the following:

1. 11 kft of 22 gauge NL
2. 17 kft of 19 gauge NL
   a. Major gauge is 19-gauge; minor gauge is 22-gauge.
   b. From Table 5-24, the constant is 1.19.
   c. Convert 22-gauge to 19-gauge:

      11-kft length of minor gauge (361 ohms) x 1.19 constant = 13.09 kft of equivalent 19-gauge length.

      17 kft 19-gauge (277 ohms) + 13.09 kft 19-gauge equivalent = 30.09 kft (round off to 30 kft).

d. From Table 5-16 for 30 kft of 19-gauge,

   BW=14, HT=7, SL=5, and EQL GN = 2.8 dB.

e. Determine cable loss:

   Total length = 11 + 17 = 28 kft

   Total resistance = 361 + 277 = 638 ohms.

   Cable loss from Figure 5-16 = 6.6 dB.

When the facility contains more than two gauges and the 19-gauge segment is a minor gauge, use the procedure for Nonloaded Cable Applications - More Than Two Gauges. If the 19-gauge segment comprises more than one-half of the total length, the facility should be reduced to a 19-gauge equivalent as described previously. If neither of these cases applies to the facility, consider the 19-gauge segment as a minor gauge and follow the procedure for Nonloaded Cable Applications - More Than Two Gauges, in this section.

Example: Given a cable facility composed of the following:

1. 8 kft of 24-gauge
2. 4 kft of 22-gauge
3. 6 kft of 19-gauge

a. Since the length of the 19-gauge segment is less than one-half of the total length, the major gauges are 24 and 22.

b. Convert 19-gauge to 22-gauge:

   6 kft 19-gauge (minor gauge) x 0.87 (constant from Table 5-24) = 5.22 kft of 22-gauge equivalent.

c. Determine table entry points:

   5.22 kft 22-gauge equivalent + 4.0 kft 22-gauge + 8.0 kft 24-gauge = 17.22 kft.

   Round off to WL = 17 kft.

   8 kft of 24-gauge and 9 kft of 22-gauge.

d. From Table 5-21, 24- and 22-gauge:

   BW=14, HT=6, SL=2, and EQL GN = 1.3 dB.

e. Determine cable loss:

   Total length = 8 + 4 + 6 = 18 kft

Total resistance = 415 + 131 + 98 = 644 ohms.

Cable loss from Figure 5-16 = 5.2 dB.

Loaded cable applications—single- or 2-gauge

NOTE:
If there is significant bridged tap, field measurements must be taken and the equalization settings selected by reference to AT&T 363-205-110.

Prescription equalizer settings for single-gauge facilities of 19-, 22-, 24-, 25-gauge MAT cable, and 26-gauge loaded cable are found in Table 5-27**,** Table 5-28**,** Table 5-29**,** Table 5-30, and Table 5-34, respectively. Settings for facilities composed of two gauges, 24/22, 26/22, or 26/24, may be found in Table 5-31**,**Table 5-32**,** and Table 5-33, respectively. Table selection depends on the gauge(s) of the facility. The following procedure is used to find the settings for single- or 2-gauge facilities:

1. Obtain BW, HT, SL settings, and EQL GN from the appropriate table for the entry nearest to the facility length.
2. The 1-kHz cable loss must be calculated using the loss constants in Table 5-26.

Table entry points for 2-gauge H88 facilities

Table entry points should be determined using the following guidelines:

1. Choose the table entry nearest the actual cable segment lengths. For example, for a cable composed of 7 kft of 26-gauge H88 and 38 kft of 24-gauge H88 (a total of seven H88 loads), the table entry is 6 kft (26-gauge) and 36 kft (24-gauge).
2. If the length of a cable segment rounds off to a lower table entry length and the other segment is exactly midway between entry points, that segment should be rounded up to the higher entry point. For example, for a cable composed of 9 kft of 26-gauge H88 and 38 kft of 24-gauge H88, the table entry is 12 kft (26-gauge) and 36 kft (24-gauge).
3. If the length of a cable segment rounds off to a higher table entry length and the other segment is exactly midway between entry points, that segment should be rounded down to the lower entry point. For example, for a cable composed of 9 kft of 26-gauge H88 and 40 kft of 24-gauge H88, the table entry is 6 kft (26-gauge) and 42 kft (24-gauge).
4. If length of both segments of cable is exactly midway between entry points, round off the coarser gauge to the lower entry point and the finer gauge to the higher entry point. For example, for a cable composed of 9 kft of 26-gauge H88 and 39 kft of 24-gauge H88, the table entry is 12 kft (26-gauge) and 36 kft (24-gauge).

The following examples apply to single- and 2-gauge facilities.

Example 1: Given 31 kft of 24-gauge loaded cable with 3.5 kft end sections:

a. Obtain BW, HT, and SL settings, and EQL GN from Table 5-29 (24-gauge, 30 kft):

   BW=3, HT=4, SL=2, and EQL GN = 2.6 dB.

b. Determine the cable loss:

   31 kft 24H88 x 0.23 loss constant from Table 5-26 = 7.13 dB cable loss.

Example 2: Given a cable facility composed of the following:

1. 21 kft of 26-gauge loaded
2. 20 kft of 24-gauge loaded
3. 2.5 kft end sections
   a. Obtain settings from Table 5-33 (26/24 gauge):

      Entry point = 24 kft of 26-gauge and 18 kft of 24-gauge:

      BW=5, HT=5, SL=11, and EQL GN = 9.5 dB.

   b. Determine the cable loss:

      21 kft 26-gauge x 0.34 constant from Table 5-26 = 7.14 dB loss of 26-gauge segment.

      20 kft 24-gauge x 0.23 constant from Table 5-26 = 4.60 dB loss of 24-gauge segment.

      7.14 dB loss of 26-gauge + 4.60 dB loss of 24-gauge = 11.74 dB total cable loss.

Table 5-10. Four-Wire VF Channel Units—19-Gauge Nonloaded Cable Pre- and Post-Equalization Using 150/600 Ohm Mismatch

See the Notes at the end of the table.

Cable Length (kft)	Effective Cable Transducer Loss, dB											
	Trunk Circuit						Line Circuit					
	3 Links			2 Links			3 Links			2 Links		
	No EQL	MDS2 Equal∗	Both Ends†	No EQL	MDS2 Equal∗	Both Ends†	No EQL	MDS2 Equal∗	Both Ends†	No EQL	MDS2 Equal∗	Both Ends†
1	0.1			0.1			0.1			0.1		
2	0.3			0.3			0.3			0.3		
4	0.5			0.5			0.5			0.5		
6	0.8			0.8			0.8			0.8		
8	1.2	4.0		1.2			1.2			1.2		
8.3	1.2											
10		4.3		1.5	4.3		1.5	4.3		1.5		
10.9				1.7								
12		4.7			4.7			4.7		1.9	4.7	
12.3										1.9		
14		5.0	7.2		5.0			5.0			5.0	
14.7		5.2										
16			7.6		5.5	7.6		5.5	7.6		5.5	
17.7								5.9	7.9			
17.8					5.9	7.9						
18			7.9			7.9			7.9		5.9	7.9
19.3											6.2	
20			8.3			8.3			8.3			8.3

Notes:
1. Disable CU equalization by selecting 0 for bandwidth (BW), height (HT), and slope (SL) options. Select N for the L-N option.
2. TRUNK connects two switches (CO-PBX, CO-ACD, or PBX-PBX). Line connects one end to a nonswitched termination (for example, station set, modem). 3 LINKS: COT and RT connect to cable; COT end of circuit extends beyond foreign CO (for example, foreign exchange trunk completed via an interLATA carrier). 2 LINKS: COT and RT connect to cable, and COT end of circuit does not extend beyond foreign CO (for example, local OPS circuit). 1 LINK: one cable segment (loop or COT metallic extension). Equalization is not required for one-link cable lengths shorter than 18 kft.

∗ Select 150 ohms impedance at the MDS2 end and 600 ohms impedance at the network channel terminating equipment (NCTE).

† Select 150 ohms impedance at both ends.

Table 5-11. Four-Wire VF Channel Units—22-Gauge Nonloaded Cable Pre- and Post-Equalization Using 150/600 Ohm Mismatch

See the Notes at the end of the table.

Cable Length (kft)	Effective Cable Transducer Loss, dB											
	Trunk Circuit						Line Circuit					
	3 Links			2 Links			3 Links			2 Links		
	No EQL	MDS2 Equal∗	Both Ends†	No EQL	MDS2 Equal∗	Both Ends†	No EQL	MDS2 Equal∗	Both Ends†	No EQL	MDS2 Equal∗	Both Ends†
1	0.2			0.2			0.2			0.2		
2	0.5			0.5			0.5			0.5		
4	1.0			1.0			1.0			1.0		
6	1.5			1.5			1.5			1.5		
8	2.0	4.8		2.0			2.0	4.8		2.0		
8.2	2.0											
9.9							2.5					
10		5.3		2.5	5.3			5.3		2.5		
10.5				2.7								
12		5.9			5.9			5.9		3.1	5.9	
14		6.5	9.1		6.5			6.5			6.5	
16			9.7		7.0	9.7		7.0	9.7		7.0	
16.3					7.1							
16.8								7.3				
18			10.3			10.3			10.3		7.7	10.3
18.2											7.7	
20			10.9			10.9			10.9			10.9

Notes:

1. Disable CU equalization by selecting 0 for bandwidth (BW), height (HT), and slope (SL) options. Select N for the L-N option.
2. TRUNK connects two switches (CO-PBX, CO-ACD, or PBX-PBX). LINE connects one end to a nonswitched termination (for example, station set, modem). 3 LINKS: COT and RT connect to cable; COT end of circuit extends beyond foreign CO (for example, foreign exchange trunk completed via an interLATA carrier). 2 LINKS: COT and RT connect to cable, and COT end of circuit does not extend beyond foreign CO (for example, local OPS circuit). 1 LINK: one cable segment (loop or COT metallic extension). Equalization is not required for line circuits with cable shorter than 18 kft. One-link trunk circuits with cable longer than 15.4 kft require MDS2 equalization; transducer loss is listed in the column under LINE CIRCUIT — 2 LINKS.

∗ Select 150 ohms impedance at the MDS2 end and 600 ohms impedance at the network channel terminating equipment (NCTE).

† Select 150 ohms impedance at both ends.

Table 5-12. Four-Wire VF Channel Units—24-Gauge Nonloaded Cable Pre- and Post-Equalization Using 150/600 Ohm Mismatch

See the Notes at the end of the table.

Cable Length (kft)	Effective Cable Transducer Loss, dB											
	Trunk Circuit						Line Circuit					
	3 Links			2 Links			3 Links			2 Links		
	No EQL	MDS2 Equal*	Both Ends†	No EQL	MDS2 Equal*	Both Ends†	No EQL	MDS2 Equal*	Both Ends†	No EQL	MDS2 Equal*	Both Ends†
1	0.4			0.4			0.4			0.4		
2	0.7			0.7			0.7			0.7		
4	1.5			1.5			1.5			1.5		
6	2.2	5.0		2.2			2.2			2.2		
7.7	2.8											
8		5.7		2.9			2.9	5.7		2.9		
9.1							3.3					
9.8		6.3		3.5	6.3							
10		6.4			6.4			6.4		3.6	6.4	
11										4.0		
12		7.2	10.2		7.2			7.2			7.2	
12.7		7.4										
14			11.0		7.9	11.0		7.9	11.0		7.9	
14.7					8.2							
15.3								8.4				
16			11.8			11.8			11.8		8.7	11.8
16.5											8.9	
18			12.5			12.5			12.5		9.5	12.5
18.1			12.6									
20						13.3			13.3			13.3

Notes:

1. Disable CU equalization by selecting 0 for bandwidth (BW), height (HT), and slope (SL) options. Select N for the L-N option.
2. TRUNK connects two switches (CO-PBX, CO-ACD, or PBX-PBX). LINE connects one end to a nonswitched termination (for example, station set, modem). 3 LINKS: COT and RT connect to cable; COT end of circuit extends beyond foreign CO (for example, foreign exchange trunk completed via an interLATA carrier). 2 LINKS: COT and RT connect to cable, and COT end of circuit does not extend beyond foreign CO (for example, local OPS circuit). 1 LINK: one cable segment (loop or COT metallic extension). Equalization is not required for line circuits with cable shorter than 18 kft. One-link trunk circuits with cable longer than 16 kft require MDS2 equalization; transducer loss is listed in the column under LINE CIRCUIT — 2 LINKS.

* Select 150 ohms impedance at the MDS2 end and 600 ohms impedance at the network channel terminating equipment (NCTE).

† Select 150 ohms impedance at both ends.

Table 5-13. Four-Wire VF Channel Units—MAT 25-Gauge Nonloaded Cable Pre- and Post-Equalization Using 150/600 Ohm Mismatch

See the Notes at the end of the table.

Cable Length (kft)	Effective Cable Transducer Loss, dB											
	Trunk Circuit						Line Circuit					
	3 Links			2 Links			3 Links			2 Links		
	No EQL	MDS2 Equal∗	Both Ends†	No EQL	MDS2 Equal∗	Both Ends†	No EQL	MDS2 Equal∗	Both Ends†	No EQL	MDS2 Equal∗	Both Ends†
1	0.5			0.5			0.5			0.5		
2	0.9			0.9			0.9			0.9		
4	1.8			1.8			1.8			1.8		
6	2.6			2.6			2.6			2.6		
8	3.3	6.1		3.3			3.3			3.3		
9.4	3.9											
10		6.9		4.1			4.1	6.9		4.1		
11.2				4.5			4.5					
12		7.6		4.8	7.6			7.6		4.8	7.6	
13.5										5.4		
14		8.4	12.0		8.4			8.4			8.4	
15.2		8.8										
16			12.7		9.1	12.7		9.1			9.1	
17.5					9.7							
18			13.5			13.5		9.9	13.5		9.9	13.5
18.3								10.0				
19.6											10.5	
20			14.3			14.3			14.3			14.3

Notes:

1. Disable CU equalization by selecting 0 for bandwidth (BW), height (HT), and slope (SL) options. Select N for the L-N option.
2. TRUNK connects two switches (CO-PBX, CO-ACD, or PBX-PBX). Line connects one end to a nonswitched termination (for example, station set, modem). 3 LINKS: COT and RT connect to cable; COT end of circuit extends beyond foreign CO (for example, foreign exchange trunk completed via an interLATA carrier). 2 LINKS: COT and RT connect to cable, and COT end of circuit does not extend beyond foreign CO (for example, local OPS circuit). 1 LINK: one cable segment (loop or COT metallic extension). Equalization is not required for one-link cable lengths shorter than 18 kft.

∗ Select 150 ohms impedance at the MDS2 end and 600 ohms impedance at the network channel terminating equipment (NCTE).

† Select 150 ohms impedance at both ends.

Table 5-14. Four-Wire VF Channel Units—26-Gauge Nonloaded Cable Pre- and Post-Equalization Using 150/600 Ohm Mismatch

See the Notes at the end of the table.

Cable Length (kft)	Effective Cable Transducer Loss, dB											
	Trunk Circuit						Line Circuit					
	3 Links			2 Links			3 Links			2 Links		
	No EQL	MDS2 Equal∗	Both Ends†	No EQL	MDS2 Equal∗	Both Ends†	No EQL	MDS2 Equal∗	Both Ends†	No EQL	MDS2 Equal∗	Both Ends†
1	0.6			0.6			0.6			0.6		
2	1.2			1.2			1.2			1.2		
4	2.2			2.2			2.2			2.2		
6	3.2	6.0		3.2			3.2			3.2		
7.3	3.8											
8		7.0		4.2	7.0		4.2	7.0		4.2		
8.6							4.5					
9.1				4.7								
10		7.9	11.5		7.9			7.9		5.1	7.9	
10.1										5.2		
11.6		8.7										
12			12.5		8.9	12.5		8.9			8.9	
13.3					9.6							
14			13.5			13.5		9.9	13.5		9.9	
15											10.4	
15.4			14.2									
16						14.5			14.5		10.9	14.5
17.2						15.1						
17.8									15.4			15.5
19.2												16.1

Notes:

1. Disable CU equalization by selecting 0 for bandwidth (BW), height (HT), and slope (SL) options. Select N for the L-N option.
2. TRUNK connects two switches (CO-PBX, CO-ACD, or PBX-PBX). LINE connects one end to a nonswitched termination (for example, station set, modem). 3 LINKS: COT and RT connect to cable; COT end of circuit extends beyond foreign CO (for example, foreign exchange trunk completed via an interLATA carrier). 2 LINKS: COT and RT connect to cable, and COT end of circuit does not extend beyond foreign CO (for example, local OPS circuit). 1 LINK: one cable segment (loop or COT metallic extension). Equalization is not required for line circuits with cable shorter than 18 kft. One-link trunk circuits with cable longer than 14.3 kft require MDS2 equalization; transducer loss is listed in the column under LINE CIRCUIT — 2 LINKS.

∗ Select 150 ohms impedance at the MDS2 end and 600 ohms impedance at the network channel terminating equipment (NCTE).

† Select 150 ohms impedance at both ends.

Table 5-15. D4 Equivalent Attenuation, Gain, and Loss Parameters for Four-Wire Channel Units

See the Notes at the end of the table.

Channel Unit	Transmit Path (T/R to −8.5 dB TLP Point)				Receive Path (+4.0 dB TLP Point to T1/R1)			
	Gt Insertion Gain (+) or Loss(−)	Attenuator Range (dB)	Input Level at T/R (dB) Min	Input Level at T/R (dB) Max	Gr Insertion Gain (+) or Loss(−)	Attenuator Range (dB)	Output Level at T1/R1 (dB) Min	Output Level at T1/R1 (dB) Max
4FXS*	+6.5	0—16.5	−15.0u*	d+1.0	+2.0	0—16.5	−10.5	+6.0
4DX*	+6.5	0—16.5	−15.0*	0	+2.0	0—16.5	−9.0	+6.0
4TO	+7.5WH†(HI)	0—16.5	−16.0	+0.5	+3.0WH†(HI)	0—16.5	−9.5	+7.0
4TO	+0.5BK†(LO)		−9.0	+7.5	−4.0BK†(LO)		−16.5	0
4ETO*	+6.5BK†(HI)	0—16.5	−15.0*	+1.0	+3.0	0—16.5	−9.5	+7.0
4ETO*	−0.5WH†(LO)		−8.0*	+8.0				
4FXO*	+6.5	0—16.5	−15.0*	+1.0	+2.0	0—16.5	−10.5	+6.0
4TDM	−4.9	0—11.6‡	−3.6	−2.1	−6.1	(None)	−2.1	−2.1
4E&M	+9.0	0—25.5	−17.5	+8.0	+4.5	0—25.5	−17.0	+8.5
PLR	+9.0	0—25.5	−17.5	+8.0	+4.5	0—25.5	−17.0	+8.5

Note: Special service CU input and output levels are recommended values. In some cases, attenuator ranges cover a wider distribution of levels. It is recommended that circuit levels be constrained within the input and output levels specified in the table.

* CUs with active post equalization only in the transmit direction.

† On WORD, use WH/BK instead of HI/LO; see AUA41, AUA141 and AUA44 CU options.

‡ The 4TDM attenuator should use only 0 to 1.5 dB.

Table 5-16. 19-GA Nonloaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings BW	Equalizer Settings HT	Equalizer Settings SL	1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
1	14	0	0	0.0	0.1
2	14	0	0	0.0	0.3
3	14	0	0	0.0	0.4
4	14	0	0	0.0	0.5
5	14	0	0	0.0	0.7
6	14	2	0	0.1	0.8

Table 5-16. 19-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
7	14	1	1	0.4	1.0
8	14	3	0	0.1	1.2
9	14	2	1	0.5	1.3
10	14	4	0	0.2	1.5
11	14	3	1	0.5	1.7
12	14	5	0	0.3	1.9
13	14	4	1	0.6	2.1
14	14	6	0	0.4	2.3
15	14	5	1	0.7	2.5
16	13	5	2	1.1	2.7
17	14	5	2	1.2	2.9
18	13	5	3	1.5	3.1
19	14	6	2	1.3	3.4
20	14	6	2	1.3	3.6
21	14	6	3	1.7	3.8
22	14	7	2	1.4	4.1
23	14	6	4	2.2	4.3
24	14	6	4	2.2	4.5
25	14	7	3	1.9	4.8
26	14	6	5	2.7	5.0
27	14	7	4	2.4	5.3
28	14	7	4	2.4	5.5
29	14	7	5	2.8	5.8
30	14	7	5	2.8	6.0
31	14	7	6	3.3	6.3
32	14	7	6	3.3	6.5
33	14	7	6	3.3	6.8

Table 5-16. 19-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
34	14	7	7	3.9	7.0
35	14	7	8	4.2	7.3
36	14	7	8	4.2	7.6
37	14	7	9	4.7	7.8
38	14	7	10	5.1	8.1
39	14	7	10	5.5	8.3
40	14	7	10	5.5	8.6
41	14	8	8	4.4	8.8
42	14	8	9	4.9	9.1
43	14	8	9	4.9	9.3
44	14	8	10	5.3	9.6
45	14	8	11	5.7	9.8
46	14	8	12	6.1	10.1
47	14	8	13	6.5	10.3
48	14	8	14	6.9	10.6
49	14	9	12	6.1	10.8
50	14	9	13	6.6	11.1
51	14	9	14	7.0	11.3
52	14	9	15	7.4	11.6
53	14	9	15	7.4	11.8
54	14	10	13	6.8	12.1
55	14	10	14	7.2	12.3
56	14	10	15	7.5	12.6
57	14	10	15	7.5	12.8
58	14	11	14	7.4	13.1
59	14	11	15	7.7	13.3
60	14	11	15	7.7	13.6

Table 5-16. 19-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
61	14	11	15	7.7	13.8
62	14	12	14	7.6	14.0
63	14	12	15	8.0	14.3
64	14	12	15	8.0	14.5
65	14	12	15	8.0	14.8
66	14	13	15	8.2	15.0

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-17. 22-GA Nonloaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
1	14	0	0	0.0	0.2
2	14	0	0	0.0	0.5
3	14	0	0	0.0	0.7
4	14	0	0	0.0	1.0
5	14	0	0	0.0	1.2
6	14	1	1	0.4	1.5
7	14	2	0	0.1	1.7
8	14	3	0	0.1	2.0
9	13	2	1	0.5	2.2
10	14	4	0	0.2	2.5
11	14	5	0	0.3	2.8
12	14	4	1	0.6	3.1
13	14	6	0	0.4	3.4
14	14	5	1	0.7	3.6
15	13	5	2	1.1	3.9
16	14	6	1	0.8	4.2
17	13	5	3	1.5	4.6
18	14	6	2	1.3	4.9
19	13	6	3	1.6	5.2
20	14	7	2	1.4	5.5
21	14	6	4	2.2	5.8
22	14	7	3	1.9	6.1
23	14	6	5	2.7	6.5
24	14	7	4	2.4	6.8
25	14	7	5	2.8	7.1

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-18. 24-GA Nonloaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
1	14	0	0	0.0	0.4
2	14	0	0	0.0	0.7
3	14	0	0	0.0	1.1
4	14	0	0	0.0	1.5
5	14	2	0	0.1	1.8
6	14	2	0	0.1	2.2
7	13	3	0	0.1	2.5
8	14	3	0	0.1	2.9
9	14	3	1	0.6	3.6
10	14	3	1	0.6	3.6
11	14	4	1	0.6	4.0
12	14	6	0	0.4	4.3
13	14	5	1	0.7	4.7
14	14	6	1	0.8	5.1
15	13	5	3	1.5	5.5
16	14	6	2	1.3	5.9
17	13	6	3	1.6	6.3
18	14	7	2	1.4	6.7
19	14	8	2	1.6	7.5
20	14	8	2	1.6	7.5
21	14	7	4	2.4	7.9
22	14	7	5	2.8	8.4
23	14	8	4	2.5	8.8
24	14	8	5	3.0	9.2
25	14	8	5	3.0	9.6
26	14	9	5	3.1	10.1

Table 5-18. 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
27	14	9	6	3.6	10.5
28	14	9	7	4.2	11.0
29	14	9	8	4.5	11.4
30	14	10	7	4.3	11.8
31	14	10	9	5.1	12.3
32	14	10	10	5.6	12.7
33	14	11	9	5.3	13.2
34	13	11	13	6.6	13.6
35	14	12	9	5.6	14.0
36	13	12	13	6.7	14.5
37	13	12	15	7.5	14.9
38	13	13	12	6.5	15.4

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-19. 25-GA (MAT) Nonloaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
1	14	0	0	0.0	0.5
2	14	0	0	0.0	0.9
3	14	0	0	0.0	1.3
4	14	0	0	0.0	1.8
5	14	2	0	0.1	2.2
6	14	2	0	0.1	2.6
7	14	2	0	0.1	2.9
8	14	2	1	0.5	3.3
9	14	2	1	0.5	3.7

Table 5-19. 25-GA (MAT) Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
10	14	5	0	0.3	4.1
11	14	5	0	0.3	4.4
12	14	5	1	0.7	4.8
13	14	5	1	0.7	5.2
14	14	5	2	1.2	5.6
15	14	6	2	1.3	5.9
16	14	6	2	1.3	6.3
17	14	7	2	1.4	6.7
18	14	7	2	1.4	7.1
19	14	7	4	2.3	7.5
20	14	7	4	2.3	7.9
21	14	7	5	2.8	8.2
22	14	8	5	3.0	8.7
23	14	8	5	3.0	9.0
24	14	8	7	4.1	9.5
25	14	8	7	4.1	9.8
26	14	9	7	4.2	10.3
27	14	9	7	4.2	10.6
28	14	10	8	4.7	11.0
29	14	10	8	4.7	11.4
30	14	11	8	4.9	11.8

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-20. 26-GA Nonloaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
1	14	0	0	0.0	0.6
2	14	1	0	0.0	1.2
3	14	2	0	0.1	1.7
4	13	1	0	0.0	2.2
5	15	1	0	0.1	2.7
6	14	2	0	0.1	3.2
7	13	3	0	0.1	3.7
8	13	2	1	0.5	4.2
9	13	3	1	0.5	4.7
10	14	5	0	0.3	5.1
11	14	6	0	0.4	5.6
12	14	5	1	0.7	6.1
13	14	6	1	0.8	6.6
14	13	6	2	1.1	7.1
15	13	6	3	1.6	7.6
16	14	7	2	1.4	8.1
17	14	7	3	1.9	8.6
18	14	8	2	1.6	9.1
19	14	8	3	2.1	9.7
20	14	8	4	2.5	10.2
21	14	8	5	3.0	10.7
22	14	8	6	3.5	11.3
23	14	9	6	3.6	11.8
24	14	9	7	4.2	12.4
25	14	11	5	3.5	12.9

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 9					
7	2	14	4	0	0.2
8	1	14	4	0	0.2
WL = 10					
5	5	13	3	1	0.5
6	4	13	3	1	0.5
7	3	13	3	1	0.5
8	2	13	3	1	0.5
9	1	14	3	1	0.6
WL = 11					
2	9	14	5	0	0.3
3	8	14	5	0	0.3
4	7	14	5	0	0.3
5	6	14	5	0	0.3
6	5	14	5	0	0.3
7	4	14	5	0	0.3
8	3	14	5	0	0.3
9	2	13	4	1	0.5
10	1	13	4	1	0.5
WL = 12					
1	11	14	4	1	0.6
2	10	14	4	1	0.6
3	9	14	4	1	0.6
4	8	14	4	1	0.6
5	7	14	4	1	0.6
6	6	14	4	1	0.6
7	5	14	4	1	0.6
8	4	14	4	1	0.6
9	3	14	4	1	0.6
10	2	14	6	0	0.4
11	1	14	6	0	0.4
WL = 13					
1	12	14	6	0	0.4
2	11	14	6	0	0.4
3	10	14	6	0	0.4
4	9	14	5	1	0.7
5	8	14	5	1	0.7
6	7	14	5	1	0.7
7	6	14	5	1	0.7
8	5	14	5	1	0.7

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
9	4	14	5	1	0.7
10	3	14	5	1	0.7
11	2	14	5	1	0.7
12	1	14	5	1	0.7
WL = 14					
1	13	14	5	1	0.7
2	12	14	5	1	0.7
3	11	14	4	2	1.1
4	10	14	4	2	1.1
5	9	14	4	2	1.1
6	8	14	4	2	1.1
7	7	14	4	2	1.1
8	6	12	5	2	1.0
9	5	13	5	2	1.1
10	4	13	5	2	1.1
11	3	13	5	2	1.1
12	2	13	5	2	1.1
13	1	14	7	0	0.5
WL = 15					
1	14	13	5	2	1.1
2	13	14	6	1	0.8
3	12	14	6	1	0.8
4	11	14	6	1	0.8
5	10	14	6	1	0.8
6	9	14	6	1	0.8
7	8	14	6	1	0.8
8	7	14	6	1	0.8
9	6	14	6	1	0.8
10	5	14	6	1	0.8
11	4	14	6	1	0.8
12	3	14	5	2	1.2
13	2	14	5	2	1.2
14	1	14	5	2	1.2
WL = 16					
1	15	14	5	2	1.2
2	14	14	5	2	1.2
3	13	14	5	2	1.2
4	12	13	5	3	1.5
5	11	13	5	3	1.5
6	10	13	5	3	1.5
7	9	13	5	3	1.5

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
8	8	13	5	3	1.5
9	7	13	5	3	1.5
10	6	13	5	3	1.5
11	5	13	6	2	1.1
12	4	13	6	2	1.1
13	3	14	6	2	1.3
14	2	14	6	2	1.3
15	1	14	6	2	1.3
WL = 17					
1	16	13	5	3	1.5
2	15	14	6	2	1.3
3	14	14	6	2	1.3
4	13	14	6	2	1.3
5	12	14	6	2	1.3
6	11	14	6	2	1.3
7	10	14	6	2	1.3
8	9	14	6	2	1.3
9	8	14	6	2	1.3
10	7	14	6	2	1.3
11	6	14	6	2	1.3
12	5	14	6	2	1.3
13	4	14	6	2	1.3
14	3	14	6	2	1.3
15	2	13	6	3	1.6
16	1	13	6	3	1.6
WL = 18					
1	17	14	6	2	1.3
2	16	14	6	2	1.3
3	15	13	5	4	2.0
4	14	13	5	4	2.0
5	13	13	6	3	1.6
6	12	13	6	3	1.6
7	11	13	6	3	1.6
8	10	13	6	3	1.6
9	9	13	6	3	1.6
10	8	14	6	3	1.7
11	7	14	6	3	1.7
12	6	14	6	3	1.7
13	5	14	6	3	1.7
14	4	14	6	3	1.7
15	3	14	7	2	1.4

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
16	2	14	7	2	1.4
17	1	14	7	2	1.4
WL = 19					
1	18	14	6	3	1.7
2	17	14	6	3	1.7
3	16	14	6	3	1.7
4	15	14	6	3	1.7
5	14	14	7	2	1.4
6	13	14	7	2	1.4
7	12	14	7	2	1.4
8	11	14	7	2	1.4
9	10	14	7	2	1.4
10	9	14	7	2	1.4
11	8	14	7	2	1.4
12	7	14	7	2	1.4
13	6	14	7	2	1.4
14	5	13	6	4	2.1
15	4	13	6	4	2.1
16	3	14	6	4	2.2
17	2	14	6	4	2.2
18	1	14	6	4	2.2
WL = 20					
1	19	14	7	2	1.4
2	18	14	7	2	1.4
3	17	14	7	2	1.4
4	16	13	6	4	2.1
5	15	13	6	4	2.1
6	14	14	6	4	2.2
7	13	14	6	4	2.2
8	12	14	6	4	2.2
9	11	14	6	4	2.2
10	10	14	6	4	2.2
11	9	14	6	4	2.2
12	8	14	7	3	1.9
16	3	14	6	4	2.2
17	2	14	6	4	2.2
18	1	14	6	4	2.2
19	1	14	8	2	1.6

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 21					
1	20	14	6	4	2.2
2	19	14	6	4	2.2
3	18	14	6	4	2.2
4	17	14	7	3	1.9
5	16	14	7	3	1.9
6	15	14	7	3	1.9
7	14	14	7	3	1.9
8	13	14	7	3	1.9
9	12	14	7	3	1.9
10	11	14	7	3	1.9
11	10	14	7	3	1.9
12	9	14	8	2	1.6
13	8	14	8	2	1.6
14	7	14	8	2	1.6
15	6	14	8	2	1.6
16	5	14	8	2	1.6
17	4	14	7	4	2.4
18	3	14	7	4	2.4
19	2	14	7	4	2.4
20	1	14	7	4	2.4
WL = 22					
1	21	14	7	3	1.9
2	20	14	7	3	1.9
3	19	14	7	3	1.9
4	18	14	7	3	1.9
5	17	14	6	5	2.7
6	16	14	6	5	2.7
7	15	14	6	5	2.7
8	14	14	7	4	2.4
9	13	14	7	4	2.4
10	12	14	7	4	2.4
11	11	14	7	4	2.4
12	10	14	7	4	2.4
13	9	14	7	4	2.4
14	8	14	7	4	2.4
15	7	14	7	4	2.4
16	6	14	7	4	2.4
17	5	14	8	3	2.1
18	4	14	8	3	2.1
19	3	14	8	3	2.1

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
20	2	14	8	3	2.1
21	1	14	8	3	2.1
WL = 23					
1	22	14	7	4	2.4
2	21	14	7	4	2.4
3	20	14	7	4	2.4
4	19	14	7	4	2.4
5	18	14	7	4	2.4
6	17	14	7	4	2.4
7	16	14	7	4	2.4
8	15	14	7	4	2.4
9	14	14	7	4	2.4
10	13	14	7	4	2.4
11	12	14	8	3	2.1
12	11	14	8	3	2.1
13	10	14	8	3	2.1
14	9	14	8	3	2.1
15	8	14	7	5	2.8
16	7	14	7	5	2.8
17	6	14	7	5	2.8
18	5	14	7	5	2.8
19	4	14	7	5	2.8
20	3	14	7	5	2.8
21	2	14	8	4	2.5
22	1	14	8	4	2.5

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 24					
1	23	14	7	4	2.4
2	22	14	7	4	2.4
3	21	14	7	4	2.4
4	20	14	8	3	2.1
5	19	14	7	5	2.8
6	18	14	7	5	2.8
7	17	14	7	5	2.8
8	16	14	7	5	2.8
9	15	14	7	5	2.8
10	14	14	7	5	2.8
11	13	14	7	5	2.8
12	12	14	7	5	2.8
13	11	14	7	5	2.8
14	10	14	7	6	3.3
15	9	14	8	4	2.5
16	8	14	8	4	2.5
17	7	14	8	4	2.5
18	6	14	8	4	2.5
19	5	14	8	4	2.5
20	4	14	8	4	2.5
21	3	14	8	4	2.5
22	2	14	8	4	2.5
23	1	14	8	4	2.5

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 25					
1	24	14	7	5	2.8
2	23	14	7	5	2.8
3	22	14	7	5	2.8
4	21	14	7	5	2.8
5	20	14	7	5	2.8
6	19	14	7	5	2.8
7	18	14	7	6	3.3
8	17	14	7	6	3.3
9	16	14	7	6	3.3
10	15	14	8	4	2.5
11	14	14	8	4	2.5
12	13	14	8	4	2.5
13	12	14	8	4	2.5
14	11	14	8	4	2.5
15	10	14	8	4	2.5
16	9	14	8	4	2.5
17	8	14	8	5	3.0
18	7	14	8	5	3.0
19	6	14	8	5	3.0
20	5	14	8	5	3.0
21	4	14	8	5	3.0
22	3	14	8	5	3.0
23	2	14	8	5	3.0
24	1	14	8	5	3.0

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 26					
1	25	14	7	6	3.3
2	24	14	7	6	3.3
3	23	14	7	6	3.3
4	22	14	7	6	3.3
5	21	14	8	4	2.5
6	20	14	8	4	2.5
7	19	14	8	4	2.5
8	18	14	8	4	2.5
9	17	14	8	4	2.5
10	16	14	7	7	3.9
11	15	14	7	7	3.9
12	14	14	8	5	3.0
13	13	14	8	5	3.0
14	12	14	8	5	3.0
15	11	14	8	5	3.0
16	10	14	8	5	3.0
17	9	14	8	5	3.0
18	8	14	8	5	3.0
19	7	14	8	6	3.5
20	6	14	8	6	3.5
21	5	14	8	6	3.5
22	4	14	8	6	3.5
23	3	14	8	6	3.5
24	2	14	9	5	3.1
25	1	14	9	5	3.1

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 27					
1	26	14	8	4	2.5
2	25	14	7	6	3.3
3	24	14	7	7	3.9
4	23	14	7	7	3.9
5	22	14	7	7	3.9
6	21	14	7	7	3.9
7	20	14	8	5	3.0
8	19	14	8	5	3.0
9	18	14	8	5	3.0
10	17	14	8	5	3.0
11	16	14	8	5	3.0
12	15	14	8	5	3.0
13	14	14	8	5	3.0
14	13	14	8	6	3.5
15	12	14	8	6	3.5
16	11	14	8	6	3.5
17	10	14	8	6	3.5
18	9	14	9	5	3.1
19	8	14	9	5	3.1
20	7	14	9	5	3.1
21	6	14	9	5	3.1
22	5	14	9	5	3.1
23	4	14	8	7	4.1
24	3	14	8	7	4.1
25	2	14	9	6	3.6
26	1	14	9	6	3.6

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	**22-GA**	**BW**	**HT**	**SL**	
WL = 28					
1	27	14	8	5	3.0
2	26	14	8	5	3.0
3	25	14	8	5	3.0
4	24	14	8	5	3.0
5	23	14	8	5	3.0
6	22	14	8	5	3.0
7	21	14	8	5	3.0
8	20	14	8	6	3.5
9	19	14	8	6	3.5
10	18	14	8	6	3.5
11	17	14	8	6	3.5
12	16	14	8	6	3.5
13	15	14	8	6	3.5
14	14	14	9	5	3.1
15	13	14	9	5	3.1
16	12	14	8	7	4.1
17	11	14	8	7	4.1
18	10	14	8	7	4.1
19	9	14	9	6	3.6
20	8	14	9	6	3.6
21	7	14	9	6	3.6
22	6	14	9	6	3.5
23	5	14	9	6	3.6
24	4	14	9	6	3.6
25	3	14	10	5	3.3
26	2	14	10	5	3.3
27	1	14	9	7	4.2

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 29					
1	28	14	8	5	3.0
2	27	14	8	6	3.5
3	26	14	8	6	3.5
4	25	14	8	6	3.5
5	14	14	8	6	3.5
6	23	14	8	6	3.5
7	22	14	8	6	3.5
8	21	14	8	6	3.5
9	20	14	8	6	3.5
10	19	14	8	6	3.5
11	18	14	8	7	4.1
12	17	14	8	7	4.1
13	16	14	8	7	4.1
14	15	14	9	6	3.6
15	14	14	9	6	3.6
16	13	14	9	6	3.6
17	12	14	9	6	3.6
18	11	14	9	6	3.6
19	10	14	10	5	3.3
20	9	14	9	7	4.2
21	8	14	9	7	4.2
22	7	14	9	7	4.2
23	6	14	9	7	4.2
24	5	14	9	7	4.2
25	4	14	9	7	4.2
26	3	14	10	6	3.8
27	2	14	10	6	3.8
28	1	14	10	6	3.8

Table 5-21. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 30					
1	29	14	8	6	3.5
2	28	14	8	6	3.5
3	27	14	8	6	3.5
4	26	14	8	6	3.5
5	25	14	8	7	4.1
6	24	14	8	7	4.1
7	23	14	8	7	4.1
8	22	14	8	7	4.1
9	21	14	8	7	4.1
10	20	14	8	7	4.1
11	19	14	9	6	3.6
12	18	14	9	6	3.6
13	17	14	9	6	3.6
14	16	14	8	8	4.4
15	15	14	9	7	4.2
16	14	14	9	7	4.2
17	13	14	9	7	4.2
18	12	14	9	7	4.2
19	11	14	9	7	4.2
20	10	14	10	6	3.8
21	9	14	10	6	3.8
22	8	14	10	6	3.8
23	7	14	10	6	3.8
24	6	14	10	6	3.8
25	5	14	9	9	5.0
26	4	14	9	9	5.0
27	3	14	10	7	4.3
28	2	14	10	7	4.3
29	1	14	10	7	4.3

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
WL = 7					
5	2	13	3	0	0.1
6	1	13	3	0	0.1
WL = 8					
4	4	14	3	0	0.1
5	3	14	3	0	0.1
6	2	14	3	0	0.1
7	1	12	2	1	0.5
WL = 9					
3	6	14	4	0	0.2
4	5	14	4	0	0.2
5	4	14	4	0	0.2
6	3	14	4	0	0.2
7	2	14	4	0	0.2
8	1	14	4	0	0.2
WL = 10					
2	8	13	3	1	0.5
3	7	14	3	1	0.6
4	6	14	3	1	0.6
5	5	14	3	1	0.6
6	4	14	3	1	0.6
7	3	14	3	1	0.6
8	2	14	5	0	0.3
9	1	14	5	0	0.3
WL = 11					
1	10	14	5	0	0.3
2	9	14	5	0	0.3
3	8	13	4	1	0.5
4	7	13	4	1	0.5
5	6	13	4	1	0.5
6	5	14	4	1	0.6

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**22-GA**	**BW**	**HT**	**SL**	
WL = 7					
5	2	13	3	0	0.1
WL = 12					
1	11	14	4	1	0.6
2	10	14	4	1	0.6
3	9	14	4	1	0.6
4	8	14	6	0	0.4
5	7	14	6	0	0.4
6	6	14	6	0	0.4
7	5	14	6	0	0.4
8	4	14	6	0	0.4
9	3	14	6	0	0.4
10	2	14	5	1	0.7
11	1	14	5	1	0.7
WL = 13					
1	12	14	6	0	0.4
2	11	14	5	1	0.7
3	10	14	5	1	0.7
4	9	14	5	1	0.7
5	8	14	5	1	0.7
6	7	14	5	1	0.7
7	6	14	5	1	0.7
8	5	14	5	1	0.7
9	4	14	4	2	1.1
10	3	12	5	2	1.0
11	2	13	5	2	1.1
12	1	14	7	0	0.5
WL = 14					
1	13	14	4	2	1.1
2	12	12	4	3	1.4
3	11	13	5	2	1.1
4	10	13	5	2	1.1
5	9	14	7	0	0.5
6	8	14	7	0	0.5
7	7	14	6	1	0.8
8	6	14	6	1	0.8
9	5	14	6	1	0.8

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
10	4	14	6	1	0.8
11	3	14	6	1	0.8
12	2	14	5	2	1.2
13	1	13	5	3	1.5
WL = 15					
1	14	14	6	1	0.8
2	13	14	6	1	0.8
3	12	14	6	1	0.8
4	11	14	5	2	1.2
5	10	14	5	2	1.2
6	9	14	5	2	1.2
7	8	13	5	3	1.5
8	7	13	5	3	1.5
9	6	13	5	3	1.5
10	5	13	6	2	1.1
11	4	13	6	2	1.1
12	3	14	7	1	0.9
13	2	14	7	1	0.9
14	1	14	7	1	0.9
WL = 16					
1	15	14	5	2	1.2
2	14	13	5	3	1.5
3	13	13	5	3	1.5
4	12	13	6	2	1.1
5	11	14	6	2	1.3
6	10	14	6	2	1.3
7	9	14	6	2	1.3
8	8	14	7	1	0.9
9	7	14	7	1	0.9
10	6	14	7	1	0.9
11	5	14	6	2	1.3
12	4	13	6	3	1.6
13	3	13	6	3	1.6
14	2	13	6	3	1.6
15	1	14	7	2	1.4

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
WL = 17					
1	16	14	6	2	1.3
2	15	14	6	2	1.3
3	14	14	6	2	1.3
4	13	14	6	2	1.3
5	12	14	6	2	1.3
6	11	13	6	3	1.6
7	10	13	6	3	1.6
8	9	13	6	3	1.6
9	8	13	6	3	1.6
10	7	14	6	3	1.7
11	6	14	7	2	1.4
12	5	14	7	2	1.4
13	4	14	7	2	1.4
14	3	14	8	1	1.1
15	2	14	8	1	1.1
16	1	13	7	3	1.7
WL = 18					
1	17	13	5	4	2.0
2	16	13	6	3	1.6
3	15	14	6	3	1.7
4	14	14	6	3	1.7
5	13	14	6	3	1.7
6	12	14	7	2	1.4
7	11	14	7	2	1.4
8	10	14	7	2	1.4
9	9	14	7	2	1.4
10	8	14	7	2	1.4
11	7	13	6	4	2.1
12	6	13	7	3	1.7
13	5	13	7	3	1.7
14	4	14	7	3	1.9
15	3	14	7	3	1.9
16	2	14	7	3	1.9
17	1	14	8	2	1.6

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
WL = 19					
1	18	14	6	3	1.7
2	17	14	7	2	1.4
3	16	14	7	2	1.4
4	15	14	7	2	1.4
5	14	13	6	4	2.1
6	13	14	6	4	2.2
7	12	14	6	4	2.2
8	11	14	6	4	2.2
9	10	14	7	3	1.9
10	9	14	7	3	1.9
11	8	14	7	3	1.9
12	7	14	7	3	1.9
13	6	14	8	2	1.6
14	5	14	8	2	1.6
15	4	14	8	2	1.6
16	3	14	7	4	2.4
17	2	14	7	4	2.4
18	1	14	9	2	1.7
WL = 20					
1	19	14	7	2	1.4
2	18	14	6	4	2.2
3	17	14	6	4	2.2
4	16	14	6	4	2.2
5	15	14	7	3	1.9
6	14	14	7	3	1.9
7	13	14	7	3	1.9
8	12	14	7	3	1.9
9	11	14	8	2	1.6
10	10	14	8	2	1.6
11	9	14	7	4	2.4
12	8	14	7	4	2.4
13	7	14	7	4	2.4
14	6	14	7	4	2.4
15	5	14	9	2	1.7
16	4	14	8	3	2.1
17	3	14	8	3	2.1
18	2	14	8	3	2.1
19	1	13	8	4	2.3

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
WL = 21					
1	20	14	6	4	2.2
2	19	14	7	3	1.9
3	18	14	7	3	1.9
4	17	14	7	3	1.9
5	16	14	6	5	2.7
6	15	14	6	5	2.7
7	14	14	7	4	2.4
8	13	14	7	4	2.4
9	12	14	7	4	2.4
10	11	14	7	4	2.4
11	10	14	8	3	2.1
12	9	14	8	3	2.1
13	8	14	8	3	2.1
14	7	14	8	3	2.1
15	6	14	8	3	2.1
16	5	13	8	4	2.3
17	4	14	8	4	2.5
18	3	14	8	4	2.5
19	2	14	8	4	2.5
20	1	13	8	5	2.8

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**22-GA**	**BW**	**HT**	**SL**	
WL = 22					
1	21	14	7	3	1.9
2	20	14	6	5	2.7
3	19	14	7	4	2.4
4	18	14	7	4	2.4
5	17	14	7	4	2.4
6	16	14	7	4	2.4
7	15	14	7	4	2.4
8	14	14	8	3	2.1
9	13	14	8	3	2.1
10	12	14	7	5	2.8
11	11	14	7	5	2.8
12	10	14	7	5	2.8
13	9	14	8	4	2.5
14	8	14	8	4	2.5
15	7	14	8	4	2.5
16	6	14	8	4	2.5
17	5	13	8	5	2.8
18	4	14	8	5	3.0
19	3	14	9	4	2.7
20	2	14	9	4	2.7
21	1	14	9	4	2.7

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		**Equalizer Settings**			**1 kHz Equalizer Gain (dB)**
26-GA	**22-GA**	**BW**	**HT**	**SL**	
WL = 23					
1	22	14	7	4	2.4
2	21	14	7	4	2.4
3	20	14	7	4	2.4
4	19	14	7	4	2.4
5	18	14	7	5	2.8
6	17	14	7	5	2.8
7	16	14	7	5	2.8
8	15	14	7	5	2.8
9	14	14	7	5	2.8
10	13	14	8	4	2.5
11	12	14	8	4	2.5
12	11	14	8	4	2.5
13	10	14	8	4	2.5
14	9	14	8	5	3.0
15	8	14	8	5	3.0
16	7	14	9	4	2.7
17	6	14	9	4	2.7
18	5	14	9	4	2.7
19	4	14	8	6	3.5
20	3	14	9	5	3.1
21	2	14	9	5	3.1
22	1	14	10	4	2.8

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**22-GA**	**BW**	**HT**	**SL**	
WL = 24					
1	23	14	7	4	2.4
2	22	14	7	5	2.8
3	21	14	7	5	2.8
4	20	14	7	5	2.8
5	19	14	7	5	2.8
6	18	14	7	6	3.3
7	17	14	7	6	3.3
8	16	14	8	4	2.5
9	15	14	8	4	2.5
10	14	14	8	4	2.5
11	13	14	8	5	3.0
12	12	14	8	5	3.0
13	11	14	9	4	2.7
14	10	14	9	4	2.7
15	9	14	8	6	3.5
16	8	14	9	5	3.1
17	7	14	9	5	3.1
18	6	14	10	4	2.8
19	5	14	10	4	2.8
20	4	14	9	6	3.6
21	3	14	9	6	3.6
22	2	14	10	5	3.3
23	1	14	10	5	3.3

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**22-GA**	**BW**	**HT**	**SL**	
WL = 25					
1	24	14	7	5	2.8
2	23	14	7	5	2.8
3	22	14	7	6	3.3
4	21	14	7	6	3.3
5	20	14	7	6	3.3
6	19	14	7	6	3.3
7	18	14	7	7	3.9
8	17	14	7	7	3.9
9	16	14	8	5	3.0
10	15	14	8	5	3.0
11	14	14	8	5	3.0
12	13	14	8	6	3.5
13	12	14	8	6	3.5
14	11	14	9	5	3.1
15	10	14	10	4	2.8
16	9	14	10	4	2.8
17	8	14	9	6	3.6
18	7	14	9	6	3.6
19	6	14	10	5	3.3
20	5	14	10	5	3.3
21	4	14	10	5	3.3
22	3	14	10	6	3.8
23	2	14	10	6	3.8
24	1	14	10	6	3.8

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
WL = 26					
1	25	14	7	6	3.3
2	24	14	7	6	3.3
3	23	14	7	6	3.3
4	22	14	7	7	3.9
5	21	14	7	7	3.9
6	20	14	8	5	3.0
7	19	14	8	5	3.0
8	18	14	8	5	3.0
9	17	14	8	6	3.5
10	16	14	8	6	3.5
11	15	14	9	5	3.1
12	14	14	9	5	3.1
13	13	14	8	7	4.1
14	12	14	9	6	3.6
15	11	14	9	6	3.6
16	10	14	10	5	3.3
17	9	14	10	5	3.3
18	8	14	9	7	4.2
19	7	14	10	6	3.8
20	6	14	10	6	3.8
21	5	14	11	5	3.5
22	4	14	11	5	3.5
23	3	13	10	8	4.3
24	2	14	10	7	4.3
25	1	14	11	6	4.0

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**22-GA**	**BW**	**HT**	**SL**	
WL = 27					
1	26	14	7	7	3.9
2	25	14	7	7	3.9
3	24	14	8	5	3.0
4	23	14	8	5	3.0
5	22	14	8	5	3.0
6	21	14	8	5	3.0
7	20	14	8	6	3.5
8	19	14	8	6	3.5
9	18	14	8	6	3.5
10	17	14	9	5	3.1
11	16	14	8	7	4.1
12	15	14	9	6	3.6
13	14	14	9	6	3.6
14	13	14	10	5	3.3
15	12	14	9	7	4.2
16	11	14	10	6	3.8
17	10	14	10	6	3.8
18	9	14	11	5	3.5
19	8	14	11	5	3.5
20	7	14	10	7	4.3
21	6	13	10	9	4.8
22	5	14	11	6	4.0
23	4	14	11	6	4.0
24	3	14	11	6	4.0
25	2	13	11	8	4.5
26	1	14	11	7	4.5

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**22-GA**	**BW**	**HT**	**SL**	
WL = 28					
1	27	14	8	5	3.0
2	26	14	8	5	3.0
3	25	14	8	6	3.5
4	24	14	8	6	3.5
5	23	14	8	6	3.5
6	22	14	8	6	3.5
7	21	14	8	6	3.5
8	20	14	8	7	4.1
9	19	14	8	7	4.1
10	18	14	9	6	3.6
11	17	14	9	6	3.6
12	16	14	9	7	4.2
13	15	14	9	7	4.2
14	14	14	10	6	3.8
15	13	14	10	6	3.8
16	12	14	11	5	3.5
17	11	14	10	7	4.3
18	10	13	10	9	4.8
19	9	14	11	6	4.0
20	8	14	11	6	4.0
21	7	13	11	8	4.5
22	6	13	11	8	4.5
23	5	14	11	7	4.5
24	4	13	11	9	4.9
25	3	13	11	9	4.9
26	2	13	11	10	5.3
27	1	13	11	10	5.3

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**22-GA**	**BW**	**HT**	**SL**	
WL = 29					
1	28	14	8	6	3.5
2	27	14	8	6	3.5
3	26	14	8	6	3.5
4	25	14	8	6	3.5
5	24	14	8	7	4.1
6	23	14	8	7	4.1
7	22	14	8	7	4.1
8	21	14	8	8	4.4
9	20	14	8	8	4.4
10	19	14	9	7	4.2
11	18	14	9	7	4.2
12	17	14	10	6	3.8
13	16	14	10	6	3.8
14	15	14	10	7	4.3
15	14	14	10	7	4.3
16	13	14	11	6	4.0
17	12	14	11	6	4.0
18	11	13	10	10	5.2
19	10	14	11	7	4.5
20	9	14	11	7	4.5
21	8	13	11	9	4.9
22	7	13	11	10	5.3
23	6	13	11	10	5.3
24	5	13	11	11	5.8
25	4	13	11	11	5.8
26	3	14	12	7	4.7
27	2	14	12	7	4.7
28	1	13	12	9	5.1

Table 5-22. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
WL = 30					
1	29	14	8	6	3.5
2	28	14	8	7	4.1
3	27	14	8	7	4.1
4	26	14	8	7	4.1
5	25	14	8	8	4.4
6	24	14	8	8	4.4
7	23	14	8	8	4.4
8	22	14	8	9	4.9
9	21	14	9	7	4.2
10	20	14	9	7	4.2
11	19	14	9	8	4.5
12	18	14	9	9	5.0
13	17	14	10	7	4.3
14	16	14	10	7	4.3
15	15	14	10	8	4.7
16	14	14	10	9	5.1
17	13	14	11	7	4.5
18	12	13	11	9	4.9
19	11	14	12	6	4.2
20	10	13	11	10	5.3
21	9	13	11	11	5.8
22	8	13	12	8	4.6
23	7	13	12	9	5.1
24	6	13	12	9	5.1
25	5	13	12	9	5.1
26	4	13	12	10	5.5
27	3	13	12	10	5.5
28	2	13	12	11	5.9

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**24-GA**	**BW**	**HT**	**SL**	
WL = 6					
5	1	14	2	0	0.1
WL = 7					
3	4	13	3	0	0.1
4	3	13	3	0	0.1
5	2	13	3	0	0.1
6	1	13	3	0	0.1
WL = 8					
1	7	14	3	0	0.1
2	6	12	2	1	0.5
3	5	12	2	1	0.5
4	4	12	2	1	0.5
5	3	12	2	1	0.5
6	2	12	2	1	0.5
7	1	12	2	1	0.5
WL = 9					
1	8	14	4	0	0.2
2	7	14	4	0	0.2
3	6	14	4	0	0.2
4	5	14	4	0	0.2
5	4	14	4	0	0.2
6	3	14	4	0	0.2
7	2	14	4	0	0.2
8	1	13	3	1	0.5
WL = 10					
1	9	14	3	1	0.6
2	8	14	5	0	0.3
3	7	14	5	0	0.3
4	6	14	5	0	0.3
5	5	14	5	0	0.3
6	4	14	5	0	0.3
7	3	14	5	0	0.3
8	2	14	5	0	0.3
9	1	14	5	0	0.3

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 11					
1	10	14	4	1	0.6
2	9	14	4	1	0.6
3	8	14	4	1	0.6
4	7	14	4	1	0.6
5	6	14	4	1	0.6
6	5	14	4	1	0.6
7	4	14	4	1	0.6
8	3	14	4	1	0.6
9	2	14	4	1	0.6
10	1	14	4	1	0.6
WL = 12					
1	11	14	6	0	0.4
2	10	14	6	0	0.4
3	9	14	5	1	0.7
4	8	14	5	1	0.7
5	7	14	5	1	0.7
6	6	14	5	1	0.7
7	5	14	5	1	0.7
8	4	14	5	1	0.7
9	3	14	5	1	0.7
10	2	14	5	1	0.7
11	1	14	5	1	0.7
WL = 13					
1	12	14	4	2	1.1
2	11	14	4	2	1.1
3	10	12	5	2	1.0
4	9	13	5	2	1.1
5	8	13	5	2	1.1
6	7	13	5	2	1.1
7	6	13	5	2	1.1
8	5	13	5	2	1.1
9	4	13	5	2	1.1
10	3	14	7	0	0.5
11	2	14	7	0	0.5
12	1	14	6	1	0.8

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 14					
1	13	14	6	1	0.8
2	12	14	6	1	0.8
3	11	14	6	1	0.8
4	10	14	6	1	0.8
5	9	14	6	1	0.8
6	8	14	6	1	0.8
7	7	15	5	2	1.2
8	6	14	5	2	1.2
9	5	14	5	2	1.2
10	4	12	5	3	1.5
11	3	13	5	3	1.5
12	2	13	5	3	1.5
13	1	13	5	3	1.5

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 15					
1	14	13	5	3	1.5
2	13	13	5	3	1.5
3	12	13	6	2	1.1
4	11	13	6	2	1.1
5	10	14	6	2	1.3
6	9	14	6	2	1.3
7	8	14	6	2	1.3
8	7	14	6	2	1.3
9	6	14	7	1	0.9
10	5	14	7	1	0.9
11	4	14	7	1	0.9
12	3	14	7	1	0.9
13	2	14	7	1	0.9
14	1	14	6	2	1.3
WL = 16					
1	15	14	6	2	1.3
2	14	14	6	2	1.3
3	13	14	6	2	1.3
4	12	14	6	2	1.3
5	11	13	6	3	1.6
6	10	13	6	3	1.6
7	9	13	6	3	1.6
8	8	13	6	3	1.6
9	7	13	6	3	1.6
10	6	13	6	3	1.6
11	5	13	6	3	1.6
12	4	14	6	3	1.7
13	3	14	6	3	1.7
14	2	14	7	2	1.4
15	1	14	7	2	1.4

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**24-GA**	**BW**	**HT**	**SL**	
WL = 17					
1	16	14	6	3	1.7
2	15	14	6	3	1.7
3	14	14	6	3	1.7
4	13	14	7	2	1.4
5	12	14	7	2	1.4
6	11	14	7	2	1.4
7	10	14	7	2	1.4
8	9	14	7	2	1.4
9	8	14	7	2	1.4
10	7	14	7	2	1.4
11	6	14	8	1	1.1
12	5	14	8	1	1.1
13	4	14	8	1	1.1
14	3	13	7	3	1.7
15	2	13	7	3	1.7
16	1	13	7	3	1.7
WL = 18					
1	17	14	7	2	1.4
2	16	13	6	4	2.1
3	15	14	6	4	2.2
4	14	14	6	4	2.2
5	13	14	6	4	2.2
6	12	14	6	4	2.2
7	11	14	6	4	2.2
8	10	14	7	3	1.9
9	9	14	7	3	1.9
10	8	14	7	3	1.9
11	7	14	7	3	1.9
12	6	14	7	3	1.9
13	5	14	7	3	1.9
14	4	14	7	3	1.9
15	3	14	8	2	1.6
16	2	14	8	2	1.6
17	1	14	8	2	1.6

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**24-GA**	**BW**	**HT**	**SL**	
WL = 19					
1	18	14	7	3	1.9
2	17	14	7	3	1.9
3	16	14	7	3	1.9
4	15	14	7	3	1.9
5	14	14	7	3	1.9
6	13	14	8	2	1.6
7	12	14	8	2	1.6
8	11	14	8	2	1.6
9	10	14	8	2	1.6
10	9	14	8	2	1.6
11	8	14	7	4	2.4
12	7	14	7	4	2.4
13	6	14	7	4	2.4
14	5	14	7	4	2.4
15	4	14	7	4	2.4
16	3	14	7	4	2.4
17	2	14	9	2	1.7
18	1	14	8	3	2.1
WL = 20					
1	19	14	8	2	1.6
2	18	14	7	4	2.4
3	17	14	7	4	2.4
4	16	14	7	4	2.4
5	15	14	7	4	2.4
6	14	14	7	4	2.4
7	13	14	7	4	2.4
8	12	14	7	4	2.4
9	11	14	7	4	2.4
10	10	14	8	3	2.1
11	9	14	8	3	2.1
12	8	14	8	3	2.1
13	7	14	8	3	2.1
14	6	14	8	3	2.1
15	5	14	8	3	2.1
16	4	14	8	3	2.1
17	3	14	8	3	2.1
18	2	13	8	4	2.3
19	1	14	8	4	2.5

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 21					
1	20	14	7	4	2.4
2	19	14	8	3	2.1
3	18	14	8	3	2.1
4	17	14	8	3	2.1
5	16	14	8	3	2.1
6	15	14	7	5	2.8
7	14	14	7	5	2.8
8	13	14	7	5	2.8
9	12	14	7	5	2.8
10	11	14	7	5	2.8
11	10	14	8	4	2.5
12	9	14	8	4	2.5
13	8	14	8	4	2.5
14	7	14	8	4	2.5
15	6	14	8	4	2.5
16	5	14	8	4	2.5
17	4	14	8	4	2.5
18	3	14	8	4	2.5
19	2	13	8	5	2.8
20	1	14	8	5	3.0

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 22					
1	21	14	7	5	2.8
2	20	14	7	5	2.8
3	19	14	7	5	2.8
4	18	14	7	6	3.3
5	17	14	8	4	2.5
6	16	14	8	4	2.5
7	15	14	8	4	2.5
8	14	14	8	4	2.5
9	13	14	8	4	2.5
10	12	14	8	4	2.5
11	11	14	8	4	2.5
12	10	14	8	4	2.5
13	9	14	8	5	3.0
14	8	14	8	5	3.0
15	7	14	8	5	3.0
16	6	14	9	4	2.7
17	5	14	9	4	2.7
18	4	14	9	4	2.7
19	3	14	9	4	2.7
20	2	14	9	4	2.7
21	1	14	8	6	3.5

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 23					
1	22	14	8	4	2.5
2	21	14	8	4	2.5
3	20	14	8	4	2.5
4	19	14	8	4	2.5
5	18	14	8	4	2.5
6	17	14	8	5	3.0
7	16	14	8	5	3.0
8	15	14	8	5	3.0
9	14	14	8	5	3.0
10	13	14	8	5	3.0
11	12	14	9	4	2.7
12	11	14	9	4	2.7
13	10	14	9	4	2.7
14	9	14	8	6	3.5
15	8	14	8	6	3.5
16	7	14	9	5	3.1
17	6	14	9	5	3.1
18	5	14	9	5	3.1
19	4	14	9	5	3.1
20	3	14	10	4	2.8
21	2	14	10	4	2.8
22	1	14	10	4	2.8

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**24-GA**	**BW**	**HT**	**SL**	
WL = 24					
1	23	14	8	5	3.0
2	22	14	8	5	3.0
3	21	14	8	5	3.0
4	20	14	8	5	3.0
5	19	14	8	5	3.0
6	18	14	8	5	3.0
7	17	14	8	6	3.5
8	16	14	8	6	3.5
9	15	14	8	6	3.5
10	14	14	8	6	3.5
11	13	14	9	5	3.1
12	12	14	9	5	3.1
13	11	14	9	5	3.1
14	10	14	10	4	2.8
15	9	14	10	4	2.8
16	8	14	9	6	3.6
17	7	14	9	6	3.6
18	6	14	9	6	3.6
19	5	14	9	6	3.6
20	4	14	10	5	3.3
21	3	14	10	5	3.3
22	2	14	10	5	3.3
23	1	14	10	5	3.3

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 25					
1	24	14	8	6	3.5
2	23	14	8	6	3.5
3	22	14	8	6	3.5
4	21	14	8	6	3.5
5	20	14	9	5	3.1
6	19	14	9	5	3.1
7	18	14	9	5	3.1
8	17	14	9	5	3.1
9	16	14	8	7	4.1
10	15	14	8	7	4.1
11	14	14	9	6	3.6
12	13	14	9	6	3.6
13	12	14	9	6	3.6
14	11	14	10	5	3.3
15	10	14	10	5	3.3
16	9	14	10	5	3.3
17	8	14	10	5	3.3
18	7	14	9	7	4.2
19	6	14	10	6	3.8
20	5	14	10	6	3.8
21	4	14	10	6	3.8
22	3	14	10	6	3.8
23	2	14	10	6	3.8
24	1	14	10	6	2.8

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 26					
1	25	14	9	5	3.1
2	24	14	8	7	4.1
3	23	14	8	7	4.1
4	22	14	8	7	4.1
5	21	14	9	6	3.6
6	20	14	9	6	3.6
7	19	14	9	6	3.6
8	18	14	9	6	3.6
9	17	14	9	6	3.6
10	16	14	10	5	3.3
11	15	14	9	7	4.2
12	14	14	9	7	4.2
13	13	14	9	7	4.2
14	12	14	10	6	3.8
15	11	14	10	6	3.8
16	10	14	10	6	3.8
17	9	14	11	5	3.5
18	8	14	11	5	3.5
19	7	14	11	5	3.5
20	6	14	10	7	4.3
21	5	14	10	7	4.3
22	4	14	10	7	4.3
23	3	13	10	9	4.8
24	2	14	11	6	4.0
25	1	14	11	6	4.0

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**24-GA**	**BW**	**HT**	**SL**	
WL = 27					
1	26	14	9	6	3.6
2	25	14	9	6	3.6
3	24	14	9	6	3.6
4	23	14	9	7	4.2
5	22	14	9	7	4.2
6	21	14	9	7	4.2
7	20	14	9	7	4.2
8	19	14	9	7	4.2
9	18	14	9	7	4.2
10	17	14	10	6	3.8
11	16	14	10	6	3.8
12	15	14	10	6	3.8
13	14	14	9	9	5.0
14	13	14	10	7	4.3
15	12	14	10	7	4.3
16	11	14	10	7	4.3
17	10	14	11	6	4.0
18	9	14	11	6	4.0
19	8	14	11	6	4.0
20	7	14	11	6	4.0
21	6	13	10	10	5.2
22	5	13	11	8	4.5
23	4	13	11	8	4.5
24	3	14	11	7	4.5
25	2	14	11	7	4.5
26	1	14	11	7	4.5

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	**24-GA**	**BW**	**HT**	**SL**	
WL = 28					
1	27	14	9	7	4.2
2	26	14	9	7	4.2
3	25	14	9	8	4.5
4	24	14	9	8	4.5
5	23	14	9	8	4.5
6	22	14	9	8	4.5
7	21	14	9	8	4.5
8	20	14	9	9	5.0
9	19	14	9	9	5.0
10	18	14	10	7	4.3
11	17	14	10	7	4.3
12	16	14	10	7	4.3
13	15	14	10	8	4.7
14	14	14	10	8	4.7
15	13	13	10	10	5.2
16	12	14	10	9	5.1
17	11	14	11	7	4.5
18	10	14	11	7	4.5
19	9	14	11	7	4.5
20	8	13	11	9	4.9
21	7	13	11	9	4.9
22	6	13	11	9	4.9
23	5	13	11	10	5.3
24	4	13	11	10	5.3
25	3	13	11	10	5.3
26	2	13	11	10	5.3
27	1	13	11	11	5.8

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 29					
1	28	14	9	8	4.5
2	27	14	9	9	5.0
3	26	14	10	7	4.3
4	25	14	10	7	4.3
5	24	14	10	7	4.3
6	23	14	10	7	4.3
7	22	14	10	7	4.3
8	21	14	10	8	4.7
9	20	14	10	8	4.7
10	19	14	10	8	4.7
11	18	14	10	8	4.7
12	17	14	10	9	5.1
13	16	14	11	7	4.5
14	15	14	11	7	4.5
15	14	14	11	7	4.5
16	13	14	11	8	4.9
17	12	14	11	8	4.9
18	11	13	11	10	5.3
19	10	13	11	10	5.3
20	9	13	11	11	5.8
21	8	13	11	11	5.8
22	7	13	11	12	6.2
23	6	14	12	7	4.7
24	5	14	12	7	4.7
25	4	13	12	9	5.1
26	3	13	12	9	5.1
27	2	13	12	9	5.1
28	1	14	12	8	5.1

Table 5-23. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		**Equalizer Settings**			**1 kHz Equalizer Gain (dB)**
26-GA	**24-GA**	**BW**	**HT**	**SL**	
WL = 30					
1	29	14	10	7	4.3
2	28	14	10	8	4.7
3	27	14	10	8	4.7
4	26	14	10	8	4.7
5	25	14	10	8	4.7
6	24	14	10	8	4.7
7	23	14	10	9	5.1
8	22	14	10	9	5.1
9	21	14	10	9	5.1
10	20	14	11	7	4.5
11	19	14	11	7	4.5
12	18	14	11	8	4.9
13	17	14	11	8	4.9
14	16	14	11	8	4.9
15	15	13	11	10	5.3
16	14	13	11	11	5.8
17	13	13	11	12	6.2
18	12	14	12	7	4.7
19	11	13	12	9	5.1
20	10	13	12	9	5.1
21	9	13	12	10	5.5
22	8	13	12	10	5.5
23	7	13	12	10	5.5
24	6	13	12	10	5.5
25	5	13	12	11	5.9
26	4	13	12	11	5.9
27	3	13	12	11	5.9
28	2	13	12	12	6.3

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-24. Gauge Conversion Constants

Major Gauge	Minor Gauge			
	19	22	24	26
19	1	1.19	1.41	1.70
22	0.87	1	1.17	1.38
24	0.76	0.86	1	1.17
25	0.77	0.77	0.77	0.77
26	0.67	0.74	0.86	1

Table 5-25. Bridged Tap Equivalent Lengths (kft) for Four-Wire Designs, Nonloaded

See the Note at the end of the table.

Bridged Tap Length (kft)	Gauge			
	26	24	22	19
0.5	0.3	0.4	0.4	0.4
1.0	0.6	0.7	0.8	0.9
1.5	0.9	1.1	1.3	1.4
2.0	1.3	1.5	1.7	1.9
2.5	1.6	1.9	2.1	2.3
3.0	2.0	2.3	2.6	2.8
3.5	2.3	2.7	3.1	3.4
4.0	2.7	3.2	3.6	3.9
4.5	3.1	3.6	4.1	4.4
5.0	3.5	4.1	4.6	5.0
5.5	3.9	4.5	5.1	5.5
6.0	4.4	5.0	5.6	6.1

Note: For equalization, not loss.

Table 5-26. H88 (Loaded) Cable Loss at 1 kHz at 68°F

See the Note at the end of the table.

Gauge	Loss/kft (dB)	
	1200/1200 Ohms	**600/900 Ohms**
26	0.33	.36
25 (MAT Cable)	0.24	.26
24	0.23	.24
22	0.15	.16
19	0.08	.084

Note: For other temperatures, change cable loss by ±1% for each change in temperature of ±5°F.

Table 5-27. 19-GA H88 Loaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)
	BW	HT	SL	
18	1	3	0	0.0
24	5	2	0	0.0
30	5	3	0	0.0
36	5	4	0	0.0
42	5	4	0	0.0
48	5	4	0	0.0
54	4	5	0	0.0
60	6	4	0	0.0
66	5	5	0	0.0
72	6	5	0	0.0
78	6	5	0	0.0
84	6	5	0	0.0
90	5	6	0	0.0
96	6	6	0	0.0
102	6	6	0	0.0
108	6	6	0	0.0
114	5	7	0	0.0
120	5	7	0	0.0
126	5	7	0	0.0
132	6	7	0	0.0
138	6	7	0	0.0
144	6	7	0	0.0
150	5	8	0	0.0
156	5	8	0	0.0
162	5	9	0	0.0
168	5	9	0	0.0
174	5	9	0	0.0
180	5	9	0	0.0
186	5	10	0	0.0
192	5	10	0	0.0

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-28. 22-GA H88 Loaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)
	BW	HT	SL	
18	3	3	0	0.0
24	6	2	0	0.0
30	4	4	0	0.0
36	3	4	1	1.4
42	4	4	1	1.4
48	4	4	1	1.4
54	3	5	1	1.4
60	4	5	1	1.4
66	4	5	1	1.4
72	3	6	1	1.4
78	4	6	1	1.4
84	4	6	1	1.4
90	3	7	1	1.4
96	3	7	1	1.4
102	4	7	1	1.4

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-29. 24-GA H88 Loaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1kHz Equalizer Gain (dB)
	BW	HT	SL	
18	3	4	1	1.4
24	3	4	1	1.4
30	3	4	2	2.6
36	3	5	2	2.6
42	4	5	2	2.6
48	3	6	3	3.7
54	3	6	3	3.7
60	2	7	4	4.7
66	3	7	5	5.6

Notes:
1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-30. 25-GA (MAT) H88 Loaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)
	BW	HT	SL	
12	15	1	0	0.1
18	15	1	0	0.1
24	15	0	2	2.6
30	15	0	3	3.7
36	15	0	3	3.7
42	15	0	4	4.7
48	15	0	5	5.5
54	15	0	7	7.2
60	15	0	10	9.0

Notes:
1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-31. Mixed 24- and 22-GA Loaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	**22-GA**	**BW**	**HT**	**SL**	
WL = 18					
6	12	4	3	0	0.0
12	6	4	3	1	1.4
WL = 24					
6	18	5	3	0	0.0
12	12	4	3	1	1.4
18	6	5	3	1	1.4
WL = 30					
6	24	2	4	1	1.4
12	18	3	4	1	1.4
18	12	3	4	1	1.4
24	6	3	4	2	2.6
WL = 36					
6	30	4	4	1	1.4
12	24	5	4	1	1.4
18	18	3	5	1	1.4
24	12	1	5	2	2.6
30	6	3	5	2	2.6
WL = 42					
6	36	5	4	1	1.4
12	30	5	4	1	1.4
18	24	4	5	1	1.4
24	18	3	5	2	2.6
30	12	3	5	2	2.6
36	6	4	5	2	2.6
WL = 48					
6	42	5	4	1	1.4
12	36	4	5	1	1.4
18	30	4	5	1	1.4
24	24	4	5	2	2.6
30	18	3	5	2	2.6
36	12	3	5	2	2.6
42	6	2	6	3	3.7

Table 5-31. Mixed 24- and 22-GA Loaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 54					
6	48	4	5	1	1.4
12	42	4	5	1	1.4
18	36	5	5	1	1.4
24	30	4	5	2	2.6
30	24	2	6	2	2.6
36	18	3	6	2	2.6
42	12	2	6	3	3.7
48	6	3	6	3	3.7
WL = 60					
6	54	4	5	1	1.4
12	48	5	5	1	1.4
18	42	3	6	1	1.4
24	36	3	6	2	2.6
30	30	3	6	2	2.6
36	24	3	6	2	2.6
42	18	3	6	3	3.7
48	12	3	6	3	3.7
54	6	2	7	4	4.7
WL = 66					
6	60	5	5	1	1.4
12	54	4	6	1	1.4
18	48	4	6	1	1.4
24	42	3	6	2	2.6
30	36	4	6	2	2.6
36	30	4	6	2	2.6
42	24	2	7	3	3.7
48	18	2	7	3	3.7
54	12	2	7	4	4.7
60	6	3	7	4	4.7
WL = 72					
6	66	4	6	1	1.4
12	60	4	6	1	1.4
18	54	4	6	2	2.6
24	48	4	6	2	2.6
30	42	4	6	2	2.6
36	36	3	7	2	2.6
42	30	3	7	3	3.7
48	24	3	7	3	3.7
54	18	2	7	4	4.7
60	12	2	7	5	5.5

Table 5-31. Mixed 24- and 22-GA Loaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	**22-GA**	**BW**	**HT**	**SL**	
WL = 78					
6	72	4	6	1	1.4
12	66	5	6	1	1.4
18	60	4	6	2	2.6
24	54	3	7	2	2.6
30	48	3	7	2	2.6
36	42	3	7	3	3.7
42	36	3	7	3	3.7
48	30	3	7	3	3.7
WL = 84					
6	78	4	6	1	1.4
12	72	5	6	1	1.4
18	66	3	7	2	2.6
24	60	3	7	2	2.6
30	54	3	7	2	2.6
36	48	3	7	3	3.7
42	42	3	7	3	3.7
WL = 84					
6	84	3	7	1	1.4
12	78	3	7	2	2.6
18	72	3	7	2	2.6
24	66	3	7	2	2.6
30	60	3	7	3	3.7
WL = 96					
6	90	4	7	1	1.4
12	84	4	7	2	2.6
18	78	4	7	2	2.6
WL = 102					
6	96	3	7	2	2.6

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-32. Mixed 26- and 22-GA Loaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer
26-GA	**22-GA**	**BW**	**HT**	**SL**	**Gain (dB)**
WL = 18					
6	12	2	3	1	1.4
12	6	6	3	2	2.6
WL = 24					
6	18	4	2	1	1.4
12	12	5	3	2	2.6
18	6	5	4	5	5.5
WL = 30					
6	24	4	3	1	1.4
12	18	5	4	2	2.6
18	12	4	4	4	4.7
24	6	4	5	9	8.4
WL = 36					
6	30	4	4	1	1.4
12	24	6	4	1	1.4
18	18	4	5	3	3.7
24	12	3	5	7	7.2
30	6	5	5	12	10.0
WL = 42					
6	36	5	4	1	1.4
12	30	7	4	1	1.4
18	24	5	5	3	3.7
24	18	4	5	6	6.3
30	12	4	5	12	10.0
36	6	6	5	12	10.0
WL = 48					
6	42	5	4	1	1.4
12	36	7	4	1	1.4
18	30	6	5	2	2.6
24	24	5	5	5	5.6
30	18	5	5	11	9.5
36	12	4	6	12	10.0

Table 5-32. Mixed 26- and 22-GA Loaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer
26-GA	22-GA	BW	HT	SL	Gain (dB)
WL = 18					
6	12	2	3	1	1.4
12	6	6	3	2	2.6
WL = 24					
6	18	4	2	1	1.4
12	12	5	3	2	2.6
18	6	5	4	5	5.5
WL = 30					
6	24	4	3	1	1.4
12	18	5	4	2	2.6
18	12	4	4	4	4.7
24	6	4	5	9	8.4
WL = 36					
6	30	4	4	1	1.4
12	24	6	4	1	1.4
18	18	4	5	3	3.7
24	12	3	5	7	7.2
30	6	5	5	12	10.0

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Table 5-33. Mixed 26- and 24-GA Loaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 12					
6	6	7	3	1	1.4
WL = 18					
6	12	4	3	2	2.6
12	6	6	3	3	3.7
WL = 24					
6	18	4	3	2	2.6
12	12	4	4	3	3.7
18	6	5	4	6	6.3
WL = 30					
6	24	4	4	2	2.6
12	18	5	4	3	3.7

Table 5-33. Mixed 26- and 24-GA Loaded Cable Without Bridged Taps (Continued)

See the Notes at the end of the table.

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
18	12	3	5	6	6.3
24	6	4	5	12	10.0
WL = 36					
6	30	4	5	2	2.6
12	24	5	5	3	3.7
18	18	4	5	6	6.3
24	12	4	5	12	10.0
30	6	5	5	12	10.0
WL = 42					
6	36	4	5	3	3.7
12	30	5	5	4	4.7
18	24	5	5	6	6.3
24	18	5	5	11	9.5
30	12	4	6	12	10.0
36	6	6	5	12	10.0
WL = 48					
6	42	3	6	3	3.7
12	36	4	6	5	5.6
18	30	4	6	8	7.8
24	24	4	6	12	10.0
30	18	4	6	12	10.0
36	12	5	6	12	10.0
WL = 54					
6	48	3	6	4	4.7
12	42	4	6	6	6.3
18	36	5	6	7	7.2
24	30	5	6	12	10.0
30	24	5	6	12	10.0
WL = 60					
6	54	3	7	4	4.7
12	48	3	7	7	7.2
18	42	3	7	12	10.0
WL = 66					
6	60	3	7	5	5.6

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Loaded cable applications—more than two gauges:

When more than two gauges make up the facility, the facility must be converted to the 2-gauge equivalent. The 1-kHz insertion loss is used as the criteria for determining the two major gauge segments. The remaining segments are minor gauges. The length of the minor gauges is added to the length of the nearest gauge size of major gauge to determine the table entry points. The settings are then determined from the appropriate 2-gauge table.

Example: Given a cable facility composed of the following:

1. 3 kft of 19-gauge loaded
2. 18 kft of 22-gauge loaded
3. 21 kft of 24-gauge loaded
4. 6 kft of 26-gauge loaded
5. 3 kft end sections
   a. Compute the 1-kHz insertion loss of each segment using the constants in Table 5-26:

      3 kft 19H88 x 0.08 constant = 0.24 dB 1-kHz loss.

      18 kft 22H88 x 0.15 constant = 2.7 dB 1-kHz loss.

      21 kft 24H88 x 0.23 constant = 4.83 dB 1-kHz loss.

      6 kft 26H88 x 0.34 constant = 2.04 dB 1-kHz loss.

      0.24 dB 19-gauge + 2.7 dB 22-gauge + 4.83 dB 24-gauge + 2.04 dB 26-gauge = 9.81 total 1-kHz insertion loss.

   b. Select two major gauges as segments with greatest loss from (a) above:

      22-gauge and 24-gauge.

   c. Add length of 19-gauge to 22-gauge:

      18 kft 22-gauge + 3 kft 19-gauge = 21 kft 22-gauge for table entry.

   d. Add length of 26-gauge to 24-gauge:

      21 kft 24-gauge + 6 kft 26-gauge = 27 kft 24-gauge for table entry.

   e. Round off 21 kft of 22-gauge to 18 kft. Round off 27 kft of 24-gauge to 30 kft. (From guidelines for loaded cable, single- or 2-gauge.)

      WL = 18 + 30 = 48 kft.

      From Table 5-31:

      BW=3, HT=5, SL=2, and EQL GN = 2.6 dB.

150-ohm mismatch equalization

This section explains when and how to use mismatch equalization by selecting 150 ohms impedance. With four-wire CUs, active equalization is available only in the transmit direction; this is called ``post-equalization" because the signal is equalized by the CU after it comes off the cable. This means that the four-wire repeater at the distant end of the cable must provide corresponding equalization in the opposite direction. Using 150-ohm mismatch equalization on both cable pairs, the CUs provide passive pre- and post-equalization that meet the roll-off requirements of the circuit for a wide range of nonloaded cable facilities. For these facilities, the repeater (if any) at the distant end does not have to provide any equalization. This range of cable facilities can be substantially increased if the far end also provides 150-ohm mismatch equalization on both cable pairs.

Table 5-10**,** Table 5-11**,** Table 5-12**,** Table 5-13, and Table 5-14 show this range of facilities for single-gauge cable without BT. The tables list the cable transducer loss for various cable lengths up to the maximum value which meets the roll-off requirements of the circuit. Four categories of roll-off are listed based on whether the circuit is a line or trunk and on the number of cable links in the circuit. Roll-off limits are taken from AT&T 851-300-100. For circuits that can be equalized from one end (no equalization at the customer end), maximum cable lengths range from 1 to 19 kft; for 26-gauge nonloaded cable, the maximum length ranges from 12 to 15 kft, depending on the roll-off requirements of the circuit. If the cable is mixed-gauge without BT, the tables can be used by interpolation. For facilities with more than two gauges, convert the mixed-gauge cable to the equivalent 2-gauge facility. (See Nonloaded Cable Applications - More Than Two Gauges) in this section.) The following interpolation formula gives the loss values for mixed-gauge cable:

$$T_h + \frac{L_h}{L_l + L_h} \times (T_l - T_h) \qquad I_{l,h} =$$

where:

$I_{l,h}$ = interpolated value for mixed-gauge cable

T_h = table value for the higher gauge

L_h = length of the higher gauge

L_l = length of the lower gauge

T_l = table value for the lower gauge

Using mismatch equalization produces mismatch loss; this loss is included in Table 5-10**,** Table 5-11**,** Table 5-12**,** Table 5-13, and Table 5-14 and the values listed should be used directly to calculate the attenuation settings of the CU. Using standard circuit design rules, first determine TLPs at the CU interface to the cable. Then use the formulas for attenuation without equalization (*CU impedance selection*.) to calculate attenuator settings. These settings will give the proper end-to-end loss (from NCTE to bit stream or the reverse). However, if the circuit has to be sectionalized to locate a loss problem, the measured level at the cable interface will be offset several dB from the calculated TLP because although the mismatch loss is assigned to the cable, it actually takes place inside the four-wire CU. Procedures for alignment of CUs and circuits that use 150-ohm mismatch are included in AT&T 363-205-402.

Attenuation (gain) calculation with active equalization

The equations in this section are used to determine the amount of attenuation for the transmit and receive paths of CUs that provide equalization. Equalizer settings must have been determined previously to provide 1 kHz equalizer gain values required for calculating attenuation. The equalizer gain values given in Table 5-16**,** Table 5-17**,** Table 5-18**,** Table 5-19**,** Table 5-20**,** Table 5-21**,** Table 5-22**,** Table 5-23**,** Table 5-27**,** Table 5-28**,** Table 5-29**,** Table 5-30**,** Table 5-31, Table 5-32, Table 5-33, and Table 5-34 are used to determine the equalization. The customer equipment TLPs, cable loss, and CU gain values must be known for the attenuation equations. The equations are based on D4 standard level points. Cable loss is obtained from the tables or from cable loss calculations (see *1 kHz cable loss* on page 5-40).

Table 5-34. 26-GA H88 Loaded Cable Without Bridged Taps

See the Notes at the end of the table.

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)
	BW	HT	SL	
12	8	3	1	1.4
18	5	4	4	3.7
24	5	4	7	7.2
30	6	4	12	10.0
36	5	5	12	10.0
42	6	5	12	10.0
48	6	6	12	10.0

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the CU transmit path.

Transmit path calculations

$$ATTt = 8.5 + Gt + Ge + TLPt,r$$

where:

ATTt = required CU transmit attenuator setting

Gt = CU transmit insertion gain (Table 5-15)

Ge = additional 1 kHz gain due to equalizer setting (from Table 5-16, Table 5-17, Table 5-18, Table 5-19, Table 5-20, Table 5-21, Table 5-22, Table 5-23, Table 5-27, Table 5-28, Table 5-29, Table 5-30, Table 5-34, Table 5-31, Table 5-34, and Table 5-33)

TLPt,r = TLP level at the tip and ring (T,R) of CU (within crosstalk limits of +6 to –9 dB TLP).

The TLPt,r value depends on the crosstalk limit and the cable loss or on the circuit objective and the cable loss. (See *Four-wire VF services* on page 5-55.)

Receive path calculations

$$ATT(r) = 4.0 + Gr - TLP(t1, r1)$$

where:

ATT(r) = required CU receive attenuator setting

Gr = CU receive insertion gain (Table 5-15)

TLP(t1,r1) = the TLP level at the tip and ring (T1, R1) of CU.

The TLP(t1,r1) value depends on the crosstalk limit and the cable loss or on the circuit objective and the cable loss. (See *Four-wire VF services* on page 5-55.)

Listed below are the design guidelines for the signal levels in the circuit, determined mainly by crosstalk limitations. These design guidelines assume that the four-wire CU is located in a CO and is working into a cable section going to a PBX. For circuits where the CU employs 150 ohm mismatch equalization, crosstalk is less severe. At the CU, the guidelines are in Table 5-35.

Table 5-35. Channel Unit Signal Levels at the Tip/Ring Interface

Equalization Type	Voice Applications		Data Applications	
	Min CU Input TLP	**Max CU Output TLP**	**Min CU Input TLP**	**Max CU Output TLP**
Active (Standard)	–9 dB	+6 dB	–10 dB	+5 dB[a]
			–23 dBm (data tone)	–8 dBm (data tone)
150 Ohm Mismatch	–15 dB	+6 dB	–16 dB	+5 dB
			-29 dBm (data tone)	–8dBm (data tone)

a. Some pre-divestiture data circuit design documents allowed +7 dB TLPs

At the customer location, the recommended signal levels also depend on whether the cable is loaded. At the cable interface, the guidelines are in Table 5-36.

Table 5-36. Customer Location Signal Levels at the Cable Interface

Equalization Type	Voice Applications				Data Applications			
	Max Cable Input TLP		Min Cable Output TLP		Max Cable Input TLP		Min Cable Output TLP	
	NL	H88	NL	H88	NL	H88	NL	H88
Active (Standard)	+6 dB	+3 dB	–9 dB	–6 dB	+5 dB[a]	+2 dB	–10 dB	–7 dB
					–8 dBm (data tone)	–11 dBm (data tone)	–23 dBm (data tone)	–20 dBm (data tone)
150 Ohm Mismatch	+6 dB	n/a	–15 dB	n/a	+5 dB	n/a	–16 dB	n/a
					–8 dBm (data tone)		–29 dBm (data tone)	

a. Some pre-divestiture data circuit design documents allowed +7 dB TLPs

These guidelines are consistent with a maximum cable transducer loss of 15 dB for nonloaded cables and 12 dB for H88 loaded cables.

Configuration Management—Digital Data Services

Overview

The *AnyMedia* Access System provides digital data special services via four CU codes which are supported by the MDS2 shelf. This section describes the services supported by the *SPQ*452, AUA200, AUA232 and *SPQ*334 CUs, and their provisioning. The *SPQ*334 is always located in the *AnyMedia* Access System central office terminal (COT).

Data applications

Circuit applications for these four data CUs can be grouped into three categories:

- Extension of DDS service to a customer by providing a digital connection between that customer and the nearest DDS central office
- Point-to-point local digital data service between two or more customer sites, exclusive of the DDS network
- Digital access to a customer for switched 56 kbps digital service.

System synchronization

For all types of digital data service, the *AnyMedia* Access System must be synchronized to a timing source which is traceable to a PRS. In general, this requirement is met when the remote terminal is line timed to DS1 signals from a local digital switch, from a digital cross-connect system, or from a COT.

For remote terminal applications that are served by SONET facilities, the external DS1 timing mode is preferred. The necessary external DS1 clock signal inputs to the *FAST* shelf can be provided by most SONET multiplexers. The SONET facilities and the SONET payload must share traceable synchronization sources to prevent periodic VT1.5 pointer adjustments and consequent synchronization hits.

Services

DDS service

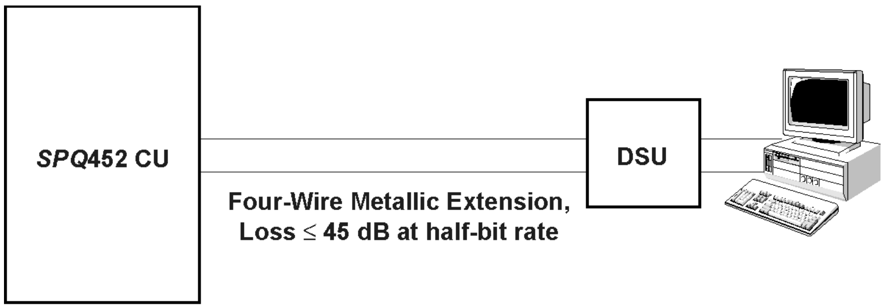
The DDS provides full-duplex private line digital data service at a variety of data rates. DDS loop design considerations are covered in AT&T 880-604-102.

Figure 5-31 shows the end link of a DDS access circuit. The *SPQ*452 CU is provisioned for the OCU generic signaling function. The data rate and other parameters must be selected according to local practice and the subscriber’s service order.

Figure 5-32 shows the end link of a DDS access circuit using the AUA232 CU. This CU combines the functions of an OCU dataport and the CSU/DSU equipment to provide a limited-range EIA-232E/574 DTE interface. Both synchronous and asynchronous subscriber interfaces are supported. This interface is suitable for deployment in protected environments, generally on customer premises. The generic signaling function for this circuit is “DATA”; additional parameters must be set manually via switches on the CU.

The *AnyMedia* Access System COT must be synchronized to the central office composite clock.

Figure 5-33 shows the office interface of a DDS access circuit. The *SPQ*334 CU is provisioned for the DS0 GSFN. The data rate and other parameters must be selected according to local practice and the subscriber’s service order.

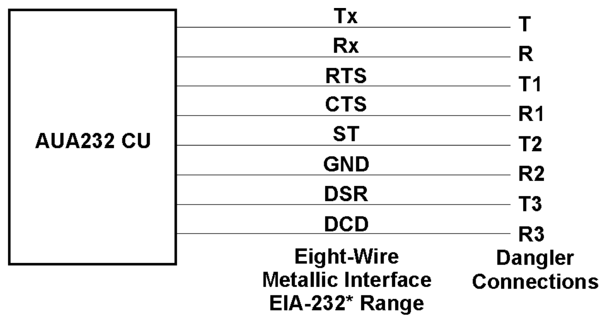


***SPQ*452 Provisioning**

Parameter	Value	Parameter	Value
GSFN	OCU (1,2,3)	ZC	Prescription-Set
RATE	Prescription-Set	SCC	Prescription-Set
EC	Prescription-Set	QM	Prescription-Set

R1.2_e12_21610_fig_43m

Figure 5-31. Digital Data Access



AUA232 Provisioning

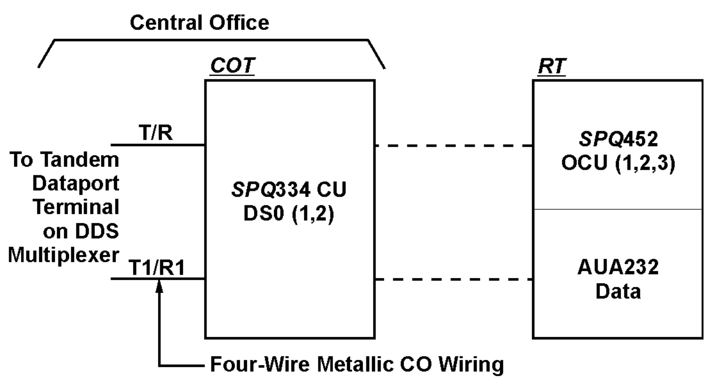
Parameter**	Value
GSFN	DATA

R1.2_e12_21610_fig_43q

* Electronic Industries Alliance, Engineering Department, *Interface Between Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange* (ANSI/EIA/TIA-232-E-91) July 1991; see Appendix A for range information (e.g., ≤25 ohms per conductor.

** Additional parameters must be set by switches on the CU. RS-232 interface is also available at a faceplate RJ45 jack.

Figure 5-32. Digital Data Access with EIA-232E/574 DTE Interface



***SPQ*334 Provisioning**

Parameter	Value
GSFN	DS0 (1,2)
RATE	Prescription - Set
EC	Prescription - Set
ZC	Prescription - Set

21610_fig_140

Figure 5-33. Digital Data Access—COT Interfaces the DDS Network

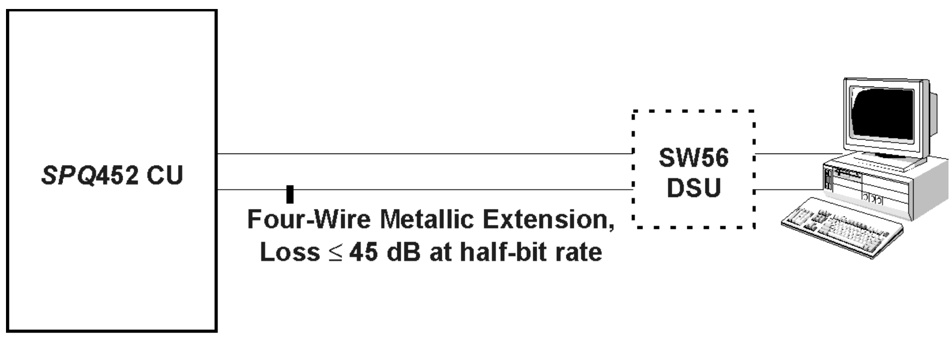
Local digital data service

Local (point-to-point) digital data services are similar to the DDS access arrangements in the preceding section, except that they do not interconnect with the DDS network. The configurations shown in Figure 5-31, Figure 5-32 and Figure 5-33 are also applicable for these services.

Digital access for switched 56 kbps service

Switched digital services are supported by the *SPQ*452 CU, AUA200 CU and by the *SPQ*334 CU. The *SPQ*452 CU provides a four-wire OCU-like interface toward the subscriber, while the AUA200 provides a two-wire interface which is compatible with the Nortel *Datapath* service. The *SPQ*334 CU provides a four-wire switched 56 kbps office interface.

Figure 5-34 and Figure 5-35 illustrate the end links of these services. Figure 5-36 illustrates the office interface of this service.



***SPQ*452 Provisioning**

Parameter	Value	Parameter	Value
GSFN	SW56	AB	Prescription-Set
EH56	Prescription-Set	QM	Prescription-Set

R1.2_e12_21610_fig_43n

Figure 5-34. Switched 56 kbps Digital Data Access with Four-Wire OCU Interface

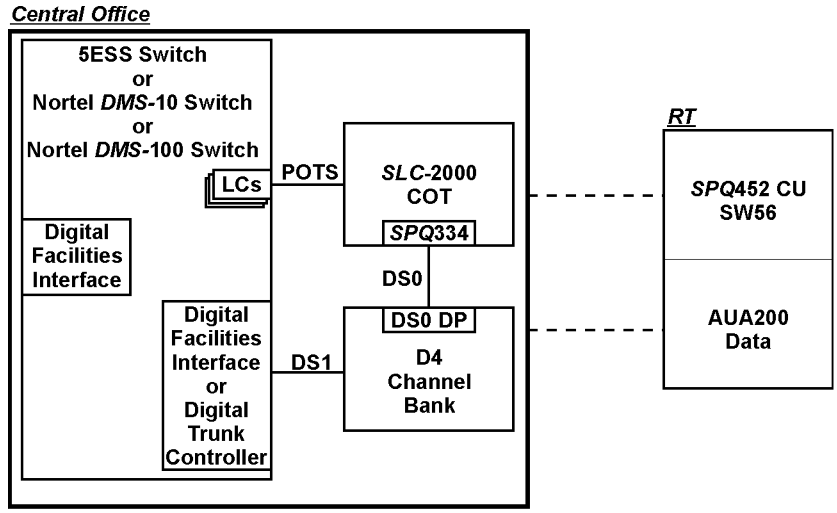
AUA200 Provisioning

Parameter*	Value
GSFN	DATA

R1.2_e12_21610_fig_43p

* Additional parameters must be set at the CU

Figure 5-35. Switched 56 kbps Digital Data Access with *Datapath* Interface



SPQ334 Provisioning

Parameter	Value
GSFN	SW56
EH56*	Prescription - Set
AB	Prescription - Set
QM*	Prescription - Set

21610_fig_141

* The *SPQ*334 CU does not support the EH56 or AM parameters and should be set to NO. If set to YES, they are ignored.

Figure 5-36. Switched 56 kbps Digital Access With Four-Wire Office Interface

Circuit design considerations

Switched 56 kbps services

Switched 56 kbps service is supported by the Nortel *DMS*-100 and *DMS*-10 switches, as well as by the Lucent *5ESS* switch. Special consideration is required regarding the central office network connections for these services. Figure 5-37 illustrates the use of switch hairpin or nail-up capabilities to route the service timeslot for a switched 56 kbps subscriber to the trunk interface of the serving LDS.

In Figure 5-38, the *AnyMedia* Access System is configured with an INA signaling (PUB43801) interface to a DCS system. The DCS system grooms the switched timeslots to the switch's trunk interface.

Figure 5-36 illustrates the central office configuration for a universal *AnyMedia* Access System (with a central office terminal).

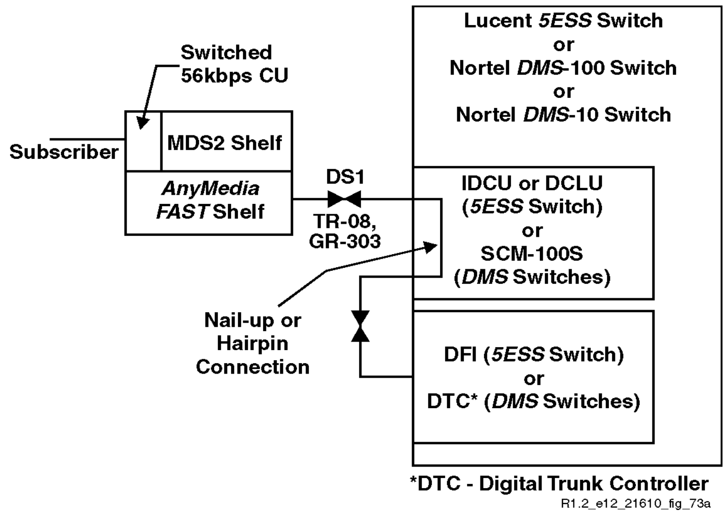


Figure 5-37. Switched 56 kbps Digital Data Access via LDS Nail-up or Hairpin

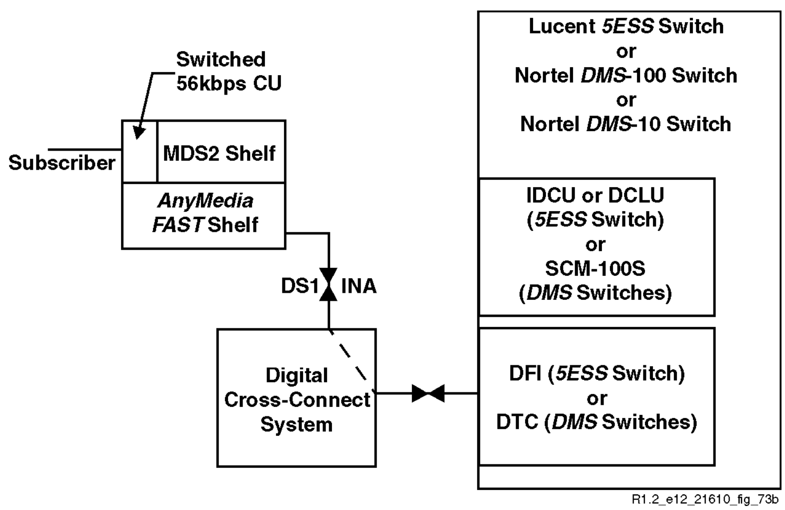


Figure 5-38. Switched 56 kbps Digital Data Access via INA and DCS

Digital data CU prescription setting

For all digital services, the generic signaling function must be entered into the *AnyMedia* Access System via the system's provisioning interface, either by the TL1 or GSI or by an external provisioning operations system. All provisioning parameters for the *SPQ*452 CU are set electronically. Additional parameters for the AUA200 and AUA232 CUs must be entered manually via switches on the CUs.

Generic signaling function

The GSFN for the service is selected using Table 5-37 and Table 5-38.

Table 5-37. Generic Signaling Functions for Digital Data Services

Service	CU	Generic Signaling Function (GSFN)
DDS End-Link	*SPQ*452	OCU(1,2,3)
	AUA232	DATA
Digital Private Line	*SPQ*452	OCU(1,2,3)
	AUA232	DATA
Switched 56 kbps	*SPQ*452	SW56
	AUA200	DATA

Table 5-38. Generic Signaling Function and Channel Units for Universal Digital Data Services

	COT		RT	
Service	CU	GSFN	CU	GSFN
DDS	SPQ334	DS0(1,2)	*SPQ*452	OCU(1,2,3)
			AUA232	DATA
Digital Private Line	*SPQ*334	DS0(1,2)	*SPQ*452	OCU(1,2,3)
			AUA232	DATA
Switched 56 kbps	*SPQ*334	SW56	*SPQ*452	SW56
			AUA200	DATA

Additional parameters for AUA200 and AUA232 CUs

All remaining parameters (with the exception of Redlined status) for the AUA200 and AUA232 CUs must be manually configured via switches on the CUs. Refer to the CU data sheets for additional information.

Additional parameters for the *SPQ*452 and *SPQ*334 CUs

The remaining parameters for the *SPQ*452 and *SPQ*334 CU are set electronically. The parameters are listed in Table 5-39 for the OCU GSFN, and in Table 5-40 for the SW56 GSFN, and in Table 5-41 for the DS01 GSFN, and in Table 5-42 for the DS02 GSFN.

Table 5-39. Provisioning Parameters for the *SPQ*452 Dual OCU CU, GSFN=OCU

Parameter	Description	Range
RATE	Subscriber Data Rate	24, 48, 96, 192 (GSFN=OCU1)
		384, 560 (GSFN=OCU2)
		640 (GSFN=OCU3)
EC	Error Correction Method	NONE, MVEC (GSFN=OCU1)
		NONE, SCEC (GSFN=OCU[2,3])
ZC	All-Zero Code Allowed	NO, YES (GSFN=OCU[1,2])
		YES (GSFN=OCU3)
SCC	Secondary Channel Enabled	NO, YES (GSFN=OCU[1,2])
		YES (GSFN=OCU3)
QM	Quality Monitor Enabled	NO, YES (GSFN=OCU[1,2])
		NO (GSFN=OCU3)

Table 5-40. Provisioning Parameters for the *SPQ*452 Dual OCU and *SPQ*334 Dual DS0 CUs, GSFN=SW56

Parameter	Description	Range
EH56[a]	Enhanced 56kbps Operation	NO, YES
AB	AB Signaling Enabled	NO, YES
QM[a]	Quality Monitor Enabled	NO, YES

a. The *SPQ*334 CU does not have EH56 or QM as provisioning parameters and should be set to NO.

Many of the parameters are determined by the service requested by the subscriber, or by local standards for data services. The ZC parameter must be set to NO if the data service is to be transported via a T1 facility which is not configured for B8ZS line coding.

Table 5-41. Provisioning Parameters for the *SPQ*334 Dual DS0 CU, GSFN=DS01

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	DS01	
rate=Subscriber data rate	RATE	2.4, 4.8, 9.6, 19.2, 38.4, 56, or 64 kbps	56
ec=Error correction	EC	NO, YES	NO
zc=All-zero-code allowed	ZC	NO, YES	NO

Values for the DS0A Service Format are selected from the following:

DS0A Service Format Selections for the *SPQ*334

Service Format	Selected Provisionable Parameters			Notes
	RATE	EC	ZC	
DS0A	64	YES / NO	YES / NO	If EC=YES, then SCEC ZC always YES, ignore ZC=NO
DS0A	56	YES / NO	YES / NO	If EC=YES, then SCEC
DS0A	38.4	YES / NO	YES / NO	If EC=YES, then SCEC
DS0A	19.2	YES / NO	YES / NO	If EC=YES, then 19.2EC
DS0A	9.6, 4.8, 2.4	YES / NO	YES / NO	If EC=YES, then MVEC

Table 5-42. Provisioning Parameters for the *SPQ*334 Dual DS0 CU, GSFN=DS02

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	DS02	
rate=Subscriber data rate	RATE	2.4, 4.8, 9.6, 19.2, 56, or 64 kbps	56
ec=Error correction	EC	NO, YES	NO
zc=All-zero-code allowed	ZC	NO, YES	NO

Values for the DS0B Service Format are selected from the following:

DS0B Service Format Selections for the *SPQ*334

Service Format	Selected Provisionable Parameters			Notes
	RATE	EC	ZC	
DS0B	64	YES / NO	YES / NO	If EC=YES, then SCEC ZC always YES, ignore ZC=NO
DS0B	56	YES / NO	YES / NO	If EC=YES, then SCEC
DS0B	19.2	YES / NO	YES / NO	If EC=YES, then SCEC
DS0B	9.6, 4.8, 2.4	YES / NO	YES / NO	If EC=YES, then SCEC

Required number of DS0 timeslots

Digital data services require one DS0 timeslot for the subscriber payload plus a second DS0 timeslot for second channel error correction, if this option is selected.

For the *SPQ*452 CU with GSFN=OCU2 or OCU3, a second timeslot is required if EC=SCEC. For all other GSFN values for the *SPQ*452 CU, only one timeslot is required.

For the *SPQ*334 CU with GSFN = DS01, if EC = YES and RATE = 64, 56, 38.4, then a second timeslot is required. For GSFN = DS02 and EC = YES, a second timeslot is required.

When digital data service is cross-connected through the serving digital switch using a nail-up or hairpin connection, the switch must be correctly configured to support the appropriate number of cross-connected timeslots. For the Lucent *5ESS* switch, the following parameter must be selected in the Recent Change/

Verify (RC/V) nail-up and hairpin specification view to cause a second timeslot to be assigned for SCEC error correction:

26. PATH NUM “2”

When digital data service is configured for TR-08 or INA virtual terminals, the number of DS0 timeslots required for the service must be considered when specifying the DS0 cross-connections for the *AnyMedia* Access System. When only one timeslot is required for the service (no SCEC), then a standard T0 cross-connection will support the channel. However, when two timeslots are required for the service, a bundled T0 cross-connection is necessary to assign two timeslots to a single subscriber line. See *Bundled T0 cross-connections* page 5-11 for bundled T0 cross-connection provisioning.

Bundled cross-connections are not required when the data service is configured within a GR-303 virtual remote terminal. In these virtual terminals, the local digital switch controls all timeslot assignments for the system. However, the switch must be correctly configured, as described above, if SCEC error correction is selected.

Configuration Management—Nonlocally Switched ISDN Basic Access (BRITE Channel Unit)

Overview

The *AnyMedia* Access System supports ISDN basic access service as a nonlocally switched service via the AUA293I2 BRITE III CU in the MDS2 shelf. This section discusses the nonlocally switched (BRITE) application.

BRITE ISDN circuit applications

Circuit applications for the AUA293I2 BRITE CU are as follows:

- Nonlocally switched ISDN service, where the local central office is not configured with the ISDN service capability. In this arrangement, a request for ISDN service from a local subscriber is served remotely by an ISDN-capable switch.
- Nonlocally switched ISDN service where the requesting subscriber is served by the *AnyMedia* Access System, but a TR-303 virtual terminal is not available.

Service description

Basic rate access ISDN service is provided by the AUA293I2 CU. It is compatible with TR-08 and INA virtual remote terminals in the *AnyMedia* Access System. BRITE service cannot be provisioned in TR-303 virtual terminals.

A BRITE circuit can be configured to provide four service types:

- 2B + D service
- B1 + D service
- B2 + D service
- D-only service.

In 2B + D service, both 64 kbps bearer channels (B-channels) and the 16 kbps data & signaling channel (D-channel) are available to carry the subscriber’s payload on an end-to-end basis. In B1 + D service and B2 + D service, the D-channel and only the first or second B-channel, respectively, are available to provide service. In D-only service, only the D-channel is provided on an end-to-end basis.

A BRITE circuit consumes one, two, or three DS0 timeslots according to the type of service which is selected. The bandwidth selection is specified in Table 5-43.

Table 5-43. Bandwidth for BRITE Service Types

Service	DS0 Timeslots Required
2B + D	3
B1 + D	2
B2 + D	
D-only	1

Figure 5-39 illustrates a service configuration using the AUA293I2 CU. Additional parameters must be set by switches on the CU.

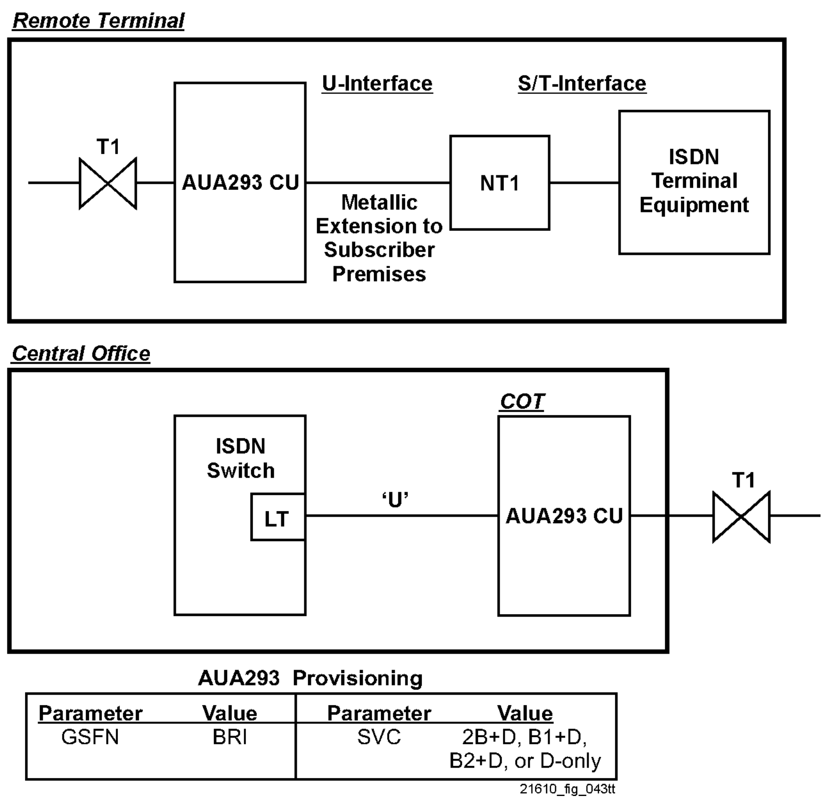


Figure 5-39. ISDN Service via BRITE CU

Circuit design considerations

ISDN via the BRITE CU is a nonlocally switched service not using TR-303 which must be converted to a metallic interface, either in the serving central office or a remote site. Figure 5-40 and Figure 5-41 illustrate two possible configurations for reconstructing the metallic interfaces.

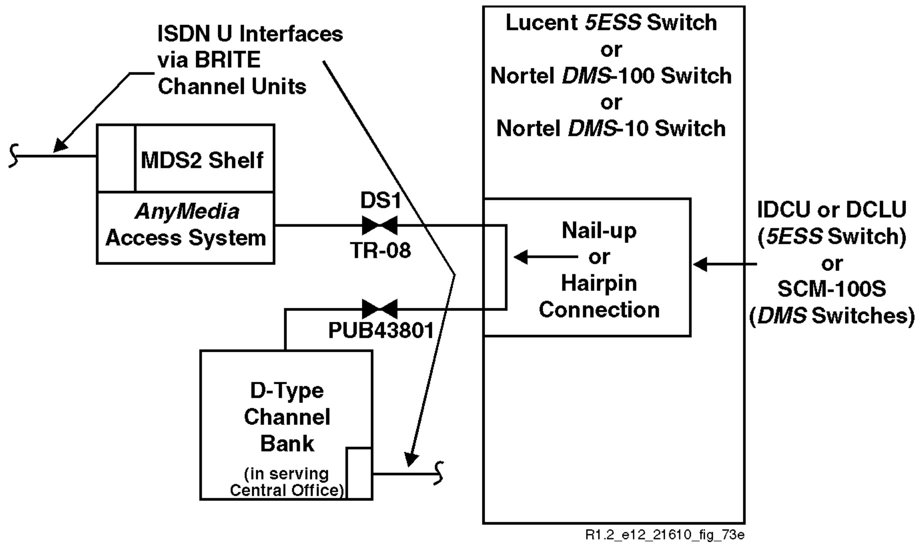


Figure 5-40. ISDN BRITE Basic Access Service via LDS Nail-up or Hairpin

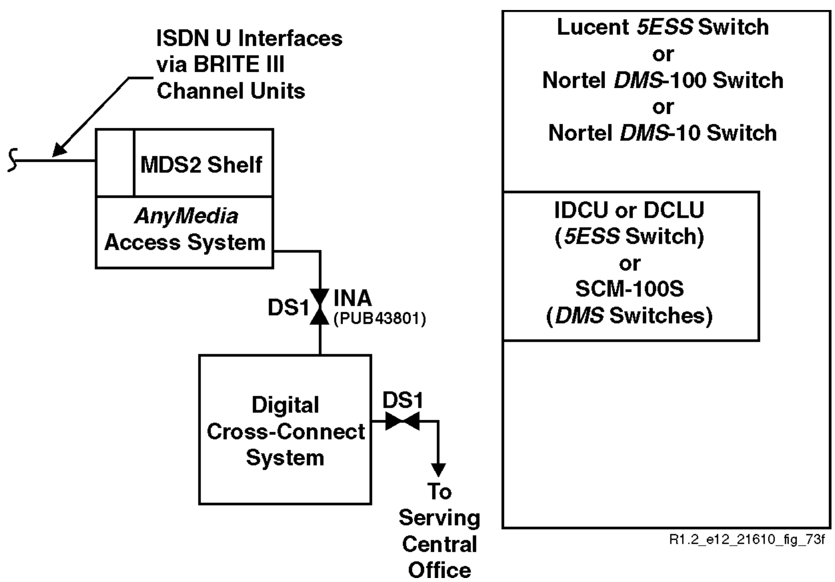


Figure 5-41. ISDN BRITE Basic Access Service via INA and DCS

BRITE service consumes one, two, or three DS0 timeslots on the DS1 facilities. If this service is cross-connected through the serving digital switch using a nail-up or hairpin connection, the switch must be correctly configured to support the multiple cross-connected timeslots while maintaining frame integrity (delay matching). The Lucent *5ESS* switch can support a maximum of two timeslots with guaranteed delay matching in a nail-up or hairpin connection; the circuit must be provisioned as a DDS service with no robbed-bit signaling and with two timeslots. The following parameters should be selected in the recent change/verify (RC/V) nail-up and hairpin specification:

23. SIGMODE “NOSIG”

25. DDS “Y”

26. PATH NUM “2”

If three timeslots are required for a BRITE service, the connection cannot be reliably cross-connected through the LDS.

When an ISDN BRITE circuit is configured for TR-08 or INA virtual terminals within the *AnyMedia* Access System, a bundled T0 cross-connection is necessary to assign two timeslots to a single subscriber line. See *Bundled T0 cross-connections* page 5-11 for bundled T0 cross-connection provisioning.

Configuration Management—DC/AC Alarm Service and DC Test Pair

Overview

The *AnyMedia* Access System supports the *Tollgrade MCU*-5205 and *MCU*-5405 CUs in the MDS2 shelf to provide DC/AC alarm services and an equivalent DC test pair, respectively.

Services

DC alarms

DC/AC alarm services are provided by the *MCU*-5205 CU in the MDS2 shelf. The service is provisioned using the NO1 GSFN code. The channel requires one DS0 timeslot. It can be supported on TR-08, GR-303, and INA VRTs.

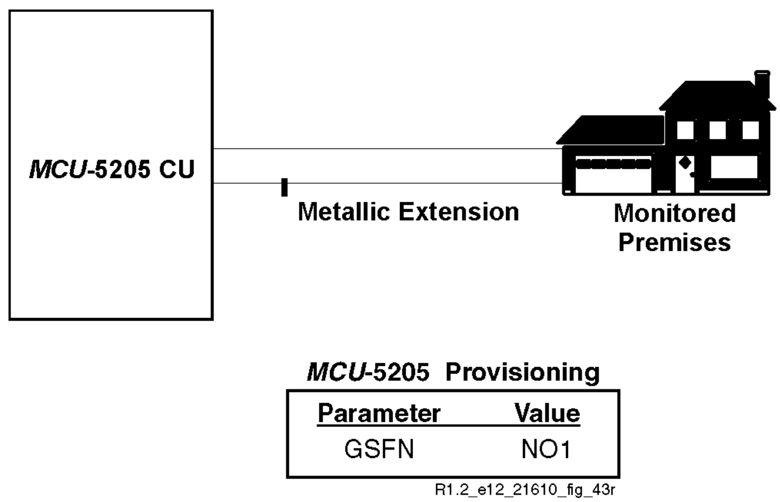
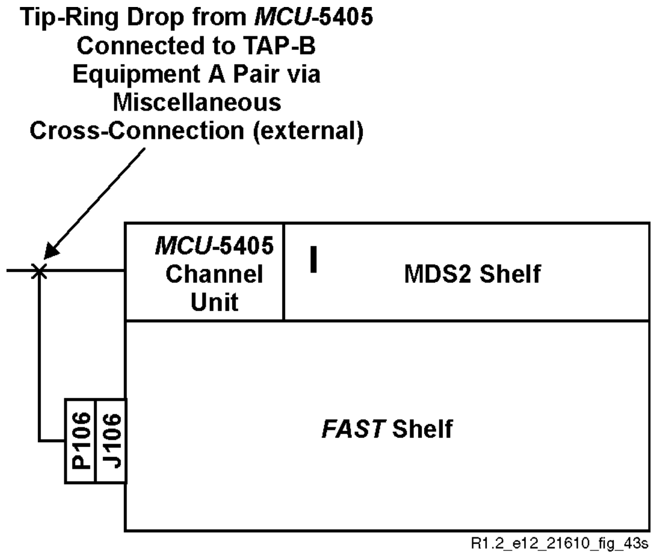


Figure 5-42. DC/AC Alarm Configuration

DC bypass pair

A DC bypass pair is provided by the *MCU*-5405 CU in the MDS2. The service is provisioned using the NO2 GSFN code. The channel requires two DS0 timeslots. It can be supported on TR-08, GR-303, and INA VRTs.



***MCU*-5405 Provisioning**

Parameter	Value
GSFN	NO2

Figure 5-43. DC Bypass Configuration (Equivalent Test Pair)

Circuit design considerations

DC/AC alarms and bypass pair circuits are nonswitched services, which must be converted to metallic interfaces either in the serving CO or a remote site. For DC bypass circuits, the derived pair will be connected to the TAP B Equipment A pair of the *FAST* shelf and to the LDS metallic test access network in the CO. For DC/AC alarm circuits, the derived pair will be connected to the monitored premises and to the alarm monitoring station. Figure 5-44 and Figure 5-45 illustrate two possible configurations for reconstructing the metallic interfaces.

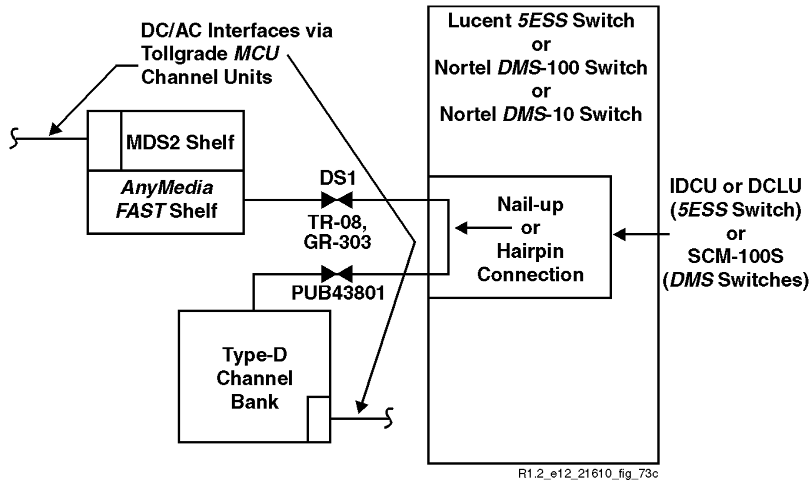


Figure 5-44. DC/AC Alarm Service or Bypass Pair via LDS Nail-up or Hairpin

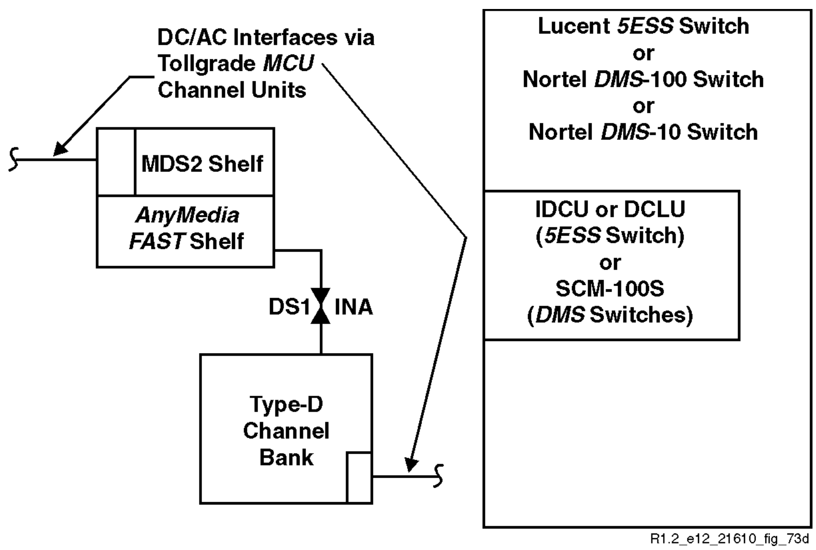


Figure 5-45. DC/AC Alarm Service or Bypass Pair via INA and Channel Bank

The DC/AC bypass service consumes two DS0 timeslots on the DS1 facilities. If this service is cross-connected through the serving digital switch using a nail-up or hairpin connection, the switch must be correctly configured to support two cross-connected timeslots. For the Lucent *5ESS* switch, the circuit should be provisioned as a DDS service with no signaling and with two timeslots. The following parameters should be selected in the RC/V nail-up and hairpin specification:

23. SIGMODE “NOSIG”

25. DDS “Y”

26. PATH NUM “2”

When a DC bypass circuit is configured for TR-08 or INA virtual terminals, a bundled T0 cross-connection is necessary to assign two timeslots to a single subscriber line. See *Bundled T0 cross-connections* page 5-11 for bundled T0 cross-connection provisioning.

Bundled cross-connections are not required when a bypass circuit is configured within a GR-303 VRT. In these virtual terminals, the local digital switch controls all timeslot assignments for the system. However, the switch must be correctly configured, as described above, for DDS service with two timeslots.

Configuration Management—Provisionable Channel Unit Parameters

Overview

Most provisionable CUs have no switch options. However, the CUs specified in Table 5-44 have option switches that must be set before they are installed.

Configuration Management—MDS2 Channel Unit Option Switch Selectable Parameters

Switch options

Table 5-44 lists the CUs that have switch options. These option values cannot be retrieved with the TL1SI or GSI.

Table 5-44. MDS2 Channel Unit Options Provisionable Using Switches

Channel Unit	Switch	Range	Description
AUA41B Four-wire CF CU	Sealing current[a]	ON, Off	Selects sealing current on or off
AUA45B dual ringing repeater	COT/RT	COT, RT	Selects CU location.
	ODD	0 dB, -3 dB	Selects the transmit and receive gain (loss) for the first (lowest-numbered) channel.
	EVEN	0 dB, -3 dB	Selects the transmit and receive gain (loss) for the second channel.
AUA75( ) dual private line auto ring	COT/RT	COT, RT	Selects CU location.
	D4/D3	D4, D3	Select signaling compatibility for the far-end CU. Set to D4 unless the far-end channel is a D3 PLAR unit in a D3 channel bank.
	ODD	0 dB, -3 dB	Selects the transmit and receive gain (loss) for the first (lowest-numbered) channel.
	EVEN	0 dB, -3 dB	Selects the transmit and receive gain (loss) for the second channel.

Table 5-44. MDS2 Channel Unit Options Provisionable Using Switches (Continued)

Channel Unit	Switch	Range	Description
AUA200 *Datapath* Extension DPX CU (two-wire switched 56-kbps data)	DTMF/DP	ON, Off	Selects dialing method (ON=DTMF/tone dialing)
	WINK	ON, Off	Controls wink indication to switch. (ON=wink start)
	AUTO TRK	ON, Off	Controls DU dialing in auto line mode. (ON=no DU dialing)
	MCD	ON, Off	Controls DU connect delay after off-hook. (ON=2-sec DU delay before connect)
	NDUTST	ON, Off	Controls test access of local DU. (ON=no DU testing)
	PSDS EN	ON, Off	Controls time-out of the handshaking sequence. (ON=time-out enabled)
	H/S SIG	ON, Off	Controls signaling detect mode (hardware/software). (ON=software signaling)

Table 5-44. MDS2 Channel Unit Options Provisionable Using Switches (Continued)

Channel Unit	Switch	Range	Description
AUA232 DSU Dataport	Error correction Location	NORM/EC COT/RT	Selects error correction Selects location
	Anti-streaming timer	NORM/ANTI-ST	Selects anti-streaming timer (when RTS EN selected)
	Switched Carrier mode	RTS DIS/RTS EN	Selects switched carrier mode (RTS EN)
	Rate	Off/56k	Selects rate
	Rate	Off/19.2k	Selects rate
	Rate	Off/9.6k	Selects rate
	Rate	Off/4.8k	Selects rate
	Rate	Off/2.4k	Selects rate
	Rate	Off/1.2k	Selects rate
	Character size	10BPC/11BPC	Selects async character size
	DTE mode	ASYNC/SYNC	Selects the DTE mode
MCU-5205 Metallic CU (for alarm circuits	S1	COT, RT	Selects CU location.
MCU-5405 Metallic CU for MLT (digital bypass pair)	S1	COT, RT	Selects CU location.

[a]When the CU is installed in the *AnyMedia* Access System MDS2 shelf, the system provisioning will override the sealing current switch on the AUA41B CU. The user is encouraged to set the switch to agree with system provisioning.

Table 5-45. MDS2 Teltrend AUA293I2 ISDN BRITE Channel Unit Options Provisionable Using Switches

Channel Unit	Switch[a]	Range	Switch Label	Description
AUA293I2 ISDN BRITE	S2-1	ON, Off	COT/RT	ON=Unit installed in COT OFF=Unit installed in RT
	S2-2	ON, Off	B1	ON=B1 channel in service OFF=B1 channel not in service
	S2-3	ON, Off	B2	ON=B2 channel in service OFF=B2 channel not in service
	S2-4	ON, Off	D	ON=D channel in service (ISDN service) OFF=D channel not in service (nonswitched service)
	S2-5	ON, Off	ZBS	ON=Zero byte substitution enabled OFF=Zero byte substitution enabled
	S2-6	ON, Off	SC	ON=Sealing current enabled OFF=Sealing current disabled

[a]When the CU is installed in an *AnyMedia* Access System MDS2 shelf, the user must set these switches to agree with system provisioning.

Table 5-46. MDS2 ADTRAN 1433105 *Total Reach* DDS-DP (OCU-DP) Channel Unit Options Provisionable Using Switches

Channel Unit	Switch	Range	Switch Label	Description
ADTRAN 1433105 *Total Reach* DDS-DP CU (OCU-DP)	SW1-1	ON, Off	64K	ON = 64kbps Clear Channel (Electronically provision gsfn=OCU3)
	SW1-2	ON, Off	19.2K	ON = 19.2 kbps Loop Rate (Electronically provision gsfn=OCU2, rate=192)
	SW1-3	ON, Off	SW56	ON enables Switched 56kbps Off disables Switched 56kbps (Electronically provision gsfn=OCU3, or gsfn=OCU2, rate=560)
	SW1-4	ON, Off	ABSIG	ON maintains A/B signaling OFF transparent to signaling
	SW1-5	ON, Off	QM	ON enables Quality Monitor OFF disables Quality Monitor

Configuration Management—MDS2 Channel Unit Provisionable Parameters

Provisioning Parameters

Table 5-47 through Table 5-68 list the valid provisioning parameters, according to function code for CUs used in the MDS2. These parameters are set using the `ENT-T0` TL1 command at the TL1 or GSI, are adjusted using the `ED-T0` command, and may be displayed using the `RTRV-T0` command.

Table 5-47. AC Function Code–Provisioning AUA45B

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	AC	

Table 5-48. BRI Function Code–Provisioning AUA293I2

Provisioning Parameter	WORD Abbreviation	Values	Default Value
svc=ISDN channel service	SVC	2B+D, B1+D, B2+D, or D	2B+D
gsfn=Generic signaling function	GSFN	BRI	

Table 5-49. DATA Function Code–Provisioning AUA200 and AUA232

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	DATA	

Table 5-50. DPT Function Code–Provisioning *SPQ*442

Provisioning Parameter	WORD Abbreviation	Values	Default Value
imp=Impedance	IMP	600 or 900	600
bal=Balance	BAL	0 to 15 in steps of 1	15
xmtgn=TransmitGain	XMT(GN)	-1.0 to 6.75 in steps of 0.25	-1.0
rcvgn=ReceiveGain	RCV(GN)	-8.0 to 1.5 in steps of 0.25	-1.0
sl=Slope	SL	0 to 7 in steps of 1	0
gsfn=Generic signaling function	GSFN	DPT	

Table 5-51. DX4 Function Code–Provisioning AUA41B

Provisioning Parameter	WORD Abbreviation	Values	Default Value
trmt=TRMT attenuator	TRMT	0 to 16.5 in steps of 0.1	16.5
rcv=RCV attenuator	RCV	0 to 16.5 in steps of 0.1	16.5
ln=Nonloaded/loaded	L-N	L or N	N
sl=Slope	SL	0 to 15 in steps 1	0
bw=Bandwidth	BW	0 to 15 in steps 1	0
ht=Height	HT	0 to 15 in steps 1	0
imp=Transmit and receive impedance	TRMT&RCV(IMP)	150, 600, or 1200	600
gsfn=Generic signaling function	GSFN	DX4[N,R]	

Table 5-52. EBS Function Code–Provisioning *SPQ*429, *SPQ*328

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	EBS	

Table 5-53. EM4C/H Function Code–Provisioning *SPQ*454

Provisioning Parameter	WORD Abbreviation	Values	Default Value
trmt=TRMT attenuator	TRMT	0 to 25.5 in steps of 0.1	16.5
rvc=RCV attenuator	RCV	0 to 25.5 in steps of 0.1	16.5
gsfn=Generic signaling function	GSFN	EM4[C,H]	

Table 5-54. ETO4 Function Code–Provisioning AUA41B

Provisioning Parameter	WORD Abbreviation	Values	Default Value
trmt=TRMT attenuator	TRMT	0 to 16.5 in steps of 0.1	16.5
rcv=RCV attenuator	RCV	0 to 16.5 in steps of 0.1	16.5
dBJ3=-7 dB (J3)	-7DB(J3)	WH or BK	BK
ln=Nonloaded/loaded	L-N	L or N	N
sl=Slope	SL	0 to 15 in steps of 1	0
bw=Bandwidth	BW	0 to 15 in steps of 1	0
ht=Height	HT	0 to 15 in steps of 1	0
imp=Transmit and receive impedance	TRMT&RCV(IMP)	150, 600, or 1200	600
sc=SealingCurrent	SC	YES or NO	YES

Table 5-54. ETO4 Function Code–Provisioning AUA41B (Continued)

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	ETO4	

Table 5-55. FXO Function Code–Provisioning *SPQ*442

Provisioning Parameter	WORD Abbreviation	Values	Default Value
imp=Impedance	IMP	600 or 900	900
bal=Balance	BAL	0 to 15 in steps of 1	3
xmtgn=TransmitGain	XMT(GN)	-1.0 to 6.75 in steps of 0.25	-1.0
rcvgn=ReceiveGain	RCV(GN)	-8.0 to 1.5 in steps of 0.25	-8.0
sl=Slope	SL	0 to 7 in steps of 1	0
td=TollDiversion	TD	NO or YES	NO
lsgs=SignalingType	LS-GS	LS or GS	GS
oht=OnHookTransmission	OHT	NO or YES	NO
gsfn=Generic signaling function	GSFN	FXO	

Table 5-56. FXO/P Function Code–Provisioning *SPQ*444

Provisioning Parameter	WORD Abbreviation	Values	Default Value
trmt=TRMT attenuator	TRMT	0 to 16.5 in steps of 0.1	16.5
rcv=RCV attenuator	RCV	0 to 16.5 in steps of 0.1	16.5
ln=Nonloaded/loaded	L-N	L or N	N
sl=Slope	SL	0 to 15 in steps of 1	0
bw=Bandwidth	BW	0 to 15 in steps of 1	0
ht=Height	HT	0 to 15 in steps of 1	0

Table 5-56. FXO/P Function Code–Provisioning *SPQ*444 (Continued)

Provisioning Parameter	WORD Abbreviation	Values	Default Value
imp=Transmit and receive impedance	TRMT&RCV(IMP)	150, 600, or 1200	600
gsfn=Generic signaling function	GSFN	FX[O,P][1,2,3,5]	

Table 5-57. FXS/T Function Code–Provisioning AUA41B

Provisioning Parameter	WORD Abbreviation	Values	Default Value
trmt=TRMT attenuator	TRMT	0 to 16.5 in steps of 0.1	16.5
rcv=RCV attenuator	RCV	0 to 16.5 in steps of 0.1	16.5
ln=Nonloaded/loaded	L-N	L or N	N
sl=Slope	SL	0 to 15 in steps of 1	0
bw=Bandwidth	BW	0 to 15 in steps of 1	0
ht=Height	HT	0 to 15 in steps of 1	0
imp=Transmit and receive impedance	TRMT&RCV(IMP)	150, 600, or 1200	600
gsfn=Generic signaling function	GSFN	FX[S,T][1,2,3,5]	

Table 5-58. LR Function Code–Provisioning AUA75( )

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	LR	

Table 5-59. NO1 and NO2 Function Code–Provisioning *MCU*-5205 and *MCU*-5405

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	NO[1,2]	

Table 5-60. OCU1 GSFN Provisioning *SPQ*452

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	OCU1	
rate=Subscriber data rate	RATE	24, 48, 96, 192	192
ec=Error correction	EC	NONE, MVEC	NONE
zc=All-zero-code allowed	ZC	NO, YES	NO
scc=Secondary channel used	SCC	NO, YES	NO
qm=Quality monitor	QM	NO, YES	NO

Table 5-61. OCU2 GSFN Provisioning *SPQ*452

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	OCU2	
rate=Subscriber data rate	RATE	384, 560	560
ec=Error correction	EC	NONE, SCEC	NONE
zc=All-zero-code allowed	ZC	NO, YES	NO
scc=Secondary channel used	SCC	NO, YES	NO

Table 5-61. OCU2 GSFN Provisioning *SPQ*452 (Continued)

Provisioning Parameter	WORD Abbreviation	Values	Default Value
qm=Quality monitor	QM	NO, YES	NO

Table 5-62. OCU3 GSFN Provisioning *SPQ*452

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	OCU3	
rate=Subscriber data rate	RATE	640	640
ec=Error correction	EC	NONE, SCEC	NONE

Table 5-63. PLR1/2 Function Code–Provisioning *SPQ*454

Provisioning Parameter	WORD Abbreviation	Values	Default Value
trmt=TRMT attenuator	TRMT	0 to 25.5 in steps of 0.1	16.5
rcv=RCV attenuator	RCV	0 to 25.5 in steps of 0.1	16.5
gsfn=Generic signaling function	GSFN	PLR[1,2]	

Table 5-64. SW56 Function Code–Provisioning *SPQ*452, *SPQ*334

Provisioning Parameter	WORD Abbreviation	Values	Default Value
eh56=Enhanced switched 56[a]	EH56	NO or YES	NO
ab=A/B signaling	AB	NO or YES	NO
qm=Quality monitoring	QM	NO or YES	NO
gsfn=Generic signaling function	GSFN	SW56	

[a]The *SPQ*334 CU does not have eh56 or qm as provisioning parameters and should be set to NO.

Table 5-65. TDO Function Code–Provisioning *SPQ*444

Provisioning Parameter	WORD Abbreviation	Values	Default Value
trmt=TRMT attenuator	TRMT	0 to 11.6 in steps of 0.1	11.6
gsfn=Generic signaling function	GSFN	TDO[A,B,C,D]	

Table 5-66. TDS Function Code–Provisioning *SPQ*444

Provisioning Parameter	WORD Abbreviation	Values	Default Value
trmt=TRMT attenuator	TRMT	0 to 11.6 in steps of 0.1	11.6
gsfn=Generic signaling function	GSFN	TDS[A,B,C,D]	

Table 5-67. TO Function Code–Provisioning *SPQ*442, *SPQ*443

Provisioning Parameter	WORD Abbreviation	Values	Default Value
imp=Impedance	IMP	600 or 900	600

Table 5-67. TO Function Code–Provisioning *SPQ*442, *SPQ*443 (Continued)

Provisioning Parameter	WORD Abbreviation	Values	Default Value
bal=Balance	BAL	0 to 15 in steps of 1	3
xmtgn=TransmitGain	XMT(GN)	-1.0 to 6.75 in steps of 0.25	-1.0
rcvgn=ReceiveGain	RCV(GN)	-8.0 to 1.5 in steps of 0.25	-8.0
sl=Slope	SL	0 to 7 in steps of 1	0

Table 5-68. TO4 Function Code–Provisioning AUA41B

Provisioning Parameter	WORD Abbreviation	Values	Default Value
trmt=TRMT attenuator	TRMT	0 to 16.5 in steps of 0.1	16.5
rcv=RCV attenuator	RCV	0 to 16.5 in steps of 0.1	16.5
dBt=-7 TRMT	-7DB TRMT	WH or BK	BK
dBr=-7 RCV	-7DB RCV	WH or BK	BK
sc=SealingCurrent	SC	YES or NO	YES
gsfn=Generic signaling function	GSFN	TO4	

Table 5-69. DS01 GSFN Provisioning *SPQ*334

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	DS01	
rate=Subscriber data rate	RATE	2.4, 4.8, 9.6, 19.2, 38.4, 56, or 64 kbps	56
ec=Error correction	EC	NO, YES	NO
zc=All-zero-code allowed	ZC	NO, YES	NO

Values for the DS0A Service Format are selected from the following:

DS0A Service Format Selections for the *SPQ*334

Service Format	Selected Provisionable Parameters			Notes
	RATE	EC	ZC	
DS0A	64	YES / NO	YES / NO	If EC=YES, then SCEC ZC always YES, ignore ZC=NO
DS0A	56	YES / NO	YES / NO	If EC=YES, then SCEC
DS0A	38.4	YES / NO	YES / NO	If EC=YES, then SCEC
DS0A	19.2	YES / NO	YES / NO	If EC=YES, then 19.2EC
DS0A	9.6, 4.8, 2.4	YES / NO	YES / NO	If EC=YES, then MVEC

Table 5-70. DS02 GSFN Provisioning *SPQ*334

Provisioning Parameter	**WORD Abbreviation**	**Values**	**Default Value**
gsfn=Generic signaling function	GSFN	DS02	
rate=Subscriber data rate	RATE	2.4, 4.8, 9.6, 19.2, 56, or 64 kbps	56
ec=Error correction	EC	NO, YES	NO
zc=All-zero-code allowed	ZC	NO, YES	NO

Values for the DS0B Service Format are selected from the following:

DS0B Service Format Selections for the *SPQ*334

Service Format	Selected Provisionable Parameters			Notes
	RATE	EC	ZC	
DS0B	64	YES / NO	YES / NO	If EC=YES, then SCEC ZC always YES, ignore ZC=NO
DS0B	56	YES / NO	YES / NO	If EC=YES, then SCEC
DS0B	19.2	YES / NO	YES / NO	If EC=YES, then SCEC
DS0B	9.6, 4.8, 2.4	YES / NO	YES / NO	If EC=YES, then SCEC

Table 5-71. DPO Function Code Provisioning [*SPQ*443]

Provisioning Parameter	WORD Abbreviation	Values	Default Value
imp=Impedance	IMP	600 or 900	600
bal=Balance	BAL	0 to 15 in steps of 1	3
xmtgn=TransmitGain	XMT(GN)	-1.0 to 6.75 in steps of 0.25	-1.0
rcvgn=ReceiveGain	RCV(GN)	-8.0 to 1.5 in steps of 0.25	-8.0
sl=Slope	SL	0 to 7 in steps of 1	0
gsfn=Generic signaling function	GSFN	DPO	

Table 5-72. FXS Function Code Provisioning [*SPQ*443]

Provisioning Parameter	WORD Abbreviation	Values	Default Value
imp=Impedance	IMP	600 or 900	600
bal=Balance	BAL	0 to 15 in steps of 1	3
xmtgn=TransmitGain	XMT(GN)	-1.0 to 6.75 in steps of 0.25	-1.0
rcvgn=ReceiveGain	RCV(GN)	-8.0 to 1.5 in steps of 0.25	-8.0
sl=Slope	SL	0 to 7 in steps of 1	0
oht=OnHookTransmission	OHT	NO or YES	NO
gsfn=Generic signaling function	GSFN	FXS	

Table 5-73. 2RVT GSFN Provisioning *SPQ*442, DPT32CS

Provisioning Parameter	WORD Abbreviation	Values	Default Value
loss=Bidirectional transmission loss	LOSS	0 or 2.5	0
gsfn=Generic signaling function	GSFN	2RVT[a]	

[a]The DPT32CS AP and the *SPQ*442 CU both share the 2RVT GSFN. The provisioning parameters shown reflect the capability of the DPT32CS. System software converts the symmetric loss value of the DPT32CS AP to the asymmetric XMTGN and RCVGN value that the *SPQ*442 CU understands as follows:

a LOSS=0 converts to XMTGN=0 and RCVGN=0
a LOSS=2.5 converts to XMTGN=-1 and RCVGN=-1

The standard default values used for the parameters not defined for the *SPQ*442 CU are as follows:

IMP=600

BAL=15

SL=0

Table 5-74. OCU1 Function Code—Provisioning ADTRAN 1433105

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	OCU1	
rate=Subscriber data rate	RATE	24, 48, 96, 192[a]	192
ec=Error correction	EC	NONE, MVEC	NONE
zc=All-zero-code allowed	ZC	NO, YES	NO
scc=Secondary channel used	SCC	NO, YES	NO
qm=Quality monitor	QM	NO, YES[a]	NO

[a]These parameter values must be set manually by switches on the channel unit.

Table 5-75. OCU2 Function Code—Provisioning ADTRAN 1433105

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	OCU2	
rate=Subscriber data rate	RATE	384[a], 560	560
ec=Error correction	EC	NONE, SCEC	NONE
zc=All-zero-code allowed	ZC	NO, YES	NO
scc=Secondary channel used	SCC	NO, YES	NO
qm=Quality monitor	QM	NO, YES[b]	NO

[a]The 38.4 kbps data rate is not supported by the channel unit.

[b]This parameter value must be set manually by a switch on the channel unit.

Table 5-76. OCU3 Function Code—Provisioning ADTRAN 1433105

Provisioning Parameter	WORD Abbreviation	Values	Default Value
gsfn=Generic signaling function	GSFN	OCU3	
rate=Subscriber data rate	RATE	640	640
ec=Error correction	EC	NONE, SCEC	NONE

Configuration Management—Inventory Management

Overview

Inventory Management is the system activity of collecting, updating, and reporting data on system equipage and system status (i.e., IS or OOS). Inventory Management includes reporting new equipment inventory upon installation, storing equipment status, removing equipment inventory upon degrowth, and reporting changes in inventory.

Retrievable inventory items

Electronically readable inventory for most circuit packs in the system can be retrieved on demand.

Retrievable inventory items include the following:

- TYPE—a mnemonic name that identifies the kind of equipment
- APP—the apparatus code that uniquely identifies the equipment function
- ICC—the interchangeability code stored in the form of S*m*-*n*, where *m* is the issue number and *n* is the series number
- *CLEI*—a 10-character code that identifies each circuit pack type
- ECI—a 6-character code that identifies each circuit pack type; the equipment catalog item code corresponds to the bar coded label on the faceplate of the circuit pack and is uniquely equivalent to the *CLEI*
- SLN—a 12-character code that uniquely identifies each circuit pack; the serial number SLN includes the date and place of manufacture.

Software identifiers (for the COMDAC only) are as follows:

- PVRSN—the program version of the software currently stored in the circuit pack
- PCDE—the program code (J code) of the software currently stored in the circuit pack.

Primary and secondary slot state information is also retrievable for each circuit pack as follows:

- Primary slot state—the valid values are as follows:
  - IS—in service
  - OOS—out of service.
- Secondary slot state—the valid values are as follows:
  - FLT—fault
  - INIT—initialization including diagnostics

— SWDL—software downloading from the TL1SI view of the GSI only to a COMDAC or between COMDACs
— UEQ—unequipped when the slot is empty.

Physical data label

On the front of each circuit pack is an electronically scannable bar code and a human readable inventory data label. The human readable component contains the *CLEI* code, apparatus code, entity type, and interchangeability code. The bar code scannable component of the label contains the equipment catalog item code.

Reportable database changes

Autonomous notification is provided when changes occur to the inventory database as a result of the execution of provisioning commands, state changes, or changes in the physical inventory.

Configuration Management—Synchronization Provisioning

Overview

Synchronization provisioning controls the synchronization mode of the *AnyMedia* Access System and its synchronization reference sources.

Synchronization modes

The synchronization mode is selected by a TL1 command.

The *AnyMedia* Access System typically operates in the line-timed mode. In this mode, the system acquires its timing from a DS1 input signal. Two input signals can be specified as the timing reference sources. If the active source fails, the system automatically selects the duplicate source. When the system's nonvolatile data store is initialized at turn-up, the line-timed mode is selected as the initial default synchronization mode for the system.

The *AnyMedia* Access System may be synchronized to external clock signals from a building timing supply or from a SONET multiplexer. The system accepts either DS1 (1.544 MHz) or composite clock (64 kHz) external clock signals. External clock signal inputs must be duplicated. The *AnyMedia* Access System automatically switches to the duplicate clock signal if the active signal fails.

The system can also operate in the free-running mode.

Line timing synchronization references

The line timing synchronization reference sources are also selected by TL1 provisioning.

The *AnyMedia* Access System supports two synchronization reference sources. When the system's nonvolatile data store is initialized at turn-up, the first DS1 inputs on each of the first two IODS1 circuit packs are selected as the initial default reference sources.

Fault Management—Alarms and Events

Overview

The surveillance capabilities of the system consist of equipment and facility monitoring. During normal operation, the system provides continuous or periodic surveillance through the following noninvasive diagnostics:

- Active and/or standby units
- DS1 signal inputs
- Equipment power
- Environmental conditions.

The results of these monitoring activities generate alarms and status condition and/or transient condition reports.

The *AnyMedia* Access System provides the following capabilities:

- Classification of detected alarms
- Reporting and retrieving alarms
- CO/remote alarm output closures and cutoff
- Inhibiting and resuming alarms
- Provisioning of alarm severity leads.

Alarm classifications

Detected alarms are classified as one of the following:

- Equipment alarms
- Facility alarms
- Environmental alarms.

Equipment alarms

Equipment alarms include the following fault conditions:

- Circuit pack faults, missing or incompatible
- Peripheral pack(s) not responding to poll
- Data link faults
- Input power failure
- System memory faults
- Failure to update system data and programs.

Facility alarms

Facility alarms indicate DS1 feeder and INA facilities problems. These alarms indicate faulty conditions in the incoming GR-303, TR-08, or INA DS1 signals, including the following:

- Loss of frame
- Loss of signal
- High BER
- AIS
- DS1 yellow received
- Synchronization signal failed.

Environmental alarms

Environmental alarms are user provisionable to define power/environmental faults. The faults may include the following:

- AC input power failure
- Battery on discharge
- Power minor (ringing generator backup failed, rectifier/converter backup failed, loss of AC power, and/or thermal probe failed)
- Power major (unprotected ringing generator failed, unprotected rectifier/converter failed, and/or excessive battery temperature)
- Fuse minor (fuse failed with backup)
- Fuse major (fuse failed without backup)
- Fan failed
- Intrusion (enclosure door open)
- –48V power feed (only for J1C282AB-1 and J1C282AC-1 shelves when connected).

Reporting and retrieving alarms

Alarm, status condition, and/or transient condition information is reported by the system over a variety of interfaces. These include the following:

- OS or TL1SI/GSI interfaces
- LDS, COT, and INA DS1 interfaces
- Visual indicators.

Autonomous message reporting

This interface transmits autonomous messages for individual and summary alarms, status condition reports, and transient condition reports. It also supports

OS or TL1SI query for alarms and status conditions. The functions supported over this interface include the following:

- Reporting equipment and facility alarms
- Reporting environmental alarms
- Reporting status and transient conditions, including TCAs
- Retrieving currently active equipment and facility alarms
- Retrieving currently active environmental alarms
- Retrieving currently active status conditions
- Retrieving alarm/status history report.

LDS, COT, and INA DS1 interfaces

GR-303 and TR-08 alarms are made available to the LDS over the EOC and DS1-A data link, respectively. In addition, DS1 maintenance signals are reported over the DS1s, including INA DS1s. All alarms and events are GR-303 and/or TR-08 compliant.

Visual indicators

- LEDs on the faceplates of all packs in the system reflect fault conditions of the circuit pack.
- A single shelf LED on the *FAST* shelf or MDS2 shelf provides a summary alarm indication with *FAST* shelf or MDS2 shelf doors closed.

CO/remote alarm output closures and cutoff

The system provides two sets of local (CO) alarm output closures:

- One set for visual alarm indications
- One set for audible alarm indications.

Each set of alarm closures is used to indicate the most severe alarm state (critical, major, minor) in the system, which includes equipment, facility, and environmental alarms. The local (CO) alarm output closures are located on the CTU.

The system provides a set of alarm closures for output to the remote telemetry system to indicate the most severe alarm state (critical, major, minor) in the system, which includes equipment, facility, and environmental alarms. The remote alarm output closures are located on the CTU.

The system supports the alarm cutoff function that, when activated, retires the audible local and remote output closures.

Inhibiting/resuming alarm

The system provides the capability to inhibit and resume autonomous alarm reporting to any telephony OAM&P interfaces.

Provisioning of alarm severity level

The system provides the capability to provision the alarm severity level for individual alarms.

Fault Management—Testing

Overview

The *AnyMedia* Access System supports a variety of tests for services, including the following:

- Turn-up tests
- Loopbacks
- Self-tests
- On-demand circuit testing.

Standard external TR-465 (PGTC)-compatible locally switched service circuit testing operations systems (such as the Lucent Technologies MLT system) are supported for both universal and integrated TR-08 and GR-303 configurations. In addition, GR-834-compatible testing operations systems are supported.

Turn-up tests

The system provides automatic circuit pack diagnostic tests as part of the turn-up process, which include built-in self-test.

Loopbacks

The system allows loopbacks of DS1 feeders or ISDN circuits for turn-up and maintenance testing of traditional DLC services. The system supports the following methods of loopback:

- The methods of controlling ESF format DS1 loopbacks are as follows:
  - — TL1 messages over the TL1SI/GSI or OS interface
  - — GR-303 EOC messages (a GR-303 LDS can use the EOC to request DS1 loopbacks of any of the DS1 feeders associated with the VRT that is served by that EOC)
  - — 16-bit coded messages over the DS1 ESF format data link.
- An LDS or a TR-08 COT can request a FELP over the TR-08 data link.
- ISDN loopbacks can be established for use in testing of ISDN lines.

Self-tests

The system supports extensive self-tests that are independent of any external connections. When installed, each circuit pack and AP designed for the *AnyMedia* Access System performs a self-test. If the self-test fails, the appropriate alarm is reported, and the fault LED is lit on the pack.

On-demand circuit testing capabilities

The system provides the following on-demand circuit testing capabilities for VF and ISDN lines:

- Local metallic test access for both locally switched and special service circuits
- On-demand AP diagnosis
- TR-465 (PGTC)–compatible channel and drop testing of locally switched services using an external TOS, such as the Lucent Technologies MLT system. (A PGTC* is needed for universal TR-08 systems, and an LDS and emulated PGTC [such as the *5ESS*-2000 switch and its test bus control unit] are needed for integrated TR-08 or GR-303 systems.)
- Routine VF ALIT using capabilities in certain LDSs (such as the *5ESS*-2000 switch) when a metallic bypass pair or an digital bypass pair is used (integrated configuration only)
- Remote on-demand U-interface ISDN digital subscriber line (U-DSL) drop and loopback testing using capabilities in the TOSs and the LDS
- Metallic test access for a GR-834-compatible RTU-2 for locally switched service or special service testing.

Local metallic test access

Local metallic access for manual testing of two-wire circuits that are served from *FAST* shelf APs is available via test access jacks on the front of the CTU. Local metallic access of two-, four-, or six-wire circuits that are served from MDS2 shelf CUs is available via test access jacks on the MDS2 shelf. The subscriber circuit to be accessed and the type of access are normally specified from a local TL1SI or GSI/TL1SI view. The following types of access are available:

- Bridging metallic access
- Full-splitting metallic access to the T, R, and (if applicable) T1, R1 leads
- Half-splitting (toward the channel unit or AP) metallic access to the E&M signalling leads, if applicable.

CAUTION:
Since bridging access connects directly onto the tip/ring pairs, any test equipment used should be placed into its “monitor” mode to avoid disturbing subscribers.

* An extended test controller (XTC) operating in its PGTC mode can be used for universal system testing instead of the PGTC. A detailed description of the XTC is provided in Lucent Technical Reference 363-205-300.

AP diagnosis

The local or remote TL1SI or GSI/TL1SI view interface or the OS interface can be used to request diagnosis of either an entire AP or a particular subscriber circuit on this pack.

CAUTION:
Diagnosis of an AP is service-affecting to the circuit being tested.

TR-465 (PGTC)–compatible channel and drop testing

The system provides both TR-08 and GR-303 metallic test access to its subscriber circuits through interfaces for TR-465 (PGTC)–compatible channel and drop testing. The *AnyMedia* Access System is compatible with TR-465-compatible locally switched services TOSs, such as the Lucent Technologies MLT system.

The CTU provides the terminations that are needed for PGTC channel testing, as well as relays that (in conjunction with relays in the AP) connect the TAP to the circuit being tested.

Following are the choices for the location of the RTU:

- The RTU can be located in the CO, with either a metallic bypass pair or digital bypass pair (e.g., as provided from a *Tollgrade MCU*-5405 channel unit in the MDS2 shelf or an external *Tollgrade Micro-Bank*) connecting it from the CO to the *AnyMedia* Access System site. In this case, the RTU is called an RTU-1.
- On-demand loop testing can also be supported with an RTU collocated with the *AnyMedia* Access System. In this case, the RTU is called an RTU-2.

CAUTION:
In all cases, the RTU (RTU-1 or RTU-2) must be compatible with the TOS (e.g., MLT).

See Chapter 6, *Using Tollgrade MCU-5405 CUs in the MDS2 Shelf* for illustrations and explanations of the various possible TR-465–compatible testing configurations for both universal and integrated *AnyMedia* Access Systems.

Routine ALIT

The *5ESS* switch can perform routine ALIT on drops connected to integrated *AnyMedia* Access Systems equipped with either a metallic bypass pair or an digital bypass pair*. The *5ESS* switch stores the ALIT test results. The Predictor test system retrieves and analyzes the test results in order to detect trends in loop

* This ALIT capability is *not* available if an RTU-2 is used.

degradation. The test system then predicts failures in subscriber loops before the failures occur.

For further details of the ALIT capability, see Lucent Technical Reference 235-105-220, *5ESS Switch Corrective Maintenance*. (The Nortel *DMS*-100 LDS provides a similar capability, but, as with the *5ESS*-2000 switch, only for drops connected to integrated systems equipped with either a metallic bypass pair or an digital bypass pair.)

ISDN U-DSL testing

When the system is configured for GR-303 operation, the system supports U-DSLs. The following capabilities for ISDN U-DSL testing are provided:

- Half-split toward the subscriber drop metallic access for drop tests. Split access can be requested either via the LDS or from the TL1SI/GSI/TL1SI view. Automated testing of the ISDN drop is provided by a TOS using either an RTU at the *AnyMedia* Access System site (RTU-2) or a centralized RTU (RTU-1) connected to the *AnyMedia* Access System via a metallic bypass pair or an digital bypass pair.
- Loopbacks in various combinations of B, 2B, and D channels controlled from the LDS user interface.
- Corrupted CRC tests, controlled from the LDS user interface.
- ISDN EOC tests, controlled from the LDS user interface.

GR-834-compatible testing

The system provides metallic access to its subscriber circuits for a collocated remote test unit (RTU-2) plus an RS-232 backplane connector for the exchange of GR-834-compatible TL1 messages with this remote test unit.

System Planning and Engineering for Traditional DLC Services

6

Overview

This System Planning and Engineering chapter provides the information necessary to plan and engineer the traditional DLC applications of the *AnyMedia* Access System.

System Capacity

Overview

This section describes the system capacity of the *AnyMedia* Access System for traditional DLC interfaces with a MDS2 shelf option.

Description

For a system with an MDS2 shelf, APs in any two adjacent slots on the *FAST* shelf can be replaced with MDSU circuit packs to support the MDS2 shelf. The capacity of the system is determined by the maximum number of circuit packs of each kind that the *AnyMedia FAST* shelf can support.

For detailed information on the *FAST* shelf capacity, see the *AnyMedia* Access System Applications, Planning, and Ordering Guide.

MDS2 shelf capacity

The *AnyMedia* Access System provides as part of its feature set the optional capability of interfacing to one MDS2 shelf. The MDS2 shelf is a supplementary shelf that is mounted in the same bay with the *FAST* shelf. The MDS2 shelf provides connectivity to a wide range of quad *SLC*-2000 and dual *SLC* Series 5 CUs. The MDS2 shelf has a maximum capacity of 96 lines (assuming that all *SLC*-2000 quad circuit packs are used). The interface between the *FAST* shelf and the MDS2 shelf is provided by an MDSU circuit pack that is plugged into an AP slot on the *FAST* shelf. Each MDSU can support half of an MDS2 shelf or 48 lines. A full MDS2 shelf requires two MDSU units in the *FAST* shelf, plus two MSC circuit packs in the MDS2 shelf. In this configuration, each MDSU can be viewed as a virtual CU of 48 lines maximum.

Maximum number of subscriber lines per *AnyMedia* Access System

The maximum number of subscriber lines per *AnyMedia* Access System is as follows:

- For standard *AnyMedia* Access System *FAST* shelf plus MDS2 shelf—544 if 14 AP slots are equipped with 32 line AP packs plus 24 CU slots at the MDS2 shelf equipped with quad CUs.

GR-303 VRT capacity

The *AnyMedia* Access System provides the capability for one GR-303 VRT. This GR-303 VRT can support the following:

- Up to 544 active logical lines for POTS on the *FAST* shelf and special services on the MDS2 shelf. To terminate the full 544 lines, concentration is required at the remote terminal, as the feeder capacity is limited to a maximum of 488 DSO timeslots.

TR-08 VRT capacity

An *AnyMedia* Access System shelf supports up to 20 individual Mode 1 TR-08 VRTs at the same time. Each of these VRTs has the following:

- Up to a maximum 96 active logical lines, if all four DS1s per VRT (designated A, B, C, and D) are provisioned.
- If an *AnyMedia* Access System *FAST* shelf or *FAST* shelf with an MDS2 shelf is configured exclusively as TR-08 Mode 1, then the maximum capacity of the shelf is limited to 480 (20 DS1s x 24 channels/DS1 = 480 channels).

NOTE:
If the *FAST* shelf is configured as TR-08 Mode 1, the 480 line capacity can be achieved with 15 POTS, PROG2W or PRCOIN APs if desired, leaving one of the AP slots empty. If the *FAST* shelf with MDS2 shelf is configured for TR-08 Mode 1, the 480 line capacity can be achieved with 12 POTS, PROG2W, PRCOIN APs, and a fully loaded MDS2 shelf.

- Up to four active logical feeder DS1s (designated A, B, C, D).
- An F_S' bit-oriented data link in the framing bit position of the “A” DS1 feeder that carries alarm messages and channel and drop testing messages.
- Processing and hardware to initiate and respond to data link messages and robbed bit signaling as defined in the Telcordia Technologies, Inc. TR-08 specification.

Since there is no concentration in Mode 1 TR-08, there is a fixed relationship between TR-08 logical feeder timeslots and TR-08 logical line numbers as follows:

Logical Lines	Digroup
1–24	A
25–48	B
49–72	C
73–96	D

However, just as with the GR-303 VRT, it is possible to associate lines as follows:

- Any DS1 feeder port with any TR-08 logical feeder DS1 by sending a T1 cross-connection message over the operations interface
- Any physical line on any AP or MDS2 CU with any TR-08 logical line by sending a T0 cross-connection message over the operations interface.

The *AnyMedia* Access System allows up to 20 TR-08 VRTs, and these VRTs can use any of the 20 feeder DS1 ports available in a shelf. The actual number of TR-08 VRTs that can be supported by a given shelf depends on the line sizes of the VRTs and the availability of feeder DS1 ports, which can vary depending on the configuration of VRTs and VBs provisioned on the shelf.

INA VB

INA VBs are the logical representations used to support nonswitched or nonlocally switched special services. INA feeder DS1s are DS1 feeder facilities of an *AnyMedia* Access System shelf that carry only nonswitched or nonlocally switched special services. INA DS1s do not connect to the local switching system; rather, they terminate on a digital channel bank, on a DCS, or on interoffice facilities. Since there is a maximum of 20 feeder DS1 ports available in one shelf, there can be at most 20 INA VBs. However, the number of active INA VBs depends on how many of these INA VBs are cross-connected to DS1 ports. An INA feeder DS1 becomes active only when an INA VB is T1 cross-connected to one of the DS1 ports. Each INA VB has only 24 logical lines to which physical lines on APs and on MDS2 CUs may be T0 cross-connected.

Capacity of mixed VRT and VB configurations

A large number of different configurations are possible for the *AnyMedia* Access System shelf in terms of mixed configurations of TR-08 VRTs, GR-303 VRTs, and INA VBs. The engineering of these mixed configurations is discussed further in the *Engineering Combinations of GR-303, TR-08, and INA Telephony Configurations* section.

The physical limit of 20 DS1 ports per *AnyMedia* Access System limits how many of the logical VRTs and VBs can be simultaneously in service. Also, the number of subscribers that may be assigned to the logical lines is determined by the smaller of the following:

- The total number of logical lines on all in-service logical VRTs and VBs
- The physical limit of 512 port circuits (with all POTS, PRCOIN, or PROG2W APs).
- The physical limit of 544 port circuits (with 14 POTS APs plus a fully loaded MDS2 shelf).

When all 20 DS1s are used for TR-08 VRTs, the total number of lines on these TR-08 VRTs cannot exceed 480 (20 DS1s x 24 channels). In the case where all 20 TR-08 VRTs are in-service, each one of these VRTs must be limited to 24 lines.

It is possible to have on a given *FAST* shelf a mixture of VRTs and VBs, including a GR-303 VRT, one or more TR-08 VRTs, and one or more INA VBs. For the *FAST* shelf, subscriber lines cross-connected to the VRTs and VBs can be chosen from APs or the MDS2 shelf. There are few restrictions on which types of lines may be cross-connected to which type of VRT or VB. The primary restriction is that the ISDN AP is intended to be cross-connected only to a GR-303 VRT and not to an INA VB or TR-08 VRT. Nonswitched and nonlocally switched special services circuits resident on the MDS2 shelf are likely to be cross-connected to an INA VB. However, these lines may also be cross-connected to a TR-08 or GR-303 VRT if these circuits are hairpinned or nailed up at the CO switch termination.

Growth Scenarios

Overview

This section defines system growth and degrowth. Sample scenarios demonstrate the methods for performing the growth and degrowth situations.

System growth

System growth is defined as the installation and turn-up of either feeder and/or distribution capacity to an existing operational *AnyMedia* Access System. The *AnyMedia* Access System will support the ability to modify capacity smoothly, without interrupting existing service.

System growth includes adding an MDS2 shelf.

NOTE:
The basic growth (and degrowth) operations may be performed by different technicians at different times without the need to complete one task before the other.

Adding an MDS2 shelf

An MDS2 shelf is grown by physically adding the MDS2 shelf into the bay lineup and then establishing connectivity with the *FAST* shelf via the MDSU and MSC circuit packs. Appropriate connector cables and powering must also be supplied. Lines from channel units plugged into the MDS2 shelf are cross-connected to VRTs and VBs in the same manner as lines on APs. To facilitate adding an MDS2 shelf, reserve two adjacent empty slots on the *FAST* shelf for the MDSU packs.

System degrowth

System degrowth is the removal of feeder and/or distribution capacity from an existing operational *AnyMedia* Access System. System capacity can be rearranged for load balancing or other needs by combining the growth and degrowth operations.

System degrowth includes MDS2 degrowth.

Examples of growth/degrowth scenarios

The following two scenarios are described below:

- Adding an MDS2 shelf
- MDS2 degrowth.

These growth scenarios assume that any necessary provisioning at the terminating end of the system (e.g., a LDS) has been performed or will be completed in time to meet the planned service date. These examples illustrate the *AnyMedia* Access System capabilities.

Scenario 1: adding an MDS2 shelf

Assume that a standard *FAST* shelf was deployed to meet POTS and ISDN demand, but there was spare channel capacity left on the system for future growth and several AP slots were initially left empty. Subsequently, a business moved into the serving area and a need for nonswitched and nonlocally switched circuits on the standard *FAST* shelf materialized. If the current *FAST* software does not support the MDS2 feature, then the *FAST* software must be upgraded (refer to the AnyMedia® Access System, *Ordering Guide* for the correct version number). Sending a technician physically to install an MDS2 shelf allows the use of *SLC*-2000 CUs to provide the needed services in a timely manner. Two adjacent slots in the *FAST* shelf are required for the MDSU circuit packs to support MDS2 shelf growth. The default *FAST* shelf AP slots for MDSU circuit packs are 14 and 15.

Scenario 2: MDS2 degrowth

This scenario assumes that an MDS2 shelf has been installed in an *AnyMedia* Access System RT bay lineup, is fully operational, and is providing both nonswitched and nonlocally switched service to a local business. Both sides of the MDS2 shelf are in use, which requires two MDSU circuit packs in the *AnyMedia* Access System RT shelf.

Suppose the services on the MDS2 shelf are no longer required, then the MDS2 shelf can be removed. This can be accomplished by de-growing the MDS2 shelf from the RT it is currently on. In this case, MDS2 shelf degrowth involves removal of the MDSU circuit packs and deleting T0 and T1 cross-connects.

Engineering Combinations of GR-303, TR-08, and INA Telephony Configurations

Overview

The *AnyMedia* Access System provides for flexible configurations and combinations of VRTs and VBs as illustrated in Figure 6-1, but the following maximums must be observed:

- 1 GR-303 VRT
- 20 TR-08 VRTs
- 20 INA VBs.

The number of VRTs and VBs may be mixed as long as the total number of DS1s does not exceed 20. As indicated in Figure 6-1, lines that are cross-connected to a VRT or a VB may be from an AP or an MDS2 shelf.

Engineering constraints

Plan according to the following constraints:

- The maximum number of DS1 lines supported is 20.
- A GR-303 VRT, if assigned, must have between 2 and 20 DS1 lines.
- Each TR-08 VRT must have at least 1 and no more than 4 DS1 lines.
- An INA VB can only have 1 DS1 line.

The DS1 lines on an IODS1 pack may be assigned to different VRTs and VBs in any arbitrary fashion (e.g., it is possible to have a TR-08 with four DS1 lines all on one IODS1 pack. On a second IODS1, there may be one INA VB using one DS1 and the other three DS1s are used for a GR-303 VRT). It is recommended in GR-303 VRT applications that logical DS1 #1 and DS1 #2 be assigned to different IODS1 circuit packs so an unprotected IODS1 can be removed without losing the EOC and TMC of the GR-303 VRT.

For any given field application, the best way to partition an *AnyMedia* Access System into a combination of TR-08 VRTs, GR-303 VRT, and INA VBs is based on a number of different factors. Some of the major factors involved are listed here for use as a general guideline.

Engineering INA VBs

The number of INA VBs required at the *AnyMedia* Access System is determined by both the number of nonlocally switched and nonswitched lines to be supported by the *AnyMedia* Access System and the far-end terminations of the INA VBs. The far-end termination may be on one or more DCS, D4, or D5 type channel banks and it is necessary to determine the number of INA VBs required for each far-end channel bank. For example, if 10 DS0s are needed for one D4 type bank and 14 DS0s are needed at a second D4 type channel bank, two INA VBs will be required, one for each channel bank*.

Do the following for each far-end channel bank or DCS:

1. Determine the number of nonlocally switched and nonswitched lines that go to the channel bank or DCS.
2. Determine the number of DS0s required by these lines (most lines require one DS0 but, for example, DDS with second channel error correction and *Tollgrade MCU*-5405 CUs require 2 DS0s per line).
3. Divide the number of DS0s by 24 and round up to the next whole number to determine the number of INA VBs for this channel bank or DCS.

The total number of INA VBs required at the *AnyMedia* Access System is the sum of the INA VBs required for the different far-end terminations.

Since the lines assigned to the INA VBs are semi-permanently cross-connected in the *AnyMedia* Access System, there are no traffic sensitivity calculations for INA VBs.

The engineering of the INA VBs also includes the DS1 line framing formats (SF or ESF) to be used. It is recommended that the ESF framing format be used unless far-end equipment limitations preclude its use. Also, since the APs cannot support all nonlocally switched and nonswitched lines, it is important to determine whether there are any lines that require CUs that must be mounted in an MDS2 shelf.

* The service demand in this example can be met using one INA VB at the *AnyMedia* Access System if there is a DCS with DS0 level cross-connect capability (e.g., a 1/0 DCS between the *AnyMedia* Access System and the two channel banks). Note that GR-303 feeder DS1s cannot be routed through a 1/0 DCS.

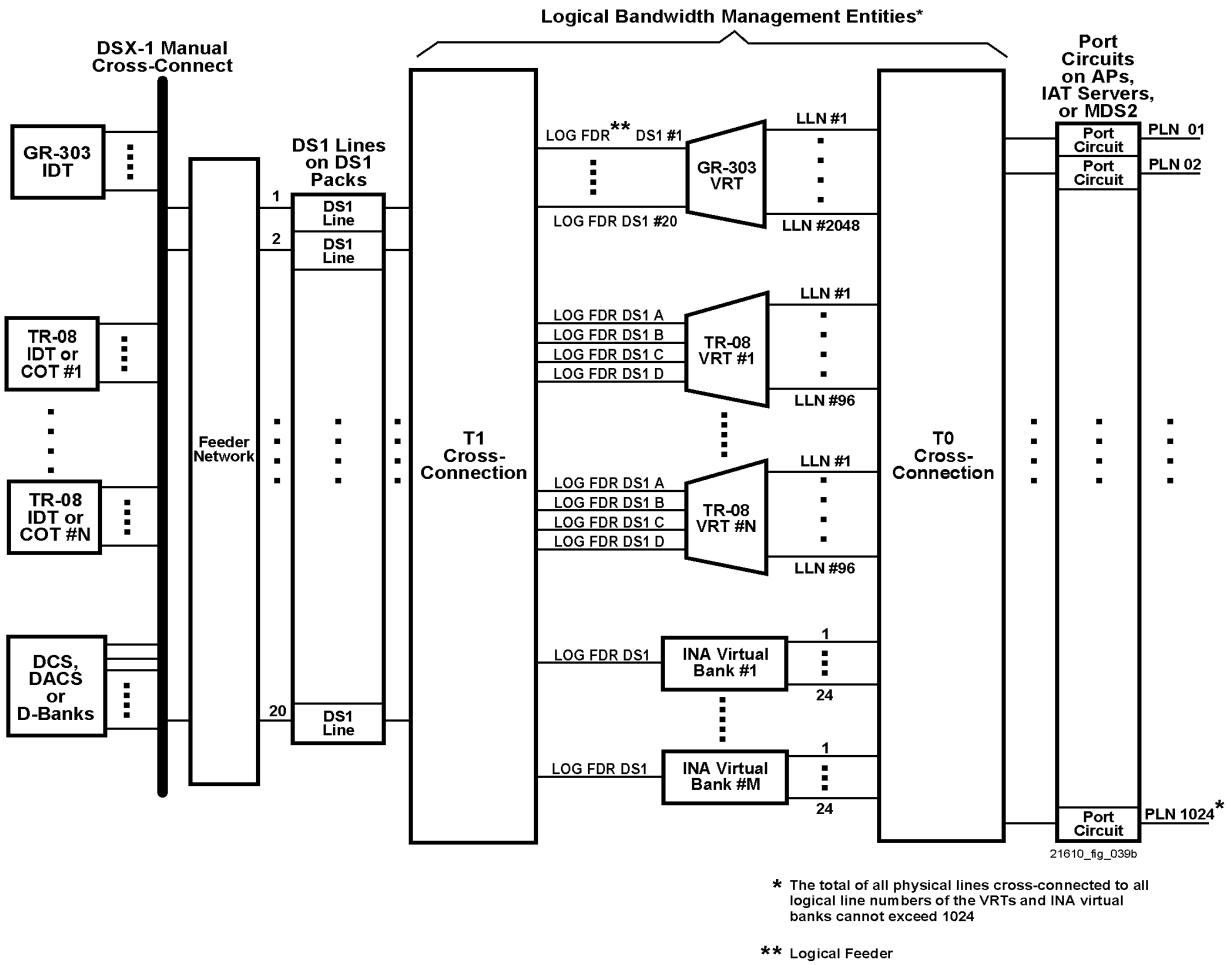


Figure 6-1. *AnyMedia* Access System with Mixed VRT and VB Configuration

Engineering TR-08 and GR-303 VRTs

The number of locally switched lines will be split between TR-08 VRTs and a GR-303 VRT, which can be integrated into an LDS (GR-303 or TR-08) or on a COT (TR-08). As shown in Figure 6-1 on page 6-10, any physical line can be T0 cross-connected to any logical line on the system†. The split of locally switched lines between GR-303 VRTs and TR-08 VRTs may depend to a great extent on the available capacity for terminating TR-08 and GR-303 types of interfaces in the CO. The availability of TR-08 and GR-303 interfaces on the LDS or availability of any universal TR-08 COT interface is an important factor that must be considered.

† The exception to this is that the lines from IAT Servers may not be cross-connected to TR-08 VRTs.

The use of a TR-08 VRT versus a GR-303 VRT may be based at least in part on the economics of concentration on the feeder side with GR-303 as opposed to the dedicated DS0 approach of Mode 1 TR-08. To assign all or part of the locally switched capacity onto a GR-303 VRT, see *Traffic and DS1 Engineering* to help determine the number of DS1 ports required. The number of ISDN circuits is also a very important factor. ISDN is supported on the GR-303 interface using an ISDN AP or via a CU plugged into the MDS2 shelf.

Preset configurations

The *AnyMedia* Access System allows one TL1 command to configure an entire shelf as either a single GR-303 VRT; 5 TR-08 VRTs; a GR-303 VRT and TR-08 VRT combination; or a mixture of GR-303 VRTs, TR-08 VRTs, and INA VBs. The same preset configurations can also be provisioned manually by using the individual TL1 commands or by using the GSI scripting capability. The *AnyMedia* Access System configuration needed may not coincide exactly with one of the preset configurations, but may be reached by starting with the default and then using TL1 commands to edit the system.

System Installation Planning

Overview

This section discusses the planning necessary for the following MDS2 shelf installations:

- RT bay mount front and rear access (typical RT bay CO installation)
- RT bay mount front-only access (typical RT or cabinet installation)
- CO flush mount bay.

RT bay mount front and rear access installation

One MDS2 shelf option can be front and rear access installed, which requires that all cabling be done upon installation. The following option is available:

- MDS2 shelf (J1C286AA-1, L3)

For the MDS2 shelf, I/O cabling for PCM, tip/ring, and TAP connections should be done upon installation. Connectorized cables are required to connect VF and E&M pairs exiting the shelf to be connected to an MDF, a cross-connect field, or protector blocks. These cables are orderable in different lengths to suit the application. E&M leads are only available in the front and rear access installations. The MDS2 server cables are separately orderable items due to the varying lengths required for different applications and placement of the MDS2 shelf in relation to its hosting *FAST* shelf. An external 64 kHz composite clock cable is available where synchronization to the MDS2 shelf is being supplied by an external clock.

RT bay mount front-only access installation

One MDS2 shelf option can be front-only access installed. The following option is available:

- MDS2 shelf (J1C286AA-1, L4)

For the MDS2 shelf, cable danglers for PCM, tip/ring, and TAP connections are routed over the top of the backplane and brought forward. E&M leads are not available for front-only access shelves. The MDS2 server cables are separately orderable items due to the varying lengths required for different applications and placement of the MDS2 shelf in relation to its hosting *FAST* shelf. An external 64 kHz composite clock cable is available when external clock synchronization is desired for the MDS2 shelf.

CO flush mount bay

The CO flush mount bay can be used similarly to the RT bay mount front and rear access configuration. The CO flush mount allows for installation that conforms to other equipment installed in a CO that is flush mounted. The following MDS2 shelf option is offered as flush mount:

- MDS2 shelf (J1C286AA-1, L3)

All shelves have a reversible flange that offers CO flush mount with front and rear access.

Cable danglers are not supplied, and all cabling must be done upon installation. See *RT bay mount front and rear access installation* above for further description.

MDS2 Shelf Planning and Engineering

MDS2 shelf installation planning

The planning information that follows provides information on how to plan for the accommodation or installation of an MDS2 shelf to support limited amounts of special services. Two basic cases are considered:

- The MDS2 shelf is not immediately needed, but its use is expected in the future.
- The MDS2 shelf is immediately needed.

In the second case there are two scenarios that will be discussed. They are as follows:

- Installed in a bay with the *FAST* shelves as part of a new installation.
- Installed in a bay when the bay is already equipped with operating *FAST* shelves.

NOTE:
The *AnyMedia* Access System has been designed to accept the addition of an MDS2 shelf as an adjunct to an operating *FAST* shelf without affecting service currently working on the *FAST* shelf.

MDS2 shelf not immediately needed

One choice in an application where many *AnyMedia* Access Systems are needed is to order a bay that is equipped with three *FAST* shelves and leaves the second shelf position empty. Depending on local installation practices, the second position could be cabled for an MDS2 shelf. This would simplify subsequent installation of the MDS2 shelf. It is recommended that AP slots 14, 15, and 16 of the first *FAST* shelf not be equipped with APs so that customer rearrangements and transfers will not be needed when the MDS2 shelf is finally installed.

If the *FAST* shelves are individually added to a bay, it is recommended that when the first MDS2 shelf is anticipated, the shelf position immediately above the latest *FAST* shelf be reserved for the MDS2 shelf. Also, two adjacent AP slots should be reserved to allow for future MDS2 shelf installation. The default AP slots for MDSU circuit pack installation at the *FAST* shelf are 14 and 15.

MDS2 shelf immediately needed

New installation—full bay

A typical bay offering places three *FAST* shelves in a bay, separated by fan shelves. Position 2 is left vacant for the addition of either a fourth *FAST* shelf or an MDS2 shelf.

If the forecast requires the addition of up to 1536 lines POTS only or 1568 lines (1472 POTS and 96 special services), a bay equipped with three *FAST* shelves and one MDS2 shelf should be ordered. Since the MDS2 shelf slaves off the *FAST* shelf, the bay comes with *FAST* shelves in positions 1, 3, and 4. The MDS2 shelf should be placed in *FAST* shelf position 2. A heat baffle should be installed above the MDS2 shelf.

This position is chosen since the *FAST* shelf 1 would be the first turned up, and cabling to the MDS2 shelf in position 2 would be most efficient.

This bay requires the use of the J1C286AA-1, L4 MDS2 shelf. It supports front-only access cabling. The MDS2 shelf comes with two danglers for PCM connection to the two MDSU circuit packs in the *FAST* shelf (position 1 in this scenario).

The MDS2 shelf requires cables to be installed for power and ringing. The cable for power is similar to the cable used for the *FAST* shelf, providing –48V A and B and a return. The ringing cable is identical to the *FAST* shelf ringing cable. The power and ringing are connected at the top front of the MDS2 shelf through its FCM.

Front access danglers are provided for connection to the three cables that carry the 96 tip/ring pairs from the MDS2 shelf. These cables use a connector type different from the AP faceplate connectors.

The power, ringing, and tip/ring cables are routed up the cable duct between bays for appropriate office, CEV, hut, or customer premises termination. The MDS2 shelf must be connected into the bay test TAP daisy-chain cables for TAPs A and B. Danglers are provided, and no new cables are needed. See the AnyMedia® Access System, *Ordering Guide*.

New installation—less than full bay

If the forecast requires less than a full bay (1536 lines POTS only or 1568 lines of POTS and special services), the engineer must order an empty bay and individually install the *FAST* shelves, their fans or baffles, and the MDS2 shelf. The correct list number of the MDS2 shelf should be used, based on whether the bay has front and rear access or is front-only access.

As in the full bay scenario, the MDS2 shelf should be installed in *FAST* shelf position 2 after the first *FAST* shelf is installed in position 1. The MDS2 shelf should be made to operate off the *FAST* shelf in position 1. Subsequent *FAST* shelves should be installed in the same positions as their full bay counterparts.

Note that when the partial bay is properly equipped, it is operationally and functionally identical to a full bay. If subsequent MDS2 shelves are needed, every attempt to install them with new *FAST* shelves in the pattern described above should be made. However, this is for administrative convenience; the MDS2 shelf can be placed anywhere within 15 cabled feet of the serving *FAST* shelf, if desired.

Cabling for this scenario is close to identical to the full bay arrangement, though installation sequencing may result in cable location variations. The same cables are used in both cases.

Retrofit of MDS2 shelves

There will be situations where there are existing bays of *AnyMedia* Access Systems and there is a desire to add an MDS2 shelf for initial special services, or where an existing MDS2 shelf is full. Careful planning can result in a cost effective addition of special services.

Two factors affect the choice of growth scenarios, the current fill of a *AnyMedia* Access System access bay, and the potential growth of POTS lines requiring more *AnyMedia* Access Systems.

New bay with MDS2

Taking the latter first, the engineer may choose to install a whole new *AnyMedia* Access System access bay that is equipped with an MDS2 shelf. This may be a wise choice if new *FAST* growth and turn-up is expected. This installation is identical to the discussions in the *Installation Manual*, Section 5.2.1, and has the potential of minimizing disruptions of existing service.

Fully equipped bay partly turned up

The engineer should determine the location of the *FAST* shelves that are not yet turned up. The process would require that the next *FAST* shelf to be turned up, counting from bottom to top, be removed and replaced with an MDS2 shelf. The tip/ring cabling to the removed shelf should be removed from the bay to make room for the MDS2 shelf cables.

The existing ringing cable can be used. A new power cable will be required. This change-out may take external alarms and test access out of service for the duration of the installation.

The new MDS2 shelf should operate with the *FAST* shelf below it.There are two exceptions for this change-out as follows:

- The availability of AP slots
- The situation of all shelves in the bay in operation.

When the AP slots are full so that the MDSUs cannot be added, or if immediate POTS line needs suggest that turn-up of POTS APs in the slots needed for MDSUs are committed, the engineer may need to turn up a new *FAST* shelf to be used with the MDS2 shelf. This affects the choice of the *FAST* shelf to be removed or associated with the MDS2 shelf.

When all *FAST* shelves are operating in the bay, other than ordering a new bay, the engineer may choose to install an MDS2 shelf in the next bay that has space for an MDS2 shelf. The top of the adjacent bay may be the preferred location for the MDS2 shelf since a maximum cabling length from the master *FAST* shelf to the MDS2 shelf is 15 feet. This approach of placing the MDS2 shelf in the next bay is not preferred, since it results in an untypical arrangement, and a physical association that may confuse technician activities. Having the *FAST* shelf that supports the MDS2 shelf always positioned below the MDS2 shelf should improve technician activity accuracy.

Other important considerations

MDSU location in a *FAST* shelf

When a *FAST* shelf has been designated the host for an MDS2 shelf, it should have two adjacent AP slots reserved for support of its MDS2 shelf. The default AP slots for the MDS2 shelf are slots 14 and 15. AP slot 16 can be reserved for an AFMDS3 circuit pack when ADSL services are needed. This restriction is based on providing a consistent layout for all installations, to improve technician operations, and to obtain consistent administrative processes such as cable records. Also, the cable jumpers/danglers have a consistent length and position associated with the two shelves.

The MDS2 shelf may be equipped so that only half of the shelf (12 CU slots) is operational. For that case, only one MDSU is needed. It is recommended that the left half of the shelf be populated first to allow for TAP A access. A partially equipped (half) MDS2 shelf requires one PTU and one MSC.

NOTE:
For full circuit testing capabilities at the MDS2 shelf, both PTU circuit packs must be installed to gain access to TAPs A and B.

Cable records

Installation of MDSUs in *FAST* shelves may require that cable records be changed to show that POTS (and other *FAST* lines) lines are eliminated and that capacity related to the MDS2 shelf has been added. Removal of pair capacity inside the AP range may require cable record changes, especially related to pair counts associated with the MDS2 shelf and the AP slot 16 if subsequently used for DS0 lines.

Lightning exposure

Some MDS2 cables (E&M, composite clock, test access, and ringing) cannot be exposed to lightning. They must be installed within the same building.

Default System Provisioning Parameters

Overview

This section provides a summary of the default provisioning parameters for the *AnyMedia* Access System. The listed parameter values are restored when the `INIT-SYS` TL1 command is executed during the initialization of the system.

MDS2 server provisioning

Upon initialization, the designated position for the left most MDS2 server is set to `AP-1-14.` Related provisioning commands: `SET-MDS2, RTRV-MDS2`

Alarm severity provisioning

The severity of alarm conditions is provisionable. Upon initialization of the nonvolatile data memory, the severities in Table 6-1 are established. Related provisioning commands: `SET-ALMCDE, RTRV-ALMCDE.`

Table 6-1. Alarm Severity Defaults

AID	Condition	Service Affect	Provisioned Severity (NTFCNCDE1 [,NTFCNCDE2])
cu-1-all	INTRMVL	SA	mn
	PRCDERR	SA	mn
m2drop-1-all-all	TSTRELAY	NSA	mn
mds2-1	PRCDERR	SA	mj
	PWR	SA	mj
msc-1-all	INT	SA	mj
	POLL	SA	mj
ptu-1-all	INTRMVL	SA	mj
	POLL	SA	mj
	RINGF	SA	mj
pwrm-1-all	PWR	SA	mj

Transmission Specifications

Overview

Table 6-2 through Table 6-5 present similar information for the MDS2 shelf CUs. Unless otherwise stated, transmission specifications apply between the system's DS1 facility bitstream and the tip/ring interface of an AP (i.e., they are half-channel specifications).

Table 6-2. Specifications for Two-Wire E *SPOTS* (*SPQ*442) Channel Units of the *AnyMedia* Access System MDS2 Shelf[a]

Parameter	Condition	Value
Min. DC supervisory range		CSA loops
Gain range and granularity	metallic interface to digital line	–1.0 dB to +6.75 dB granularity = 0.25 dB
	digital line to metallic interface	–8.0 dB to +1.5 dB granularity = 0.25 dB
Gain tracking at 1004 Hz	relative to 0 dBm0	
	–37 to +3 dBm	± 0.25 dB
	–50 to –37 dBm	± 0.50 dB
Equalization		Equalized CSA cable roll-off at 0.4 k Hz varies from 0.0 dB to 1.1 dB; at 2.8 kHz, roll-off varies from 0.3 dB to 1.75 dB
Output impedance		600 ohms + 2.16 μF or 875 ohms + 2.16 μF
Return Loss at CU interface	minimum, relative to provisioned output impedance	28 dB ERL, 20 dB SRL
Hybrid balance (minimum)	CSA Loops with XMTGN=0 and RCVGN=0	14 dB ERL, 9 dB SRL
Longitudinal balance (measured per IEEE 455-1976)		Minimum Average
	200 Hz - 1000 Hz	58 dB 63 dB
	200 Hz - 3000 Hz	53 dB 58 dB
Crosstalk (maximum)	measured from 200 Hz to 3400 Hz with 0 dBm0 input	–65 dBm0C
Idle channel noise	end-to-end *SPQ*442/*SPQ*443 pair	≤ 20 dBrnC0

Table 6-2. Specifications for Two-Wire E *SPOTS* (*SPQ*442) Channel Units of the *AnyMedia* Access System MDS2 Shelf[a] (Continued)

Parameter	Condition	Value
Impulse noise	counts in 15 minutes at a threshold of 47 dBrnC0, on-hook and off-hook	≤ 15 counts
Nominal 1000 Hz on-hook loss	"OHT=YES;" Terminated with Structural Impedance; Slope=0	Rcv (to T/R) Xmt (from T/R)
	IMP=600	9dB 2.5dB
	IMP=900	9dB 4.5dB
Signal-to-distortion ratio	measured at –10 dBm	> 33 dB
Single frequency distortion (max)	measured from 0 to 12 kHz, with an input of 0 to 12 kHz at 0 dBm0, end-to-end *SPQ*442/*SPQ*443 pair	< –28 dBm0, 0 to 12 kHz
	measured from 0 to 4 kHz, with an input of 1004 Hz to 1020 Hz at 0 dBm0, end-to-end *SPQ*442/*SPQ*443 pair	–40 dBm0, 0 to 4 kHz
Intermodulation distortion	–13 dBm0 input	A-B (R2) < –43 dB 2A-B (R3) < –44 dB
Pulse distortion (P/AR)	–13 dBm0 input	≥ 90
Frequency response	measured from 400 Hz to 2800 Hz with SLOPE=0, loss relative to loss at 1 kHz, end-to-end *SPQ*442/*SPQ*443 pair	–0.25 to +1.0 dB

[a]Off-hook unless specified.

Table 6-3. Specifications for AUA45B Dual Ringing Repeater Channel Unit of the *AnyMedia* Access System MDS2 Shelf[a,b,c]

Parameter	Condition	Value
Min. DC supervisory range	not including the terminating equipment	Total combined loop resistance should not exceed 1500 ohms. Neither loop should exceed 1300 ohms.
Max. cable loss		< 9 dB, split in any proportion between the two end cable links
Output impedance		900 ohms + 2.16 µF
Balance impedance		900 ohms + 2.16 µF
Return loss at CU interface	minimum, measured with respect to 900 ohms + 2.16 µF with the opposite end terminated in 900 ohms + 2.16 µF	23 dB ERL, 17 dB SRL
Minimum longitudinal balance (measured per IEEE 455-1976)	200 Hz to 1000 Hz	58 dB
	200 Hz to 3000 Hz	53 dB
60 Hz rejection (minimum):	loss relative to loss at 1004 Hz	21dB
1000 Hz loss		0 dB or 3 dB (switch selectable)
1000 Hz loss tolerance	measured as insertion loss between 900 ohm terminations	±0.5 dB typical, ±1.0 dB max
Frequency response	measured from 400 Hz to 2800 Hz, loss relative to loss at 1 kHz	+1 to –0.5 dB
Gain tracking at 1004 Hz	relative to 0 dBm0	
	–37 to +3 dBm0	±0.5 dB
	–50 to –37 dBm0	±1.0 dB
Idle channel noise	measured with 900 ohm terminations at both ends	≤20 dBrnC
Signal-to-distortion ratio	–10 dBm0 input	> 33 dB
Intermodulation distortion	–13 dBm0 input	> 43 dB [A-B (R2) product] > 44 dB [2A-B (R3) product]

Table 6-3. Specifications for AUA45B Dual Ringing Repeater Channel Unit of the *AnyMedia* Access System MDS2 Shelf[a,b,c] (Continued)

Parameter	Condition	Value
Single frequency distortion (max)	measured from 0 to 12 kHz, with an input of 0 to 12 kHz at 0 dBm0	< –28 dBm0
Pulse distortion (P/AR)	–13 dBm0 input	> 90
Overload at COT and RT		≤ 0.5 dB compression at +3 dBm0
Crosstalk (maximum)	measured from 200 Hz to 3400 Hz with 0 dBm0 input	–65 dBm0
Ringing delay		≤ 200 ms
Ringing distortion		≤ ±50 ms
Ring trip delay	Rdc ≤ 1800 ohms	≤ 200 ms
Ring trip immunity		8 μF in parallel with 10k ohms at T/R
Ringing range at COT[d]		40 Vrms across 3 REN
Ringing range at RT[d]		40 Vrms across 4 REN

[a] AUA45B at COT and RT, provisioned for 0 dB loss.
[b] Measured at 25°C.
[c] Transmission enabled except during ringing.
[d] COT Ringing 86 Vrms and 1300 ohms of cable. RT Ringing 100 Vrms and 1300 ohms of cable.

Table 6-4. Specifications for AUA75( ) Dual Private Line Auto Ring Channel Unit of the *AnyMedia* Access System MDS2 Shelf[a,b,c]

Parameter	Condition	Value
Min. DC supervisory range	not including the terminating equipment	Total combined loop resistance should not exceed 1500 ohms. Neither loop should exceed 1300 ohms.
Max. cable loss		< 9 dB, split in any proportion between the two end cable links
Output impedance		900 ohms + 2.16 μF
Balance impedance		900 ohms + 2.16 μF
1000 Hz off-hook loss		0 dB or 3 dB (switch selectable)
1000 Hz loss tolerance	measured as insertion loss between 900 ohm terminations	±0.5 dB typical, ±1.0 dB max
1000 Hz on-hook loss		3 dB
Frequency response	measured from 400 Hz to 2800 Hz, loss relative to loss at 1 kHz	+1 to –0.5 dB
Return loss at CU interface	minimum, measured with respect to 900 ohms + 2.16 μF with the opposite end terminated in 900 ohms + 2.16 μF	23 dB ERL, 17 dB SRL
Idle channel noise	measured with 900 ohm terminations at both ends	≤20 dBrnC
Signal-to-distortion ratio	–10 dBm0 input	> 33 dB
Pulse distortion (P/AR)	–13 dBm0 input	> 90
Gain tracking at 1004 Hz	relative to 0 dBm0	
	–37 to +3 dBm0	±0.5 dB
	–50 to –37 dBm0	±1.0 dB
Intermodulation distortion	–13 dBm0 input	> 43 dB [A-B (R2) product] > 44 dB [2A-B (R3) product]

Table 6-4. Specifications for AUA75( ) Dual Private Line Auto Ring Channel Unit of the *AnyMedia* Access System MDS2 Shelf[a,b,c] (Continued)

Parameter	Condition	Value
Single frequency distortion (max)	measured from 0 to 12 kHz, with an input of 0 to 12 kHz at 0 dBm0	< –28 dBm0
Impulse noise	counts in 15 minutes at a threshold of 47 dBrnC0	≤ 15 counts
Overload at COT and RT		≤ 0.5 dB compression at +3 dBm0
Minimum longitudinal balance (measured per IEEE 455-1976)	200 Hz to 1000 Hz	58 dB
	200 Hz to 3000 Hz	53 dB
Crosstalk (maximum)	measured from 200 Hz to 3400 Hz with 0 dBm0 input	–65 dBm0
Ringing delay		≤ 200 ms
Ring trip delay	Rdc ≤ 1800 ohms	≤ 200 ms
Ring trip immunity		8 μF in parallel with 10k ohms at T/R
Ringing range at COT[d]		40 Vrms across 3 REN
Ringing range at RT[d]		40 Vrms across 4 REN
Ringing cycle		2 seconds on (100 msec) 4 seconds off (100 msec)
Audible ringing		440 Hz plus 480 Hz (1.6%)
Audible ringing level		–47 to –16 dBm0 (with no more than 5 dB between components)

[a] AUA75( ) at COT and RT, provisioned for 0 dB loss.
[b] Measured at 25° C.
[c] Off-hook unless specified.
[d] COT Ringing 86 Vrms and 1300 ohms of cable. RT Ringing 100 Vrms and 1300 ohms of cable.

Table 6-5. Specifications for Four-Wire Voice Frequency Channel Units (AUA41B, *SPQ*444, *SPQ*454) of the *AnyMedia* Access System MDS2 Shelf[a]

Parameter	Condition	Value
Max. DC supervisory range	not including the terminating equipment	2800 ohms (loop-start, ground-start) 5000 ohms (duplex) 500 ohms (E&M Type II[b])
Gain range (granularity)	range depends on GSFN provisioning	Granularity = 0.1 dB
Gain tracking at 1004 Hz	relative to 0 dBm0	
	–37 to +3 dBm	±0.25 dB
	–50 to –37 dBm	±0.5 dB
Equalization		Post-equalization of cable less than 15 dB (H88) or 18 kft (NL) is comparable to D4 4FXS CU (J98726SB). Pre-equalization and post-equalization available by emulating 150-ohm mismatch.
Output impedance	AUA41B (4FXS, 4DX, 4ETO) and *SPQ*444 (4FXO)	600 or 1200 ohms
	*SPQ*454, AUA41B(4TO), and *SPQ*444(4TDM)	600 ohms
Return loss at CU interface	minimum, relative to provisioned output impedance	
	300-3000 Hz	23 dB
	1 kHz	28 dB
Minimum longitudinal balance (measured per IEEE 455-1976)	200 Hz to 1000 Hz	≥ 67 dB
	200 Hz to 3000 Hz	≥ 62 dB
Crosstalk (maximum)	measured from 200 Hz to 3400 Hz with 0 dBm0 input	–65 dBm0C
Idle-channel noise	AUA41B - per CU pair	20 dBrnC0
	*SPQ*444/*SPQ*454	20 dBrnC0

Table 6-5. Specifications for Four-Wire Voice Frequency Channel Units (AUA41B, *SPQ*444, *SPQ*454) of the *AnyMedia* Access System MDS2 Shelf[a] (Continued)

Parameter	Condition	Value
Impulse noise	counts in 15 minutes at a threshold of 59 dBrnC0 with holding tone at –13 dBrnC0	≤15 counts
Signal-to-distortion ratio	–10 dBm input	>33 dB
Single frequency distortion (max)	measured from 0 to 12 kHz, with an input of 0 to 12 kHz at 0 dBm0	–28 dBm0
Frequency response	measured from 400 Hz to 2800 Hz with SLOPE=0, loss relative to loss at 1 kHz, end-to-end AUA41B/*SPQ*444 pair	–0.25 to +0.5 dB
Intermodulation distortion	–13 dBm0 input	< –49 dB [A-B (R2) product] < –51 dB [2A-B (R3) product]
Pulse distortion (P/AR)	–13 dBm0 input	
	end-to-end AUA41B/ *SPQ*444 pair	≥ 94
	end-to-end *SPQ*454 pair	> 90

[a]*SPQ*454 cannot connect to cable that extends to outside plant.
[b]May be limited by customer equipment

Synchronization and Timing

Overview

Network synchronization is critical for error-free services. Synchronization problems show up as clicking on voice calls, retransmission or errors on data and facsimile calls, or possible dropping of calls altogether. Proper synchronization engineering will ensure transmission quality and network performance by reducing timing slips and limiting network degradation from synchronization faults that are passed on to the *AnyMedia* Access System. The *AnyMedia* Access System supports different timing modes:

- Normal line-timed mode
- External DS1 (1.544 MHz) timing*
- External composite clock (64 kHz) timing*
- Free-running mode.

Details about these timing modes can be found in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide*.

Attributes of the line-timed mode

The system distributes the recovered timing (from any of its sources) to the remaining DS1 interfaces to the *FAST* shelf APs and to the MDS2 shelf. Attributes of loop-timing include:

- Any of the shelf's 20 DS1 ports can be selected as the primary and secondary sources.
- The primary source default is the first DS1 feeder of the first IODS1 circuit pack.
- The secondary source default is the first DS1 feeder of the second IODS1 circuit pack. If there is only one IODS1 circuit pack, there is no secondary reference because the secondary source is on the second pack (the default) and an alarm will show up.

* Both of these synchronized timing modes require the installation of the ED7C818-34, Group 1 Composite Office/ BITS Clock Kit. One kit terminates and distributes the clock for up to four shelves (*FAST* and/or MDS2) in a bay frame.

Traffic and DS1 Engineering

Overview

Traffic engineering of the *AnyMedia* Access System determines the proper number of DS1 feeders to be allocated for the desired level of service, types of service to be engineered, and selected interfaces (INA, TR-08). Projected growth for the RT should be considered when engineering the *AnyMedia* Access System.

The principles described in this section apply to the *AnyMedia* Access System only. Any blocking in the local digital switch should be considered separately.

Details about traffic engineering can be found in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide*.

Principles of the MDS2 shelf traffic model

The principles that apply specifically to the MDS2 traffic model includes the following:

- Some special services require more than one DS0 per line. The number of timeslots for these services must be calculated separately (see Table 6-6).

Table 6-6. Number of Timeslots Required for Special Services

Special Service Type	System Provisioning	DS0 Timeslots Required
Nonlocally switched and nonswitched VF services (e.g., FX lines and trunks, tie trunks, voice private lines)	GSFN=AC, DPT, DX4[N,R], EBS, EM4[C,H], ETO4, 2FX, 2FXLS, FX[O,P,S,T][1,2,3,5], FXO, LR, 2NOS, PLR[1,2], 2RVO, TD[O,S][A,B,C,D], TO, TO4, or DPO	1
Digital data services *with* second-channel error correction	GSFN=DATA *and* an AUA200 Channel Unit is equipped with **56** *and* **EC** switches selected, or GSFN=OCU[2,3] *and* EC=SCEC, or GSFN=DS0[1,2] and ED=Yes and depending on RATE	2
Digital data services *without* second-channel error correction	GSFN=DATA (except as above), OCU[1,2,3] (except as above), or SW56	1

Table 6-6. Number of Timeslots Required for Special Services (Continued)

Special Service Type	System Provisioning	DS0 Timeslots Required
ISDN basic access service via Teltrend AUA293I2 BRITE CU	GSFN=BRI *and* SVC=D-ONLY	1
	GSFN=BRI *and* SVC=B1+D or GSFN=BRI *and* SVC=B2+D	2
	GSFN=BRI *and* SVC=2B+D	3
Tollgrade MCU-5205 DC alarm service	GSFN=NO1	1
Tollgrade MCU-5405 digital bypass pair	GSFN=NO2	2
AnyMedia Access System remote operations channel	GSFN=4DO	1

TR-08 VRTs— traffic engineering

See the Chapter 4, *Traditional DLC Interfaces*, *Virtual Remote Terminals* section for more information on TR-08 VRTs and Chapter 5, *OAM&P for Traditional DLC Services*, *Configuration Management—Service Activation* section for more details on TR-08 VRT cross-connections.

Product Reliability

Details about Product Reliability are in the AnyMedia® Access System, *Applications, Planning, and Ordering Guide*.

MDS2 Shelf Powering

Overview

Powering for the *AnyMedia* Access System MDS2 shelf includes engineering for the following:

- Shelf powering
- Ringing
- Fusing
- Grounding
- Power drain.

Shelf powering

The MDS2 shelf accommodates two –48V inputs (–48V M1 and –48V M2) and one electrical –48V return (–48V RTN). Two options for powering the MDS2 shelf are available and are accommodated by cabling differences.

First, the MDS2 shelf can be powered from the *FAST* shelf M1 and M2 power distribution feeds. Two 10A fuses are located on the FCM, which supply power to both the MDS2 and fan shelves. Second, the MDS2 shelf can be powered from an independent source. Both –48V inputs must come from the same power plant if the system is used in a single-point ground environment, but they can be sourced from different power plants in an integrated (mesh) ground plane environment.

The AUA232 CU cannot be used in single-point ground environment schemes.

Shelf power distribution

The –48V M1 input at the MDS2 shelf feeds the half of the MDS2 shelf containing CU slots 1 through 12. The –48V M2 input at the MDS2 shelf feeds the half of the MDS2 shelf containing CU slots 13 through 24.

The shelves are compatible with battery plant supplying input in the range of –42.5V DC to –56.5V DC.

Ringing

The MDS2 shelf receives a single –20 Hz ringing input. It is expected that the ringing plant would provide redundancy. The PTU has a ringing detector for the –20 Hz input signal.

Table 6-7 shows the ringing capacity needed to meet the TR-57 ringing requirements.

Table 6-7. MDS2 Shelf Ringing Estimate

Assumes Nontraffic-sensitive system, 9CCS per line

Ringing voltage	86 to 104 Vrms superimposed on –42.5 to –56.7 VDC
Frequency	20 +/- 1 Hz
Crest Factor	1.35 to 1.45
5-REN load	1400 ohms at 20 Hz

	MDS2 Shelf	**3 *FAST* Shelves and MDS2 Shelf**
Lines per entity	96	1568
CCS per entity (for TR-57 ringing capacity)	864	14112
Lines rung simultaneously (TR-57)	5	22
Ringing Current (A rms)	0.2	1.1

Fusing

The MDS2 shelf has three fuses and five test points for power and ringing inputs, as shown in Figure 6-2. Each –48V feeder is fused at 5A on the shelf. Ringing is fused at 0.5A at the shelf level, which supports 12 simultaneous ringing on 12 lines, per TR-57 requirements. All fuses at the shelf level are field replaceable fuses.

Test points are provided on the fuse control module between the fuses and the MDS2 shelf for the –48V and ringing power feeds. The PTU monitors the power feeds and the ringing feed and raises an alarm on failures of the feed or opening of the fuses.

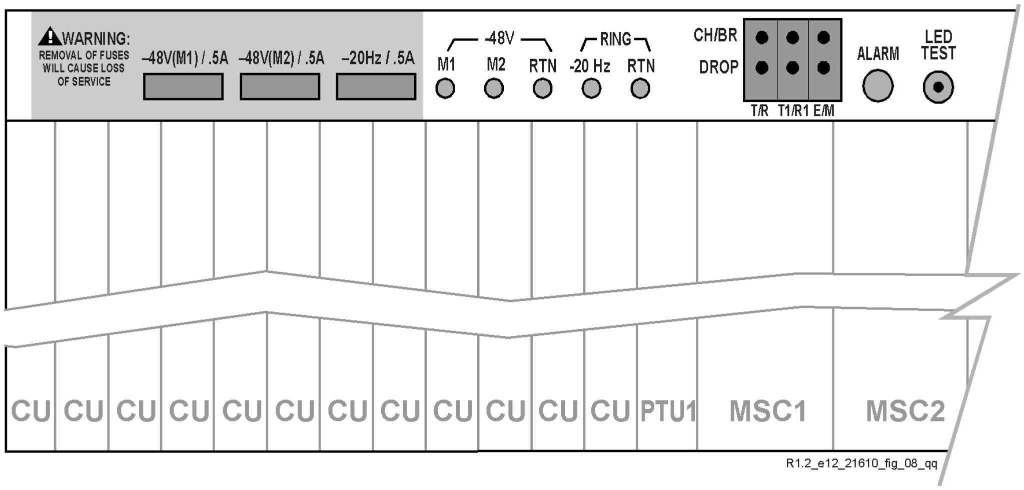


Figure 6-2. MDS2 Shelf Fusing and Test Points

Grounding

The MDS2 shelf is designed to operate in integrated ground plane (common bonding) environment or in a single-point (isolated ground plane) environment. The default factory configuration is common bonding mode. The mode of operation can be changed by removing four fasteners on the backplane at the time of installation.

Ringing voltage return is not grounded at the shelf; rather, it should be connected to the CO ground system at the source.

A jack is located on the right side of the shelf assembly of the MDS2 shelf only for an ESD wrist strap connection. This makes a good connection to the bay frame ground through the shelf metalwork.

Power drain

For more power drain information, refer to the AnyMedia® Access System, *Applications, Planning, and Ordering Guide*, Appendix C, Floor Plan Data Sheets. To order the sheets, see the AnyMedia® Access System, *Ordering Guide*.

Using *Tollgrade MCU*-5405 CUs in the MDS2 Shelf

Overview

When an MDS2 shelf is present at the RT site, there is a less costly alternative to installing a *Tollgrade MCU*-4496 or *MCU*-4496ER CU in a *Tollgrade Micro-Bank* system that is collocated with the *FAST* shelf. This alternative is to install a *Tollgrade MCU*-5405 CU in the MDS2 shelf. Figure 6-3 shows the connections.

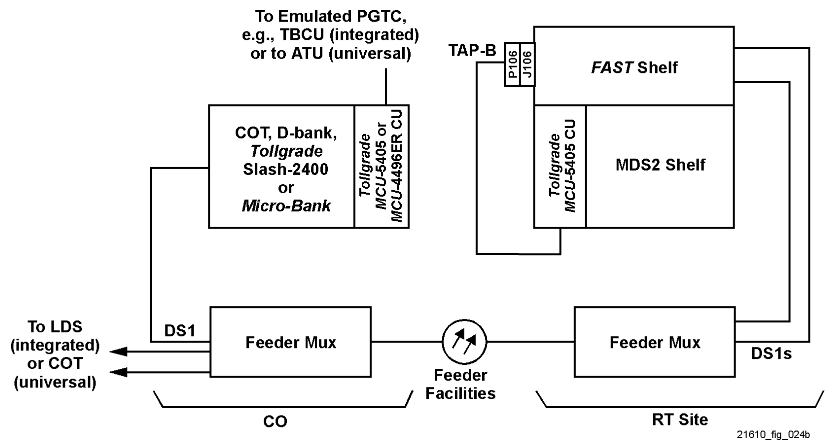


Figure 6-3. Connections for TR-465-Compatible Circuit Testing with *Tollgrade MCU*-5405 CU in MDS2 Shelf

5ESS switch provisioning for *Tollgrade* digital bypass pair

Refer to the AnyMedia® Access System, *Applications, Planning, and Ordering Guide* for information on this topic.

GR-834-Compatible On-Demand Circuit Testing

Overview

The *AnyMedia* Access System is compatible with testing operations systems that support the TL1 messages defined in GR-834 when a suitable RTU is collocated at the RT. The RT provides a GR-834-compliant interface to an external RTU. The RTU port on the backplane provides communication between the RT and the RTU.

GR-834 testing may be used to test either locally switched services or special services. A GR-834-compliant RTU-2 that is compatible with the TOS must be used.

A GR-834 compliant RTU-2 may perform any or all of the following functions:

- Makes electrical measurements on the accessed circuit
- Transmits and measures frequency level
- Measures noise, impulse noise, and return loss
- Provides monitor/talk, loopback, and quiet termination functions.

These tests may be applied to any selected circuits that have test access relays on their AP or CU.

Figure 6-4 on page 6-36 gives an overall view of remote on-demand testing using GR-834-compatible testing. Figure 6-5 on page 6-36 gives a more detailed view of the connections to the *AnyMedia* Access System.

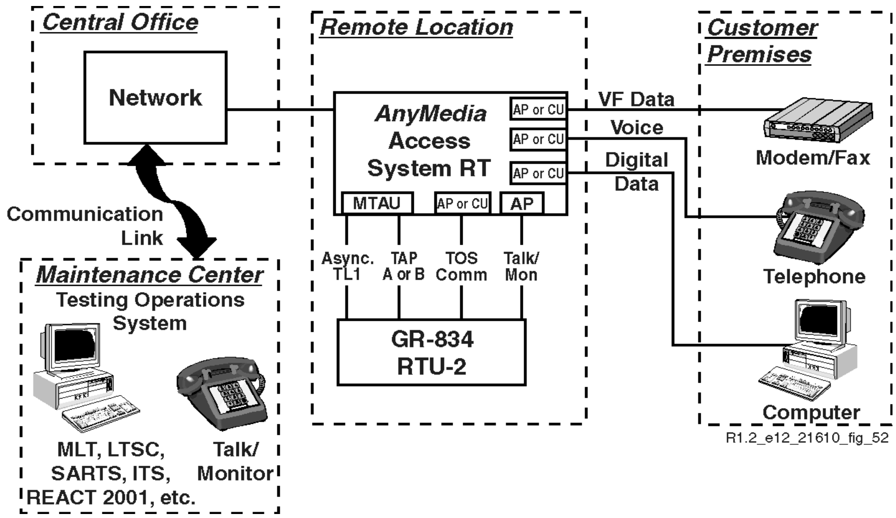


Figure 6-4. Typical Connections of a GR-834-Compatible RTU-2 to an *AnyMedia* Access System RT

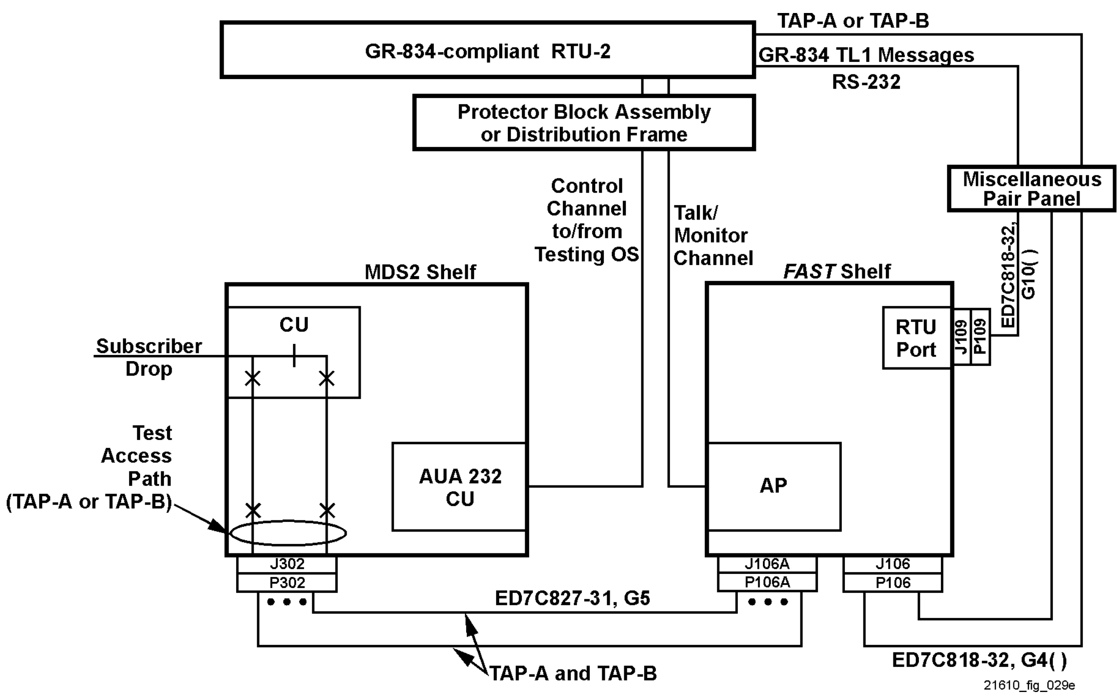


Figure 6-5. GR-834 Testing Environment

Connections

As shown in Figure 6-5, an RTU-2 used for GR-834-compliant testing is connected to the following places:

- TAP-A (twelve-wire) or TAP-B (four-wire) for bridging or full splitting metallic access (for a description of TAP-A and TAP-B, see *TAP* in Chapter 6, *Traditional DLC Interfaces* in the AnyMedia® Access System, *Applications, Planning, and Ordering Guid*e).

> **NOTE:**
> Although it is possible to equip an MDS2 shelf with common circuit packs (PTU and MSC) on only one side of the shelf (the slots associated with CU slots 1 to 12 on the left side), the following conditions must be met for TAP-A and TAP-B access to the MDS2 shelf:
>
> - MSC1 and PTU1 must be installed in the slots associated with CU slots 1-12 in order to have TAP-A access.
> - MSC2 and PTU2 must be installed in the slots associated with CU slots slots 13 to 24 in order to have TAP-B access.

- The RTU port on the backplane for exchanging GR-834 TL1 test access control messages with the *AnyMedia* Access System
- A port circuit on an MDS2 shelf CU* or a *FAST* shelf AP to provide a data path between the RTU-2 and the TOS; this port circuit must be cross-connected through the *AnyMedia* Access System and the network to reach the TOS
- A VF port circuit on a *FAST* shelf AP to provide a talk/monitor channel back to the maintenance center.

GR-834 vs. TR-465 testing

The major differences between GR-834 testing and TR-465 (PGTC) testing of locally switched services using an RTU-2 (see Figure 6-6) are as follows:

- In TR-465 testing, the LDS (integrated) or PGTC/COT (universal) sends messages to the *AnyMedia* Access System to set up test access, and then the TOS sends commands to the RTU (via its data path) to instruct the RTU-2 to run drop tests. At the same time that these drop tests are being run, the PGTC/COT or LDS and the *AnyMedia* Access System cooperate to run channel tests.

* In Figure 6-5 on page 6-36, a Dataport CU housed in the MDS2 shelf is assumed for the control channel. This choice is dependent on the particular TOS being used. Connecting to TOSs other than the one (the Lucent SARTS special services TOS) for which this figure was drawn may require using VF APs for both the control channel and the talk/monitor channel.

- In GR-834 testing, the LDS or PGTC/COT is not involved at all. The TOS sends commands to the RTU-2 (via its data path) both to set up and tear down test access and to instruct the RTU-2 to run its tests. These tests can be run in either the equipment (drop) direction or in the facility (channel) direction. In the case of test access setup/teardown, the RTU-2 converts commands from the TOS into GR-834 TL1 messages for the *AnyMedia* Access System RT. When the RT receives these GR-834 messages, it operates the appropriate relays to set up (or tear down) the requested metallic test access.

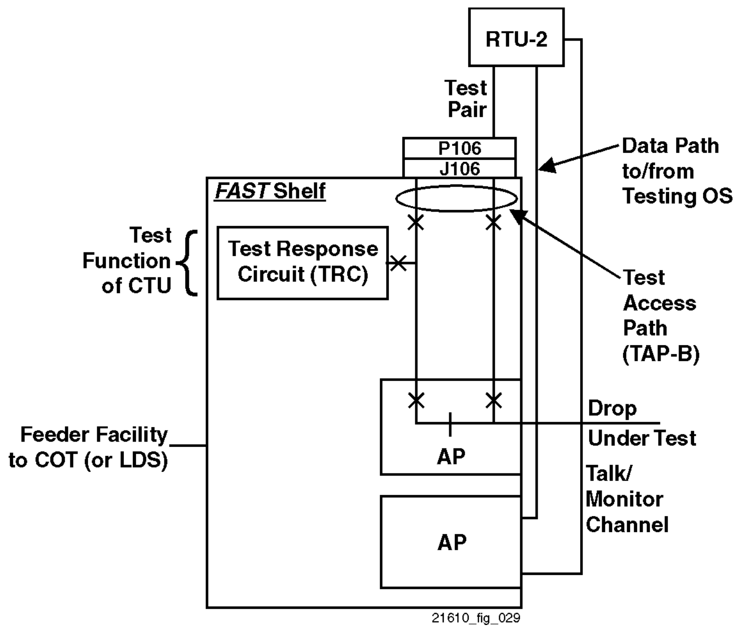


Figure 6-6. Typical Connections of a TR-465 (PGTC) Compatible Locally Switched Services RTU-2 to an *AnyMedia* Access System

Engineering Work Order

Overview

The AnyMedia® Access System, *Applications, Planning, and Ordering Guide*, Appendix D, Engineering for Traditional DLC Turnup and Service Activation Provisioning, contains an example of an Engineering Work Order that can be used by a technician to complete initial turn-up of an *AnyMedia* Access System. This template can be modified as needed and adapted to suit individual applications.

Ordering

All ordering information is now located in the AnyMedia® Access System, *Ordering Guide*, code 363-211-125. Ordering information has been moved to a separate document to facilitate updating the information.

List of Acronyms

A

A/D	analog/digital
AAL	ATM adaptation layer
ABN	active balance network
ABSBH	average busy season busy hour
AC	alternating current
ACD	automatic call distributor
ACE	ATM circuit emulation
ACF	AC fault
ACO	alarm cutoff
ADPCM	adaptive differential PCM
ADSL	asymmetric digital subscriber line
ADSL-R	ADSL transceiver unit—remote end
AFM	ATM feeder multiplexer
AID	access identifier
AIP	access interface platform or alarm interface panel (not used as ac)
AIS	alarm indication signal
AIS-L	alarm indication signal-line
AIU	access interface unit
ALC	automatic loss control; automatic level/loss compensation

ALC5	automatic loss compensation—5
ALIT	automatic line insulation test
AMI	alternate mark inversion
ANSI	American National Standards Institute
AOS	*AnyMedia* Access System operations software
AP	application pack
APOG	applications, planning, and ordering guide
ARM	access resource manager
ASCII	American standard code for information interchange
ATM	asynchronous transfer mode
ATU	alarm test unit
ATU-C	ADSL transceiver unit - Central Office
ATU-R	ADSL transceiver unit - remote end
AWG	American wire gauge

B

B8ZS	bipolar with eight zeros substitution
BAIU	broadband access interface unit
BB	broadband
BCF	battery cell fault
BDFB	battery distribution fuse bay
BER	bit error ratio
BIST	built-in self-test
BITS	building integrated timing supply
BRI	basic rate interface
BRITE	basic rate interface transmission extension
BT	bridged tap
BVC	bearer virtual channel
BVPT	bearer virtual path termination
BWM	broadcast warning message

C

C/N	carrier-to-noise ratio
CAC	connection admission control
CALRS	centralized automatic loop reporting system
CASTL	customer advocate system test lab
CBR	constant bit rate
CC	clear channel
CCITT	international telephone and telegraph consultative committee
CCN	customer change notice
CCS	hundred call seconds
CD-ROM	compact disk - read only memory
CDV	cell delay variation
CDVT	cell delay variation tolerance
CES	circuit emulation service
CES-IWF	circuit emulation service interworking function
CEV	controlled environment vault
CF	current feed
CHAN/MON	channel testing and monitoring (switch side)
CIT	craft interface terminal
CL	center line
CLF	carrier line failure
CLP	cell loss priority
CMI	control mode idle
CMIS	common management information service
CN	change notice
CO	central office
COACH	customized online aid for customer help
COMDAC	common data and control
COPM	customer operations and program management
CORRCNT	corrected HEC error counter
COT	central office terminal

CPE	customer premises equipment
CPFT	customer premises facility terminal
CPI	calling party identification
CPS	cabinet power system
CR	critical
CRC	cyclic redundancy check
CRV	call reference value
CS	current sink
CSA	carrier serving area
CSMD/CD	carrier sense multiple access/collision detection
CSS	controlled slip seconds
CSS-P	controlled slip seconds-path
CSU	channel service unit
CTS	customer technical support
CTU	craft test unit
CU	channel unit
CV	coding violation
CV-L	coding violation-line
CV-LFE	coding violations-line - far end
CV-P	coding violation-path
CV-S	coding violations-section
CVC	control virtual channel
CVPT	control virtual path termination

D

DACS	digital access cross-connect system
dB	decibel
dBm	decibel referenced to one milliwatt
DC	direct current
DCD	received line signal detector
DCE	data communication equipment
DCLU	digital carrier line unit

DCN	data communication network
DCS	digital cross-connect system
DCTP	direct current test pair
DDL	delivered data link
DDM	digital data multiplexer
DDS	digital data services
DFI	digital facilities interface
DHCP	dynamic host configuration protocol
DID	direct inward dialing
DIP	dual in-line package
DLC	digital loop carrier
DLCI	data link connection identifier
DM	degraded minute
DMT	discrete multitone
DMU	digital measurement unit
DNIS	dialed number identification service
DNS	domain name service
DNUS	digital network unit–subscriber
DOD	direct outward dialing
DP	data port or dial pulse
DPFU	dual power feed unit
DPO	dial pulse originate
DPT	dial pulse terminate
DRAM	dynamic random access memory
DS0	digital signal, level 0
DS1	digital signal, level 1
DS3	digital signal, level 3
DSL	digital subscriber line
DSP	digital signal processor
DSR	DCE ready
DSU	data service unit

DSX	digital signal cross-connect
DSX-1	digital signal cross-connect, level 1
DSX-3	digital signal cross-connect, level 3
DTC	digital trunk controller
DTE	data terminal equipment
DTMF	dual tone multifrequency
DU	data unit
DX	duplex

E

EBS	enhanced business service
EC	error correction
ECI	equipment catalog item
E&M	ear and mouth
EM	element manager
EMC	electromagnetic compatibility
EMF	electromotive force
EMI	electromagnetic interference
EMS	element management system
EOC	embedded operations channel
EPD	echo path delay
ERL	echo return loss
ES	errored seconds
ES-L	errored second-line
ESD	electrostatic discharge
ESF	extended superframe
ES-L	errored seconds-line
ES-LFE	errored seconds-line far end
ES-P	errored seconds-path
ES-S	errored seconds - section
ETO	equalized transmission only

F

4TDM	four-wire tandem
FC	failure count
FC-L	failure counts-line
FC-LFE	failure counts-line - far end
FCC	Federal Communications Commission
FCM	fuse circuit module
FDI	feeder distribution interface
FE	far end
FEAC	far end alarm and control
FELP	far end loopback
FITL	fiber in the loop
FITs	failure in 10^9 hours
fpm	flashes per minute
FPT	framed path termination
FSA	first site application
FSAN	full service access network
FTP	file transfer protocol
FX	foreign exchange
FXO	foreign exchange office
FXS	foreign exchange station
FRMGND	frameground

G

GA	general availability
GCRA	generic cell rate algorithm
GOS	grade of service
GPB	general purpose bus
GPC	general purpose communications
GR-303	Telcordia Technologies, Inc. Standard GR-303
GSFN	generic signaling function

GSI	graphical system interface
GTL	Gunning transceiver logic
GTSIP	global technical support information platform

H

HBER	high BER
HCS	header check sequence
HDBH	high day busy hour
HDLC	high-level data link control
HDSL	high bit rate digital subscriber line
HDSL2	high bit rate digital subscriber line-second generation
HDT	host digital terminal
HEC	header error code
HTTP	hypertext transfer protocol
Hz	hertz

I

I/O	input/output
IAD	integrated access device
IAT	integrated access terminal
IATSI	IAT system interface
IBERT	integrated bit error test
ICLE	initial customer laboratory evaluation
ICP	IMA control protocol
ID	identifier
IDCU	integrated digital carrier unit
IDLC	integrated digital loop carrier
IDT	integrated digital terminal
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IMA	inverse multiplexing for ATM
IMLT	integrated mechanized loop testing

INA	integrated network access
INIT	initialization/diagnostic
IP	Internet protocol
IPX	Internet packet exchange
IS	in service
ISDL	integrated subscriber digital line
ISDN	integrated services digital network
ISO	international organization for standards
ISP	Internet service providers
ITU	International Telecommunications Union
IV	ICP cell violation
IV-IMA	IPC violations (count of errored, invalid or missing IPC cells)
IXC	interexchange carrier

K

kbps	kilobits per second
kBps	kilobytes per second
kHz	kilohertz
kW	kilowatt

L

LAN	local area network
LAPD	link access protocol D-channel
LBO	lightguide build out
LCD	loss of cell delineation
LDS	local digital switch
LED	light-emitting diode
LFACS	loop facilities assignment and control system
LFP	logical feeder port
LLN	logical line number
LMI	local management interface
LOCD	loss of cell delineation

LOF (lof)	loss of frame
LOFA	loss of frame alignment
LOP	loss of pointer
LOS (los)	loss of signal
LOST	loss of signal timeout
LSAS	line side answer supervision
LTD	local test desk
LTF	loop test frame
LTS	loop test system
LULT	line unit network termination
LUNT	line unit network termination
LVD	low voltage disconnect

M

mA	milliampere
MAT	Metropolitan Area T-carrier
Mbps	megabits per second
MBps	Megabytes per second
MBS	maximum burst size
MDF	main distributing frame
MDS2	metallic distribution shelf 2
MDSU	metallic distribution server unit
MEA	mismatch of equipment and attributes
MHz	mega hertz
MIB	management information base
MJ	major
MLTS	multiline telecommunications system
MMSU	modular metallic service unit
MN	minor
MR	modification request
ms	millisecond
MSC	metallic shelf controller

MSG	message switch
MTBF	mean time between failures
MTU	maximum transfer unit
MVEC	majority vote error correction

N

NB	narrowband
NCTE	network channel terminating equipment
NE	near end or network element
NEBS	network equipment building systems
NEC	national electric code
NI	network interface
NIC	network interface card
NMP	network management protocol
NMS	network management station
nrt-VBR	nonreal time variable bit rate
NSA	nonservice affecting
NT 1	network termination - 1
NTP	network time protocol
NTT	no test trunk
NTR	network timing reference
NVDS	nonvolatile data storage
NVPS	nonvolatile program storage

O

OAM&P	operations, administration, maintenance, and provisioning
OAP	optical application pack
OC	optical carrier
OCD	out of cell
OCP	optical controller pack
OCU	office channel unit
OE	originating equipment

OHT	on-hook transmission
OLIU	optical line interface unit
ONU	optical network unit
OOS	out of service
OPS/INE	operations system for intelligent network
OS	operations system
OSMINE	operations systems modification of intelligent network elements
OSP	outside plant
OTGR	operations technology generic requirements

P

P-AIS	path alarm indication signal
P/AR	peak to average ratio
PAM	pulse amplitude modulation
PBX	private branch exchange
PC	personal computer
PCI	peripheral component interconnect
PCM	pulse code modulation
PCR	peak cell rate
PDF	portable document format
PDU	protocol data unit
PFP	physical feeder port
PGTC	pair gain test controller
PIDB	processor interface data bus
PLAR	private line automatic ring
PLCP	physical layer convergence protocol
PLN	physical line number
PLR	pulse line repeater
POTS	plain old telephone service
ppm	parts per million
PPP	point to point protocol
PRC-Access	Product Realization Center-Access

PRF	power rectifier fault
PRI	primary rate interface
PRS	primary reference source
PRU	power rectifier unit
PSAP	public safety answering point
PSC	protection switching counts
PSD	power spectral density
PSDM	power spectral density mask
PSES	p-bit severely errored seconds
PSTN	public switched telecommunications network
PTU	power and test unit
PVC	permanent virtual circuit
PVP	permanent virtual path

Q

QMON	quality monitoring
QoS	quality of service

R

RACO	remote alarm cutoff
RADSL	rate adaptive digital subscriber line
RAI	remote alarm indication
RAM	random access memory
RCLK	receive clock
RC/V	recent change/verify
RD	ring down
RDI	remote defect indication
REFCLK	reference clock
REN	ringing equivalence number
RFI	remote failure indication
RGU	ringing generator unit
RIP	routing information protocol

RMC	remote maintenance connection
RMU	remote measurement unit
ROC	remote operations channel
R-S	Reed-Solomon
RSF	receive signal failed
RT	remote terminal
rt-VBR	real time variable bit rate
RTAC	regional technical assistance center
RTLP	receive transmission level point
RTU	remote test unit
Rx-UUS-IMA	receive unusable seconds-IMA

S

SA	service affecting
SARTS	Switched Access Remote Test System
SAS-P	severely errored framing/alarm indication signal seconds-path
SCEC	second channel error correction
SCR	sustained cell rate
SDSL	symmetric digital subscriber line
SHDSL	single-pair high bit-rate digital subscriber line
SEFS	severely errored framing seconds
SEFS-P	severely errored framing seconds-path
SEFS-S	severely errored framing seconds-section
SES	severely errored seconds
SES-P	severely errored second-path
SES-S	severely errored seconds-section
SES-IMA	severely errored seconds-IMA
SES-L	severely errored seconds-line
SES-LFE	severely errored seconds-line far end
SES-P	severely errored seconds-path
SES-S	severely errored seconds-seconds
SF	superframe

shelf_PCR	shelf peak cell rate
SID	source identifier
SL	selecting slope
SNMP	simple network management protocol
SNR	signal to noise ratio
SONET	synchronous optical network
SWDL	software download

T

TAP	test access path
TAP100	test application pack
TBCU	test bus control unit
TC	TAP connected
TCA	threshold crossing alert
TCP/IP	transmission control protocol/Internet protocol
TDM	time division multiplexing
TDR	time domain reflectometry
TL1	transaction language -1
TL1SI	TL1 system interface
TLP	transmission level point or test level point
TMC	timeslot management channel
TMS	transmission (test) measuring set
TO	transmission only
TOS	test operations system
TR	technical reference
TR-08	Telcordia Technologies, Inc. Standard TR-008
TSA	timeslot assignment
TSC	test system controller
TSG	timing signal generator
TSI	time slot interchange
TTF	transmission test facility

TTLP	transmit transmission level point
Tx-UUS-IMA	transmit unusable seconds-IMA

U

UART	universal asynchronous receiver/transmitter
UAS	unavailable seconds
UAS-IMA	unavailable seconds-IMA
UAS-L	unavailable seconds-line
UAS-LFE	unavailable seconds-line far end
UAS-P	unavailable seconds-path
UBR	unspecified bit rate
UCC	universal communication channel
UDP	user datagram protocol
U-DSL	U-interface digital subscriber line
UIP	user interface panel
UNCCNT	uncorrected HEC error counter
UNI	user network interface
UPC	usage parameter control
USB	universal serial bus
UPN	urgent problem notification
UVG	universal voice grade

V

VB	virtual bank
VBR	variable bit rate
VC	virtual circuit (traditional DLC services) or virtual channel (ATM xDSL services)
VCC	virtual channel connection
VCI	virtual channel identifier
VCOT	virtual central office terminal
VDC	volts direct current
VDSL	very high speed digital subscriber line

VF	voice frequency
VFDE	voice frequency data enhancement
VGA	video graphics array
VoDSL	voice over digital subscriber line
VOM	volt ohm meter
VP	virtual path
VPC	virtual path connection
VPI	virtual path identifier
VPN	virtual private network
VPT	virtual path termination
VRLA	valve-regulated lead-acid
Vrms	volts root mean square
VRT	virtual remote terminal
VT	virtual tributary

W

WAN	wide area network
WATS	wide area telephone service
WL	working length

X

XTC	extended test controller

Z

ZBS	zero byte substitution
ZCS	zero code suppression

Glossary

Numerics

10BaseT — IEEE 802.3 standard for Ethernet transmission over unshielded twisted pair.

A

Access interface platform — A family of equipment that provides cost-effective and flexible access for different services; e.g., voice and data, using a common platform.

ACE COMDAC — An ATM COMDAC which implements circuit emulation service (CES) for the DS1 links to the backbone network using unstructured data transfer mode (UDT).

ADSL-lite — A version of asymmetric digital subscriber line (ADSL) that is less expensive than full-rate ADSL and that operates at a lower bit rate than full-rate ADSL. This version of ADSL is specified in ITU-T G.992.2.

AFMO logical feeder port — An entity used to address a SONET path or a protection group.The logical feeder port concept allows addressing of attributes or entities that are common to all physical feeder ports associated with the logical feeder port and that are independent of simplex or duplex mode. The AFMO and the AFMDS3 have two logical feeder ports.

AFMO physical feeder port — Corresponds to the physical termination of the optical feeder. The physical feeder port concept allows the addressing of SONET physical medium, selection, and line layer entities. An *AnyMedia* shelf has two physical feeder ports when using one AFMO in simplex mode and four physical feeder ports when using two AFMOs in duplex mode.

***AnyMedia* operations gateway** — Operations access for up to 20 RTs via universal communication channels (UCCs).

Application layer (OSI) A layer of OSIRM. Provides the management of communications between user applications. Examples include e-mail and file transfer.

Asymmetric digital subscriber line (ADSL) A method of data transmission over unloaded copper loops. The data rate transmitted toward the end user is typically much higher (e.g., 6 Mbps) than the data rate transmitted by the end user (e.g., 640 Kbps).

Asynchronous transfer mode (ATM) A high-speed connection-oriented mulitplexing and switching method that utilizes fixed-length cells to support multiple types of traffic. Transmission is synchronized at the start and end of each character, allowing different types of services to be carried over one system.

ATM adaptation layer (AAL) A set of internationally standardized protocols and formats that define support for circuit emulation, packet video and audio, and connection-oriented and connectionless data services. There are four standard protocols defined for AAL—AAL1, AAL2, AAL3/4, and AAL5.
AAL5 is used for bursty LAN traffic and uses the conventional five-byte ATM header. AAL5 does not support cell multiplexing.

ATM feeder The connection from the AFM to the ATM transport network. This connection may be either DS3, DS1, or OC-3c. The ATM feeder may connect directly to an ATM switch or access concentrator device. In addition, the connection between the AFM and the switch or access concentrator may incorporate a multiplexer. In daisy-chained configurations, the ATM feeder for each AFM, except the one closest to the switch or access concentrator, connects to the previous AFM in the chain. This connection may be direct or through a multiplexer. Note that daisy-chaining is available only with DS3 and OC-3c AFMs.

ATM-RSF on ADSL line Ten consecutive seconds with each second having one or more of the following anomalies:
At least 18 ADSL superframes with ATM HEC anomalies
At least one ADSL superframe with ATM cell delineation anomalies.

ATM technology Asynchronous transfer mode is a data communications format in which transmission is synchronized at the start and end of each character, allowing different types of services to be carried over one system.

Attenuation of ADSL line The difference in dB between the power received at the far end and the power transmitted by the near end.

Authentication Process used to verify that only those users or operating systems authorized to access the system are permitted to do so and to ensure that the user or operating system is only allowed to alter or extract its authorized data.

Auto discovery Automatically updates and maintains an inventory of the *AnyMedia FAST* shelf.

Autonomous reports Messages sent by the *AnyMedia* Access System to operations systems or element managers (EMs) to report conditions such as errors, faults, and threshold crossings. The *AnyMedia* Access System's processors decide when or what messages are sent; they are not externally requested.

B

Basic rate interface (BRI) An ISDN access interface type made up of two B channels, each at 64 kbps, and one D channel at 16 kbps (2B+D).

B channel An ISDN bearer service channel that can carry either voice or data at a speed of 64 kbps.

Bit error ratio The quality of transmission is measured in the number of errored bits per number of bits received.

Broadband services High speed data and asynchronous transfer mode services.

C

Cell A fixed-length 53-octet packet used in ATM. The AM cell has a 5-octet header and a 48-octet payload.

Cell delay variation (CDV) The amount of difference between a cell's expected arrival time and its actual arrival time. Also called "jitter".

Cell delay variation tolerance (CDVT) A parameter which, in CBR transmissions, determines the level of jitter (i.e., cell delay variation). The upper bound on the jitter measurement is the CDVT.

Cell header A 5-octet header that defines control information used in processing, multiplexing, and switching cells.

Cell loss priority A field in the ATM cell header showing two levels of priority for ATM cells. CLP=0 cells are a higher priority than CLP=1 cells and may be discarded if there is a congestion to preserve the cell loss ratio of CLP=0 cells.

Cell loss ratio (CLR) The value the network agrees to offer as an objective over the lifetime of the connection. This value is specified per service class at the turn-up.

Cell transfer delay (CTD) The transit delay of an ATM cell successfully passed between two designated boundaries on the *AnyMedia* Access System, when the system is loaded conservatively.

Cells received The total number of cells that the shelf received from the CPE.

Channel	The electronics portion of a digital loop carrier line; typically from the tip/ring output of the channel unit or application pack toward the central office. Includes up to the switch interface if integrated DLC. Includes the transmit and receive DS0s, codecs, and hybrids.
Circuit emulation service (CES)	An ATM configuration that allows the ATM network to act as a transparent transport pipe for constant bit-rate circuits.
CES interworking function (CES-IWF)	That part of a CES system that interfaces the signal to be emulated, converting such signals to ATM format in the transmit direction and converting ATM signals to the original format in the receive direction.
Circuit pack protection	The capability for a given pack to relinquish its functionality to another instance of the same circuit pack. The circuit pack that provides system functionality is called the *active* pack, while the circuit pack that protects the active pack is called the *standby* pack. When a switch occurs, the roles of the active and standby circuit packs are reversed. A switch occurs, for example, when the active pack fails or when an administrator issues an OAM&P command.
***ClearReach* feature**	The *ClearReach* feature for the *ConnectReach* and *ConnectReach Plus* terminals that improves modem performance. The *ClearReach* feature requires voice frequency data enhancement (VFDE) in the *AnyMedia FAST* shelf.
Collocation	Grouping entities in the same physical location.
Common unit	A unit, or application pack, that performs the main bandwidth management and control for the *AnyMedia FAST* shelf.
Competitive access	The ability for nonincumbent carriers to provide local access.
Configuration management	Consists of a set of functions to exercise control over elements in the network, including initialization, parameter setting, starting and stopping, and collection of information about the configuration.
Connection admission control (CAC)	CAC is a set of actions taken by the network during the call set-up phase to determine whether a connection request can be accepted, should be rejected, or may be re-allocated based on QoS definitions.
COSET	The header error co-setting (55 hex by ATM standards) is used to maintain a value other than zero in the header error code (HEC) field. If the first four bytes in the header are zero, the HEC derived from these bytes is also zero. When this occurs and there are a string of zeros in the data, the receiver cannot determine the cell boundaries. Therefore, it is recommended that the value 55 hex be added to the HEC before transmission.
Craft interface terminal (CIT) port	The port on the craft test unit (CTU) where the graphical system interface (GSI) or a TL1 system interface (TL1SI) is connected.

Customer premises equipment (CPE)	Equipment that resides and is operated at a customer site.
Cyclic redundancy check (CRC)	An algorithm that detects bit errors causes in data transmission.

D

D4	A framing and synchronization format for T1 transmission facilities.
Dangler cable	Cable that effectively brings a backplane connector to the front of the shelf.
Database evolution	When AFM software is upgraded to provide new features, it is usually necessary to adapt or extend the database structure to accommodate these features. This is done automatically as part of software activation and is termed database evolution.
Data communications (or circuit termination) equipment (DCE)	A modem or network communications interface device.
Data terminal equipment (DTE)	Data processing equipment that interfaces to the communications network (DCE).
DC alarm services	Point-to-point metallic services that connect subscriber premises with fire, police, or security services' monitoring locations. These services are delivered by the MDS2 shelf using DC circuit-emulation technology provided by *MCU* CUs from Tollgrade Communications, Inc.
D channel	The ISDN out-of-band (16 kbps in BRI) signaling channel that carries the ISDN user signals or can be used to carry packet-mode data.
Degrowth	The removal of circuit packs or traffic from a system via a provisioning operation (may be accompanied by the physical removal of associated equipment, but this is not required).
Digital bypass pair	A pair of MDS2 CUs (such as the *Tollgrade MCU*-5405 CUs) that provide the equivalent of a metallic bypass pair without requiring a physical copper pair.
Digital data services	Digital data services refer to 64 kbps clear channel digital service provided between the customer and the CO.
Digital signal 0 (DS0)	One 56-kbps framed channel out of the 24 contained in a DS1 channel.
Digital signal 1 (DS1)	The North American standard 1.544-Mbps digital channel.
Digital signal 3 (DS3)	The North American standard 44.736-Mbps digital channel.

Distribution cable	The cable from the field side of an FDI to the customer's ready access case or distribution box, but not including the drop (formal definition) or inside wiring.
Downstream direction	Transmission direction from ATM data network or telephony switch to customer.
Drop	Formal definition is the short cable from an aerial ready access case or buried plant distribution box to the customer's house, not including inside wiring. Informally used, especially when describing test configurations like "splitting access," to be equal to line or loop. In this latter informal case (loop), it is all the copper cable to and including the telephone set.
Dropped cells	The number of cells that are dropped as a result of exceeding either a particular connection's traffic contract or the total allowable bandwidth of the shelf.
DS1 framing format	The prescribed recurring pattern of bits transmitted that enables the receiver to identify the start of a frame and the frame number in a sequence of frames. The system supports two different DS1 frame formats, extended superframe (ESF), or superframe (SF).
DS1 link	The general term *DS1 link* can denote a physical DS1 link when using a TDM COMDAC, or a circuit emulated link when using an ACE COMDAC.
DS1 logical feeder port	These ports are associated with the VRT structure of the *AnyMedia* Access System. The VRT structure allows the flexible assignment of APs and CUs to VRTs that are associated with specific functional needs of partitioning the *AnyMedia* Access System. Three forms of VRTs are allowed: GR-303 (up to 3 allowed), TR-08 (up to 20 allowed), and INA (up to 20 allowed). The total number of VRTs and the DS1 content of each VRT are limited by the total number of DS1 physical feeder ports. Any DS1 physical feeder port can be associated with any DS1 logical feeder port.
DS1 physical feeder port	These ports provide two twisted pair transmit/receive DS1 interfaces to the *AnyMedia* Access System. Up to 20 DS1 physical feeder ports are available and are physically identified through the AID with the DS1 (shelf number), pack number (1 to 5), and the port number (1 to 4).
Dying gasp	A message the ATU-R transmits to the ATU-C when its electrical power is being shut off. The message indicates to a service technician or an administrator that an interruption on an ADSL line was caused by a power interruption at the ATU-R and not caused by a transmission failure or an *AnyMedia FAST* shelf failure.

E

Errored cells received	The number of cells that the shelf received from the CPE with detected errors.
ES on upstream SDSL line	The corrected HEC error counter (CORRCNT) and the uncorrected HEC error counter (UNCCNT) event counter data are accumulated and mapped to ES. The total count in one second is the number of ESs. The HEC error counter data is accumulated, and the ES counts are reported on a 15-minute and 1-day basis. The CORRCNT counter tracks the number of corrected HEC errors. The UNCCNT counter tracks the number of uncorrected HEC errors.
Ethernet	A LAN that uses the CSAM/CD media access method and operates at 10 Mbps, usually over coax medium.

F

Facility protection	The capability for a system to choose which signal from two facilities to pass along to the internal, unprotected transmission paths. A system switches from one facility to the other, for example, when the facility being used fails or when an administrator issues an OAM&P command.
Fault management	Consists of a set of functions, such as testing, that enable the detection, isolation, and correction of abnormal operation of the telecommunications network and its environment.
Feeder cable	The portion of a customer loop from the central office switch (integrated), or from the main distribution frame (MDF) to the office side of the feeder/distribution interface (FDI). In the case of DLC it includes the DLC line plus any copper cable from the RT to the FDI.
Fixed wireless network	A digital loop carrier (DLC) system that uses wireless (radio) transmission through the air as the distribution medium to the home, replacing the traditional copper wire outside plant. A radio unit is mounted on the outside of the home (network interface unit) and is connected to standard twisted pair wiring within the home.
FLASH memory device	A nonvolatile memory device that may be reprogrammed in the field through software download.
Framed path termination	The physical framer device on the ACE COMDAC which terminates a DS1 signal delivered by a CES-IWF. There is one framed path termination corresponding to each logical DS1 port on the ACE COMDAC.
Front and rear access	The mounting of the bay with its back away from a wall, etc., which allows access to the rear of the shelves.

Front-only access The mounting of the bay with its back next to a wall, etc., which prohibits access to the rear of the shelves.

Full-rate ADSL The version of asymmetric digital subscriber line (ADSL) defined by *ANSI* T1.413.

G

General user User login that allows access to all messages except those for Security Management messages that affect other users, such as login creation and deletion, and password modification for all user classes.

Generic cell rate algorithm (GCRA) For each cell arrival the GCRA determines whether the cell conforms to the traffic contract of the connection. The GCRA is defined with two parameters: the increment (I) and the limit (L).

Generic signaling function A parameter required for provisioning of subscriber service. The generic signaling function is used to condition the *AnyMedia FAST* shelf loop interface circuit to provide the desired signaling protocol. The values are based on Network Channel Interface (NCI) codes described in Telcordia Technologies, Inc. TR-TSY-000335.

GET The simple network management protocol (SNMP) operation used by the OS to retrieve specified information such as the values of MIB variables.

Global ATM parameters Includes the *FAST* shelf VPIs and the ATM operations channel VPI and VCI (also known as ATM OAM&P PVC).

Graphical system interface (GSI) The GSI is part of the Management Interface package of software that is an interface to control and maintain the *AnyMedia FAST* shelf telephony and data services and subshelves.

H

Hi-cap High capacity (hi-cap) subscriber services direct DS1 paths from subscriber equipment to the serving CO.

High BER on ADSL line Ten consecutive seconds with each second having one or more of the following anomalies:
At least 18 ADSL superframes with ADSL CRC anomalies
At least 0.1 seconds in which the received power has dropped to 6 dB below the reference power
At least one ADSL superframe with synchronization anomalies.

High BER on upstream SDSL line — The SDSL signal received from the CPE is considered to be in a high-BER condition when ten consecutive SESs have occurred. The high-BER condition is cleared when ten consecutive seconds have occurred that are not SESs. The system tracks SESs for the SDSL signal received from the CPE. An SES for upstream SDSL transmission is observed when either of the following conditions exists during a given clock second:
If the number of HEC errors (corrected and uncorrected) divided by the number of cells received is greater than or equal to 0.3, then SES occurs.
If at least one los or lof occurs, then SES occurs.
If an auto change in bit rate occurs, start over in both cases.

High bit rate digital subscriber line (HDSL) — A method of transmitting T1 over twisted-pair copper lines. Unlike other DSL types, HDSL uses four wires (two pairs). HDSL supports 1.544 Mbps full-duplex transmission.

I

IAT01 — IAT01 indicates an IAT type supported by a proprietary (modified D4) interface such as *ConnectReach* and *ConnectReach Plus* terminals.

IAT02 — IAT02 indicates an IAT type supported by a D4 open interface.

IATSI view — A window available on the GSI that is launched by executing the `ACT-IAT` TL1 command.

IMA group — An operational collection of IMA links that functions to multiplex and de-multiplex ATM cells in a cyclical fashion among the links, to form a higher bandwidth logical path between a pair of IMA terminals separated by multiple feeders. The AFMDS1 pack uses one group and up to eight links, with a direct, one-to-one mapping between the links and feeders.

IMA link — A circuit path within the AFMDS1 that connects its feeder interface with a circuit that combines the link’s broadband payload (ATM cells) with the payload of other links, in the downstream direction, and distributes the composite ATM payload cells among the links in the upstream direction.

Integrated access device (IAD) — A device on the customer premises that consolidates traffic from several subscriber interfaces into a single pipe. Often, the pipe connects to a host terminal that consolidates traffic from several IADs into a larger pipe.

Integrated configuration — A remote terminal (RT) connected to a local digital switch (LDS) digital interface without a central office terminal (COT).

Integrated Mechanized Loop Testing (IMLT) — IMLT is a feature of the *5ESS* switch that allows LoopCare (formerly MLT) to use the directly connected test unit (DCTU) of the *5ESS* switch to make metallic tests on subscriber loops (including those on digital loop carrier systems).

Integrated services digital network (ISDN)	CCITT I-series recommendation that defines the digital network standard for integrated voice and data network access and services and user-network messages.
Inventory management	Consists of a set of functions to track, report, and ensure adequate supplies of equipment.

L

Latency	In the *AnyMedia* Access System, this parameter is used to choose whether or not interleaving is used on an ADSL circuit. If the latency parameter is set to Interleaved, then interleaving is used. If the Latency parameter is set to Fast, then interleaving is not used. This parameter is called Latency because the amount of transmission delay through an ADSL transmission span is affected by interleaving.
Legacy services	A large set of service types traditionally supported by the DLC network element (NE).
Lightguide build out (LBO)	An attenuation network for optical signals between ATM circuit packs in an ATM switch or multiplexer and the AFMOs in an *AnyMedia* shelf, or between separate AMFOs in multiple *AnyMedia* shelves in a daisy chain. LBO guarantees the proper signal level.
Line	Formally represents the connection from the customer's telephone to the switch. Has been recently used to represent the copper cable from the DLC channel unit's or application pack's tip/ring output to the customer's telephone. Used equivalent to "loop," but usually does not include the telephone set.
Local login	Login into the *AnyMedia* Access System via the CIT or External System LAN 10BaseT interface from the collocated GSI or dumb terminal.
Local test desk	LTD is a test position located in a local end office that is capable of accessing and making metallic tests on subscriber loops served out of that office (including those on digital loop carrier systems).
LOF on ADSL line	ADSL frame synchronization has been lost at the ADSL for at least 2.5 seconds.
LOF on upstream SDSL line	The SDSL signal from the CPE is considered to be in a LOF condition after 2.5 ± 0.5 seconds of contiguous lof defect. The LOF condition is cleared when 10 ± 0.5 seconds have occurred that do not have the lof defect. The loss of cell delineation (LOCD) event counter data is mapped to lof. The firmware collects this 0.5-second interval data. If there are 2.5 seconds of contiguous lof, it is considered to be LOF. This LOCD event counter data is accumulated and reported on a 15-minute and 1-day basis.

Logical feeder port An entity used to address a SONET path or a protection group. The logical feeder port concept allows addressing of attributes or entities that are common to all physical feeder ports associated with the logical feeder port and that are independent of simplex or duplex mode. The AFMO has two logical feeder ports.

Logical ports Port assignments made through software, as opposed to actual, physical ports.

Loop Formally represents the connection from the customer's telephone to the switch. Has been recently used to represent the copper cable from the DLC channel unit's or application pack's tip/ring output to the customer's telephone. Used equivalent to "line," but may include the telephone set also.

LoopCare LoopCare (formerly called MLT) is a Tollgrade testing operations system capable of making both narrowband and broadband tests on subscriber lines and of analyzing and reporting the results of these tests.

LOS on ADSL line Received power has dropped to 6 dB below the reference power. The timing threshold is as follows:
Downstream: 1.5 seconds
Upstream: 2.5 seconds.

LOS on upstream SDSL line The loss of signal interrupts are timed, accumulated, and stored and are mapped to los. The loss of signal timeout (LOST) is used to time the los. If the LOST bit is set, then it is a LOS condition. The firmware collects this data, accumulates it, and reports the number of los occurrences on a 15-minute and 1-day basis. The LOS failure parameter is the accumulated los.

M

Management Interface The Management Interface is a package of software that is used for managing traditional DLC services and ATM xDSL services.The Management Interface allows the user to provision a single NE at a time through its GSI, while simultaneously monitoring alarms of multiple NEs through its Network Maintenance Manager. It is installed on a personal computer running under the *Windows* operating system.

Management information base (MIB) Declaration of a collection of objects that defines the network or network element (NE) for a given interface protocol. For example, there is a MIB defined for access using the simple network management protocol (SNMP) and a different MIB defined for access using the protocol of the GR-303 Embedded Operations Channel (EOC).

Maximum burst size (MBS) Specifies the largest burst of data above the insured rate that will be allowed temporarily on an ATM PVC, but will not be dropped at the edge by the traffic policing function, even if it exceeds the maximum rate.
In the signaling message, the burst tolerance is conveyed through the MBS, which is coded as a number of cells. The burst tolerance together with the sustainable cell rate and the generic cell rate algorithm determine the MBS that may be transmitted at the peak rate and still be in conformance with the generic cell rate algorithm.

Metallic bypass pair A physical copper pair running between the CO and the RT site that allows a test head located at the CO to perform metallic tests on RT subscriber drops.

Minimum bit rate The minimum rate at which the ADSL and SDSL and SHDSL link will train, upstream and downstream. This rate is used to in determining whether a new connection can be admitted to the shelf.

Mismatch of equipment and attributes (MEA) alarm This alarm signals that the equipped pack and its provisioning do not match. The alarm is cleared either by deleting the cross-connect or by replacing the pack with one that supports the service category.

Multiplexing The technique of combining multiple single channels onto a single aggregate channel for sharing facilities and bandwidth.

Multi-point grounding The circuit and frame (earth) grounds are tied together at each piece of equipment. This allows battery return to use the building ground as a path. Multi-point grounding is also called mesh, integrated ground plane, or common bonding network . (See single-point grounding.)

N

Narrowband services Services include voice and voice-frequency data transmission.

NE name The network element (NE) name is a unique provisioned name given to an *AnyMedia* shelf. This name is identified by the GSI as the site ID.

Network Maintenance Manager The Network Maintenance Manager is part of the Management Interface package of software that is used to monitor alarms over multiple NEs. The Network Maintenance Manager allows a user to choose which NEs to monitor, to filter viewed alarms, and to manage the display of these alarms

Non-real time variable bit rate (nrt-VBR) A service category for data traffic that has no fixed timing relationships but has a guaranteed QoS. Statistical multiplexing is provided to make optimum use of network resources.

Nonvolatile data storage (NVDS)	That part of the database which is retained even after a power failure, for example, provisioning parameters.
Nonvolatile program storage (NVPS)	Nonvolatile memory on the COMDAC and the AFM used to store the load image.

O

OLIU	The optical line interface unit (OLIU) circuit pack is used in the FiberReach shelf.The OLIU interfaces with an optical line in the transmit and receive directions and supports DDM-2000 FiberReach self-healing ring configurations through its time slot interchange (TSI) capabilities. For specific information on the OLIU, see the *DDM-2000 FiberReach Multiplexer Applications, Planning, and Ordering Guide*, 363-206-300.
Open systems interconnection reference model (OSIRM)	A seven-layer model that defines the protocol standards for data communications.
Operations system (OS)	A centralized system of software and/or hardware for remotely testing or administering telecommunications equipment (e.g., SARTS, LoopCare [formerly MLT], OPS/INE, etc.)
Optical carrier level *N* (OC-*N*)	The optical carrier level signal in SONET that results from an STS-*N* signal conversion. In SONET, the basic transmission speed unit is 58.34 Mbps.
Overlay solutions	Additional infrastructure to carry new services.

P

Packet switch public data network (PSPDN)	A public data network that utilizes packet switching technology (X.25, SMDS, ATM).
Partial packet discard (PPD)	In severe ATM traffic congestion, the traffic manager discards packets arriving from any connection, regardless of whether or not the traffic on the connection is exceeding its bandwidth. The traffic manager discards all remaining cells in the packet, even if the severe congestion clears in the meantime.
Peak cell rate (PCR)	A traffic parameter measured in cells per second that specifies the maximum number of cells that can be transmitted on an ATM network. PCR defines the shortest period between two cells.
Performance management	Consists of a set of functions to evaluate and report on the behavior of telecommunication equipment and the effectiveness of the network and/or network elements (NEs).
Permanent virtual circuit (PVC)	A logical dedicated circuit between two user ports in a point-to-point configuration.

Physical feeder port	Corresponds to the physical termination of the optical feeder. The physical feeder port concept allows the addressing of SONET physical medium, section, and line layer entities. An *AnyMedia* shelf has two physical feeder ports when using one AFMO in simplex mode and four physical feeder ports when using two AFMOs in duplex mode.
Physical layer convergence protocol (PLCP)	The IEEE 802.6 standard that defines the physical layer that adapts the actual capabilities of the underlying physical network to provide the services required by the ATM layer.
Private (automatic) branch exchange (PBX/ PABX)	A customer-site telephone switch.
Privileged user	User login allows access to all TL1 commands and GSI capabilities.
Protected pack	A circuit pack for which there is a backup. Protection may be one-to one, or it may be one-to-more-than-one (1:n).
Protection switching	A reliability feature that causes service to switch to the backup equipment during faults or testing.
PSD of ADSL transmission	The actual ADSL transmit power level. This value may be lower than the provisioned PSDM.
PSDM of ADSL transmission	A provisionable value representing the maximum allowed ADSL transmit power level. The ADSL transceiver may choose a lower power level based on line conditions.
Pulse code modulation (PCM)	Modulation in which an analog signal is sampled and the sample is quantized and coded. Standard North American sampling is 8,000 times per second with 8 bits representing each sample pulse, giving a transmission rate of 64 kbps.

Q

Quality of service (QoS)	An indicator of the performance of a transmission system on the Internet and other networks. QoS is measured in transmission rate, error rates, latency, and other characteristics.

R

Real-time variable bit rate (rt-VBR)	A service category with strict cell transfer and delay variation demands and cell loss requirements.
Remote login	Login into the *AnyMedia* Access System via IAO LAN, ROC, or External System LAN (over TCP/IP DCN) from OSs, EM, or GSI.
Reports-only user - broadband	User login that allows access to GET messages for retrieving system information and autonomous reports. Reports-only users do not have access to any SNMP messages that create, change or remove service or to any security messages that affect other users.

Reports-only user - narrowband	User login that allows access to a limited set of TL1 messages, for retrieving system information and autonomous messages. Reports-only users do not have access to any TL1 messages that create, change or remove service to any security messages that affect other users.
RFI on ADSL line	ADSL frame synchronization has been lost at the ATU-R for at least 1.5 seconds.
Right-of-way	Permission to have access to specified local network and to use a specific portion of it.
Ring	A closed-loop, common bus network topology.
Router	A LAN/WAN device that operates at layers 1 (physical), 2 (data link), and 3 (network) of the OSIRM. Distinguished from a bridge by its capability to switch and route data based upon network protocols such as IP.

S

Sealing current	5 mA current used (historically) to prevent oxidation buildup on tip/ring pairs.
Security management	Consists of a set of functions that protect telecommunications networks and systems from unauthorized access by persons, acts, or influences, and to track and report access attempts.
SET	The simple network management protocol (SNMP) operation used by the OS to change the value of specified information such as a MIB variable.
Shelf daisy-chain	Connecting *AnyMedia FAST* shelves to daisy-chain AFMs together for ADSL services only.
Shelf overbooking factor	Overbooking means allocating bandwidth to connections on a port, where their total bandwidth allocation is greater than bandwidth minus CAC Reserve. Booking can exceed bandwidth and also the bandwidth of the port, but traffic throughput can never exceed bandwidth.
Simple network management protocol (SNMP)	Used by the OS and the GCT for the AnyMedia *FAST* shelf broadband product for accessing the MIB objects.
Single-pair high bit-rate digital subscriber line (SHDSL)	A physical layer technology used to transport digital bit stream over one pair of nonloaded existing copper distribution cable. SHDSL provides equal transmission bit rates for both the upstream and downstream directions ranging from 192 to 2304 kbps. SHDSL is based on use of the TC-PAM line coding scheme. TC-PAM is a baseband line coding scheme that does not allow the option to share the copper loop from a baseband POTS signal.

Single-point grounding	The circuit and frame (earth) grounds are tied together at a single specific point of the central office. This does not allow the battery return to use the building ground as a path. Single-point grounding is also called floating point, isolated ground plane, or isolated bonding network. (See multi-point grounding.)
Site ID	A unique provisioned name given to an *AnyMedia* shelf. This name is identified by the *Navis AnyMedia* EMS as the NE name.
SNR margin of ADSL line	The increase in noise, relative to the current received noise power, that can occur with a BER of 10^{-7} still being met.
Software upgrade	Installing newer system software.
Standby	A backup circuit pack or system entity that may be activated during a equipment failure or testing.
Sustainable cell rate (SCR)	The average cell transmission rate in ATM, measured in cells per second and converted internally to bits per second. Usually, SCR is a fraction of the peak cell rate.
Switch consolidation	Grouping telecommunications lines (increasing density) for better efficiency, ease of maintenance, reduced cost, space, etc.
Symmetric digital subscriber line (SDSL)	A physical layer technology used to transport digital bit stream over one pair of nonloaded existing copper distribution cable. SDSL provides equal transmission bit rates for both the upstream and downstream directions ranging from 144 to 2320 kbps. SDSL is based on use of the 2B1Q line coding scheme. 2B1Q-SDSL is a baseband line coding scheme that does not allow the option to share the copper loop from a baseband POTS signal.
Synchronous optical network (SONET)	A United States high-speed, fiber-optic transport standard for a fiber-optic digital hierarchy (speeds range from 51.84 Mbps to 2.4 Gbps).

T

T1	A four-wire repeater system; commonly used to refer to a DS1 signal.
T1 carrier	The TDM digital T1 hierarchy used in North America and Japan with 24 voice channels constituting a single 1.544-Mbps T1 trunk.
TDR testing	A type of wideband metallic drop test in which a test head sends a narrow-width pulse over a subscriber loop and looks for any returned pulses that were reflected back from the loop.
Test operations system	Any of a number of testing systems used to perform channel and drop testing, such as the Tollgrade LoopCare (formerly MLT) system and PGTC-compatible test systems for channel testing.

Threshold crossing alert A threshold is a value assigned by the system user to a certain desired level (e.g., errored seconds); when the level is exceeded, a threshold crossing alert is issued.

Tier 2 NMS A generic term for a network management system that can manage multiple kinds of network elements as a connected network. Tier 3 refers to element managers and Tier 1 refers to customer service support systems.

Time domain reflectometry (TDR) testing A type of wideband metallic drop test in which a test head sends a narrow-width pulse over a subscriber loop and looks for any returned pulses that were reflected back from the loop.

TL1 system interface (TL1SI) Any ASCII terminal connected to a port via an EIA-232E/574 format that uses TL1 commands to turn up a system and perform maintenance, provisioning, and other system operations.

TL1SI view A window available in the GSI by launching a TL1SI view window though the GSI of the *AnyMedia* Management Interface.

Token A marker that indicates the station's right to transmit that can be held by a station on a token ring or bus.

Transmission control protocol/Internet protocol (TCP/IP) The combination of a network and transport protocol developed by ARPANET for internetworking IP-based networks.

TRAP The simple network management protocol (SNMP) operation used by a network element (NE) to send an autonomous report.

Twisted pair (TP) The basic transmission medium consisting of 22 to 26 American wire gauge (AWG) insulated copper wire. TP can be either shielded (STP) or unshielded (UTP).

U

Universal communication channel (UCC) A DS0 communications path between a COT and an RT of a universal *AnyMedia* Access System. The UCC is used as a LAN extension to allow a remote operations system to provision and monitor the RT via a COT that is connected to the data communications network.

Universal configuration A remote terminal (RT) connected to a central office terminal (COT) capable of providing an analog interface to a local analog or digital switching system.

Unspecified bit rate (UBR) An ATM service category where traffic is allocated whatever bandwidth is available at any given time. UBR does not have a pre-connection negotiated bandwidth and there are no guarantees in terms of cell loss rate and delay.

Unstructured data transfer mode (UDT)	One of the two AAL1 modes of data transfer. When using it, the circuit emulation service (CES) acts as a transparent pipe for the DS1 signal, passing all its bits while trying to maintain bit sequence integrity and bit count.
Upstream direction	Transmission direction from customer to ATM data network or telephony switch.
User security classes	Refers to different user groups, each assigned with certain system access privileges. See Privileged User, General User, and Reports-only User definitions.
User-to-network interface (UNI)	The point at which the user accesses the network.

V

Variable bit rate (VBR)	A service category that supports variable bit rate data traffic with average and peak traffic parameters.
Virtual channel (VC)	A virtual link defined at an ATM interface. The lower of the two levels of cell multiplexing defined for ATM.
Virtual channel connection (VCC)	The sum of all the unidirectional virtual channel links traveled by an ATM payload from its originating point to its user destination.
Virtual circuit (VC)	A voice communications link that appears to the user to be a dedicated point-to-point circuit.
Virtual connection	A connection between end-users in which data may be passed over various circuit configurations during a single period of communication. Virtual circuits are generally set up on a per-call basis and are disconnected when the call is terminated.
VF cables	Refers generically to the tip/ring pair cables that attach to the faceplates of all APs, including the telephony and ATM xDSL APs.
VF growth	Increased demand for voice frequency capacity.
virtual DS1 feeder	CES does not use physical DS1 feeders (as are used in a TDM COMDAC configuration). With CES, the functionality formerly provided by physical DS1 feeders is performed by ATM circuit emulation, a “virtual” DS1 feeder capability which is also called a framed path termination (fpt).
Virtual channel identifier (VCI)	A sixteen-bit field in the ATM cell header that uniquely identifies the virtual channel link with which the cell is associated. This identifier is of local significance only. It provides the lower of two levels of multiplexing.
Virtual path identifier (VPI)	In ATM, a field within the cell header that is used to switch virtual paths, defined as groups of virtual channels (VCs).

Voice frequency data enhancement (VFDE)	The feature of the *AnyMedia FAST* shelf that enhances the GR-303 interface to improve modem performance. Also see *ClearReach* feature.
Voice over DSL (VoDSL)	An application requiring a gateway that converts the voice signal from a digital switch to ATM format for transport toward the customer premises. Special CPE is required at the customer premises to provide the voice service.
Volatile data storage	Data storage (e.g., RAM, that will lose information when power is lost).
Virtual path (VP)	A virtual link defined at an ATM interface. The higher of the two levels of multiplexing defined for ATM. Used to transport an aggregation of virtual channels (VCs) between network locations in a manner somewhat analogous to a DS3 transporting multiple DS1s.
Virtual path identifier (VPI)	An eight-bit field in the ATM cell header that uniquely identifies the virtual path link with which the cell is associated. This identifier is of local significance, across an ATM interface. It distinguishes the data of one virtual path from the data of another, thus providing the higher of two levels of multiplexing.

W

Wide area network (WAN)	A network that operates over a large region and commonly uses carrier facilities and services.
Wire center consolidation	Grouping a number of central offices into one center.

X

xDSL	Refers to a variety of DSL services, such as HDSL, HDSL2, SDSL, SHDSL, and ADSL.

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