ISU 2V35
Dual Port ISDN Service Unit
User Manual

Part Number

1200234L1
U-Interface Version, 115 VAC

61200234L1-1A
December 1998

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901 Explorer Boulevard
P.O. Box 140000
Huntsville, AL 35814-4000
Phone: (256) 963-8000

FCC regulations require that the following information be provided in this manual:

1. This equipment complies with Part 68 of the FCC rules. On the bottom of the equipment housing is a label that shows the FCC registration number and Ringer Equivalence Number (REN) for this equipment. If requested, provide this information to the telephone company.

2. If this equipment causes harm to the telephone network, the telephone company may temporarily discontinue service. If possible, advance notification is given, otherwise, notification is given as soon as possible. The telephone company will advise the customer of the right to file a complaint with the FCC.

3. The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of this equipment; advance notification and the opportunity to maintain uninterrupted service is given.

4. If experiencing difficulty with this equipment, please contact ADTRAN for repair and warranty information. The telephone company may require this equipment to be disconnected from the network until the problem is corrected, or it is certain the equipment is not malfunctioning.

5. This unit contains no user serviceable parts.

6. An FCC compliant telephone cord with a modular plug is provided with this equipment. In addition, an FCC compliant cable appropriate for the dial backup option ordered is provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using an FCC compatible modular jack, which is Part 68 compliant.

7. The following information may be required when applying to the local telephone company for leased line facilities.

Service Type	Digital Facility Interface Code	Service Order Code	Network Jacks
ISDN	02IS5	6.0F	RJ-49C

FEDERAL COMMUNICATIONS COMMISSION
RADIO FREQUENCY INTERFERENCE STATEMENT

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

Shielded cables must be used with this unit to ensure compliance with Class A FCC limits.

WARNING

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

CANADIAN EMISSIONS REQUIREMENTS

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of the Department of Communications.

Cet appareil numerique respecte les limites de bruits radioelectriques applicables aux appareils numeriques de Class A prescrites dans la norme sur le materiel brouilleur: "Appareils Numeriques," NMB-003 edictee par le ministre des Communications.

CANADIAN EQUIPMENT LIMITATIONS

Notice: The Canadian Industry and Science Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single-line individual service may be extended by means of a certified connector assembly (telephone extension cord). Compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

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

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all devices does not exceed 100.

IMPORTANT SAFETY INSTRUCTIONS

When using your telephone equipment, basic safety precautions should always be followed to reduce the risk of fire, electric shock and injury to persons. The precautions are listed below.

1. Do not use this product near water (for example, near a bath tub, wash bowl, kitchen sink or laundry tub, in a wet basement or near a swimming pool).
2. Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.
3. Do not use the telephone to report a gas leak in the vicinity of the leak.
4. Use only the power cord, power supply, and/or batteries indicated in the manual. Do not dispose of batteries in a fire. They may explode. Check local codes for any special disposal instructions.

SAVE THESE INSTRUCTIONS

AFFIDAVIT REQUIREMENTS FOR CONNECTION TO DIGITAL SERVICES

- An affidavit is required to be given to the telephone company whenever digital terminal equipment without encoded analog content and billing protection is used to transmit digital signals containing encoded analog content which are intended for eventual conversion into voiceband analog signals and transmitted on the network.
- The affidavit shall affirm that either no encoded analog content or billing information is being transmitted or that the output of the device meets Part 68 encoded analog content or billing protection specifications.
- End user/customer will be responsible to file an affidavit with the local exchange carrier when connecting unprotected CPE to a 1.544 Mbps or subrate digital services.
- Until such time as subrate digital terminal equipment is registered for voice applications, the affidavit requirement for subrate services is waived.

AFFIDAVIT FOR CONNECTION OF CUSTOMER PREMISES EQUIPMENT TO 1.544 MBPS AND/OR SUBRATE DIGITAL SERVICES

For the work to be performed in the certified territory of _____

(telco name)

State of _____

County of _____

I, _____ (name), _____

(business address), _____ (telephone number) being

duly sworn, state:

I have responsibility for the operation and maintenance of the terminal equipment to be connected to 1.544 Mbps and/or _____ subrate digital services. The terminal equipment to be connected complies with Part 68 of the FCC rules except for the encoded analog content and billing protection specifications. With respect to encoded analog content and billing protection:

( ) I attest that all operations associated with the establishment, maintenance, and adjustment of the digital CPE with respect to analog content and encoded billing protection information continuously complies with Part 68 of the FCC Rules and Regulations.

( ) The digital CPE does not transmit digital signals containing encoded analog content or billing information which is intended to be decoded within the telecommunications network.

( ) The encoded analog content and billing protection is factory set and is not under the control of the customer.

I attest that the operator(s)/maintainer(s) of the digital CPE responsible for the establishment, maintenance, and adjustment of the encoded analog content and billing information has (have) been trained to perform these functions by successfully having completed one of the following (check appropriate blocks):

( ) A. A training course provided by the manufacturer/grantee of the equipment used to encode analog signals; or

( ) B. A training course provided by the customer or authorized representative, using training materials and instructions provided by the manufacturer/grantee of the equipment used to encode analog signals; or

( ) C. An independent training course (e.g., trade school or technical institution) recognized by the manufacturer/grantee of the equipment used to encode analog signals; or

( ) D. In lieu of the preceding training requirements, the operator(s)/maintainer(s) is (are) under the control of a supervisor trained in accordance with _____ (circle one) above.

I agree to provide _____ (telco's name) with proper documentation to demonstrate compliance with the information as provided in the preceding paragraph, if so requested.

_____Signature

_____Title

_____ Date

Transcribed and sworn to before me

This _____ day of _____, 199___

_____

Notary Public

My commission expires:

_____

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Chapter 1 Understanding ISDN/ISU 2V35

ISDN OVERVIEW

The Integrated Services Digital Network (ISDN) is a public or private *switched digital* network. ISDN is an international standard for digital communications, allowing a full range of enhanced services supporting voice, data, and image applications through standard interfaces over a single pair of telephone wires. ISDN provides a means of integrating these services and modernizing communication networks for information movement and management efficiency.

THE ADTRAN ISU 2V35

ADTRAN's ISU™ 2V35 is a stand-alone ISDN service unit that connects data terminal equipment to the ISDN network. The ISU 2V35 is a dual-port ISDN terminal adapter available with an optional integrated NT1. The ISU 2V35 supports two applications at data rates of up to 64 kbps on each DTE interface, or one application using a data rate greater than 64 kbps (maximum 128 kbps) on a single DTE interface. Target applications for the ISU 2V35 include video conferencing, audio broadcasting, and as dual modem replacement.

The ISU 2V35 features two V.35 DTE interfaces. Synchronous data transfer rates from 2400 bps to 128 kbps are supported on a single DTE interface. Synchronous data transfer rates from 2400 bps to 64 kbps are supported when using two DTE interfaces. For speeds over 64 kbps using a single DTE interface, the industry standard BONDING protocol aggregates the two 64 kbps B channels for a maximum of 128 kbps.

Dialing from the ISU 2V35 is accomplished in a variety of ways:

- Dialing manually from the front panel
- Dialing automatically from stored numbers
- V.25 bis in-band dialing (used in applications such as LAN/WAN bridging)
- Dialing when DTR is asserted (some Bridge/Routers raise DTR when bandwidth on their dedicated line is exceeded)

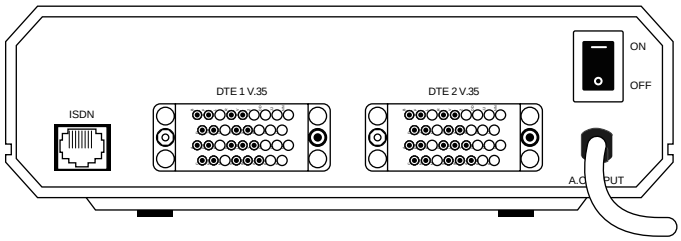

Figure 1-1. ISU 2V35 Rear Panel

The ISU 2V35 allows the user to migrate ISDN into existing network services and data communications equipment. The ISU 2V35 interoperates with ISU 128s, Switched 56 DSUs, various ISDN terminal adapters, and BONDING inverse multiplexers (for example ASCEND®, PROMPTUS, and Teleos®). For instance, in a video conferencing application, this compatibility allows the ISU 2V35 to interoperate with networks utilizing two Switched 56 DSUs.

The ISU 2V35 front panel accommodates a 2-line by 16-character LCD display. Seven LED indicators monitor data flow and display the status of key DTE interface leads (see Table 1-1 and Figure 1-2). A front panel keypad supports configuration, test modes, test status, and dialing.

Table 1-1. DTE Indicators

Indicator	Definition
RS	Request to Send. Indicates the DTE is ready to transmit.
CS	Clear to Send. Indicates the ISU 2V35 is ready to transmit.
TD	Transmit Data. On when the DTE is transmitting to the ISU 2V35.
RD	Receive Data. On when the ISU 2V35 is receiving data from the far end.
CD	Carrier Detect. On when the ISU 2V35 is connected to a remote unit.
TR	Data Terminal Ready from DTE. On when DTR is active at DTE interface.
SR	Data Set Ready.

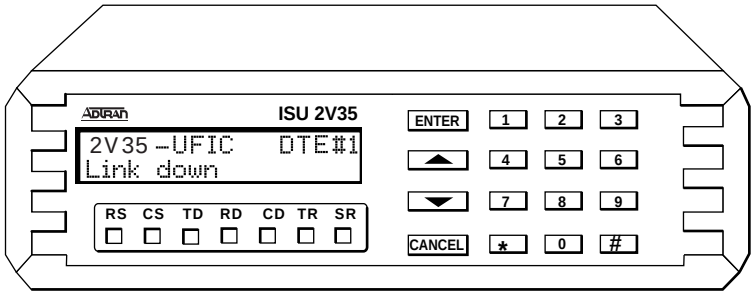

Figure 1-2. ISU 2V35 Front Panel

ISU 2V35 INTEROPERABILITY

Telephone networks are evolving from analog technologies to digital technologies such as ISDN. This transition is time-consuming and costly for the telephone companies and upgrading all locations and facilities is a lengthy process.

The ISU 2V35 bridges this transition by supporting communications with existing and future network services and equipment. The ISU 2V35 supports communications with Switched 56 Service and Switched 56 DSUs (2-wire and 4-wire) as well as various ISDN terminal adapters, ISDN terminal equipment, and BONDING-compatible Inverse Multiplexers.

Figure 1-3 on page 1-6 illustrates the ISU 2V35 operation in various switched network services and customer premises products.

ISU 2V35 SINGLE PORT OPERATION

The ADTRAN ISU 2V35 is designed to operate over multipoint ISDN lines in North America that will require two Service Profile Identification (SPID) numbers from the telephone company when the ISDN lines are installed. These SPID numbers tell the ADTRAN ISU 2V35 which port or DTE# to route incoming and outgoing calls. See Appendix D “Ordering ISDN Without IOCs” on page D-1 for further details on ordering multipoint ISDN service.

When the ISU 2V35 is used on an existing ISDN line that is not multipoint, with one SPID or no SPID numbers, additional considerations should be addressed. If DTE specific operation is desired, the ISDN line must be converted to multipoint operation (2 SPIDS). If not, the following applies:

1. If a single SPID is assigned, it must be entered under SPID **DTE#1**.
2. When no calls are active, the first incoming call is always directed to **DTE#1**.
3. **DTE#2** only accepts incoming calls when a call is active on **DTE#1**.
4. Outgoing calls can be placed without restrictions from either port.

For applications involving only one SPID being used on a multipoint line, the SPID assigned must be entered under SPID **DTE#1**. The call will be routed to the appropriate port based on the directory number entered under the local directory number (LDN) prompt . See the section "Setting the Terminal ID" on page 6-4 for more detail on entering SPID numbers.

RECOMMENDED OPERATING PROTOCOLS

The ISU 2V35 supports a wide range of operating modes. Many combinations of circuit type, protocol, and data rate may be selected. However, only the combinations shown in Table 1-2 on page 1-7 are recommended.

Table 1-2 shows that a given data rate may be achieved by more than one protocol/rate adaptation selection. The table is organized so that selections with lower throughput delay are nearer the top of the table for any given circuit type. Therefore, users should choose a protocol and rate nearer the top of the list for any given circuit type.

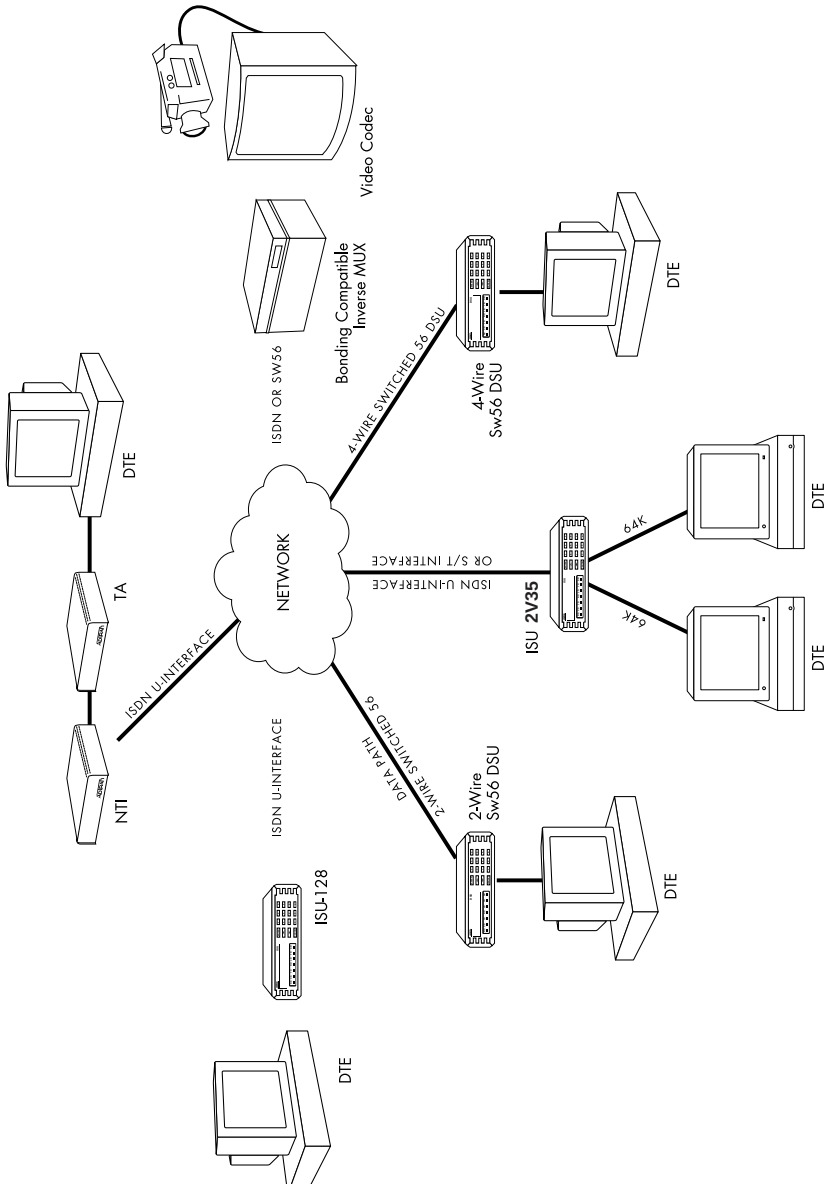

Figure 1-3. ISU 2V35 Interoperability

Table 1-2. Recommended Operating Modes

Call Type	Protocol	Sync/ Async	Rates Supported (bps)						
DIAL-64K	BONDING	Sync	56000	64000					
	Clear Chan	Sync	48000	56000	64000				
	PPP	Sync	2400	4800	9600	19200	38400	56000	64000
	V.110	Sync	2400	4800	9600	19200	38400v		
	V.120	Sync	9600	19200	38400	48000			
	Tlink	Sync	2400	4800	9600	19200	56000	64000	
	SAP	Sync	38400						
DIAL-56K	BONDING	Sync	56000						
	Clear Chan	Sync	48000	56000					
	PPP	Sync	2400	4800	9600	19200	38400	56000	
	V.110	Sync	2400	4800	9600	19200			
	V.120	Sync	9600	19200	38400	48000			
	TLINK	Sync	2400	4800	9600	19200	56000		
DIAL-64K*2	BONDING	Sync	128000						
	MPPP	Sync	128000						
DIAL-56K*2	BONDING	Sync	112000						
	MPPP	Sync	112000						
LEASED 64K	Clear Chan	Sync	48000	56000	64000				
	SAP	Sync	2400	4800	9600	19200	38400		
LEASED 128K	Clear Chan	Sync	128000						

1. *All dial-up modes support front panel, DTR, and V.25 dialing methods.*
2. *Given a choice between two protocols, pick the protocol closer to the top of the list.*
3. *Rate marked with v is available on Port 1 only.*

Chapter 2 ISDN Service

ISDN ORDERING CODES

ISDN is a complex service with many network options. Obtaining service from the local telephone company and long distance providers can be complicated.

In North America, the development of ISDN ordering codes (IOCs) simplifies the process of ordering ISDN service. The ISDN Solutions Group, a consortium of ISDN equipment vendors, service providers, and Bellcore, established these codes to represent predetermined line configurations for ISDN Basic Rate service for specific applications.

ADTRAN and Bellcore have registered and tested eight generic IOCs. These IOCs are supported by all major local exchange carriers as well as several independent carriers. After reviewing the following list, order ISDN lines from the local service provider. Request the appropriate IOC for your application. If the local service provider does not support IOCs, see Appendix D "Ordering ISDN Without IOCs" on page D-1.

Capability S (previously **Generic Data M**) ordering code is recommended for ISU 2V35 applications. It is the most feature-rich and supports most voice and data applications. The voice capability is not necessary for operation in ISU 2V35 in data-only application, however it is useful in troubleshooting a mis-configured ISDN line. In some areas, ISDN tariffs may warrant the use of ordering codes with less features. For example, in a particular region, there may be additional monthly expense associated with having voice service on each B channel. If you have a data-only application, then **Capability R** (previously **Generic Data I**) may be more cost-effective.

ADTRAN has registered the following ISDN ordering codes to support a variety of tariffs and applications:

Capability S (previously Generic Data M)

- 2B service
- Both B channels alternating voice and data
- Two directory numbers

Applications

- Host data center, internet access, bulletin board, and modem pooling applications
- Modem capability
- Generic data transfer, including remote access and LAN/WAN connectivity and telecommuting

Capability R (previously Generic Data I)

- 2B service
- Data only
- Two directory numbers

Applications

- Host data center, internet access, bulletin board, and modem pooling applications
- Data only applications, no modem capability
- Data transfer applications, including remote access and LAN/WAN connectivity, telecommuting

B1 (previously Generic Data B)

- 1B service
- Data only
- One directory number

Capability C (previously Generic Data C)

- 1B service
- Alternating voice and data
- One directory number

I2 (previously Generic Data I-1DN)

- 2B service
- Data only
- One directory number

I2 is not available for services provided by a Northern Telecom switch. Two directory numbers are required for 2B operation. In this case, use ***Capability R.***

J3 (previously Generic Data J-1DN)

- 2B service
- 1B alternating voice/data, 1B data only
- One directory number

J3 is not available for services provided by a Northern Telecom switch. Two directory numbers are required for 2B operation. In this case, use ***J2****.*

J2 (previously Generic Data J)

- 2B service
- 1B alternating voice/data, 1B data only
- Two directory numbers

M5 (previously Generic Data M-1DN)

- 2B Service
- 1B alternating voice/data, 1B data only
- One directory number

M5 is not available for services provided by Northern Telecom or LUCENT switches.

Chapter 3 Installation

After unpacking the unit, immediately inspect it for possible shipping damage. If damage is discovered, file a claim immediately with the shipping carrier, then contact ADTRAN Technical Support.

Each ISU 2V35 is provided with an eight-foot power cord terminated by a three-prong plug which connects to a grounded power receptacle.

ADTRAN ISU 2V35 (part number 1200234L1) requires a grounded 115 VAC, 60 Hz receptacle for power.

NETWORK CONNECTION

An eight-pin RJ-45 modular jack on the rear panel of the ISU 2V35 allows connection to ISDN Basic Rate service provided by the telephone company or to a leased type of service. This leased service can be dedicated 2B1Q data service or a nailed-up circuit that provides a dedicated connection between end points such as a limited distance modem or LAD circuit.

Connect the telephone company-provided ISDN Basic Rate U-Interface to the RJ-45 connector marked ISDN IFC. An external NT1 is not needed in this configuration. If using a leased service, connect the network interface to the RJ-45 connector marked ISDN IFC.

See Appendix C “Connector Pinouts” on page C-1 for network connection pin assignments.

DTE DATA CONNECTION

Data terminal equipment (DTE) is connected to the ISU 2V35 by using the V.35 interface. A maximum cable length of 50 feet is recommended. The pin assignments for the DTE interfaces are shown in Appendix C "Connector Pinouts" on page C-1. See "DTE Options for Synchronous Operation" on page 6-16.

The DTE rate is configured from the front panel of the ISU 2V35. See "Configuration" on page 6-1 to configure the ISU 2V35 with the appropriate data rates for your application.

To prevent possible radio frequency interference emissions, a shielded V.35 cable is required.

Chapter 4 Operation

MENU NAVIGATION

Moving through the various menu selections on the ISU 2V35 is a simple task. Four function keys on the left-hand side of the keypad allow the user to enter, exit, and scroll through the various menu branches. The four function keys are defined below.

To aid the reader, function keys are represented in bold, initial caps text. Selectable menu items and messages displayed on the LCD are represented in bold type as they appear on the LCD.

Enter	Enters the selected item.
Up arrow	Scrolls up a menu tree.
Down arrow	Scrolls down a menu tree.
Cancel	Exits (back one level) from the current branch of the menu.

Press either the Up or Down arrow to scroll through the menu tree. To choose an item, press the corresponding number on the keypad. The item blinks to show it is selected. Press **Enter** to select the item. Press **Cancel** to exit back through the menu tree.

It is important to note that some features in the ISU 2V35 do not immediately take effect upon selection. This prevents unintentional reconfiguration of the ISU 2V35 during an active call. To ensure the ISU is actually

performing as configured, cycle the power off then back on again, especially after changing **ISDN switch type, SPIDs, LDNs**, or **Leased/dial line**. Also, items such as **bit rate**, **protocol**, and **call type** take effect only at the beginning of a new call.

Front Panel DTE Indicators

The front panel DTE indicators (see Figure 4-1) reflect the status of each DTE port on the ISU 2V35. The indicators show the current state of the port being displayed from the **Current Status** menu. To change the DTE indicators between the two DTE ports, use the Up and Down arrow keys to bounce between the two DTE ports **Current Status** menus. Once this menu is exited, the DTE indicators reflect the status of the DTE# that was last shown. See Table 1-1 on page 1-3 for a listing of the front panel DTE indicators.

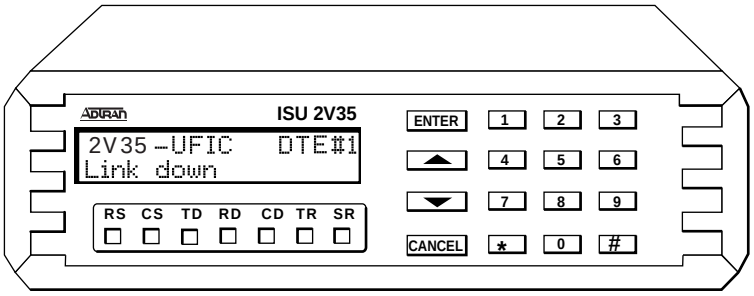

Figure 4-1. Current Status Menu

The ISU 2V35 automatically updates the Current Status menu to the DTE# that is receiving an incoming call For example, if the **Current Status** menu shows the state of DTE#1, and a call is incoming on DTE#2, the ISU 2V35 automatically changes the display to show the **Current Status** menu for DTE#2. Change this by using the Up and Down arrow keys to select either DTE.

GETTING STARTED

At power up, the ISU 2V35 runs a self test as indicated on the display. After approximately 10 seconds, **Passed** is momentarily displayed (if the ISU 2V35 does not pass the self test. See "If Self Test Fails" on page 10-1). This is followed by the **Current Status** mode of **DTE#1**. The **Current Status** mode **DTE#2** is shown by pressing either arrow key. This is the recommended resting place for the unit since it shows the current operational status of the unit. For instance, if the ISU 2V35 is not connected to the network, the Current Status menu displays **ISU 2V35 DTE# (1 or 2) Link down**. If the unit is connected to the network and functioning properly, it displays **ISU 2V35 DTE# (1 or 2) Ready**. A list of Current Status messages is provided in Appendix A "Current Status Messages" on page A-1. Repeatedly pressing the **Cancel** key returns the unit to the Current Status menu. While at the Current Status menu, pressing any key except the **Cancel** and **#** keys repeatedly changes the display to the top of the menu tree. Pressing the **#** key brings up the **Dial** submenu. While in a menu tree, pressing the **#** key causes the unit to return to the **Current Status** menu.

The menu tree allows for set up and operation of the ISU 2V35 from the front panel. The main branches of the menu tree follow:

STATUS

TEST

CONFIG (Configuration)

DIAL

Status Buffer

Selecting **1=STATUS** from the top of the menu tree displays the contents of the status buffer. The Up and Down arrow keys allow the viewing of the last fifty status messages generated during the operation of the unit. (An explanation of Status Buffer Messages can be found in Appendix B "Status Buffer Messages" on page B-1). Pressing the **Cancel** key returns you to the top of the menu. Pressing the **0** key will clear the entries from the status buffer.

Chapter 5 Testing

TEST OPTIONS

Select **2=TEST** from the top of the menu tree (Figure 5-1) to display available local testing options.

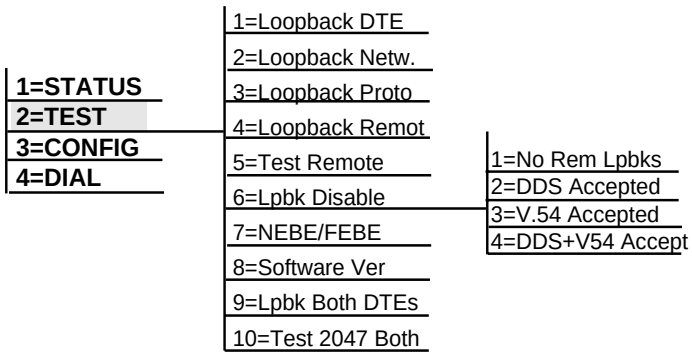

Figure 5-1. Test Menu Tree

Loopback DTE

This test causes the DTE port to loop back toward user equipment. This allows a bit error rate test (BERT) to be performed from the local end-user equipment to the ISU 2V35 to verify proper cable connection, etc. Either a BERT tester or DTE data packet test must be used for this test.

Loopback Network

This test forces the ISU 2V35 to loop back both the B1 and B2 channels toward the network. This can be used to allow a far-end user to perform a BERT all the way through the network.

Loopback Protocol

This test causes data to be looped back toward the network after passing through a selected protocol such as T-Link or BONDING. See Figure 5-2 for loopback points.

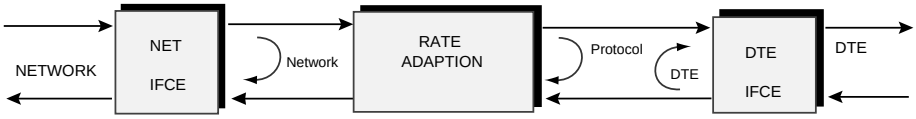

Figure 5-2. Loopback Points

Loopback Remote

This test causes the ISU 2V35 to issue a V.54 inband loopback command to a far-end unit. External test equipment must be used to generate/check test patterns. To use this feature, both units must be configured for Clear Channel operation and the far-end unit must be able to respond to V.54 loopback commands. See "Setting Protocol Options" on page 6-18 to configure the unit for Clear Channel operation. Press **Cancel** to end the test.

Test Remote

This test causes the ISU 2V35 to issue a V.54 inband loopback command to a far-end unit and BERT test the link using a built-in pattern generator/checker. This allows a circuit to be tested without any extra test equipment. To use this feature, both units must be configured for Clear Channel operation and the far-end unit must be able to respond to V.54 loopback commands. See the "Setting Protocol Options" on page 6-18 to configure the unit for Clear Channel operation. The built-in 2047 pattern generator/checker displays the number of bytes transmitted on the top line and the number of errored bytes received on the lower line of the front panel display. Pressing **0** will clear the counts. Pressing the **Cancel**

key ends the test. Pressing the down arrow will loop down the remote unit, allowing a test to a loopback plug. Pressing **2** will insert errors.

Loopback Disable

The following options are available in Loopback Disable.

No Rem Lpbks: The ISU 2V35 ignores all V.54 and DDS loopback commands.
DDS Accepted: The ISU 2V35 responds to DDS latching loopback commands. This option only takes effect if the unit is in Leased Line mode.
V.54 Accepted: The ISU responds to V.54 loopback commands.
DDS+V54 Accept: The ISU 2V35 responds to both DDS latching loopback commands (Leased Line mode only) and V.54 loopback commands.

The ISU 2V35 must be optioned for Clear Channel operation for DDS and V.54 loopbacks to take effect.

NEBE/FEBE

This test reports the quality of the network connection between the T-1 and the switch by viewing the number of near-end block errors (NEBE) and far-end block errors (FEBE) occurring on the ISDN interface. An incrementing count in NEBE means the problem is in the direction of the NT-1. An incrementing count in FEBE means the problem is in the direction of the switch.

Software Version

This test determines the software version in use on the ISU 2V35.

Loopback Both DTEs

Choosing this option loops back both DTE ports simultaneously.

Test 2047 Both

Choosing this option is similar to Test Remote, except both ports are tested simultaneously.

Press **Cancel** to exit any of these options.

Chapter 6 Configuration

DIAL LINE OPERATION

This section explains how to configure the ISU 2V35 when using ISDN Basic Rate switched service. Figure 6-2 on page 6-2 illustrates the entire menu tree.

The following are step-by-step procedures for configuring the unit for dial line operation, switch protocol, call type, terminal ID, dial options, auto answer, answer tone, connect timeout, and call screening.

To dial calls over the ISDN, the unit must be configured for **Dial Line**. The menu path to select Dial Line operation is shown in Figure 6-1.

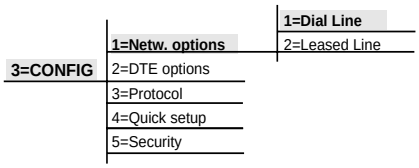

Figure 6-1. Dial Line Menu Tree

Setting the Switch Protocol

Find out what kind of ISDN switch the local CO is using by asking the telephone administrator or telephone company representative. Configure the ISU 2V35 for either Northern Telecom DMS-100, LUCENT 5ESS™, or a switch conforming to the National ISDN-1 standard (usually a LUCENT 5ESS, NT DMS-100™, or Siemens EWSD).

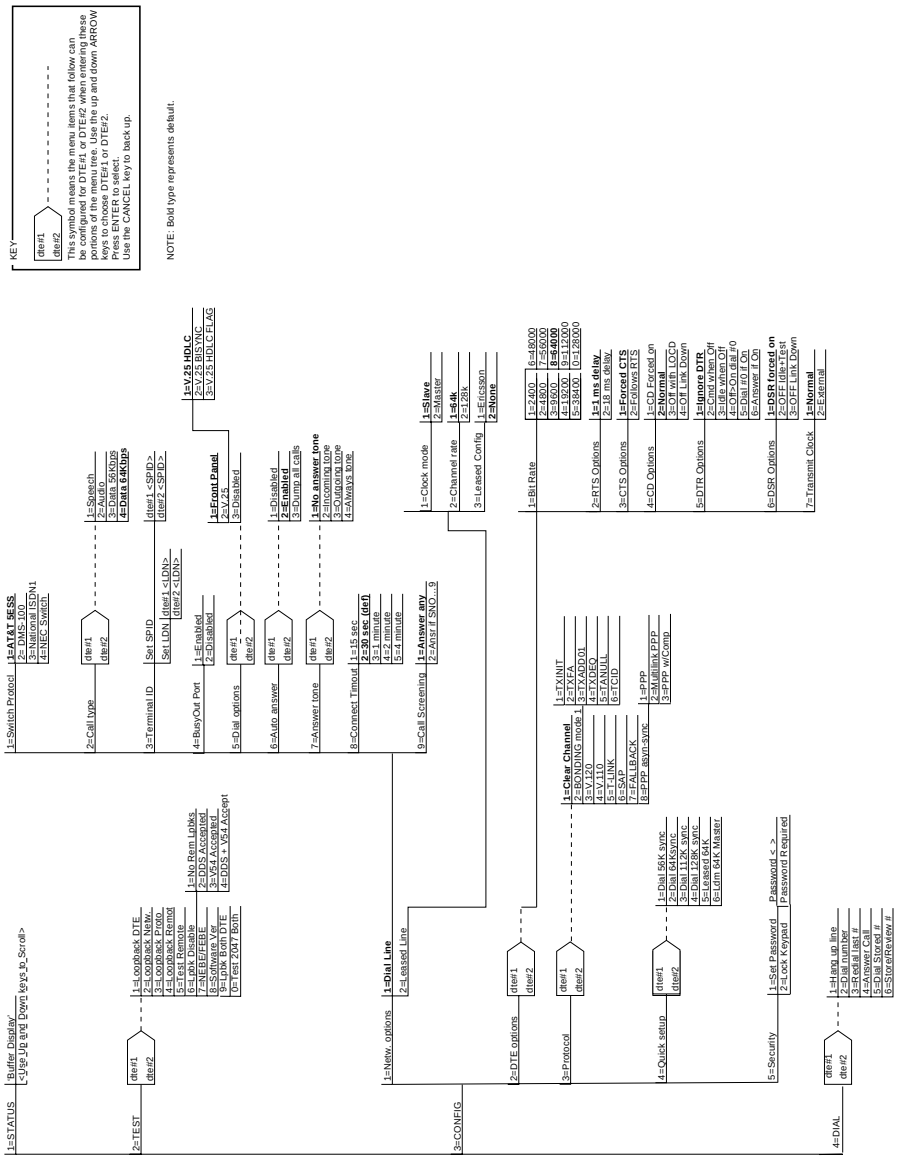

Figure 6-2. LCD Configuration Menu Tree

Setting the Call Type

Call type is configured for both **DTE#1** and **DTE#2**. When using the front panel, select the appropriate DTE with either arrow key and press **Enter**.

The **Call type** can be configured four different ways, depending on the type of service used: Speech, Audio, Data 56 kbps, or Data 64 kbps.

Speech

Speech directs the call control software to request a Mu-law (or A-law) speech circuit as the bearer capability for outgoing calls. The **Speech** option is used with an ISDN line configured for voice service. In some areas voice service is less expensive than data service. A **Speech** call type does not guarantee an end-to-end digital connection with some local and long distance carriers.

Audio

Audio directs the call control software to request a 3.1 kHz audio circuit as the bearer capability for outgoing calls. The **Audio** option is used with an ISDN line configured for voice service. In some areas audio service is less expensive than data service. Selecting **Audio** guarantees a digital end-to-end ISDN connection.

Data 56kbps

Data 56kbps directs the call control software to request a 64 kbps data circuit that is rate-adapted to 56 kbps. **Data 56 kbps** is intended for use in circumstances where interoperability with Switched-56 service is desired.

Data 64kbps

The default **Call type** for ISDN service is **Data 64 kbps**. This directs the call control software to request an unrestricted 64 kbps circuit.

Smart Dial Strings

In some cases during a dial session it may be desired to change the call type temporarily. At the end of a dialed phone number, a #1,2,3, or 4 can be used to change the call type. A #1 changes it to speech, #2 to Audio, #3 to 56K, and #4 to 64K.

Setting the Terminal ID

Terminal identification is assigned by the local telephone company and consists of a SPID and LDN number.

Setting the SPID

In North America, the SPID is a sequence of digits used to identify ISDN terminal equipment to the ISDN switch. The SPID is assigned by the local phone company when the ISDN line is installed and usually looks similar to the phone number. Obtain the SPIDs from the telephone administrator or local telephone representative. The number of SPIDs required (0, 1, or 2) depends on how the ISDN line is configured. For instance, a point-to-point line has no SPID. Multipoint lines may have one or two SPIDs. If the line has only one SPID, then it must be entered in SPID DTE#1. It is recommended to use two SPIDs with the ISU 2V35, with a SPID assigned to each DTE port.

When entering a SPID using the front panel, use the Up and Down arrow keys to select between **SPID DTE#1** and **SPID DTE#2**. Press **Enter** to select the DTE. Use the keypad to enter the SPID. While keying/editing a SPID, the Down arrow allows backspacing through the number string to correct mistakes. The Up arrow scrolls back to the last digit entered. After entering each SPID, press **Enter**. To abort changes at any time, press **Cancel**. The changes are discarded, leaving the original number unchanged.

Disconnect the network interface from the unit before initially entering and/or altering the SPIDs or LDNs.

Setting the LDN

This option allows the entry of 0, 1, or 2 LDNs. The LDN is used when receiving BONDING calls or receiving separate calls for each DTE connection. The LDN is the seven-digit local phone number assigned to the line.

When entering an LDN using the front panel, use the Up and Down arrow keys to select between **LDN DTE#1** and **LDN DTE#2**. Press **Enter** to select the DTE. Use the keypad to enter the LDN. The Up and Down arrow keys edit the number if necessary. To store the number press **Enter**. To cancel a number, use the Down arrow to backspace through the number, then press **Enter.** After entering each LDN, press **Enter**. To abort changes at any time, press **Cancel**. The changes are discarded, leaving the original number unchanged.

SPID and LDN numbers are entered in pairs and should not be crossed between the two DTE ports. Each SPID has a unique LDN. Enter a SPID-LDN pair for **DTE#1** and a separate SPID-LDN for **DTE#2**. Ensure that the SPID for **DTE#1** matches the LDN for **DTE#1**, and the SPID for **DTE#2** matches the LDN for **DTE#2**.

Disconnect the network interface from the unit before initially entering and/or altering the SPIDs or LDNs.

Setting the Busy Out Port

The Busy Out Port is recommended for use in Hunt Group applications only. This option allows the ISU 2V35 to command the switch to no longer route calls to the 2V35. The Busy Out Port requires the ISDN line to be configured by the telephone company to support the Make Busy feature and a feature button number to be assigned for activating and deactivating busy status.

Feature buttons are buttons that are normally available on ISDN telephone sets. The ISU 2V35 simulates pressing a feature button when the Busy Out Port option is changed. When the Busy Out Port option is changed, the ISU 2V35 sends a Feature Activation message to the switch using the feature button number stored. The telephone company will

need to tell you which feature button number was assigned to the Make Busy feature.

Enabled

To turn on the Make Busy feature, configure **Busy Out Port** for **Enabled**.

Disabled

To turn off the Make Busy feature, configure **Busy Out Port** for **Disabled**.

Multi-point lines must be used for per-port operation of the Busy Out Port feature.

Setting the Dial Options

The ISU 2V35 can be configured to dial using the Front Panel or V.25 bis Commands.

Front Panel

To establish and disconnect calls from the front panel keypad configure **Dial options** for **Front Panel**. See "Front Panel Dialing Options" on page 7-1 for more detail.

V.25

Configuring the ISU 2V35 for **V.25 bis** (see Figure 6-3) enables inband dialing over a DTE interface using synchronous V.25 bis commands. **V.25 bis** can be used to establish and end a call. Disconnecting calls can also be done from the front panel (as described previously) or from the far-end unit.

V.25 bis dialing is used primarily by DTE with synchronous interfaces (HDLC/SDLC or BSC/BISYNC) not supporting the AT command set, which is commonly used by asynchronous devices. The ISU 2V35 supports V.25 bis inband dialing in accordance with Fascicle V.III-V.25 bis (Malaga-Torremolinos 1984, Melbourne 1988).

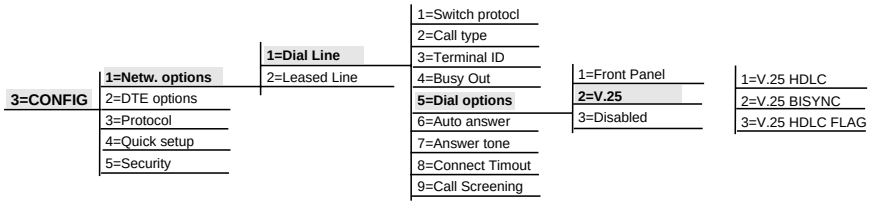

Figure 6-3. Dial Options, V.25 bis Menu Tree

Recommendation V.25 uses the following DCE/DTE control signals:

Transmitted Data	Circuit 103
Received Data	Circuit 104
Ready for Sending	Circuit 106
Data Set Ready	Circuit 107
Data Terminal Ready	Circuit 108/2
Calling Indicator	Circuit 125

The ISU supports the following V.25 bis commands to control automatic calling and answering:

CRN	Call Request (number in command)
CRS	Call Request (using stored number)
PRN	Program Stored Number
RLN	List Stored Number
CIC	Connect Incoming Call
DIC	Disconnect Incoming Call

When using stored numbers, V.25 bis accesses stored numbers 1 through 9 used by front panel dialing. See "Front Panel Dialing Options" on page 7-1.

The following configuration (see Figure 6-4) for **Auto answer** should be selected if V.25 bis is in control of answering incoming calls with the

CIC/DIC commands, since the other settings for **Auto answer** will override V.25 control of the answer function.

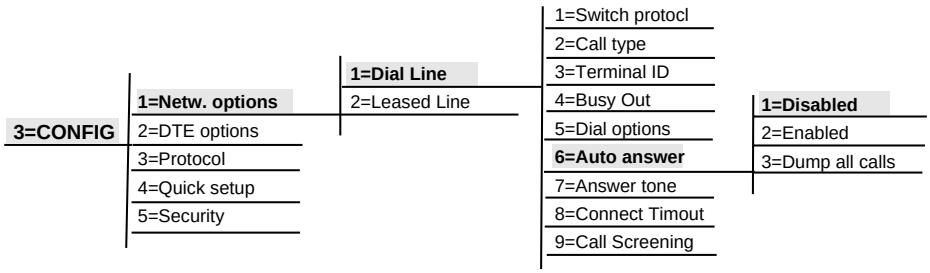

Figure 6-4. Dial Line, Auto Answer Menu Tree

V.25 SYNC HDLC Dialing

To set the Dial Options for V.25 HDLC, choose 1=V.25 HDLC from the front panel. This setting provides V.25 bis messages in bit-synchronous format (for example HDLC, SDLC, X.25). The bit-synchronous format is the most commonly used by V.25 bis.

This option specifies that the characters should be 7-bit ASCII, with the 8th bit ignored (it may be either 0 or 1).

The first byte of each packet contains all ones (A = FF HEX), and the second byte of each packet (the C byte) is either 13 HEX or 03 HEX if not the final packet.

V.25 SYNC BISYNC Dialing

To set the Dial Options for V.25 BISYNC, choose 3=V.25 BISYNC from the front panel. This setting allows for V.25 bis messages in byte synchronous format (BISYNC). V.25 bis specifies that the characters should be ASCII, 7 bits, and odd parity. This setting allows synchronous data terminal equipment which does not use HDLC to support serial inband dialing.

V.25 HDLC FLAG

To set the Dial Options for V.25 HDLC FLAG, choose 4=V.25 HDLC FLAG from the front panel. Configuring the ISU 2V35 for HDLC FLAG V.25 bis

enables in-band dialing over a DTE interface using standard synchronous HDLC V.25 bis commands with 7E HEX idle.

Disabled

This selection disables in-band dialing over the DTE interface.

Setting Auto Answer

Auto answer is configured separately for both DTE#1 and DTE#2. Using the front panel, select the appropriate DTE with either arrow key and press **Enter**.

The ISU 2V35 can be configured to automatically answer in one of three ways: Disabled, Enabled, or Dump all calls.

Disabled

When **Disabled** is selected, the ISU 2V35 will not answer the call. To accept an incoming call, select **Answer Call** from the Dial menu. (These commands are found under the **Dial** branch of the menu tree. See "Front Panel Dialing Options" on page 7-1.)

Enabled

When **Enabled** is selected, the incoming call is answered. If that call is a BONDING call and requires two B channels, the second call is answered. The port assigned to that second SPID-LDN pair is disabled during the duration of the BONDING call.

Dump all calls

When **Dump all calls** is selected, the ISU 2V35 does not accept any incoming calls. This keeps the line clear for outgoing calls.

Setting Answer Tone

Answer tone is configured separately for both DTE#1 and DTE#2. Using the front panel, select the appropriate DTE with either arrow key and press **Enter**. (See Figure 6-5.)

The **Answer tone** option enables the transmission of a modem answer tone at the start of voice and audio calls. The purpose of this tone is to disable echo suppression for echo cancellation on the circuit in order to get a clear digital circuit. This may be necessary on some long distance circuits. The specifics of the tone are 4 seconds, 2100 Hz at a -10 dB level with phase reversals every 475 µs.

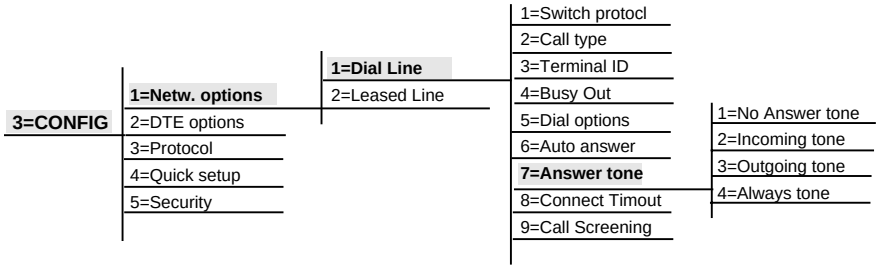

Figure 6-5. Answer Tone Menu Tree

No Answer tone (Default)

This option disables the **Answer tone** on all calls.

Incoming tone

This option enables the **Answer tone** on incoming calls.

Outgoing tone

This option enables the **Answer tone** on outgoing calls.

Always tone

This option enables the **Answer tone** on either incoming or outgoing calls.

Setting Connect Timout

Connect Timout sets the length of time that the ISU 2V35 waits for a far-end unit to answer an outgoing call. These choices are illustrated in Figure 6-6.

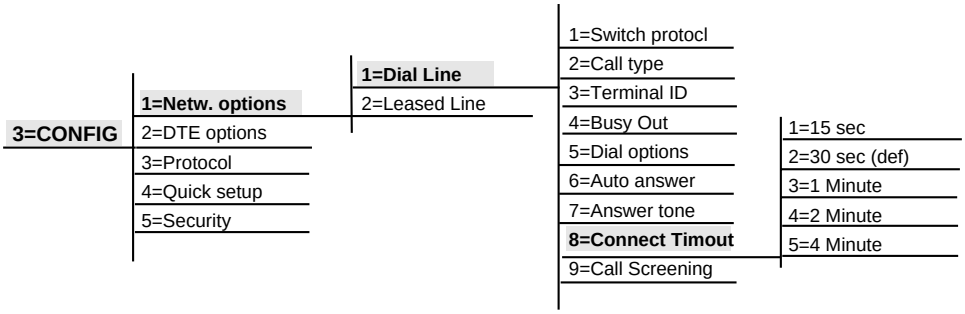

Figure 6-6. Connect Timout Menu Tree

Setting Call Screening

Call Screening allows the ISU 2V35 to either answer all incoming calls (default) or only calls originating from phone numbers stored in the Dial menu as stored numbers SN0 through SN9. See "Front Panel Dialing Options" on page 7-1 to review how to store numbers. Figure 6-7 illustrates the menu tree for setting call screening.

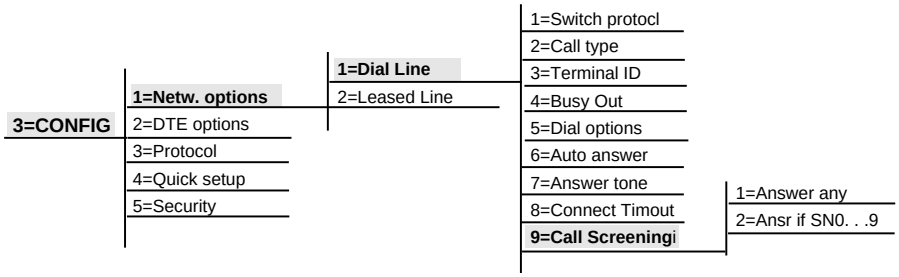

Figure 6-7. Call Screening Menu Tree

When **Call Screening** is set to **Ansr if SN0. . .9**, an incoming call is not answered if the Call ID received from the switch does not match a stored number. Depending on the switch type, the Call ID may be presented in either a seven- or ten-digit format. The ISU 2V35 displays the Call ID for all dumped calls in the **Status Buffer**. See "Status Buffer" on page 4-3 for more information.

Because different switches handle calls and Call ID differently, first find out if the switch uses a seven- or ten-digit Call ID format. Use the following procedure to determine if a seven- or ten-digit Call ID (phone number) should be stored.

1. Select **Ansr if SN0. . .9** under **Call Screening**.
2. Store the seven-digit number in SN0.
3. Place a call to the ISU 2V35 with the stored number to see if it answers properly.
4. If the ISU 2V35 does not answer the call, check the Call ID message in the Status Buffer. More than likely, the Call ID number will be a ten-digit number.
5. Reenter the number in SN0 as it is displayed in the Call ID message and test **Call Screening** again.

LEASED LINE SERVICE

This section explains how to configure the ISU 2V35 when using a 2B1Q leased digital service or a service providing a permanent connection between end points. The distance can be up to 18000 feet.

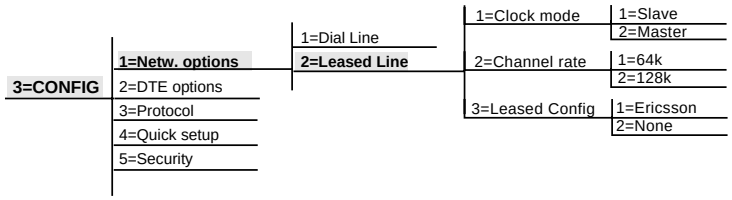

Figure 6-8. Leased Line Menu Tree

Selecting **Leased Line** configures the unit for leased line service or service providing a permanent connection between end points such as limited distance modem or LDM service.

Follow this step-by-step procedure to configure the ISU 2V35 for **Leased Line, Clock mode, Channel rate,** and **Leased Configuration**.

Clock mode: Slave/Master

By configuring the ISU 2V35 for **Master** timing, the ISU 2V35 can provide clocking for both ends of the phone line. This **Master** option is intended to be used at one end of a limited distance modem application, where two ISU 2V35 units are directly connected without the use of channel banks (see Figure 6-9). The far-end unit should be configured for **Slave** and derives its clocking from the ISU 2V35 configured as **Master**.

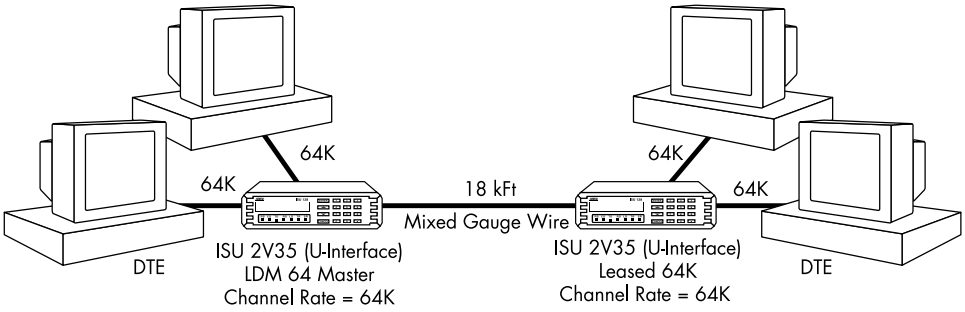

Figure 6-9. Limited Distance Modem Applications

If two ISU 2V35 units are connected through channel banks, both units should be configured for **Slave** mode (see Figure 6-10).

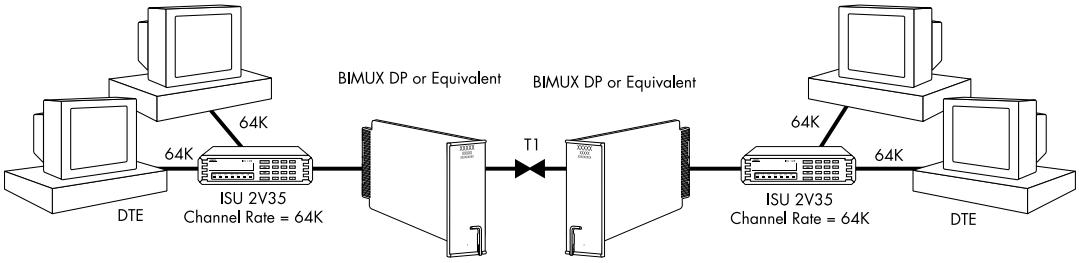

Figure 6-10. Leased Application with Channel Banks

Channel Rate

In **Leased Line** operation, the channel rate for the ISU 2V35 can be configured for 64 kbps or 128 kbps. When the channel rate is set to 64 kbps, each DTE port is assigned one of the bearer channels. For example, if two ISU 2V35 units are configured for leased line service and the channel rate is set to 64 kbps in both units, then DTE#1 of the master unit and DTE#1 of the slave unit would be connected through one of the bearer channels and could utilize up to 64 kbps of bandwidth. Likewise, DTE#2 of the master and DTE#2 of the slave would be connected through the other bearer channel and could also utilize up to 64 kbps of bandwidth (see Figure 6-10).

When the channel rate is set for 128 kbps in both units, both bearer channels are assigned to one DTE port. This assignment is user-configured. Select a DTE rate higher than 64 kbps for the DTE port that will run the application requiring greater than 64 kbps bandwidth. Select the same DTE port for both Master and Slave 2V35 units. Set the unused DTE port's DTE rate to a rate less than 64 kbps to facilitate correct operation between the two ISU 2V35 units.

For example, if an application requiring 128 kbps was run through **DTE#1**, first configure the channel rate of the leased line to 128 kbps and set the DTE rate for **DTE#1** to 128 kbps synchronous. The DTE rate for **DTE#2** should be set at 56 kbps or lower. Enter these settings into both units. This allows an application to utilize up to 128 kbps of bandwidth between **DTE#1** on the master unit and **DTE#1** on the slave unit.

Leased Configuration

This option sets a D channel leased line configuration. These configurations specify types of network management that can be used to configure the unit from a leased line multiplexer located at the Central Office. A typical application would have many 2V35s connected to a multiplexer via their ISDN U interfaces.

None

Sets unit for no D channel configuration, which is typical leased line mode.

No network management (such as loopbacks and unit status) is available with this option.

Ericsson Local

When this option is set, the Ericsson multiplexer connected to the 2V35 can perform loopbacks or read the settings for the bit rate and connector type.

The 2V35 can only be configured from the front panel.

Ericsson Remote

When this option is set, the Ericsson multiplexer remotely connected to the 2V35 can read the status of the 2V35, perform loopbacks, or configure the product. A device connected to the 2V35 can read the status for the bit rate and the connector type.

In this configuration, DTE leads and flow control cannot be set, and only V.110 and Clear Channel protocols are supported. The 2V35 can only be configured from the network.

TelLabs

For future implementation.

DTE Options for Synchronous Operation

The DTE options are configured separately for both DTE#1 and DTE#2. When using the front panel, select the appropriate DTE with either arrow key and press **Enter**. (See Figure 6-11.)

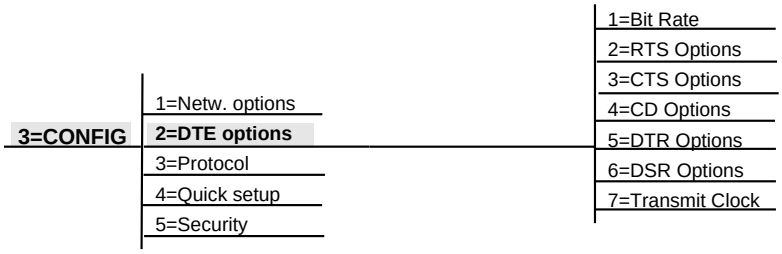

Figure 6-11. Synchronous DTE Options Menu Tree

Bit Rate

The **Bit Rate** can be set synchronously for 2400, 4800, 9600, 19200, 38400, 48000, 56000, 64000, 112000, and 128000 bps.

RTS Options

1 ms delay causes the **Clear to Send** signal to change state one millisecond after the DTE **Request to Send** signal changes state. The **18 ms delay** causes the **Clear to Send** signal to change state 18 milliseconds after the DTE **Request to Send** signal changes state.

CTS Options

Forced CTS causes the CTS signal on the DTE connector to be continually asserted. **Follows RTS** causes the CTS signal to follow the state of the RTS lead.

CD Options

CD Forced On causes the carrier detect (CD) signal to always be asserted. **Normal** causes the CD signal to be asserted when a call has been successfully established. **Off with LOCD** (local disconnect) causes the CD signal to be disasserted for a period of 5 seconds and then be reasserted at the termination of a call. **Off Link Down** causes the CD signal to be disasserted when the ISDN interface is not ready.

DTR Options

Ignore DTR causes the ISU 2V35 to disregard the state of the data terminal ready (DTR) pin. **Cmd when Off** forces the unit into the AT command processor mode when DTR is not asserted. To return online, DTR must be asserted, followed by the AT0 command. **Idle when Off** forces the unit to end the current call when DTR is no longer asserted. **Off>On dial #0** allows one call attempt to be automatically established when the DTR signal goes from inactive to active. While DTR is active, front panel dialing is also possible. When DTR goes inactive, any outgoing call present is disconnected. **Off>On dial #0** uses the phone number in stored number register 0 to establish the call. To store a number for automatic dialing, see "Front Panel Dialing Options" on page 7-1. **Dial #0 if On** allows calls to be automatically established when the signal is in the active state. The unit attempts to establish a call using SN0 until the call is established or DTR goes inactive. **Answer if On** only allows the unit to answer an incoming call if DTR is asserted.

DSR Options

DSR forced on causes the data set ready (DSR) signal on the DTE connector to always be asserted. **Off Idle+Test** causes the DSR to be disasserted if the ISU 2V35 is in test or there is not an active call. **Off Link Down** causes the DSR signal to be disasserted when the ISDN interface is not ready.

Transmit Clock (synchronous data format)

Selecting the **Normal** option causes the ISU 2V35 to be the synchronous DTE interface transmit timing source. Transmit data is timed from the transmit clock provided by the ISU 2V35. With the **External** option selected, the ISU 2V35 slaves to an external transmit timing source. The external clock is provided to the ISU 2V35 by the external transmit clock signal at the DTE connector. This signal is echoed by the ISU 2V35 to the transmit clock signal on the DTE connector. When using the ISU 2V35 in a Tail Circuit application, it may be necessary to add delay to accommodate clock jitter. Entering a number from **0-255** under **TxRxDelay** will yield the size of the delay buffer, which is approximately 8X the number selected in bytes. See Figure 6-12 for the menu tree.

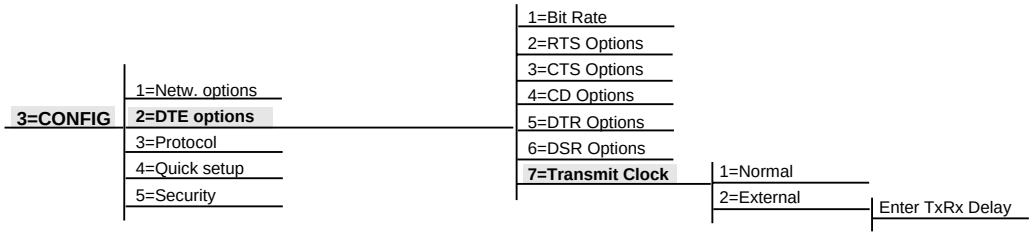

Figure 6-12. Transmit Clock Menu Tree

Setting Protocol Options

The ISU 2V35 communicates with many different types of telecommunication equipment including other ISU 2V35s, ISDN terminal adapters, Switched 56 DSUs, and BONDING-compatible inverse multiplexers. Communicating between such diverse types of equipment requires various rate adaptation protocols to support various bit rates and DTE settings. See Figure 6-13 for the menu tree. The ISU 2V35 supports the following rate adaptation protocols:

- Clear Channel (no rate adaptation protocol) (synch. only)
- BONDING mode 1 (Bandwidth on Demand Interoperability Group)
- CCITT V.120
- CCITT V.110
- T-LINK (Dial DDS DSU/CSU)
- SAP (Simple ADTRAN Protocol)
- PPP async-sync

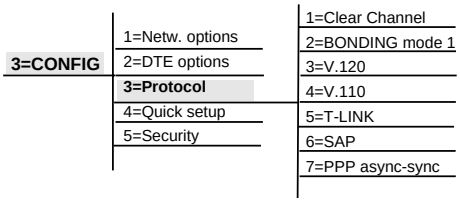

Figure 6-13. Protocol Menu Tree

See "Recommended Operating Protocols" on page 1-5 for more information on recommended modes of operation.

The desired protocol may be selected from the ISU 2V35 front panel. A description of protocols follows.

Clear Channel

Clear channel provides the entire bearer channel to the DTE without regard to data format or protocol. This provides a rate adaptation at or near the ISDN circuit rate. The primary usage for **Clear Channel** in dial line mode is 56 kbps and 64 kbps synchronous. It is useful when the DTE performs its own internal synchronous protocol/rate adaptation or the ISU 2V35 is calling a 4-wire Switched 56 DSU. In the leased line mode, clear channel can provide synchronous bit rates of 56 kbps, 64 kbps, 112 kbps, and 128 kbps.

BONDING mode 1

The **BONDING mode 1** protocol allows the ISU 2V35 to communicate at bit rates in excess of 64 kbps to a maximum of 128 kbps. BONDING provides high-speed communication between ISU 2V35s, ISDN TE/TAs, and inverse multiplexing equipment supporting the **BONDING** protocol. The protocol allows for the use of both synchronous and asynchronous bit rates. When the ISU 2V35 uses the **BONDING mode 1** protocol, it must make two separate ISDN phone calls to seize control of both ISDN bearer channels. The protocol corrects any delays existing between the two bearer channels and presents a single high-speed data channel to the DTE. For successful high-speed operation, both the near- and far-end DCE need to be configured to use **BONDING mode 1** protocol. **BONDING mode 1** protocol negotiation phase has numerous timers to allow for transmission delays due to satellite hops, international calls, etc. The timers may be adjusted if necessary by entering into **BONDING mode 1** submenu. See Figure 6-14 for the menu tree.

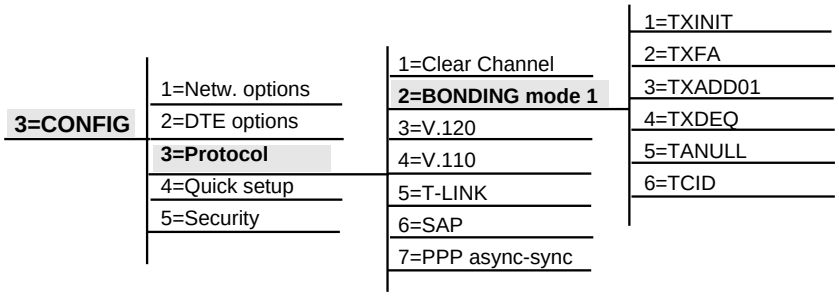

Figure 6-14. Protocol BONDING, Mode 1 Menu Tree

The timers are defined as follows:

TXINIT

This option specifies the length of time the originating endpoint attempts to detect BONDING negotiation pattern from the answering endpoint before determining the BONDING call has failed. In general, this timer value should be left at the factory default setting of 10 seconds. Select from values of 1, 2, 5, 10 (default), 20, 50, 100, and 200 seconds.

TXFA

This option specifies the length of time both endpoints attempt to detect the BONDING frame pattern when a call is connected before determining the BONDING call has failed. This timer value should be left at the factory default setting of 10 seconds. However, when interoperating with other manufacturers' BONDING equipment it may be necessary to lengthen this timer to match TXADD01. Values of 1, 2, 5, 10 (default), 20, 50, 100, and 200 seconds may be selected.

TXADD01

This option specifies the length of time both endpoints wait for the additional call to be connected at the end of negotiation before determining the BONDING call has failed. The factory default setting of 20 seconds is sufficient for most calls to go through, although when dialing overseas it may be necessary to lengthen this timer to allow for slower call routing. Values of 1, 2, 5, 10, 20, 50 (default), 100, and 200 seconds may be selected.

TXDEQ

This option specifies the length of time both endpoints attempt to equalize the network delay between the bearer channels before determining the BONDING call has failed. Values of 1, 2, 5, 10, 20, 50 (default), 100, and 200 seconds may be selected.

TANULL

This option specifies the length of time the answering endpoint attempts to detect the BONDING negotiation pattern from the originating endpoint before aborting to clear channel mode. In general, this timer value should be left at the factory default setting of 10 seconds. However, it may be necessary to shorten this timer if the DTE equipment connected to the ISU also has timer constraints for completing non-BONDING parameter negotiation. Values of 1, 2, 5, 10 (default), 20, 50, 100, and 200 seconds may be selected.

TCID

This option specifies the length of time both endpoints attempt to negotiate an agreeable value for bearer channels and channel capacities before determining the BONDING call has failed. Select from values of 1, 2, 5 (default), 10, 20, 50, 100, and 200 seconds.

V.120

The V.120 protocol is a CCITT compliant rate adaptation method providing DTE service between the ISU 2V35 and other V.120 compliant devices at rates less than the 64 kpbs ISDN bearer channel rate. See “Recommended Operating Protocols” on page 1-5 and Table 1-2 on page 1-7 for available V.120 rates. Figure 6-13 illustrates the menu path for selecting V.120.

V.110

The V.110 protocol is a CCITT compliant rate adaptation method providing DTE service between the ISU 2V35 Dual Port ISDN Service Unit and other V.110 compliant devices. See “Recommended Operating Protocols” on page 1-5 and Table 1-2 on page 1-7 for available V.110 rates. Figure 6-13 illustrates the menu path for selecting V.110.

T-Link

The **T-Link** protocol allows the ISU 2V35 to communicate with 2-wire Switched 56 DataPath DUs. The **T-Link** protocol performs two functions:

- It adapts the data rate of sub 64 kbps DTE devices to the 64 kbps bandwidth of the ISDN bearer channel.
- For synchronous DTE rates up to 19.2 kbps, T-Link transmits the status of the DCE-DTE EIA leads to facilitate flow control and maintenance.

In addition to 2-wire Switched 56 DataPath DUs, the ISU 2V35 communicates with any other device using the **T-Link** protocol. Figure 6-13 illustrates the menu path for selecting **T-Link**.

SAP

The Simple ADTRAN Protocol (SAP) is a rate adaptation method which provides DTE service between ISU 2V35 units at a channel rate lower than the 64 kbps ISDN bearer. Selecting this menu item causes the ISU 2V35 to use **SAP** protocol.

The primary usage for **SAP** is general purpose asynchronous rate adaptation in a dial-up or leased environment. **SAP** only operates on a 64 kbps data link. Figure 6-13 illustrates the menu path for selecting **SAP**.

Point-to-Point (PPP) Async-to-Sync

PPP provides a standard method for transporting multi-protocol datagrams over point-to-point links. The ADTRAN PPP async-sync protocol allows the ISU 2V35 and a PC or Macintosh® running PPP software, to communicate with a PPP-compatible bridge or router. The PPP async-sync protocol complies with Internet Engineering Task Force (IETF) RFC 1662. The menu path to select PPP is shown in Figure 6-15.

The asynchronous control character map (ACCM) option is scanned during the negotiation. When the ACCM option is seen in a configure ACK link control packet, it is adopted by the ISU 2V35. In addition, when the ACCM option is not seen in the configure-request packet from the network, the ISU 2V35 will add it to the packet.

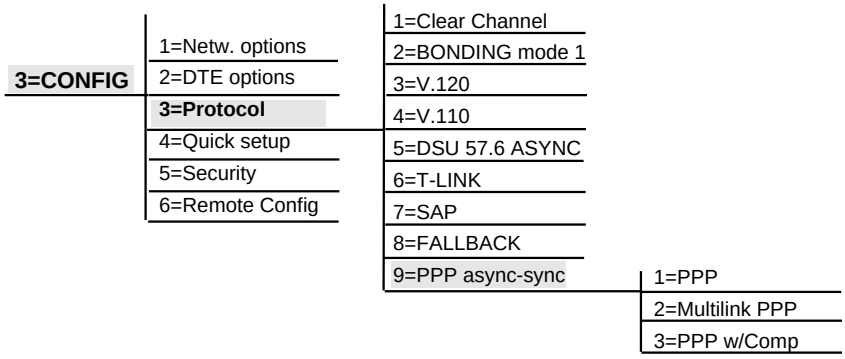

Figure 6-15. PPP Menu Tree

Point-to-Point Protocol (PPP)

The ISU 2V35 can be configured for PPP from the protocol options of the configuration menu by selecting **1=PPP**. The menu path is shown in Figure 6-15.

Multilink PPP

The ISU 2V35 can be configured for multilink PPP from the protocol options of the configuration menu by selecting **2= Multilink PPP**. (See Figure 6-15.) In this mode, the ISU 2V35 dials a second number to establish a second point-to-point link. Once the second PPP is established, multilink PPP is performed over both B-channels.

The phone number for the second call should be placed in stored number 1 (SN1). If no number is stored in SN1, the same phone number is dialed to establish the second link.

PPP with Compression

The ISU 2V35 can be configured for PPP with compression from the protocol options of the configuration menu by selecting **3=PPP w/Comp**. The menu path is shown in Figure 6-15.

Chapter 7 Dial Options

FRONT PANEL DIALING OPTIONS

Selecting **4=DIAL** or pressing the **#** key from the front panel displays the available dialing options (see Figure 7-1). The dial options are only available when the ISU is configured for Dial Line operation (not Leased Line).

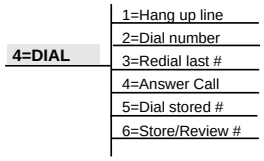

Figure 7-1. Dial Menu Tree

Hang up line

Terminates current call.

Dial number

Enter and dial a number from the keypad. If an error is made, press the Down arrow to edit the number. After the number is entered, press **Enter** to dial the number and save as stored number 9 for redialing purposes.

Redial last

Redial the last number called (or attempted) from the front panel. This number is saved as stored number 9 from the last attempted phone call.

Answer Call

Selectively answer incoming calls when Auto answer is configured for disable. (See "Setting Auto Answer" on page 6-9.)

Dial stored

Dial one of ten stored phone numbers. The Up and Down arrows permit viewing/selection of a stored number. Press **Enter** to dial number and save as stored number 9 (SN9) for redial purposes.

Store/Review

Enter and review stored numbers. Press the Up and Down arrows to scroll through the 10 stored numbers (SN0 - SN9). To store a number, scroll to the desired stored number location, enter the number to be stored, and press **Enter** to save the number. If an error is made, use the Up and Down arrows to edit the number. Press **Enter** to save the number and exit. Press **Cancel** to exit without changing the number.

Chapter 8 Quick Setup

QUICK SETUP CONFIGURATION

To configure the **DTE Options** quickly and easily, the **Quick Setup** menu is available to automatically set up the six most common DTE configurations. (See Figure 8-1.) See "DTE Options for Synchronous Operation" on page 6-16 for step-by-step procedures for detailed configuration of the DTE Options.

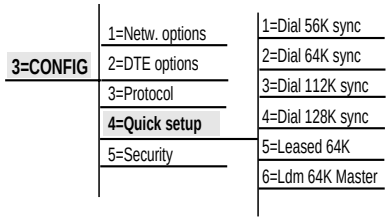

Figure 8-1. Quick Setup Menu Tree

Quick Setup

To aid in configuring the ISU 2V35, six common configurations are preset for **Quick Setup**. These include:

- Synchronous dial operation for 56, 64, 112, and 128 kbps
- 64 kbps Limited Distance Modem using Master clocking
- 64 kbps leased service

If indicated with an asterisk, the option requires the end user to configure the ISDN switch type, SPID1-LDN1 and SPID2-LDN2. See "Setting the Dial Options" on page 6-6.

Dial 56K sync*

When the ISU 2V35 is configured for **Dial 56 Sync** service, the following parameters are automatically preset:

Service type ..... ISDN dial line
Automatic answering ..... Enabled
ISDN call type..... 56 kbps data
Data protocol ..... Clear Channel
DTE mode ..... Synchronous
DTE connector bit rate..... 56 kbps
DTE flow control..... none
RTS line..... 1 mS delay
CTS line..... Forced on
Transmit data clock..... Normal clock source
V.54 Loopbacks..... Accepted

Dial 64K sync*

When the ISU 2V35 is configured for **Dial 64K sync** service, the following parameters are automatically preset:

Service type ..... ISDN dial line
Automatic answering ..... Enabled
ISDN call type..... 64 kbps data
Data protocol ..... Clear Channel
DTE mode ..... Synchronous
DTE connector bit rate..... 64 kbps
DTE flow control..... none
RTS line..... 1 mS delay
CTS line..... Forced on
Transmit data clock..... Normal clock source
V.54 Loopbacks..... Accepted

Dial 112K sync*

When the ISU 2V35 is configured for **Dial 112K sync** service, the following parameters are automatically preset:

Service type ..... ISDN dial line
Automatic answering ..... Enabled
ISDN call type ..... 56 kbps data
Data protocol..... BONDING mode 1
DTE mode..... Synchronous
DTE connector bit rate..... 112 kbps
DTE flow control ..... none
RTS line..... 1 mS delay
CTS line..... Forced On
Transmit data clock..... Internal clock source
BONDING timer TXINIT..... 10 seconds
BONDING timer TXFA ..... 10 seconds
BONDING timer TXADD01 ..... 50 seconds
BONDING timer TXDEQ..... 50 seconds
BONDING timer TANULL..... 10 seconds
BONDING timer TCID..... 5 seconds

Dial 128K sync*

When the ISU 2V35 is configured for **Dial 128K sync** service, the following parameters are automatically preset:

Service type ..... ISDN dial line
Automatic answering ..... Enabled
ISDN call type ..... 64 kbps data
Data protocol..... BONDING mode 1
DTE mode..... Synchronous
DTE connector bit rate..... 128 kbps
DTE flow control ..... none
RTS line..... 1 mS delay
CTS line..... Forced On
Transmit data clock..... Internal clock source
BONDING timer TXINIT..... 10 seconds
BONDING timer TXFA ..... 10 seconds
BONDING timer TXADD01 ..... 50 seconds
BONDING timer TXDEQ..... 50 seconds
BONDING timer TANULL..... 10 seconds
BONDING timer TCID..... 5 seconds

Leased 64K

When the ISU 2V35 is configured for **Leased 64K** service, the following parameters are automatically preset:

Service type ..... Leased Line
Network clock source ..... Slave
Channel rate 64K
Data Protocol ..... Clear Channel
DDS loopbacks enabled ..... Yes
DTE mode ..... Synchronous
DTE connector bit rate ..... 64 kbps
DTE flow control ..... none
RTS line ..... 1 mS delay
CTS line ..... Forced On
Transmit data clock ..... Normal clock source

Ldm 64K Master

When the ISU 2V35 is configured for a point-to-point application, such as a Limited Distance Modem arrangement, the **Ldm 64K Master** option automatically presets the following parameters:

Service type ..... Leased Line
Network clock source ..... Master
Channel rate 64K
Data Protocol ..... Clear Channel
DDS loopbacks enabled ..... Yes
DTE mode ..... Synchronous
DTE connector bit rate ..... 64 kbps
DTE flow control ..... none
RTS line ..... 1 mS delay
CTS line ..... Forced On
Transmit data clock ..... Normal clock source

Factory Setup

To restore the ISU 2V35 to the factory default setup, power the unit off and perform the following steps:

1. While pressing **0**, power the unit on.
2. Continue pressing **0** until the front panel displays the top of the menu tree. **1=STATUS** will be blinking.

Factory default erases all stored phone numbers, SPIDs, and LDNs, and sets parameters as follows:

Service type ..... ISDN dial line
ISDN switch type ..... LUCENT 5ESS
ISDN call type ..... 64 kbps data
Dialing Mode ..... Front Panel
Data protocol ..... Clear Channel
DTE connector bit rate ..... 64 kbps
RTS line ..... 1 ms delay
CTS line ..... Forced CTS
CD line ..... Normal
DSR line ..... Forced on
Transmit Data Clock ..... Normal clock source
BONDING timer TXINIT ..... 10 seconds
BONDING timer TXFA ..... 10 seconds
BONDING timer TXADD01 ..... 10 seconds
BONDING timer TXDEQ ..... 50 seconds
BONDING timer TANULL ..... 50 seconds
BONDING timer TXID ..... 5 seconds
Automatic Answering ..... Enabled

Chapter 9 Security

SECURITY

The ISU 2V35 provides a front panel keypad locking feature to prevent tampering with configuration settings. The feature requires a password to access menus below the top Current-Status menu level. The menu options are shown in Figure 9-1.

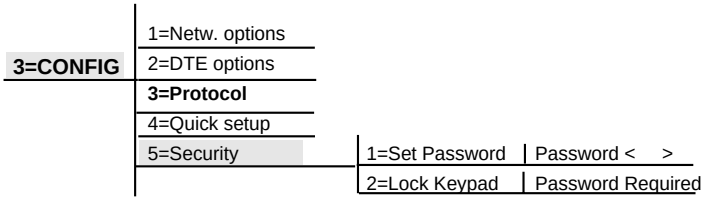

Figure 9-1. Security Menu Tree

When the front panel keypad is locked, only the top menu is available on the LCD display. The LCD can be toggled between **DTE1** and **DTE2** current status displays with the cursor keys. Any key other than a cursor key prompts the user for a password. If the entered password matches the stored password, the LCD displays a brief message indicating that the front panel is active and the configuration menus will be displayed as normal. After configuration is complete, the users must re-enable front panel locking by selecting **2=Lock Keypad** in the Security menu. If the entered password does not match the stored password, the LCD displays a brief message indicating that the entered password was invalid and the top menu is displayed.

Set Password

Set Password prompts the user to enter a numeric code that will be required for access to configuration menus from the front panel. The code can be up to six digits long. The default state is nothing entered in the password option.

Lock Keypad

Lock Keypad locks the front panel keypad and displays a brief message on the LCD indicating that the front panel is locked. The top menu is displayed after the message.

Chapter 10 Troubleshooting

When the ISU 2V35 powers up, it performs an internal self test that takes approximately 10 seconds. At the end of the test, the front panel momentarily displays **Self Test Passed**.

If Self Test Fails

If **Self Test Passed** is not displayed, the following steps will verify whether or not the problem can be fixed locally:

1. Ensure the ISU 2V35 is receiving power.
2. Turn off the ISU 2V35 while holding down **0**, then power back on.
3. Continue to press down **0** for 15 seconds. This resets all the internal settings to factory defaults.
4. If the ISU 2V35 still does not pass self test, call ADTRAN Technical Support for assistance; see the back of this manual for phone numbers.

If The ISU 2V35 Does Not Read Ready

When the ISU 2V35 has been set up and connected to a line, but the front panel does not read **Ready** after a few minutes, use the following troubleshooting procedure:

1. Cycle power on the ISU 2V35, leaving it off for a minimum of 2 seconds. Turn the power on for one full minute to ensure the unit does not read **Ready**.
2. Disconnect the ISDN line from ISU 2V35. From a functioning voice phone, call the local directory number(s) provided with the line. Calling a good ISDN line with nothing connected usually results in a ring or fast busy tone. If someone answers or you get a not-in-service intercept, there is probably something wrong with the translation of the line. The phone service provider should be able to help.
3. If the ISU 2V35 continues to display **Link Down**, there is a physical problem with the phone line (more than likely, a problem with the layer 1 setup). The problem is in one or more of the following places:
   - The ISU 2V35 software setup
   - The ISU 2V35 hardware
   - The wiring on your premises
   - The telephone service provider's wiring
   - The telephone service provider's hardware
   - The telephone service provider's software setup

To isolate the problem, perform the following procedure:

A. Ensure the ISDN line is plugged into the ISU 2V35 connector marked **ISDN** on the back of the ISU 2V35.

B. Ensure the ISU 2V35 is configured for dial line service.

C. Try another piece of functioning ISDN equipment on the line.

D. Talk to the service provider and ensure you have an ISDN Basic Rate U-Interface with 2B1Q line coding (wrong options are an S or T interface or AMI line coding).

E. Ensure that the phone line is connected to the actual telephone line or PBX provided by your telephone company. If using the ISU 2V35 with the U-interface, make sure your line is not connected through another piece of equipment such as an NT1 in a wiring closet somewhere.

F. Ensure nothing else is bridged across the ISDN line pair.

G. With a minimum of extra wiring, try connecting to the ISDN line pair at the point where service provider's wiring ends.

H. With the ISU 2V35 connected to the ISDN line and powered up, talk to your service provider's repair group and inform them that your ISDN basic rate line has a physical layer 1 problem. Ask them to check the line. If using the ISU 2V35 with the U-interface, tell them that you have an NT1-like device at the end of the ISDN line.

4. If the ISU 2V35 continuously reads **Getting TEI #1**, the ISU 2V35 is physically connected to the local telephone service provider but is unable to establish logical layer 2. The problem is in one or more of the following places:
   - The ISU 2V35 software setup
   - The telephone service provider's software setup
   - Hardware configuration, if the line is extended from the switch

To isolate the problem, use the following procedure:

A. Ensure the ISU 2V35 is set up for the correct switch type.

B. Ensure the quality of the line is satisfactory by checking for near- and far-end block errors (NEBEs and FEBEs). If the counts are non-zero, there may be a physical link problem as described under **Link Down** (Step 3).

C. Try another piece of functioning ISDN equipment on the ISDN line.

D. With the ISU 2V35 connected to the ISDN line and powered up, talk to the service provider's repair group and tell them you have an ISDN basic rate line that appears physically okay but has no terminal endpoint identifier (TEI). Ask them to check the line translation and ensure that the line supports dynamic TEI

allocation. If using the ISU 2V35 with the U-interface, tell them that you have an NT1 and terminal adapter device connected to the line.

5. If the ISU 2V35 continuously reads **Register SPID #1,** the ISU 2V35 is physically connected to the local telephone service provider and has established logical layer 2. The ISU 2V35 is unable to establish layer 3. The problem is in one or both of the following places:
   - The ISU 2V35 software setup
   - The telephone service provider's software setup

To isolate the problem, perform the following procedure:

   A. Ensure the ISU 2V35 is set up for the correct switch type.

   B. Ensure the ISDN line is multipoint.

   C. Ensure that the ISU 2V35 is set up with the correct SPIDs and LDNs.

   D. Try another piece of functioning ISDN equipment on the ISDN line.

   E. With the ISU 2V35 connected to the ISDN line and powered up, talk to the service provider's repair group and tell them you have an ISDN basic rate line that appears physically okay but is unable to register its SPID(s). Ask them to check the line translation, ensure that the ISDN line supports dynamic TEI allocation, and verify the SPID(s). If using the ISU 2V35 with the U-interface, tell them that you have an NT1 and terminal adapter device connected to the line.

6. If the ISU 2V35 continuously reads **Getting TEI #2,** the ISU 2V35 has completely initialized the first phone number but is unable to establish logical layer 2 for the second phone number. The problem is in one or both of the following places:
   - The ISU 2V35 software setup
   - The telephone service provider's software setup

To isolate the problem, perform the following procedure:

   A. Ensure the ISDN line is multipoint with two phone numbers.

B. Ensure that the ISU 2V35 is set up with the correct SPIDs and LDNs.

C. Try swapping SPID1 with SPID2 and LDN1 with LDN2. Determine if the problem is the second phone number or the quantity of phone numbers.

D. Try another piece of functioning ISDN equipment on the ISDN line.

E. With the ISU 2V35 connected to the ISDN line and powered up, talk to the service provider's repair group and tell them you have an ISDN basic rate line that appears physically okay but has no terminal endpoint identifier (TEI). Ask them to check the line translation and ensure that the ISDN line supports dynamic TEI allocation. If using the ISU 2V35 with the U-interface, tell them that you have an NT1 and terminal adapter device connected to the line.

7. If the ISU 2V35 continuously reads **Register SPID #2,** the ISU 2V35 has completely initialized the first phone number but is unable to establish logical layer 3 for the second phone number. The problem is in one or more of the following places:
   - The ISU 2V35 software setup
   - The telephone service provider's software setup

To isolate the problem, perform the following procedure:

A. Ensure the ISDN line is multipoint with two phone numbers.

B. Ensure that the ISU 2V35 is set up with the correct SPIDs and LDNs.

C. Try swapping SPID1 with SPID2 and LDN1 with LDN2. Determine if the problem is the second phone number or the quantity of phone numbers.

D. Try another piece of functioning ISDN equipment on the ISDN line.

E. With the ISU 2V35 connected to the ISDN line and powered up, talk to the service provider's repair group and tell them you have an ISDN basic rate line that appears physically okay but is unable to register its SPID(s). Ask them to check the line translation, ensure that the ISDN line supports dynamic TEI allocation, and verify the SPID(s). If using the ISU 2V35 with the U-interface, tell them that you have an NT1 and terminal adapter device connected to the line.

If the Wrong DTE Port Answers a Call

A common mistake that can easily be made is entering the SPID/LDN pair swapped between the two DTE ports. For example, your telephone company has given you two SPID/LDN numbers as follows:

SPID1 - 201555701111	LDN1 - 5557011
SPID2 - 201555702222	LDN2 - 5557022

If you were to enter the pairs for DTE#1 as SPID1/LDN2 and SPID2/LDN1, the ISU 2V35 would get confused during incoming calls because the SPID/LDN pair does not match. Be sure to enter the SPID/LDN pairs for each DTE# as follows:

Enter SPID dte1	Enter LDN dte1
201555701111	5557011
Enter SPID dte2	Enter LDN dte2
201555702222	5557022

Proper entry of the SPID/LDN pair is crucial to proper operation of the ISU 2V35.

If You Cannot Connect Calls

See Table 10-1 for corrective actions if you cannot place calls.

Table 10-1. Troubleshooting Calls

Condition	Corrective Action
The ISU 2V35 reads **Ready** but calls cannot be placed.	There is most likely a problem in the software setup (translation) at the CO switch or the network setup in the ISU 2V35.
Local voice calls can be transmitted, but data calls to the same exchange cannot.	The ISDN line is probably not set up to support data calls.
Local data calls go through, but long distance data calls do not.	Ensure the far end is working. If not already doing so, place the call explicitly specifying the prefix of the long distance service (for example, 10288 for AT&T). If this does not work, then most likely the problem is the long distance service provider. Another possibility is that the local service provider is not providing long distance access.
Data calls can be made, but BONDED data calls cannot.	There is most likely a problem in the software setup (translation) at the CO switch or the network setup in the ISU 2V35. Another possibility is that the data circuits provided are not good enough to support the BONDING negotiation process. If the line has two phone numbers, make sure the second SPID and LDN are entered correctly in SPID2 and LDN2 in the ISU 2V35. Check with the local service provider to ensure that the line supports two data calls. The ISU 2V35 status log buffer shows the sequence of events that occurred. You need to know which piece of equipment first caused the BONDING process to terminate. The status logs from both ends may be necessary to determine this.

Chapter 11 Specifications

Network Interface

- RJ-45 for ISDN Basic Rate U-Interface

DTE Interface

- Two V.35 interfaces

Dialing Selections

- In-band DTE Dialing: V.25 bis
- Manual or automatic stored number dialing, DTR Assertion
- Front panel manual dialing

Data Rates (Network)

- 64 kbps (1 B channel), 128 kbps (2 B channels)

Data Rates (DTE)

When using single DTE interface:

- 2400 bps to 128 kbps synchronous

When using dual DTE interfaces:

- 2400 bps to 64 kbps synchronous on each interface

B Channel Aggregation

- BONDING Protocol Mode 1. Used for speeds over 64 kbps from a single DTE interface.

Rate Adaptation

- T-Link
- CCITT V.120
- CCITT V.110
- Clear Channel
- SAP
- BONDING mode 1
- PPP Async-Sync
- Multilink PPP

Interoperability

- BONDING Mode 1-compatible Inverse Multiplexers (ASCEND, PROMPTUS, Teleos, etc.)
- Switched-56 DSUs (2-wire and 4-wire), ISU 128s, ISDN TAs
- PPP/Multilink compatible devices

Switch Compatibility

- LUCENT 5ESS, NTI DMS-100, National ISDN-1, AND NEC

Display

- Two-line by 16-character LCD
- LED Indicators:

RS	Request to Send	Indicates the DTE is ready to transmit.
CS	Clear to Send	Indicates the ISU 2V35 is ready to transmit.
TD	Transmit Data	On when the DTE is transmitting to the ISU 2V35
RD	Receive Data	On when the ISU 2V35 is receiving data from thefar-end
CD	Carrier Detect	On when the ISU 2V35 is ready to transmit data
TR	Data Terminal Ready from DTE	On when DTR is active at the DTE interface
SR	Data Set Ready	

Environmental

- Operating Temperature: 0 to 50 °C
- Storage Temperature: -20 to 70 °C
- Relative Humidity: Up to 95%, non-condensing

Physical

- 2.25" high x 8.75" wide x 11.00" deep, 2.5 lbs

Power

- 115 VAC, 60 Hz, 8 W maximum dissipation

Appendix A Current Status Messages

This appendix lists the status line messages and their definitions. Messages shown entirely in capital letters are generated by the ISDN network. Messages with lower case letters are generated by the ISU 2V35.

Call Connect B1

Bearer channel 1 is connected and is active.

Call Connect B2

Bearer channel 2 is connected and is active.

CALL xxxxxxx

The ISU is calling phone number xxxxxxx.

DEACTIVATED

The network interface is not active.

DISCONNECTED

The network has activated layer 1 but layer 2 is inactive. To activate the unit a setup message must be sent or received.

DISCONNECTING

The current phone call is being disconnected (hung up).

DMS-100 Ready

The ISU is connected to a DMS-100 switch and is ready to place/receive calls.

Getting TEI #1

The ISU is receiving its first TEI from the network.

Getting TEI #2

The ISU is receiving its second TEI from the network.

ISDN-1 Ready

The ISU is connected to an ISDN-1 compliant switch and is ready to place/receive calls.

Link down

The network interface is not active.

Link In Sync

The ISU has successfully connected to the network but is waiting for the switch to issue the ACT bit.

LPBK DTE

The DTE connector is looped back in the DTE direction.

LPBK Netw

The ISU 2V35 is in a customer initiated loopback.

LPBK Protcl.Net

The ISU 2V35 has been commanded to perform a loopback in the network direction after letting the incoming data pass through the current protocol.

LUCENT-5ESS Ready

The ISU 2V35 is connected to a LUCENT 5ESS switch and ready to place/receive calls.

NEC Ready

The ISU 2V35 is connected to an NEC switch and is ready to place/receive calls.

NET EOC LOOPBACK

The ISU 2V35 has been commanded to perform an ISDN loopback toward the network.

NET REM LOOPBACK

The ISU 2V35 is performing a V.54 or DDS latching loopback toward the network.

Ready

The unit is ready to make or accept a call.

Register SPID #1

The ISU 2V35 is registering its first SPID with the network.

Register SPID #2

The ISU 2V35 is registering its second SPID with the network.

RINGING

The phone number just dialed is ringing.

xxxx nnnn

A rate adaptation is running at the bit rate specified by nnnn.

xxxxx Quitting

A rate adaptation protocol is turning off.

xxxxx Ready

A rate adaptation protocol is ready.

xxxxx Setup

A rate adaptation protocol is setting up.

xxxxx can be any <u>of the following:</u>

BONDING

Bandwidth on Demand Interoperability Users Group protocol.

CLEAR CHAN

No rate adaptation protocol (allows use of maximum bandwidth).

FALLBACK

FALLBACK rate adaptation protocol.

SAP

Simple Adtran Protocol.

TLINK

TLINK rate adaptation protocol.

V120

V.120 rate adaptation protocol.

V110

V.110 rate adaptation protocol.

Appendix B Status Buffer Messages

Messages shown entirely in capital letters are generated by the ISDN network. Messages with lower case letters are generated by the ISU 2V35.

Answer 1/2

The ISU answered a call on either the first or second B channel. The calling phone number is displayed if available.

ACCESS_INFO_DISCARDED

The network was unable to deliver access information to the far-end.

Back to online

ISU 2V35 went back on line.

Bad AT bit field

User issued an AT command with an argument that was out of range.

Bad B channel

Bonding negotiation determined the delay in one of the Bearer channels was uncorrectable.

Bad call type

ISU 2V35 placed a call with an improper call type.

Bad DTE baud

The DTE bit rate does not match a valid bit rate for the protocol selected.

Bad DTE bps

Bonding negotiation determined the chosen DTE bit rate is invalid.

BAD_INFO_ELEM

Call control error.

Bad phone number

ISU 2V35 attempted to call an invalid phone number.

Bad TLK Version

Invalid TLINK parameters found during end-to-end negotiations.

Baud Rate

ISU 2V35 does not support the negotiated TLINK baud rate.

BEAR_CAP_NOT_AVAIL

The bearer channel requested by the user is not available.

Bearer mode

Incoming call is not of a type the ISU 2V35 can accept.

Bearer info mode

Incoming call information transfer capability is not known.

BONDING (+/- XXX)

The amount of bytes of corrected delay between the B2 and B1 bearer channels (XXX can range from -8000 to +8128 bytes).

BPS mismatch

Bonding negotiation found a bit rate mismatch.

Break to AT cmd

User issued a break-in request (+++).

Break ignored

User issued an extra break-in request.

BUSY

The called number is busy.

CallID 1 in use

ISU 2V35 tried to place a call using SPID 1 when SPID 1 was already in use.

CallID 2 in use

ISU 2V35 tried to place a call using SPID 2 when SPID 2 was already in use.

Call not ringing

User executed an answer command (ATA) but there was not a call present.

CALL_REJECTED

The call has been rejected by the ISDN network.

Can't go online

ISU 2V35 cannot go back on line. User issued an unknown command.

CAP_NOT_IMPLEMENTED

The network or far-end does not support the bearer capability requested.

CHAN_DOES_NOT_EXIST

The bearer channel requested is not present.

CHAN_NOT_IMPLEMENTED

The bearer channel requested has not been implemented.

CHANNEL_UNACCEPTABLE

The channel requested has not been subscribed.

CID>0 rcvd

Received an incoming call from a third party during Bonding setup with far end.

DEST NOT ISDN

The number called is not ISDN (warning only).

DEST_OUT_OF_ORDER

The called number is out of order.

Dial1/2

The ISU 2V35 placed a call on either the first or second channel. The number called is displayed following the message.

Discon1/2

The call on either the first or second channel was disconnected from the network. The far-end phone number is displayed if available.

Disconnect Req

Far-end unit disconnected during BONDING negotiation.

DPUMP END RCVD

Indication of a hang-up or disconnect occurring during BONDING. Does not indicate an error condition has occurred.

DTE must be SYNC

For the protocol chosen, the DTE connector must be optioned as synchronous.

DTE not set V25

The DTE equipment is not optioned for the same bit rate as the ISU 2V35 for V.25 bis dialing.

DTR not up

ISU 2V35 tried to place a call in a dialing mode that requires DTR to be in an active state but it is not.

Dump call

ISU 2V35 could not accept an incoming call because it was already involved in a call.

Dump1/2

An incoming call on either the first or second channel was discarded by the ISU. The calling number is displayed if available.

FACILITY_NOT_IMPLEMENT

The network does not support the requested supplementary service.

FACILITY_REJECTED

A facility requested cannot be provided by the network.

FACILITY_NOT_SUBSCRIBED

The channel type requested has not been subscribed.

FALLBACK ERROR

Attempt to fallback to normal mode failed.

FBW disconnect

BONDING negotiation has failed due to a disconnect on a B-Channel.

FlowCtl mismatch

Bonding negotiation determined a flow control mismatch.

FlowCtl required

Bonding negotiation determined that flow control needs to be optioned on.

Hangup1/2

The call on either the first or second channel was disconnected by the ISU 2V35. The far-end phone number is also displayed.

InCmptblFound

TLINK end-to-end negotiations found an optioning incompatibility between the two end units.

INCOMMING_CALL_BARRED

The network will not allow an incoming call.

INCOMPATIBLE_DEST

The called number cannot accept the type of call that has been placed.

INTRWORKING_UNSPEC

A message was sent by a far-end network that was not understood.

INVALID_CALL_REF

Call control error.

INVALID_ELEM_CONTENTS

Call control error.

INVALID_MSG_UNSPEC

Invalid message, protocol error.

INVALID_NUMBER_FORMAT

The dialed number has an invalid format.

L1 not up

Call has been attempted while the network interface is not active.

L2 not up

Call has been attempted while the data link layer interface is not active.

L3 not up

Call has been attempted while the call control interface is not active.

L2 #2 not up

Call has been attempted while the data link layer interface for a second call (BONDING) is not active.

L3 #2 not up

Call has been attempted while the call control layer interface for a second call (BONDING) is not active.

LDN TOO LONG

The local directory number entered has too many digits.

MANDATORY_IE_LEN_ERR

Mandatory information element length error.

MANDATORY_IE_MISSING

Mandatory information element missing.

Need 2 B chan

The DTE bit rate requires the BONDING protocol.

Need 64K call

The BONDING protocol requires the ISU 2V35 to be configured for a 64kbps data call type.

Negotiation fail

The BONDING negotiation has failed.

NETWORK BUSY

The ISDN switch is busy and unable to process a call.

NETWORK_CONGESTION

The phone network is currently congested.

NETWORK_OUT_OF_ORDER

The phone network is out of order.

No 48K Support

The ISU 2V35 does not support 48 kbps TLINK. Local DTE setup error.

NO_CIRCUIT_AVAILABLE

The requested bearer channel is not available.

NONEXISTENT_MSG

Nonexistent message was sent by the ISU 2V35.

No Sreg number

Attempt to access an S register without specifying a specific S-register (example: ATS=1).

No Sreg value

Attempt to change an S-register without specifying a value (example: ATS2=).

NO_ROUTE

The phone network was unable to find a route to the destination number.

NO_USER_RESPONDING

The dialed number is not responding.

NORMAL_CLEARING

The network is disconnecting the current call.

NOT end2end ISDN

The path that the call was routed over is not ISDN from end-to-end (warning only).

NUMBER_CHANGED

The number dialed has been changed.

OUTGOING_CALL_BARRED

The network will not allow the outgoing call to be placed.

PROTOCOL_ERROR

Call control error.

REQ_CHANNEL_NOT_AVAIL

The channel type requested is currently not available.

Remote not ISU

Bonding negotiation determined the far-end unit is not another ISU.

RESP_TO_STAT_ENQ

Response to status inquiry.

Ring 1/2

An incoming call on either the first or second channel entered the Ring state. The calling phone number is displayed if available.

S cmd not = or ?

User did not use proper syntax.

SAP idle timeout

Unit at far-end is not configured to use the SAP protocol.

SERVICE_NOT_AVAIL

The requested service is not available.

SOURCE NOT ISDN

The incoming calling party is not ISDN (warning only).

Sync BPS < 56K

The synchronous bit rate selected is too slow for the BONDING protocol.

Synch Mismatch

Both ends bad synchronization.

TAINIT expired

Bonding timer TAINIT expired.

TANULL expired

Bonding timer TANULL expired, non BONDING equipment attempted to call into the ISU 2V35 while optioned for BONDING.

TEMPORARY_FAILURE

The network has temporarily failed; try the call again.

TIMER_EXPIRY

Call control error.

TLINK ErrorOne

Catastrophic TLINK error.

TXADD01 expired

Bonding timer TXADD01 expired, probably making a long distance call to a foreign country; adjust timer value to correct.

TXFA1 expired

Bonding timer TXFA1 expired; other vendor's BONDING equipment did not operate properly.

TXFA2 expired

Bonding timer TXFA2 expired; other vendors BONDING equipment did not operate properly.

TXINIT expired

Bonding timer TXINIT expired, called non-BONDING equipment or B channel not error free.

UNASSIGNED_NUMBER

The phone number dialed does not exist.

UNSPECIFIED_CAUSE

Received a cause message from the network that is not understood.

Unsupported baud

The ISU 2V35 does not support the negotiated baud rate.

USER_BUSY

The dialed number is busy.

V120 timeout

The far end unit is not set up for V.120 or B channel not error free.

V120 connected

The V.120 rate adaptation successfully connected to the far-end unit.

WRONG_MESSAGE

Call control error.

WRONG_MSG_FOR_STATE

Call control error.

Appendix C Connector Pinouts

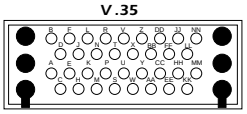

Figure C-1. V.35 Interface

Table C-1. V.35 Interface

Pin	Name	I/O	Description
A	Shield	I/O	Shield for cable
B	SG	I/O	Signal Ground
C	RTS	I	Request To Send
D	CTS	O	Clear To Send
E	DSR	O	Data Set Ready
F	CD	O	Carrier Detect
H	DTR	I	Data Terminal Ready
J	RI	O	Ring Indicator
P	SD-A	I	Send Data
R	RD-A	O	Receive Data
S	SD-B	I	Send Data (return)
T	RD-B	O	Receive Data (return)
U	TC-A	I	External Transmit Clock
V	RC-A	O	Receive Clock
W	TC-B	I	External Transmit Clock (return)
X	RC-B	O	Receive Clock (return)
Y	ST-A	O	Send Timing
AA	ST-B	O	Send Timing (return)
K,L	NC	N/A	No Connection
M,N	NC	N/A	No Connection
BB	NC	N/A	No Connection
CC	NC	N/A	No Connection
DD	NC	N/A	No Connection
EE	NC	N/A	No Connection
FF	NC	N/A	No Connection
HH	NC	N/A	No Connection
JJ	NC	N/A	No Connection
KK	NC	N/A	No Connection
LL	NC	N/A	No Connection
MM	NC	N/A	No Connection
NN	NC	N/A	No Connection

I = Input O = Output N/A = Not Applicable

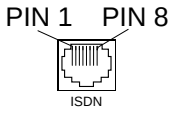

Figure C-2. RJ-45 Dial Line Connector U Interface

Table C-2. RJ-45 Dial Line Connector U Interface

Pin	Description
4	Ring
5	Tip

Appendix D Ordering ISDN Without IOCs

ISDN is a complex service with multiple options. Obtaining service from your local telephone company and long distance providers can sometimes be complicated. This appendix guides you and your telephone company in specifying and obtaining your ISDN service requirements.

To support most of the features in the ISU 2V35, your telephone service needs to meet certain requirements. A general description of these requirements follows. Depending on your actual data service needs, some features may be deleted. Other features may not be available in your area. Also, features may be deleted for economic reasons, depending on your needs and local tariffs. Talk to your telephone company first, and find out which of the services listed on the following pages are provided.

The following form has been designed to assist you. Complete and FAX this form to your telephone company to request the proper type of ISDN telephone line for use with the ADTRAN ISU 2V35.

ISDN Service Ordering Information for the ADTRAN ISU 2V35

For ADTRAN ISU 2V35 applications, the following guide can be used as an aid in ordering basic ISDN service from your local telephone company.

The ADTRAN ISU 2V35 ISDN Service Unit (part numbers 1200051L1 and 1200051L3) includes NT1 and Terminal Adapter functionality and supports data at rates up to 128 kbps. The ADTRAN ISU 2V35s (part numbers 1200051L2 and 1200051L4) are traditional Terminal Adapters and do not include NT1 functionality. The ADTRAN ISU 2V35 International (part numbers 1200051L5 and 1200051L6) also do not include NT1 functionality.

Name:_____

Address:_____

City: _____ State:_____

Zip Code: _____ Daytime telephone number: _____

Request an ISDN Basic Rate Interface (BRI) line.

- U-interface reference point
- 2B1Q line coding
- 2B+D Service (supports up to 128 kbps)

The ISU 2V35 supports the following switch types and software protocols.

AT&T 5ESS	Custom, 5E6 and later software, National ISDN-1
NTI DMS-100	BCS-32 and later software (PVC1), National ISDN-1 (PVC2)
Siemens EWSD	National ISDN-1
NEC Switch	NTT Protocol
Euro ISDN	ETS300 Protocol

Request that the ISDN line allocate one dynamic terminal endpoint identifier (TEI) per phone number.

For service offered from an AT&T 5ESS, request a multipoint line, with the following features:

Feature	Value
B1 Service	On Demand (DMD)
B2 Service	On Demand (DMD)
Data Line Class	Multipoint
Maximum B Channels	2
Circuit Switched Voice Bearer (CSV) Channels	Any
Number of CSV calls	1 (recommended for testing purposes)
Circuit Switched Data (CSD) Bearer Channels	Any
Number of CSD calls	2
Terminal Type	Type A

Turn the following features off:

Packet Mode Data
Multiline Hunt
Multiple Call Appearances
Electronic Key Telephone Sets (EKTS)
Shared Dictionary Numbers
Accept *Special* Type of Number
Intercom Groups
Network Resource Selector (Modem Pools)
Message Waiting
Hunting
InterLATA Competition

For service offered from a Northern Telecom DMS-100, request a multipoint line, with the following features.

Line Type	Basic Rate, Functional
Electronic Key Telephone Sets (EKTS)	No
Call Appearance Handling (CACH)	No
Non-Initializing Terminal	No
Circuit Switched Service	Yes
Packet Switched Service	No
TEI	Dynamic
Bearer Service	Circuit Switched Voice and Data Permitted on any B Channel (Packet mode data not permitted)

Identify your long distance carrier of choice and request circuit-switched 64 kbps Clear Channel access if possible.

Long distance access should be provided through_____.

Ensure that the telephone company provides you with the following information for configuring the ISU 2V35:

- ISDN switch type
- ISDN switch protocol version
- ISDN phone number(s)
- Service profile identification (SPID) number(s) with prefixes and suffixes, if applicable (if ISDN line is multipoint)

LOCAL INTERFACE REQUIREMENTS

Physical Interface

- ISDN Basic Rate Interface (BRI) line
- U-interface reference point
- 2B1Q line coding

ISDN service must be provided from one of the following CO switches and protocols:

Switch	Protocol
LUCENT-5ESS	Custom (5E6 or later software) National ISDN-1
Northern Telecom DMS-100	BCS-32 or later software (Pvc1) National ISDN-1 (Pvc2)
Siemens EWSD	National ISDN-1

The interface provides the ability to allocate one dynamic (TEI) per phone number.

Local Service

- Bearer capabilities:
  - Circuit mode voice service for speech and 3.1 kHz audio.
  - Circuit mode data service for 56 kbps and 64 kbps unrestricted data.
- Two simultaneous calls supported on the interface. Any mix of speech and data bearer capabilities is supported for both bearer channels on incoming and outgoing calls.
- Service provided inside the LATA for the bearer capabilities.
- Long distance access for the bearer capabilities to and from the long distance providers of choice.

Long Distance Service

If facilities are available, subscribe to long distance service supporting the bearer capabilities previously listed. Request service supporting circuit-switched 64 kbps or 56 kbps access. It is recommended that the same long distance carrier end-to-end throughout the network to be used.

Deciding What Services to Order

If you are new to ISDN, first obtain the features previously listed. Refer to the section *ISDN Service Ordering Information* in this appendix as a basic guide. It is easier to begin operating on a full featured line because more options are available. Later, features not actually used can be deleted.

If all of the previous features are not available, compare the actual data service requirements with those which are available. A likely problem is the lack of a clear trunk to provide 64 kbps unrestricted data service. A solution is to use to 56 kbps service. Sometimes voice circuits are suitable for data service at a reduced bit rate.

5ESS Custom Line Additional Parameters

The AT&T 5ESS central office telephone switch supports a proprietary ISDN D-channel call control protocol called Custom which is based on CCITT recommendations. The ISU 2V35 configured for switch type AT&T 5ESS will work with lines providing this protocol on 5ESS switches with software version 5E6 or later.

The ISU 2V35 supports the following configurations on 5ESS custom lines:

- Point-to-point with one phone number
- Multipoint with one phone number
- Multipoint with two phone numbers (recommended configuration)

The requirements for the 5ESS point-to-point line are defined in Table D-1.

Table D-1. 5ESS Features

B1 service	On-Demand (DMD)
B2 service	On-Demand(DMD)
Data line class	Point-to-point
Maximum B channels	2
Number of circuit switched voice (CSV) calls	2
Circuit switched voice bearer channels	Any
Number of circuit switched data (CSD) calls	2
Circuit switched data bearer channels	Any
Terminal type data bearer channels	Type A

Multipoint lines require the phone company to create a SPID for each phone number on the line. With the exception of the ability to spread two calls across two phone numbers, multipoint lines offer no special features, and may create complications. However, if you use a multipoint line, the parameters are similar to the point-to-point line, except for the SPIDs.

The 5ESS switch can provide a variety of supplementary features which the ISU 2V35 may not support. Enabling these features may have undesirable consequences. Avoid the following features:

- Packet Mode Data
- Multiline hunt groups
- Electronic key telephone set (EKTS)
- Shared directory numbers
- Intercom groups
- Network resource selector (modem pools)
- Message waiting
- Hunting
- InterLATA competition
- Accept special type of number

DMS-100 Protocol Version 1 Line Additional Parameters

The Northern Telecom DMS-100 telephone switch supports a proprietary ISDN D-channel call control protocol called Pvc1 which is based on CCITT recommendations. The ISU 2V35 configured for switch-type DMS-100 is functional on lines providing this protocol on DMS-100 switches with software version BCS-32 or later. The ISU 2V35 supports the following configurations on DMS-100 lines:

- Multipoint with one phone number (1B+D service)
- Multipoint with two phone numbers (for 2B+D service)

The requirements for the DMS-100 multipoint line are defined in the sections *Local Interface*, *Local Service*, and in Table D-2, all in this appendix. The line should have two service profiles with the following parameters to support BONDING.

Table D-2. DMS Features

Line type	Basic Rate, Functional
Electronic key telephone set (EKTS)	No
Call appearance handling (CACH)	No
Initializing terminal	Yes
Bearer service	Circuit Switched Voice and Data permitted. Packet mode data not permitted.
Circuit switched service	Yes
Packet switched service	No
Protocol Version	Functional PVC 1
TEI	Dynamic

After Service Is Installed

When the line is installed, the following information will be provided by the local phone service provider:

- A seven-digit LDN for the line. If the line is multipoint with two phone numbers, two LDNs are provided.
- If the line is multipoint, a SPID is provided for each LDN.
- Dialing information, including the area code, for the line.
- Any special instructions for dialing outside lines, dialing 4-digit local extension numbers, and prefixes for using the desired long distance provider.

SETTING UP THE ISU 2V35 FOR A NEW LINE

1. Disconnect the ISDN line from the ISU 2V35.
2. Turn on the ISU 2V35, verify that it passes self test.
3. Turn off the ISU 2V35; while holding down 0, turn on the ISU 2V35. Continue to press down 0 for 15 seconds. This will reset all the internal settings to factory defaults.
4. The ISU 2V35 is now set up for 5ESS Custom. If this is not the correct line-type, select **CONFIG**, **Netw. Options**, **Dial Line**, **Switch Type**, and the desired switch type.
5. Enter the SPIDs and LDNs for the ISDN multipoint line. Select **CONFIG**, **Netw. Options**, **Dial Line**, **Terminal ID**, **Set SPID/Set LDN** and enter the SPIDs and LDNs. Make sure that SPID1 corresponds to LDN1 and SPID2 corresponds to LDN2.
6. Turn the ISU 2V35 off for 2 seconds, then on. This is required after changing any of the previous settings. The ISU 2V35 should now be set up for your ISDN line. You may wish to verify the settings.
7. Connect the ISDN line to the **ISDN IFC** connector on the ISU 2V35. The front panel should read **Link Down** and progress to **Ready** as the line is activated. This process may take a minute.

At this point, if the ISU 2V35 does not read **Ready**, see "If The ISU 2V35 Does Not Read Ready" on page 10-2.

Acronyms

2B1Q	2 Binary, 1 Quarternary
AMI	Alternate Mark Inversion
B (Channel)	A 64 kbps digital information channel
BONDING	Bandwidth On Demand Interoperability Group
bps	Bits per second
BRI	Basic Rate Interface
CCITT	Consultative Committee for International Telegraphy and Telephony
CD	Carrier Detect
CIC	Connect Incoming Call
CTS	Clear to Send
DCE	Data Communications Equipment
DMS	Digital Multiplex Switching
DSR	Data Set Ready
DTE	Data Terminal Equipment
EKTS	Electronic Key Telephone Service
FAX	Facsimile
HLC	High Layer Compatibility
ID	Identification
IFCE	Inteface
I/O	Input/Output
ISDN	Integrated Services Digital Network
ISO	International Standardization Organization
kbps	Kilobits per second
kHz	Kilohertz
LAN	Local Area Network
LDN	Local Directory Number
Mbps	Megabits per second

NT1	Network Termination 1
PBX	Private Branch Exchange
PC	Personal Computer
PRI	Primary Rate Interface
SPCS	Stored Program Controlled Switching System
SPID	Service Profile Identifier
TA	Terminal Adapter
TE	Terminal Equipment
TEI	Terminal Endpoint Identifier
WAN	Wide Area Network

Glossary

asynchronous transmission
Not Synchronous. A method of data transmission which allows characters to be sent at irregular intervals by preceding each character with a *start* bit and following it with a *stop* bit. The timing of the transmission is not determined by the timing of a previous character. Applications include communication between most small computers (especially PCs) and mainframes, lower speed transmission, and less expensive computer transmission systems. See **Synchronous**.

B-channel
64 kbps *bearer* channel used for voice, circuit, or packet switched data.

bandwidth
The range of electrical frequencies a device is capable of handling. The amount of bandwidth a channel is capable of carrying tells you what kinds of communications can be carried on it. For example, a wide band circuit can carry a TV channel. A wide band circuit that is capable of providing one video channel can also provide 1,200 voice telephone channels.

bearer service
As defined by CCITT standards, a type of telecommunication service that provides the capability for the transmission of information between user-to-network interfaces. Bearer services defined for ISDN are circuit mode and packet mode.

BONDING mode 1 protocol
Industry standard B-channel aggregation protocol. Developed by the Bandwidth on Demand Interoperability Group.

BRA
basic rate access. The BRA includes two 64 kbps B-channels and one 16 kbps D-channel. Also known as Basic Rate Interface (BRI).

bridging
The technique whereby additional stations may be served from a two-point facility by extending the facility from a *bridge* at one of the facility's terminating points.

CCITT
Consultative Committee on International Telephony and Telegraphy. A body of the International Telegraph Union (ITU) which prepares recommendations, commonly referred to as international standards, to resolve technical telegraph and telephone problems.

central office (CO)
In telephony, the facility housing the switching system and related equipment that provides telephone service for customers in the immediate geographical area.

circuit mode
Type of switching that assigns a call to a specific circuit path. The circuit is not shared with other calls.

clear channel
A channel in which all the 64 kbps are used for transmission. To achieve this, bit robbing signalling must be eliminated. (NOTE: Not to be confused with clear channel protocol.)

common channel interoffice signalling (CCIS)
A signalling system developed for use between stored program switching systems. All of the signalling information for a group of trunks is transmitted over a dedicated high-speed data link rather than on a trunk. CCIS reduces call setup time compared to individual trunk signalling.

CPE
Customer premises equipment. A generic term for communications terminal gear owned by the customer, residing on customer premises.

CSU
Channel service unit. A component of CPE used to terminate a digital circuit, such as DDS or T1 at the customer site. Performs certain line-conditioning functions, ensures network compliance per FCC rules, and responds to loopback commands from the central office. Also ensures proper 1s density in transmitted bit stream and performs bipolar violation correction. See **DSU**.

D-channel
The ISDN channel that carrier signalling information to control the call setup, teardown, or invocation of supplementary services. The D-channel may also be used to provide packet mode data service.

DCE
data communications equipment. The portion of a data terminal that provides the interface to the network.

DDS
dataphone digital service. AT&T private line service for transmitting data over a digital system. The digital transmission system transmits electrical signals directly, instead of translating the signals into tone of varied frequencies as with traditional analog transmission systems. Digital techniques provide more efficient use of transmission facilities, resulting in lower error rates and costs than analog systems.

digital
Referring to communications procedures, techniques, and equipment where information is encoded as either a binary 1 or 0, the representation of information in discrete binary form, discontinuous in time, as opposed to the analog representation of information in variable but continuous waveforms.

DSU
data service unit. A device providing interface between a data terminal or other data communications device and a digital access line.

DTE
data terminal equipment. The portion of a data terminal that interfaces to the end-user's equipment. The main difference between DCE and DTE is that pins 2 and 3 are reversed on the EIA-232.

Frame
A group of bits sent serially over a communications channel. Generally a local transmission unit sent between data-link-layer entities that contains its own control information for addressing and error checking. The basic data transmission unit is employed with bit-oriented protocols, similar to blocks. In video transmission, a set of electron scan lines that comprise a television picture (usually 525 in the U.S.).

in-band signalling
Signalling made up of tones which pass within the voice frequency band and are carried along the same circuit as the talk path being established by the signals. Virtually all signalling (request for service, dialing, disconnect, etc.) in the U.S. is in-band signalling. Most of that signalling is MF (multi-frequency) dialing. The more modern form of signalling is out-of-band.

information element
The name for the data fields within an ISDN Layer 3 message.

interface
A common boundary between two systems over which the inter-system communication occurs.

interworking
Communication between two types of networks or end equipment. This may or may not involve a difference in signalling or protocol elements supported.

ISDN
Integrated service digital network. A network architecture that enables end-to-end digital connections. The network supports diverse services through integrated access arrangements and defines a limited set of standard, multipurpose interfaces for equipment vendors, network providers, and customers. Interworking with a public switched telephone network is retained.

LATA
Local Access and Transport Area. One of 161 local telephone serving areas in the United States, generally encompassing the largest standard statistical metropolitan areas. Subdivisions established as a result of the AT&T divestiture that now distinguish local from long distance service. Circuits with both end-points within the LATA (intraLATA) are generally the sole responsibility of the local telephone company, while circuits that cross outside the LATA (interLATA) are passed on to an interexchange carrier.

Loopback
A diagnostic procedure where data is sent to the device being tested, and the output of the device is fed directly back to its input, looped around, and the returning data is checked against that which was sent.

loopback test
A test typically run on a 4-wire circuit. Two transmit leads are joined to the two receive leads. A signal is then sent around the loop. Measuring differences between the sent and received signal is the essence of a loopback test.

master clock
The source of timing signals, or the signals themselves, which all network stations use for synchronization.

message
The Layer 3 information that is passed between the CPE and SPCS for signalling.

multiplexing
The combining of multiple data channels onto a single transmission medium. Any process through which a circuit normally dedicated to a single user can be shared by multiple users. Typically, user data streams are interleaved on a bit or byte basis (time division) or separated by different carrier frequencies (frequency division).

multipoint circuit
A circuit consisting of three or more stations connected directly electrically.

NEXT (near-end crosstalk)
Unwanted energy transferred from one circuit to an adjoining circuit. Occurs at the end of the transmission link where the signal source is located. The absorbed energy is usually propagated in the direction opposite to the absorbing channel's normal current flow. Caused by high-frequency or unbalanced signals and insufficient shielding.

non-ISDN line
Any connection from a CPE to a SPCS that is not served by D-channel signalling.

non-ISDN trunk
Any trunk not served by either SS7 or D-channel signalling.

NT1
Network Termination 1. A unit that provides physical and electromagnetic termination of the U-interface 2-wire transmission line, converts between Layer 1 formats used at the U- and T- reference points, and performs some maintenance functions.

packet mode
Refers to switching of packets of information for different users by statistically multiplexing them over the same transmission facilities. ISDN packet mode capabilities are based on CCITT Recommendation X.25 procedures.

point-to-point
Describing a circuit connecting two points directly with no intermediate processing nodes or computers (although switching facilities could exist). A type of connection that links two logical entities (i.e., phone-line circuit).

S-interface
S-reference point. The interface that connects an ISDN terminal (TE1) or Terminal Adapter (TA) to the NT2 reference point as defined in the I.411 Recommendation.

SPCS
stored program controlled switch. A digital switch that supports call control, routing, and supplementary services provision under software control. All ISDN switches are SPCSs

SDLC
synchronous data link control. A data communications line protocol associated with the IBM System Network Architecture. SDLC is a bit-oriented protocol (not a character-oriented protocol) that includes multiple block error checking and full duplex line operation.

sync bits
Framing or synchronizing bits in synchronous transmission.

synchronous
1. The condition occurring when two events happen in a specific time relationship with each other, both under control of a master clock. **2.** A method of data transmission requiring the transmission of timing pulses to keep the sender and receiver synchronized in their communication used to send blocks of information. Synchronous data transmission is used in high-speed data circuits because there is less overhead than asynchronous transmission of characters which contain two extra bits per character to affect timing.

T1
Also T-1. A digital transmission link with a capacity of 1.544 Mbps. T1 uses two pairs of normal twisted wires. T1 normally can handle 24 voice conversations with each conversation being digitized at 64 kbps. With more advanced digital voice encoding techniques, it can handle more voice channels. T1 is a standard for digital transmission in North America.

TA
Terminal Adapter. A DCE that connects to the ISDN S-Interface and enables non-ISDN terminal equipment to communicate over ISDN.

TE1
terminal equipment type 1. ISDN-compatible terminals.

TE2
terminal equipment type 2. Non-ISDN terminal equipment linked at the EIA-232, RS-449, or V.35 interface.

transmission
The dispatching of a signal, message, or other form of intelligence by wire, radio, telegraphy, telephony, facsimile, or other means. A series of characters, messages or blocks including control information and user data. The signalling of data over communications channels.

transmission level
The power of a transmission signal at a point of a transmission facility. It may be measure in absolute terms (dBm) or in a ratio to its level at some reference point (dB).

twisted pair
Two wires twisted around each other to reduce induction (interference) from one wire to the other. Several sets of twisted pair wires may be enclosed in a single cable. Twisted pair is the normal cabling from a Central Office to your home or office, or from your PBX to your office phone. Twisted pair wiring comes in various thicknesses. As a general rule, the thicker the cable is, the better the quality of the conversation and the longer cable can be and still get acceptable conversation quality. However, the thicker it is, the more it costs.

2B+D
The basic rate interface (BRI) in ISDN. A single ISDN circuit divided into two 64 kbps digital channels for voice or data and one 16 kbps channel for low speed data (up to 9,600 baud) and signalling. 2B+D is carried on one or two pairs of wires depending on the interface, the same wire pairs that today bring a single voice circuit into your home or office. See **ISDN.**

U-interface
A twisted pair subscriber loop that connects the NT1 reference point to the ISDN network, as defined in the I.411 Recommendation. This interface provides basic rate access with an operating frequency of 160 kbps and an information rate of 144 kbps. Under U.S. regulations, this also marks the line of demarcation between customer-owned equipment and the public network.

V.32
9.6 kbps, 2-wire duplex modem standard.

videoconferencing
The real-time, usually two-way, transmission of digitized video images between two or more locations. Videoconferencing requires a wideband transmission facility. Transmitted images may be freeze-frame (where television screen is repainted every few seconds to every 20 seconds) or full motion. Bandwidth requirements for two-way video conferencing range from six MHz for analog, full-motion, full-color, commercial grade TV to 56 kbps for digitally-encoded freeze-frame to 1.544 kbps for high-quality, full-color, full-motion TV.

X.25
A packet data transfer protocol for the B and D-channels. Defines the interface between data terminal equipment (DTE) and data circuit terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuits.

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Product Support Information

Presales Inquiries and Applications Support
Please contact your local distributor, ADTRAN Applications Engineering, or ADTRAN Sales:

Applications Engineering	(800) 615-1176
Sales	(800) 827-0807

Post-Sale Support
Please contact your local distributor first. If your local distributor cannot help, please contact ADTRAN Technical Support and have the unit serial number available.

Technical Support (888)4ADTRAN

Repair and Return
If ADTRAN Technical Support determines that a repair is needed, Technical Support will coordinate with the Customer and Product Service (CAPS) department to issue an RMA number. For information regarding equipment currently in house or possible fees associated with repair, contact CAPS directly at the following number:

CAPS Department (256) 963-8722

Identify the RMA number clearly on the package (below address), and return to the following address:

ADTRAN Customer and Product Service
6767 Progress Old Madison Pike
Building #6 Suite 690
Huntsville, Alabama 35807

RMA # _____