



T1 Access Product Selection Guide

CSUs, DSU/CSUs, Multiplexers



SELECT THE
T1 ACCESS DEVICE
TO MEET YOUR
T1 APPLICATION.



Experts choose ADTRAN.™

ADTRAN



TSU ACE



TSU LT



TSU



TSU ESP



IQ 710 with T1 Network Module



TSU 100



TSU 100e



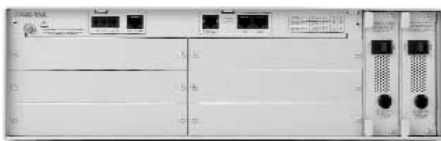
TSU 120



TSU 120e



TSU 600



TSU 600e

This document provides the information you need to select the appropriate T1 access device to best meet your T1 application. It offers a series of questions for various applications to help with the selection.

T1 Technology

The term T1 circuit commonly refers to a multiplexed 24-channel, 1.544 Mbps digital circuit that provides communications between two facilities or between a network service provider and a customer's facility. The T1 circuit transports a DS1-formatted signal to deploy voice, data, videoconferencing, or frame relay services. It can provide a high-speed, synchronous interface to a LAN router or voice PBX.

T1 Products

For T1 network termination, ADTRAN offers flexible, reliable products to support end user and service provider requirements. Backed by over 10 years of innovative product design, ADTRAN continues as the technology leader in the T1 equipment market.

ADTRAN offers T1 CSU™s for applications such as PBX connectivity. For single-port data applications, such as connecting a router to a Frame Relay or point-to-point T1/FT1 circuit, ADTRAN has a number of single-port T1 DSU/CSUs. For applications requiring multiple data and/or voice connections, ADTRAN has a family of T1 multiplexers with integral DSU/CSUs.

Expansion Modules

The TSU multiplexer products (TSU xx0 and TSU/TDUxx0e), which accommodate optional expansion modules, can be configured to support a wide variety of applications using voice and data interfaces. These easy-to-install interfaces reside on expansion modules: plug-in modules plug in to the multiplexer's expansion slot, and plug-on modules attach as a daughter card to the plug-in module's board (see the picture below). The flexibility in configuring these expansion modules can provide up to four voice or data ports per expansion slot for a wide variety of interface combinations.

Most plug-in modules provide hot-swap capability, allowing them to be replaced without powering down the base unit. Control, configuration, testing, and monitoring of the units and modules are performed using one of the following methods:

- Front panel keypad and LCD (select units)
- SNMP or Telnet (select units)
- VT100 terminal (select units)
- Optional Windows®-based T-Watch PRO™ software on a PC
- Optional N-Form™ software (select units)

Plug-on module



Plug-in module

T1 DSU/CSUs and Multiplexers

Each of these units contains an integral T1 DSU/CSU. The basic differences in the units are the type of DTE interface(s) and the number of expansion slots. Each expansion slot can accommodate one plug-in module. Most plug-in modules can accommodate one plug-on module (see specifications on each plug-in module).

To select the appropriate equipment, you must first identify the number and types of interfaces required by the application. You can then select the most appropriate unit and, if necessary, the appropriate expansion modules for the application.

T1 Access Devices

Quick Reference Guide

T1 Hardware	TSU ACE	TSU LT	TSU	TSU RM*	TSU ESP	IQ 710 w/T1 IQ 710 w/T1+DSX-1	TSU 100	TSU 100e	TSU 120	TSU 120e	TDU 120e	TSU 600	TSU 600e
Part Number	1202295L1	1203060L1	1200060L2	V.35-1202077L1 EIA-530-1200099L1	1200169L1	4202802L1 4202803L1	1202052L2	1202052L1	1202129L2	1202129L1	DC-1202155L2 AC-1202156L2	AC-1202076L2 DC-1202076L2#DC	AC-1202076L1 DC-1202076L1#DC
Product Features													
T1/FT1 (SF/ESF, AMI/B8ZS)	●	●	●	●	●	●	●	●	●	●	●	●	●
TR-08 Support													
Expansion Slots	0	0	0	0	0	0	1	1	1	1	1	6	6
TSU Expansion Modules Available							●	●	●	●	●	●	●
DBU and 10BaseT Modules Available					●	DBU							
Front Panel LCD (■ see notes)	●	●	●	■	●	●	●	●	●	●		●	●
Bantam Test Jacks		●	●	●	●	●	●	●	●	●	●	●	●
Redundant Power Option				Smart 16/16e									AC
NEBS Compliant											●		
External Alarm Contacts											●		
Voice and Data Support													
Integral DSX-1						4202803L1			●	●	●		
Integral V.35	●	●	●	V.35 Only	●	●	●	●	●	●	●		
V.35 with Integral DBU				V.35 Only			◆		◆	◆			
Optional Dial Backup (DBU)					●	●	●	●	●	●	●	●	●
Management													
Embedded SNMP (SLIP, 10BaseT)				★	SLIP	●	SLIP	●	SLIP	●	●	SLIP	●
VT100 Terminal Interface		●	●	●	●	●	●	●	●	●	●	●	●
N-Form Support						●		●		●	●		●
In-Band 8K & FDL DTE Management	●	●	●	V.35 Only	●		●	●	●	●	●	FDL	FDL
Remote Configuration Support	●	●	●	●	●	●	●	●	●	●	●	●	●
Frame Relay Specific Diagnostics						●							
Frame Relay Monitoring						●							
Test Capabilities													
Local Loopback (payload, line)	●	●	●	●	●		●	●	●	●	●	●	●
Remote Loopback (payload, line)	●	●	●	●	●		●	●	●	●	●	●	●
Remote DTE (V.54)	●	●	●	●	●		●	●	●	●	●	▲	▲
511 Test Pattern	●	●	●	●	●		●	●	●	●	●	▲	▲
1:8 Test Pattern	●	●	●	●									
QRSS Test Pattern	●	●	●	V.35 Only	●		●	●	●	●	●	●	●
All 1s Test Pattern	●	●	●	●	●		●	●	●	●	●	●	●
All 0s Test Pattern	●	●	●	●	●		●	●	●	●	●	●	●
Typical Applications													
Single Data Port Applications	●	●	●	●	●	●							
Multiple Data Port Applications							●	●	●	●	●	●	●
T1 Drop & Insert							●	●	●	●	●	●	●
Multiple Analog Voice							●	●	●	●	●	●	●
Product Includes													
T1 Loopback Plug	●	●	●	●	●	●	●	●	●	●	●	●	●
6' T1 Line Cord	●	●	●	●	2	2	●	●	●	●	●	●	●
15' T1 Line Cord							●	●			●	●	●
Two 15' T1 line cords									●	●			
Female DB-15 to RJ-45 DSX-1 Adapter									●	●			
Female DB-25 to RJ-45 RS-232 Adapter					●		●	●	●	●	●	●	●
Female RJ-45 to DB-9 Adapter						●	●	●	●	●	●	●	●
5 Year Warranty	●	●	●	●	●	●	●	●	●	●	●	●	●

★ TSU RM cards install in the Smart 16/16e shelf

▲ Requires optional module

★ When installed in Smart 16e shelf.

◆ Requires optional V.35 cable Part #1200196L1

■ Requires optional hand-held DATAMATE™, Part #1200045L1

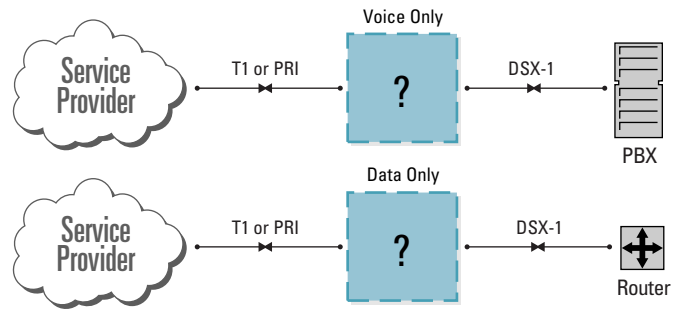
✕ Supported via 8K inband or FDL when attached remotely to a TSU that has T-Watch™ support.

PRELIMINARY QUESTIONS

CSUs

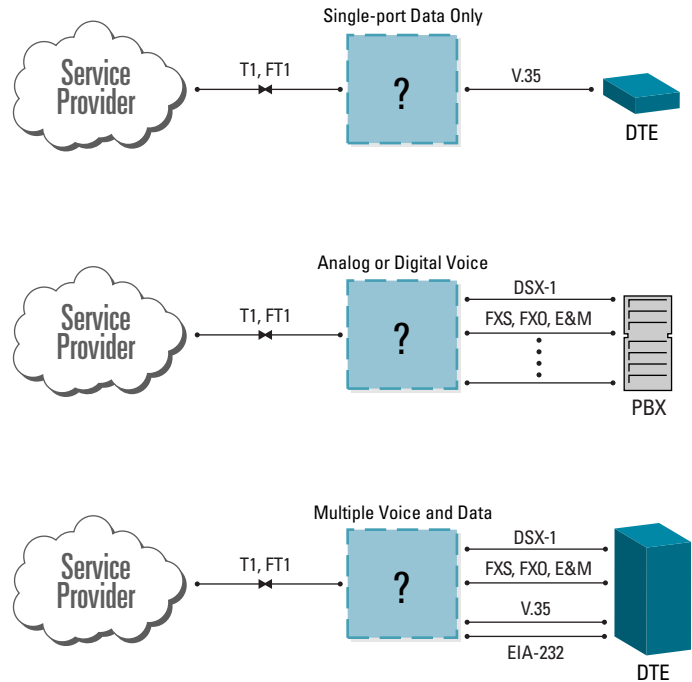
- Will the entire T1, FT1, or PRI connect to a channelized T1 or PRI interface (as opposed to a serial interface) on the customer's equipment (PBX, router, etc.)? If so, then the customer needs a T1 CSU. Refer to the product literature on the T1 CSU ACE™ (1203022L1) and T1 ESF CSU™ (1203025L1).

Application Diagrams



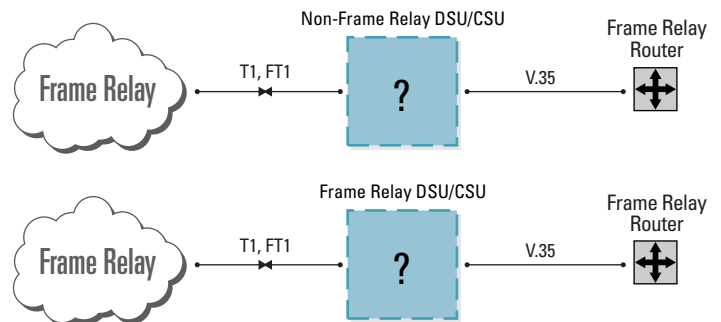
DSU/CSUs and Multiplexers

- Will the T1, FT1 carry voice and/or data services to deliver to the customer's equipment on **various types of interfaces**? Use the T1 Product Selection Tree on the following page to determine the ADTRAN products required for your application.
- If the base chassis selected is a TSU xx0/xx0e Multiplexer, continue with the following questions. Otherwise, skip to the Frame Relay section.
- Is SNMP management or telnet access required? If so, then select the TSU 100e, TSU120e, TDU120e, or TSU600e.
- Need assistance with the selection of voice modules? If so, then see the voice over T1 decision trees on page 6 and 7.
- Need assistance with the selection of data modules? If so, then see the data over T1 decision trees on pages 8 and 9.
- Will the application require two T1s from the service provider to terminate on a single unit? If so, then a T1 multiplexer and the Full Drop & Insert Module (1200065L1) are required. The D&I module is only available as a plug-in module and must reside in slot 6 when installed in a TSU600/600e. Applications requiring both T1s to support digital voice with Robbed-Bit signaling to the customer's equipment (i.e., PBX) would have to use an ATLAS™ product.



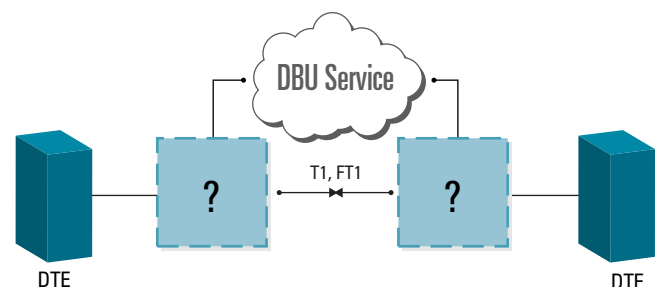
Frame Relay

- Will the T1 access device need to transparently pass Frame Relay service to a Frame Relay router? Select the appropriate TSU device using the Frame Relay over T1 decision tree on page 10.
- Will the T1 access device need to terminate Frame Relay service in order to perform traffic monitoring and shaping to effectively manage the bandwidth? Select the appropriate IQ710 using the Frame Relay over T1 decision tree on page 10.

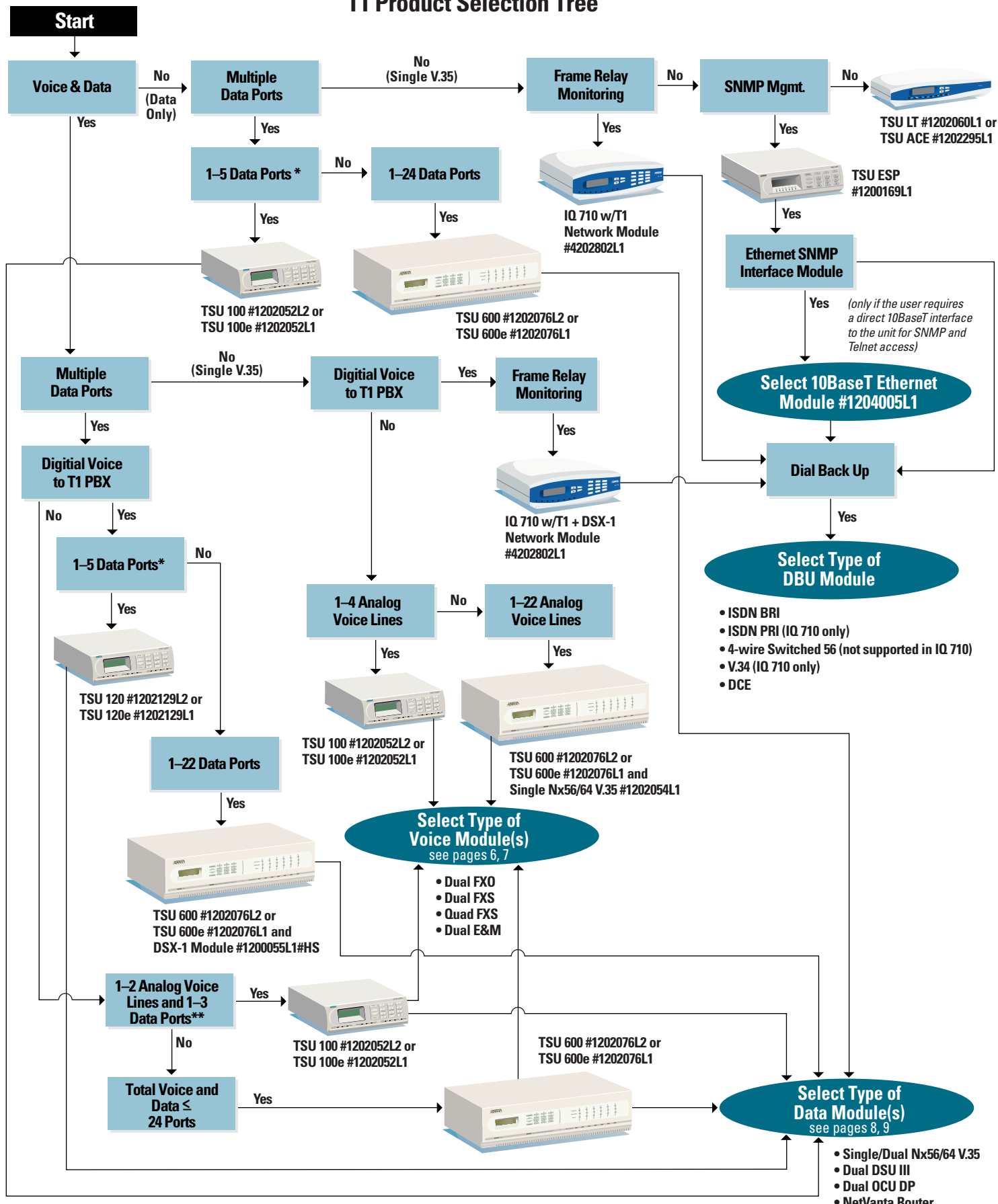


Dial Backup

- Does the application require dial backup (DBU) for disaster recovery? If so, then see the dial backup for T1 decision tree on page 11.



T1 Product Selection Tree



• Voice and data modules can be combined in a TSU XX0 or TSU XX0e.

• If 10BaseT interface for SNMP or Telnet access is required in a T1 multiplexer then select the TSU 100e, TSU 120e, or TSU 600e.

* Integral V.35 and optional 1-4 data ports

** Integral V.35 and optional 1-2 data ports

VOICE OVER T1

Two typical applications for voice over T1 are:

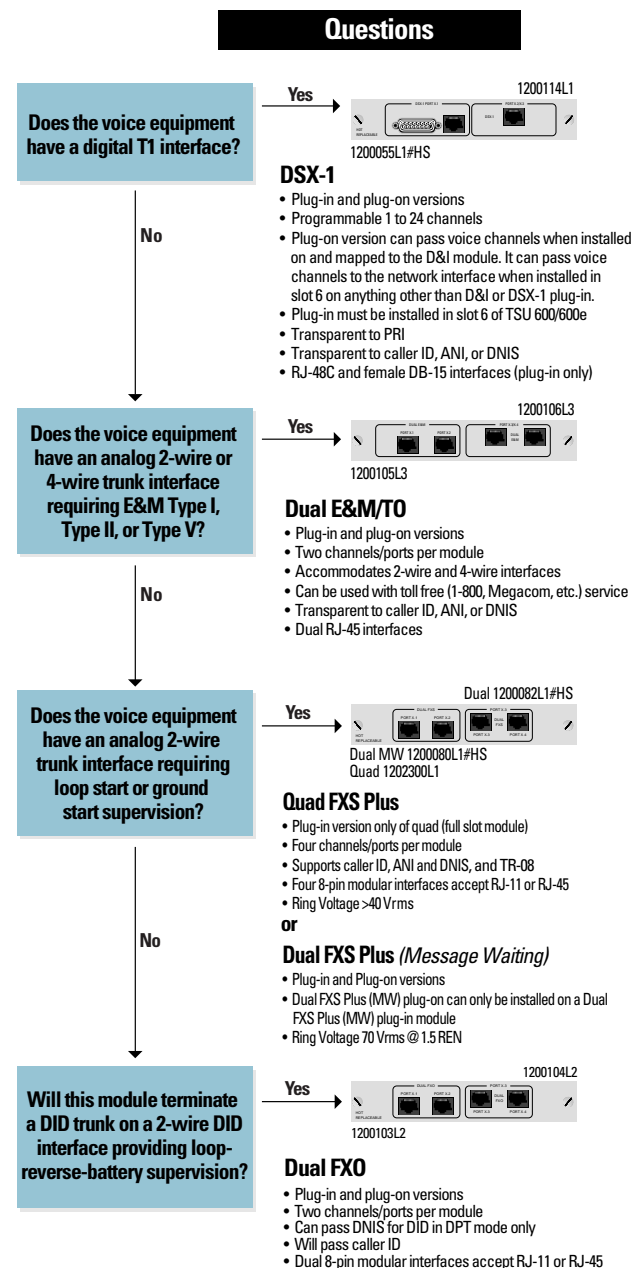
Delivering switched voice services from a carrier over T1 facilities, and connecting voice equipment at two sites over point-to-point T1 facilities. For each of these applications you need to determine the following:

- Type of interface on the voice equipment to be connected
- Number of channels to be allocated to voice

Delivering Switched Voice Services from a Carrier over T1 Facilities

See the decision tree for questions and configurations.

Decision Tree: Delivering Switched Voice Services from a Carrier Over T1 Facilities



Connecting Voice Equipment at Two Sites over Point-to-point T1 Facilities

See the decision tree on the following page for questions and configurations; it addresses three voice configurations over a point-to-point T1:

- Tie lines: connecting the trunk interfaces on two PBXs, key systems, or hybrid systems (trunk to trunk).

- Off-Premises Extensions (OPX): extending the station side of one PBX or hybrid system across a T1 to phones or to the trunk side of another phone system (station to trunk).
- Hotlines (PLAR): directly connecting two phones across a T1 such that the far end phone rings immediately when the near end phone goes off hook (phone to phone).

Decision Tree: Connecting Voice Equipment Between Two Sites Over a Dedicated T1

Questions

Application Diagrams

Tie Trunks

Does the voice equipment have a digital T1 interface?

Yes

DSX-1

- Plug-in and plug-on versions
- Programmable 1 to 24 channels
- Plug-on version can pass voice channels when installed on and mapped to the D&I module. It can pass voice channels to the network interface when installed on anything other than D&I or DSX-1 plug-in module.
- Plug-in must be installed in slot 6 of TSU 600/600e
- Transparent to PRI
- Transparent to caller ID, ANI, or DNIS
- RJ-48C and female DB-15 interfaces (plug-in only)

No

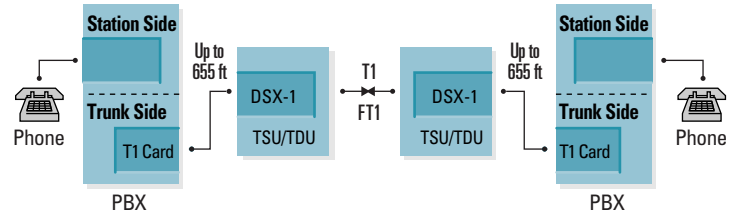
Does the voice equipment have an analog 2-wire or 4-wire trunk interface require E&M Type I, Type II, or Type V supervision?

Yes

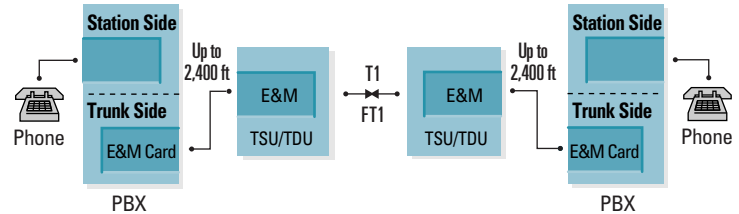
Dual E&M/TO

- Plug-in and plug-on versions
- Two channels/ports per module
- Accommodates 2-wire and 4-wire interfaces
- Dual RJ-45 interfaces

NOTE: Tie trunk applications do not always require the voice equipment on both ends to have the same physical interface.



Connecting to PBX, Hybrid, or Key System with a T1 Card



Connecting to PBX, Hybrid, or Key System with an E&M Card

2-wire Off Premises Extension or Foreign Exchange

Will this module connect to a 2-wire analog port providing dial tone, battery, and ring voltage?

Yes

Dual FXO

- Plug-in and plug-on versions
- Two channels/ports per module
- Can send message waiting signal to remote Dual FXS Plus (MW) module
- Two 8-pin modular interfaces accept RJ-11 or RJ-45

No

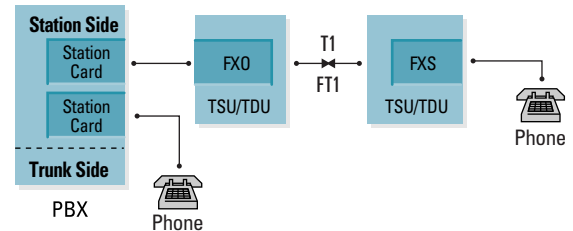
Dual MW1200082L1#HS
Dual MW 1200080L1#HS
Quad 1202300L1

Quad FXS Plus

- Plug-in versions only of quad (full slot module)
- Four channels/ports per module
- Four 8-pin modular interfaces accept RJ-11 or RJ-45
- Ring Voltage > 40 Vrms

Or Dual FXS Plus (Message Waiting)

- Plug-in and plug-on versions
- Dual FXS Plus (MW) plug-on can only be installed on a Dual FXS Plus (MW) plug-in module
- Ring Voltage 70 Vrms @ 1.5 REN



Off Premises Extensions

Hotline

Is this a Private Line Automatic Ringdown (PLAR) application? (a.k.a. the Batphone)

Yes

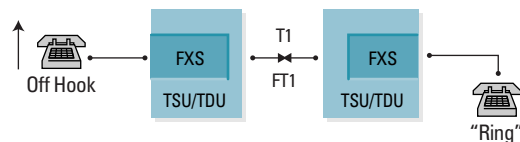
Dual MW 1200082L1#HS
Dual MW 1200080L1#HS
Quad 1202300L1

Quad FXS Plus

- Plug-in version only of quad (full slot module)
- Four channels/ports per module
- Four 8-pin modular interfaces accept RJ-11 or RJ-45
- Ring Voltage > 40 Vrms
- PLAR mode

Or Dual FXS Plus (Message Waiting)

- Plug-in and plug-on versions
- Dual FXS Plus (MW) plug-on can only be installed on a Dual FXS Plus (MW) plug-in module
- Ring Voltage 70 Vrms @ 1.5 REN
- PLAR mode



Private Line Automatic Ringdown (PLAR)

DATA OVER T1

Typical applications for data over T1 are delivering either analog or digital data services over T1 facilities.

For each piece of data equipment, you need to determine the following:

- Type of interface on the data equipment to be connected
- Number of channels to be allocated to that interface

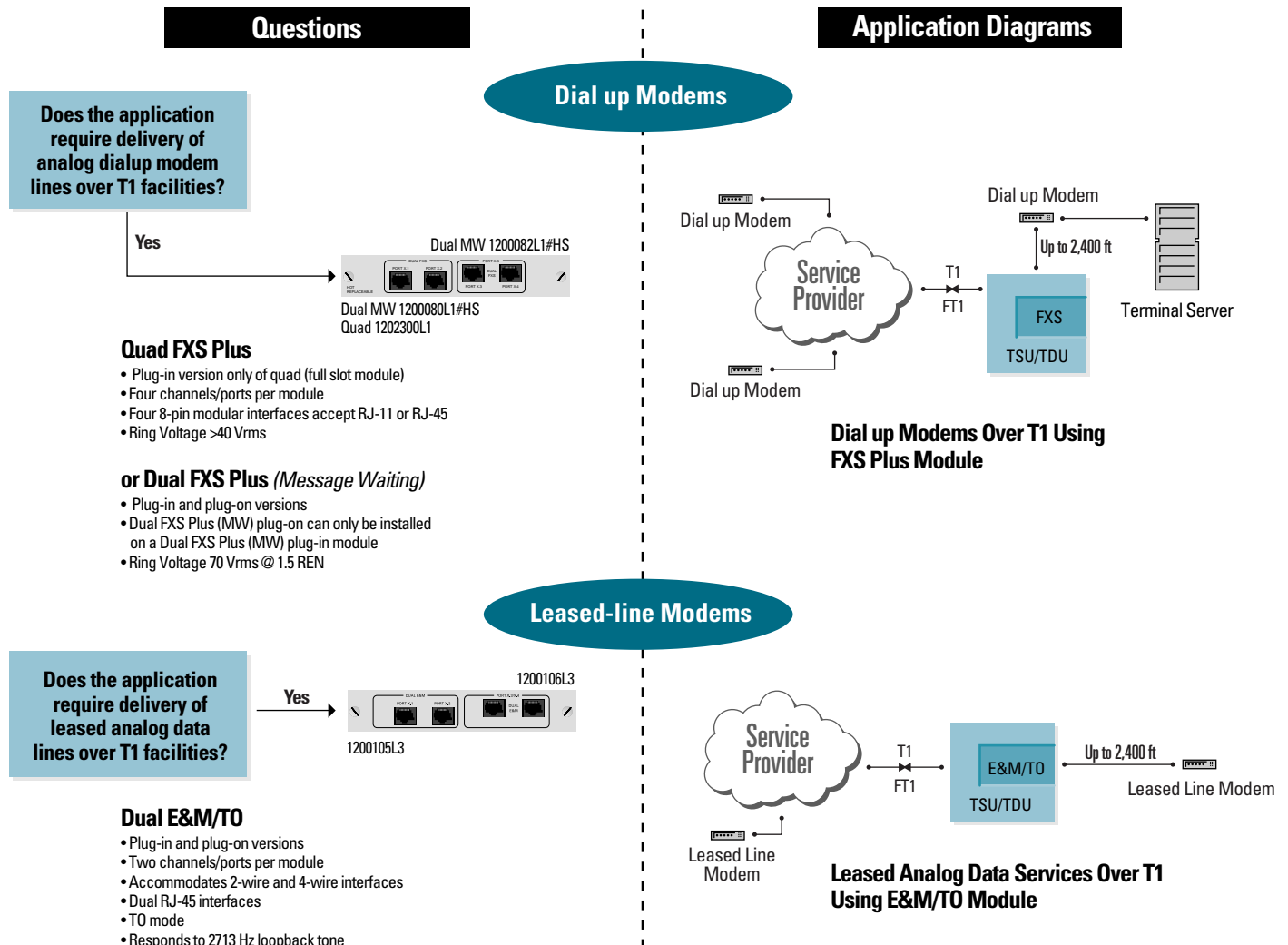
Delivering Analog Data Services over T1 Facilities

Common applications for delivering analog data services are:

- Dial-up access to a corporate LAN
- Dial-up access to an internet service provider

See the decision tree for questions and configurations for terminating analog modem lines, using either dialup modems or leased line modems.

Decision Tree: Delivering Analog Data Services Over T1 Facilities



Delivering Digital Data Services over T1 Facilities

Common applications for delivering digital data services are:

- LAN-to-LAN bridging
- Remote terminal access to host computer

See the decision tree on following page for questions and configurations, using synchronous Nx56/64 or digital 56/64 Kbps or subrates.

Decision Tree: Delivering Digital Data Services Over T1 Facilities

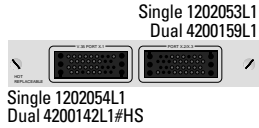
Questions

Synchronous Nx56/64

Application Diagrams

Does the data equipment have a V.35 interface?

Yes



Nx56/64 V.35 or Dual Nx56/64

- Plug-in and plug-on versions of single and dual modules
- Programmable 1 to 24 channels per port
- Dual modules have 2 subminiature DB-26 connectors.
- Adapter cable (1200167L1) converts DB-26 to V.35
- Female 34-pin Winchester style V.35 interfaces

No

Does the data equipment have an EIA-530 interface?

Yes



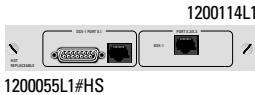
EIA-530

- Plug-in version only
- Programmable 1 to 24 channels
- Female DB-25 interface

No

Does the data equipment have a channelized T1 interface with an 8-pin modular or DB-15 connector?

Yes



DSX-1

- Plug-in and plug-on versions
- Programmable 1 to 24 channels
- RJ-48C and female DB-15 interfaces
- Transparent to PRI
- Plug-in must be installed in slot 6 of TSU 600/600e

No

Is IP router required for a small office LAN?

Yes



NetVanta Router

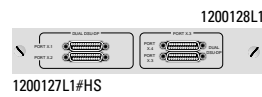
- Same feature set as NetVanta 3200
- Plug-in version only
- Programmable 1 to 24 channels
- 10/100BaseT Ethernet interface
- Supports routing over Frame Relay or PPP
- Works in any TSU/TDU
- VPN capability (optional)

Does the data equipment require sync communications at rates 2.4-64 Kbps or async communications at rates 2.4-57.6 Kbps?

Yes

Is the data equipment in close proximity (50' for RS-232; 100' for V.35) to where the TSU XX0 will be installed?

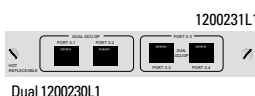
Yes



Dual DSU III

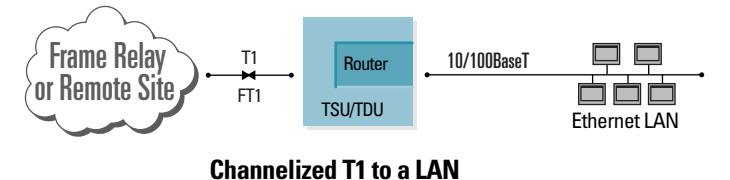
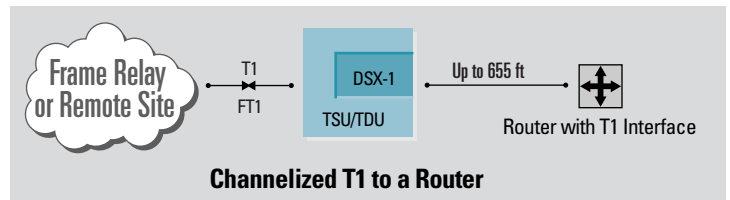
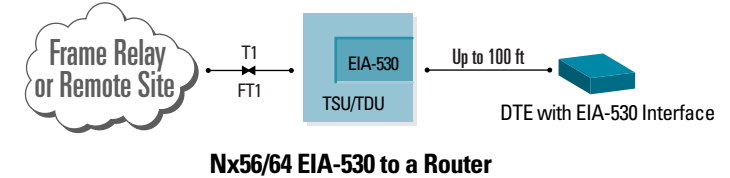
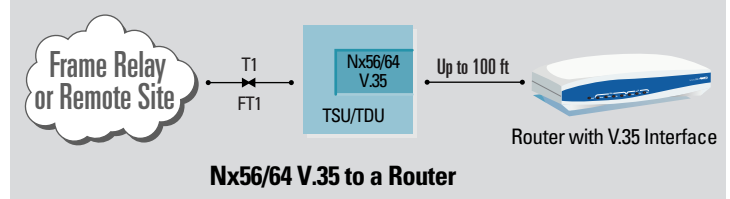
- Plug-in and plug-on versions
- Two channels/ports per module
- Two 56/64 Kbps DSU/CSUs per module
- Same features as DSU III AR™ minus secondary channel
- Dual subminiature DB-26 connectors
- Adapter cables convert to RS-232 (female DB-25) or V.35 (female Winchester style)
- A.K.A. Dual DSU DP module

No



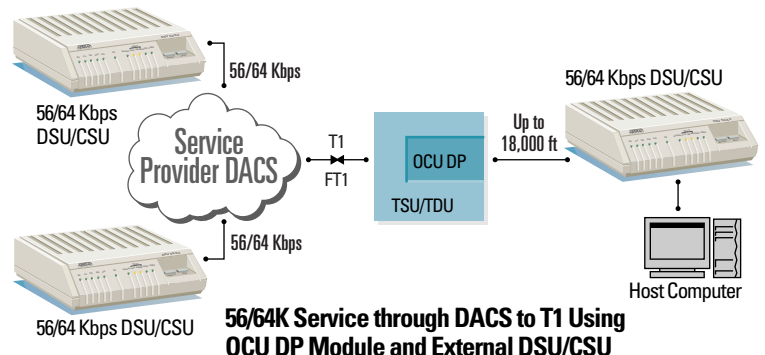
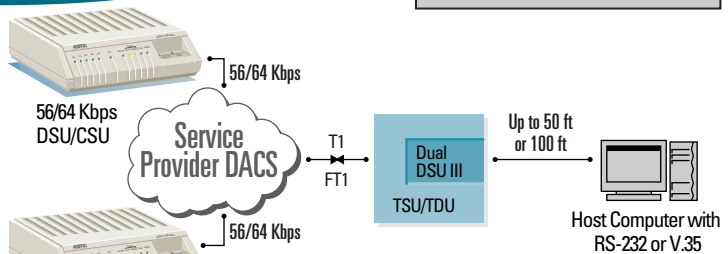
Dual OCU DP

- Plug-in and plug-on versions
- Two channels/ports per module
- Connects to external 56/64 Kbps DSU/CSU
- DSU/CSU can be up to 18,000 ft away
- Supports all rates and secondary channel
- RJ-48C interface



Digital 56/64 kbps or Subrates over T1

For applications that do not have an existing router, the NetVanta 3200 may offer a more economical solution.



DELIVERING AND MONITORING FRAME RELAY SERVICE OVER T1

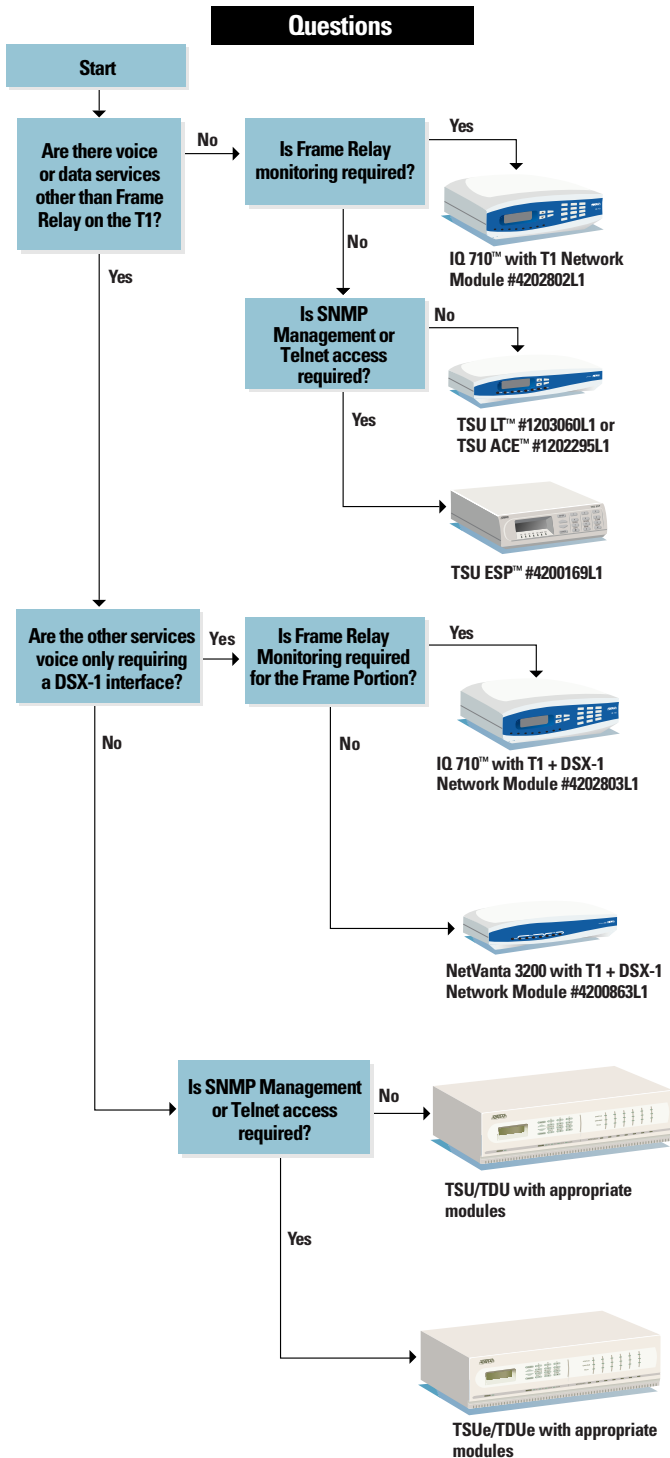
The number of Frame Relay service lines being deployed is exploding. ADTRAN® offers a number of solutions for terminating T1/FT1 circuits that are carrying Frame Relay traffic.

These solutions offer various levels of management and monitoring capabilities. To select the appropriate device, you must determine:

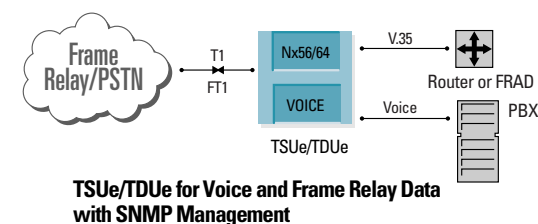
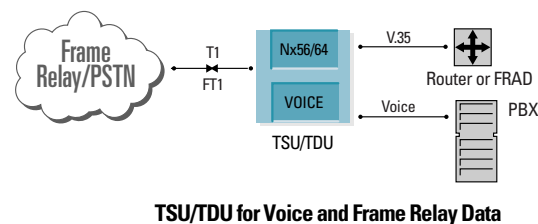
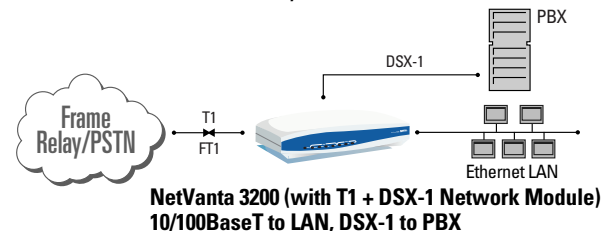
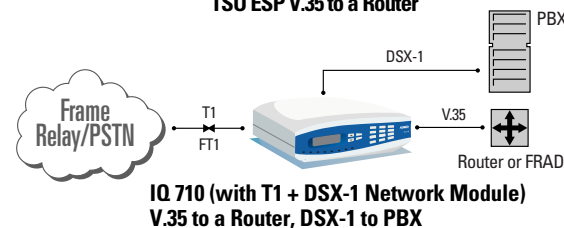
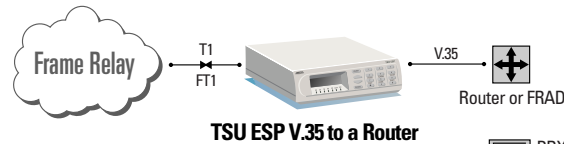
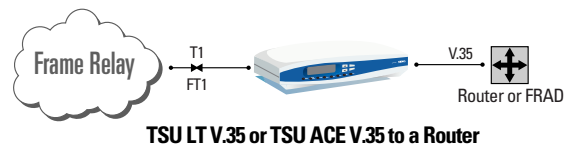
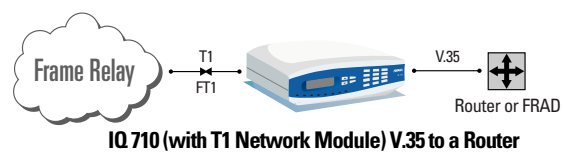
- Is Frame Relay traffic the only traffic on the T1/FT1?
- Is SNMP management required for the DSU/CSU or multiplexer?
- Is Frame Relay service monitoring required?

See the decision tree for questions and configurations for Frame Relay over T1.

Decision Tree: Delivering Frame Relay Services Over T1 Facilities



Application Diagrams



DIAL BACKUP (DBU) FOR T1

ADTRAN offers a number of dial backup (DBU) solutions for dedicated T1 circuits. These solutions ensure that mission critical data applications will keep running in the event of a failure on the T1 circuit. Each solution allows the user to select:

- How long the failure condition must exist prior to initiating dial backup

- Automatic or manual T1 circuit restoral
- How long the T1 must be stable prior to automatic circuit restoral
- Weekend and time-of-day backup disable

See the decision tree for questions and configuration options for T1 dial backup applications.

Decision Tree: Disaster Recovery (Dial Backup) Solutions for T1 Applications

Questions

Does the application require a single port (V.35) T1 DSU/CSU with dial backup?

Yes



TSU ESP with DBU Card

- Single port T1/FT1 DSU/CSU
- DBU option cards: ISDN, 4-wire Switched 56, or external DCE modules*
- Embedded SNMP with optional 10BaseT interface
- V.35 port programmable 1 to 24 channels
- Female 34-pin Winchester style V.35 interface
- TSU XX0 with the Nx DBU module can also be used for this application

No

Does the application require multiple data ports to be backed up over a single DBU link?

Yes



Multiport DBU

- Plug-in version only
- Female V.35 DCE interface to connect to external DBU device
- "Multiport" mode robs 8 Kbps from first DSO to maintain data alignment between ports being backed up
- 2nd gen Nx56/64 V.35 port must be the first port assigned in the DBU map
- Only one multiport DBU module can be installed in a TSU XX0
- T1 interface is disabled when in DBU mode
- Must be installed in slot 2 of a TSU 600/600e
- Requires 64K DSOs
- Must dial backup to another multiport DBU

No

Does the application require disaster recovery for multiple sites?

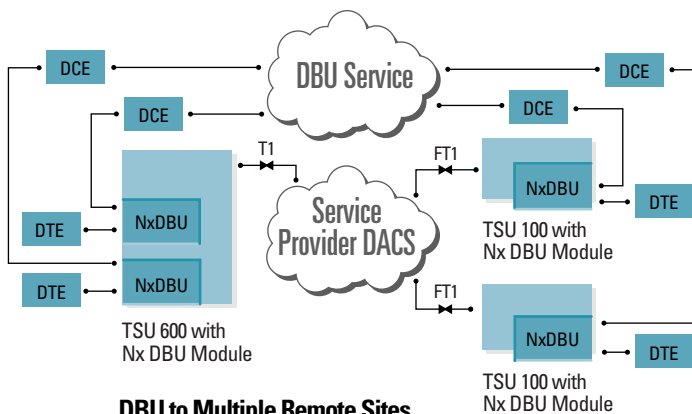
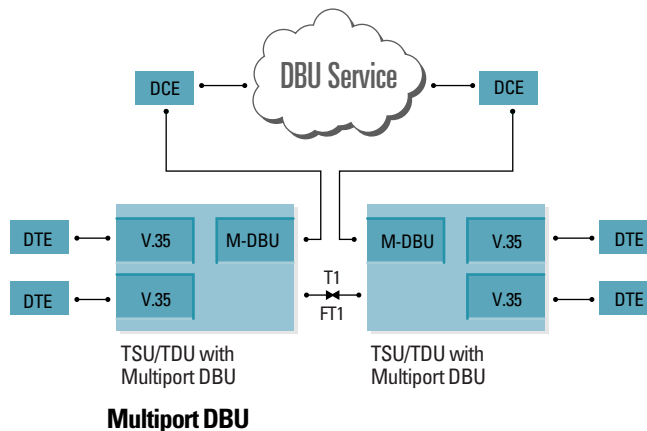
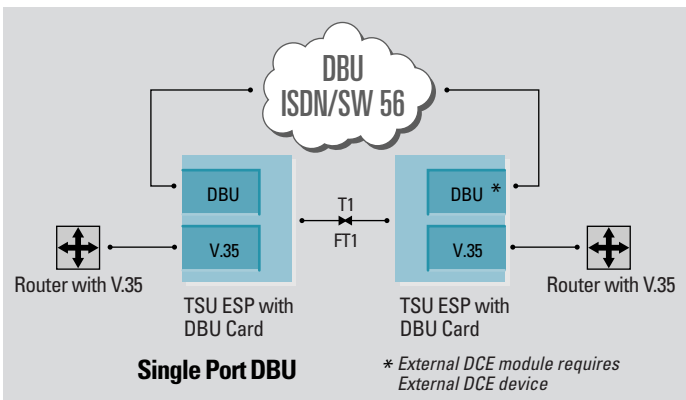
Yes



NxDBU

- Plug-in version has two V.35 ports and occupies a full slot
- Multiple Nx DBU modules can be installed in a TSU 600
- One female 34-pin Winchester style DTE interface
- One 34-pin Winchester style DCE interface
- Recommended if T1 connects to DACs
- TSU 100e™ and TSU 120e™ have this capability built into the base Nx56/64 V.35 port. Cable 1200196L1 required.

Application Diagrams



NOTES:

These DBU Solutions apply only to point-to-point T1 connections.

Contact ADTRAN for more information about DBU of Frame Relay Connections.

For applications that do not have an existing router, the NetVanta 3200 may offer a more economical solution.

T1 Access Product Selection Guide

CSUs, DSU/CSUs, Multiplexers

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