ISU 128 RACKMOUNT

128 kbps ISDN Service Unit

User Manual

1200087L1 ISU 128 Rackmount

61200087L1-1A
September 1994

901 Explorer Boulevard
Huntsville, AL 35806-2807
Phone: (205) 971-8000
Fax: (205) 971-8699

FCC regulations require that the following information be provided to the customer in this manual.

1. If your telephone equipment (ISU 128) causes harm to the telephone network, the Telephone Company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice isn't practical, you will be notified as soon as possible. You will be advised of your right to file a complaint with the FCC.

2. Your telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of your equipment. If they do, you will be given advance notice so as to give you an opportunity to maintain uninterrupted service.

3. If you experience trouble with this equipment (ISU 128), please contact ADTRAN at (800) 726-8663 for repair/ warranty information. The telephone company may ask you to disconnect this equipment from the network until the problem has been corrected, or until you are sure the equipment is not malfunctioning.

4. This unit contains no user-serviceable parts.

To ADTRAN service personnel: For continued protection against risk of fire, replace F1 with the same type and rating of fuse *only*: .2 A, 250 V.

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.

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

WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within five years from the date of shipment if it does not meet its published specifications or fails while in service (refer to ADTRAN Equipment Warranty and Repair and Return Policy and Procedure).

A Return Material Authorization (RMA) is required prior to returning equipment to ADTRAN.

For service, RMA requests, or further information, contact ADTRAN at the numbers listed below.

ADTRAN Customer Service:

RMA (205) 971-8722
Technical Support (800) 726-8663
Sales (800) 827-0807

ADTRAN Repair and Return Address:

ADTRAN, Inc.
901 Explorer Boulevard
Huntsville, Alabama 35806

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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 telephone wire. ISDN provides a means of integrating these services and modernizing communication networks for information movement and management efficiency.

THE ADTRAN ISU 128 RACKMOUNT

The ADTRAN Rackmount ISDN Service Unit (ISU 128 Rackmount) is a rackmount device, installed in the ADTRAN Smart 16 shelf. The ISU 128 Rackmount connects Data Terminal Equipment (DTE) to the ISDN network or to a Leased Digital Network for data transmission. The ISU 128 Rackmount allows you to take advantage of high-speed data transmission (up to 128 kbps) using a single ISDN line. Figure 1-1 is an illustration of the ADTRAN ISU 128 Rackmount front panel.

From the network, ISDN is delivered by a single 2-wire 2B1Q U-interface which is connected directly to the ISU 128 Rackmount. ISDN network termination is designed into the ISU 128 Rackmount, eliminating the need and expense of a separate NT1. For network testing, the ISU 128 Rackmount responds to NT1 test commands from the telephone company Central Office (CO).

The ISU 128 Rackmount transmits data over a RS-530A, V.35, or RS-232 interface. The ISU 128 Rackmount performs at synchronous data transfer rates of 2400 bps to 128 kbps and asynchronous rates of 300 bps to 115.2 kbps. At rates over 64 kbps, the BONDING delay equalization protocol synchronizes data over the two 64 kbps B-channels. The ISU 128 Rackmount is intended to support the transfer of data and images over ISDN. The ISU 128 Rackmount may be viewed as an *ISDN dial modem* that allows cost-effective, high-speed data transmission at rates up to 128 kbps.

The ISU 128 Rackmount has two RJ45 jacks available on the rear panel for network connection (see Figure 1-2). The U-interface jack labeled **DIAL** is for Basic Rate ISDN. ISDN Basic Rate Service divides a standard telephone line into three digital channels capable of simultaneous voice and data transmission. The three channels are comprised of two Bearer (B) channels at 64 kbps and one Data (D) channel at 16 kbps (also known as 2B+D).

The ISU 128 Rackmount also supports a Leased Digital Connection that allows data to be transferred at up to 128 kbps over a 2-wire facility using the U-interface jack labeled **LEASED**. This type of service is a permanent connection between end points and is sometimes referred to as a leased connection, a dedicated connection, a nailed-up connection, a private circuit, or a limited distance modem connection. Leased connection or leased application is used in this manual to represent these types of services.

Dialing from the ISU 128 Rackmount is accomplished in a variety of ways:

- Manually from the DATAMATE keypad or terminal keyboard.
- Automatically from up to ten stored numbers.
- Dialing over the DTE interface using the AT command set.
- V.25bis in-band dialing (used in applications such as LAN/WAN bridging).
- Dialing while DTR is enabled. Routers raise DTR when bandwidth on their dedicated line is exceeded. In high-traffic times, this allows the ISU 128 to dial out over the ISDN for an extra 128 kbps of *bandwidth-on-demand*.

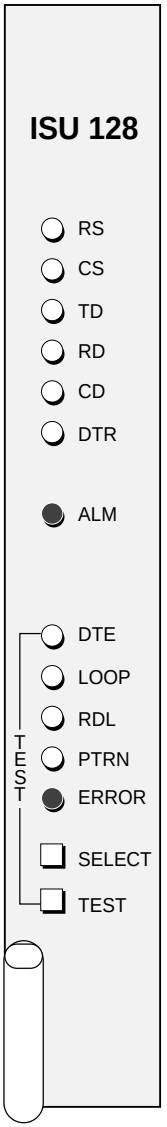


Figure 1-1
ISU 128 Rackmount Faceplate

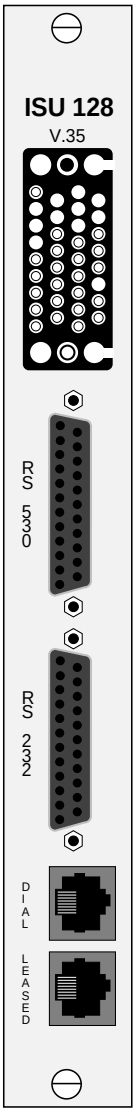


Figure 1-2
ISU 128 Rackmount Rear Panel

The ISU 128 Rackmount is configured by using the DATAMATE keypad supplied with the Smart 16 shelf controller, or through the use of a terminal attached to the Smart 16 shelf controller. The DATAMATE provides a 2-line by 16-character LCD display. The keypad is used for selecting and configuring the boards present in the shelf (see the Smart 16 shelf controller manual for more details).

Before the ISU 128 Rackmount can be configured, the board must be selected. To select the ISU using the DATAMATE, the proper board and slot must be entered. Once this is done, the display will change to show the front panel display of the ISU 128 Rackmount. Figure 1-2 is an illustration of the ISU 128 Rackmount front panel.

To select the ISU 128 Rackmount using a terminal, the proper slot and rack must be entered. For more information on the terminal and DATAMATE interfaces, refer to the user manual provided with your Smart 16 shelf.

Table 1-A defines the DTE indicators.

Table 1-A
DTE Indicators

Indicator	Definition
RS	Request to Send
CS	Clear to Send. Indicates that the ISU 128 Rackmount is ready to transmit.
TD	Transmit Data. On when the DTE is transmitting to the ISU 128 Rackmount.
RD	Receive Data. On when the ISU 128 Rackmount is receiving data from the far end.
CD	Carrier Detect. Indicates that the ISU 128 Rackmount is connected to a remote unit.
DTR	Terminal Ready from DTE. On when DTR is active at DTE interface.

ISU 128 RACKMOUNT 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 will be a lengthy process.

The ISU 128 Rackmount bridges this transition by supporting communications with existing and future network services and equipment. The ISU 128 Rackmount 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 mode 1-compatible Inverse Multiplexers.

RECOMMENDED OPERATING PROTOCOLS

The ISU 128 Rackmount 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-B are recommended. As noted in Table 1-B, all asynchronous rates will support flow control. However, the 115200 rate (only with SAP and a 64 kbps circuit type) requires the use of flow control.

Table 1-B shows that a given data rate may be achieved by more than one protocol/rate adaption selection. The table is organized so that selections with the least transport delay are closer to the top of the table for any given circuit type. Therefore, users should choose a protocol and rate closer to the top of the protocol rate list for a given circuit type.

Table 1-B

Recommended Operating Modes

			Rates													
Call Type	**Sync/Async**	**Protocol**	300	1200	2400	4800	9600	19200	38400	48000	56000	57600	64000	112000	115200	128000
DIAL-64K	SYNC	BONDING									√		√			
		CLEAR CHAN								√	√		√			
		V.120					√	√	√	√						
		TLINK			√	√	√	√			√		√			
		SAP							√							
	ASYNC	BONDING		√	√	√	√	√	√			√				
		V.120		√	√	√	√	√	√			√			√ƒ	
		TLINK		√	√	√	√	√								
		SAP							√			√			√ƒ	
DIAL-56K	SYNC	BONDING									√					
		CLEAR CHAN								√	√					
		V.120					√	√	√	√						
		TLINK			√	√	√	√			√					
	ASYNC	BONDING		√	√	√	√	√	√			√				
		DSU 57.6										√				
		V.120		√	√	√	√	√	√			√			√ƒ	
		TLINK		√	√	√	√	√								
DIAL-64K*2	SYNC	BONDING														√
	ASYNC	BONDING													√	
DIAL-56K*2	SYNC	BONDING												√		
	ASYNC	BONDING													√	
DIAL AUDIO†	ASYNC	V.32BIS	√	√	√	√	√	√ƒ								
LEASED 64K	SYNC	CLEAR CHAN								√	√		√			
		SAP			√	√	√	√	√							
	ASYNC	DSU 57.6										√				
		SAP		√	√	√	√	√	√			√			√ƒ	
LEASED 128K	SYNC	CLEAR CHAN														√
	ASYNC	SAP										√			√	

NOTE

1. *All asynchronous rates support flow control*
2. *All dial-up modes support front panel, DTR, AT command, and V.25bis dialing methods.*
3. *Rates marked with ƒ require flow control.*
4. *Given a choice between two protocols, pick the protocol closer to the top of the list for the circuit type.*
5. *† - Available only in ISU 128 with V.32bis modem option, P/N 1200029L3.*

Chapter 2
Ordering ISDN Service From Your Telephone Company

ISDN is a complex service with multiple options. Obtaining service from your local telephone company and long distance providers can sometimes be complicated.

To help in this process, the ISU 128 Rackmount supports the most common CO telephone switches in a variety of configurations.

Refer to the appendix *Ordering ISDN From Your Telephone Company* for a list of requirements from the telephone service providers to support the features in the ISU 128 Rackmount.

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 128 Rackmount.

ISDN SERVICE ORDERING INFORMATION FOR THE ADTRAN ISU 128 RACKMOUNT

For ADTRAN ISU 128 Rackmount applications, the following guide can be used as an aid in ordering basic ISDN service from your local telephone company.

The ADTRAN ISU 128 Rackmount ISDN Service Unit, includes NT1 and Terminal Adapter functionality and supports data at rates up to 128 kbps.

Name: _____

Address: _____

City: _____ **State:** _____

Zip Code: _____ **Daytime telephone number :** _____

Request an ISDN Basic Rate Interface (BRI) line.

- U-interface reference point
- 2B1Q line coding

Choose one of the following.

☐ 2B+D Service (supports up to 128 kbps)

☐ 1B+D Service (supports up to 64 kbps)

The ISU 128 Rackmount 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

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 Point-to-Point line, with the following features:

Feature: ..... Value
B1 Service: ..... On Demand (DMD)
B2 Service: ..... On Demand (DMD) if 2B+D
Data Line Class: ..... Point-to-Point (PP)
Maximum B Channels: ..... 2 if 2B+D, 1 if 1B+D
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 if 2B+D, 1 if 1B+D
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 an Northern Telecom DMS-100, request a Point-to-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 _____ long distance carrier.

Ensure that the telephone company provides you with the following information for configuring the ISU 128 Rackmount.

- ISDN Switch Type
- ISDN Switch Protocol Version
- ISDN Phone Number(s)
- Whether the ISDN line is Point-to-Point or Multipoint
- Service Profile Identification (SPID) number(s) with prefixes and suffixes, if applicable (if ISDN line is Multipoint)

Chapter 3
ADTRAN ISU 128 Rackmount 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 Repair and Return department at 1-205-971-8722.

A DTE connector card is provided with each ISU 128 Rackmount. The unit may be installed in any slot of a Smart 16 shelf. Once the unit is installed in the slot, the provided DTE connector board must be installed in the corresponding slot at the rear of the Smart 16 shelf. Ensure that a tight connection is made between the DTE card and the ISU 128 Rackmount.

NETWORK CONNECTION

The ISU 128 Rackmount supports either **Dial** or **Leased** operation. Two eight-pin RJ45 modular jacks on the rear panel of the ISU allow connection to either network service.

Dial operation uses the ISDN Basic Rate U-interface and allows the ISU 128 Rackmount to *dial out* over the ISDN network. When used in this mode of operation, the telephone company-provided ISDN Basic Rate U-interface is connected to the RJ45 connector marked **Dial**.

The **Leased** mode of operation supports a dedicated 2B1Q data service at rates of up to 128 kbps. It uses a *nailed up* circuit, that is, a permanent connection between end points. This could be a limited distance modem or point-to-point connection. When using this type of service, the dedicated 2B1Q data service is connected to the RJ45 connector marked **Leased**.

Refer to the appendix *Connector Pinouts* for network connection pin assignments.

DTE DATA CONNECTION

Data terminal equipment is connected to the ISU 128 Rackmount by using the RS-530A interface, V.35 interface, or RS-232 interface on the DTE connector of the ISU 128 Rackmount. The maximum cable lengths recommended are 50 feet for the RS-530A interface, or 30 feet for the V.35 interface. Maximum recommended cable length for a full specification RS-232 interface is 15 feet. The pin assignments for the DTE interfaces are shown in Appendix D, Connector Pin-Outs.

The RS-530A interface, the V.35 interface, and the RS-232 interface supports data rates up to 128 kbps. The DTE rate is configured from the Datamate or terminal interface of the ISU 128 Rackmount or by using AT commands. Refer to the chapter *Configuring the ADTRAN ISU 128 Rackmount* to configure the ISU 128 Rackmount with the appropriate data rates for your application.

NOTE

Ensure that there is only one DTE cable connected to the ISU 128 Rackmount; i.e., if an RS-530A cable is being used, do not have a V.35 cable connected to the unit at the same time, and vise versa.

CAUTION

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

Chapter 4
Configuring the ADTRAN ISU 128 Rackmount

MENU NAVIGATION

Moving around the various menu items on the ISU 128 Rackmount is a simple task. Four function keys on the top of the DATAMATE allow the user to enter, exit, and scroll through the various menu branches. The four function keys are:

Enter ..... Selects a displayed 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.


NOTE

For the reader's ease, 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.

To choose an item, press the number on the keypad corresponding with that item. That item blinks on and off to show that it is the currently selected choice. Pressing either the **Up** or **Down** arrow deselects the current choice (it stops blinking). Pressing **Enter** selects the item. Figure 4-1 is a breakdown of the Configuration menu.

The ISU 128 Rackmount may also be configured by using the terminal interface. Menu selections are made by entering the appropriate numbered item displayed on the terminal. The screen will change to show the effect of your selection. Figure 4-2 illustrates the configuration structure for the terminal interface.

It is important to note that some features in the ISU 128 Rackmount do not immediately take effect upon selection. This prevents unintentional reconfiguration of the ISU 128 Rackmount during an active call. Items such as **Leased/Dial line**, **SPID/LDN**, and **ISDN switch type**, take effect *only* when the ISU 128 Rackmount is powered up or the U-interface is *bounced* (line broken and restored). Also, items such as **Bit Rate**, **Protocol**, and **Call type** will take effect *only* at the beginning of a new call.

GETTING STARTED

The ISU 128 Rackmount will go through an initial self test upon initial installation. Once the self test is successfully completed, the unit may be configured, tested, or used. Select the unit by entering the proper shelf and slot number on the DATAMATE or terminal keypad. For details on shelf numbering, refer to the Smart 16 Shelf Controller manual.

Once the unit is selected, the DATAMATE display is in the Current Status mode. This is the recommended *resting place* for the display as it shows the current operational status of the unit. For instance, if the ISU 128 Rackmount is not connected to the network the Current Status menu will display **ISU 128 Slot#:XX Link Down**. If the unit is connected to the network and functioning properly, it will display **ISU 128 Slot#:XX Ready.** A list of current status messages is provided in the appendix *Current Status Messages*. Pressing **Cancel** repeatedly will always return the user to this screen. Pressing *any* key will change the display to the top of the menu tree. The menu tree allows the user to setup and operate the ISU 128 Rackmount from the front panel.

The main branches of the menu tree are:

1. STATUS
2. TEST
3. CONFIG (Configuration)
4. DIAL

Once the unit is selected using the terminal interface, the display will show the initial menu tree. To determine the current status of the unit, selection **1 - STATUS** must be entered. This screen shows the current configuration, line, and call status for the selected unit.

The main branches of the terminal menu tree are:

1. STATUS
2. TEST
3. CONFIG
4. DIAL
5. QUICK SETUP
6. Aux CONFIG

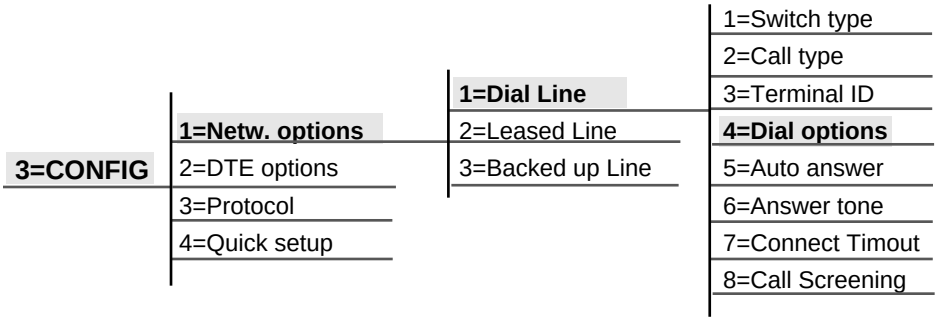
No distinction between the terminal and DATAMATE interfaces will be made in the remainder of this chapter. The actual choice made will not differ between the two interfaces, although the process of selecting each might. For instance, the DATAMATE user must use the **Up** and **Down** arrows to make selections. This is not applicable to the terminal user.

To switch from the DATAMATE to the terminal, press the DATAMATE **Cancel** button until the **Select Unit** option is present. You can then press **Return** twice on the terminal keyboard to enter terminal mode. To change from terminal to DATAMATE interface, press ESC until the **Select Unit** prompt is displayed, then press ESC twice.

Follow these steps to select the ISU 128 Rackmount **Dial options**:

1. Press any key to change the display from the Current Status mode to the top of the menu tree.
2. To select **CONFIG**, press 3, then **Enter**. Use the **Up** and **Down** arrow keys to choose an item on the next submenu like Network Options (**Netw. options**).
3. To select **Netw. options**, press 1, then **Enter**.
4. Press 1, then **Enter** to select **Dial Line**.
5. Press 4, then **Enter** to select **Dial options**.

The following diagram illustrates these steps. These diagrams are used throughout the manual to help you quickly configure the ADTRAN ISU 128 Rackmount.



To quickly and easily configure the ISU 128 Rackmount for most common applications, refer to *Configuring for Quick Setup*.

The following subsections describe in detail more customized applications.

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(CONFIGURATION MENU TREE)

Figure 4-1
Configuration Menu Tree

```
                    ISU 128 Rackmount STATUS SLOT#:01
 UNIT/LOOP STATUS                          STATUS BUFFER
 Loop Rate     = 64K                        1 = EMPTY
 DTE Rate      = 64000                      2 = EMPTY
 DTE Format    = Synchronous                3 = EMPTY
 Test Status   = No Test                    4 = EMPTY
 Self Test     = Passed                     5 = EMPTY
 Software Rev = ISU Ver R.48                6 = EMPTY
 Checksum      = 2cfe                       7 = EMPTY
 Loop Status   = Link down                  8 = EMPTY
 Num Dialed    = No Call                    9 = EMPTY
 RTS = Off                                 10 = EMPTY
 CTS = On                                  11 = EMPTY
 TD  = Off                                 12 = EMPTY
 RD  = Off                                 13 = EMPTY
 DCD = Off                                 14 = EMPTY
 DSR = On                                  15 = EMPTY
 DTR = Off                                 16 = EMPTY
--------------------------------------------------------------------------------


--------------------------------------------------------------------------------
ESC TO EXIT
```

Main Menu

```
                        ISU128 Rackmount U SLOT#:01

 1 STATUS
 2 TEST
 3 CONFIGURE
 4 DIAL
 5 QUICK SETUP
 6 AUX CONFIG









--------------------------------------------------------------------------------


--------------------------------------------------------------------------------
ESC TO EXIT   ENTER SELECTION :
```

Status Menu

Figure 4-2
Terminal Interface Menu Screens

```
                    ISU 128 Rackmount TEST MENU SLOT#:01
TEST                                    ENABLE/DISABLE TESTS
1 Loopback DTE                          7 Lpbk=No Rem Lpbks
2 Loopback Netw.
3 Loopback Proto
4 Loopback Remot
5 Test Remote
6 NEBE/FEBE
```

Test Menu

```
                  ISU 128 Rackmount CONFIGURATION SLOT#:01
LINE OPTIONS                            DTE OPTIONS
1 Line type=Dial Line                   14 Data Format=Synchronous
2 Switch type=AT&T 5ESS                 15 Bit Rate=64000
3 Call type=Data 64Kbps                 16 Connector Type=RS-530
4 SPID1=                                17 RTS Options=1 ms delay
5 SPID2=                                18 CTS Options=Forced CTS
6 LDN 1=                                19 CD Options=Normal
7 LDN 2=                                20 DTR Options=Ignore DTR
8 Dial options=Front Panel              21 DSR Options=DSR forced on
9 Auto answer=Enabled
10 Answer tone=No Answer tone
11 Connect Timout=30 sec (def)
12 Call Screening=Answer any
13 Protocol=Clear Channel
```

Configuration Menu

Figure 4-2
Terminal Interface Menu Screens (cont.)

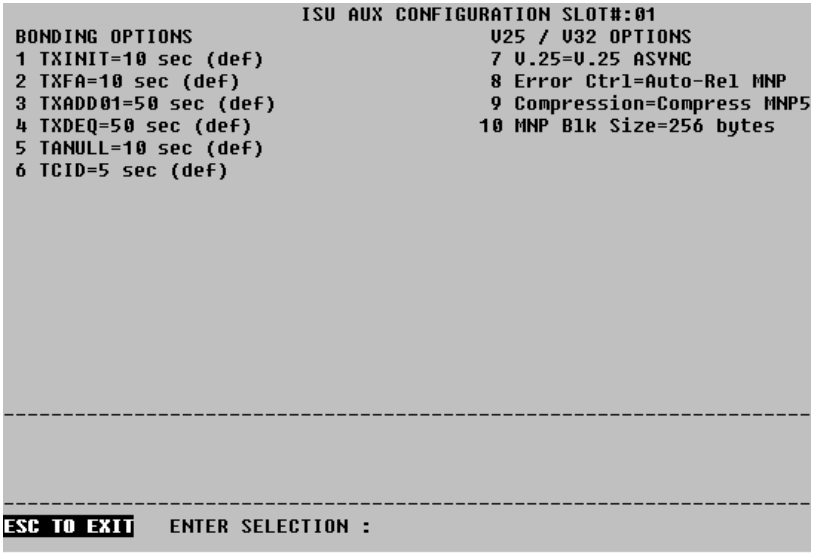
```
                    ISU 128 Rackmount DIAL MENU SLOT#:01

 1 Hang up line
 2 Dial number
 3 Redial last #
 4 Answer Call
 5 Dial stored #
 6 Store/Review #
 7 Switch Backup

-------------------------------------------------------------------

-------------------------------------------------------------------
ESC TO EXIT   ENTER SELECTION :
```

Dial Menu

```
                  ISU 128 Rackmount QUICK SETUP SLOT#:01

 1 Dial 56K sync                      9 Leased 64k
 2 Dial 64K sync                     10 Ldm 64k Master
 3 Dial 112K sync                    11 Leased 128K
 4 Dial 128K sync                    12 Ldm 128 Master
 5 V32 19.2 async                    13 Backed up 56k
 6 Dial 57.6 asyn                    14 Backed up 64k
 7 Dial 115.2 asy                    15 Backed up 128k
 8 Fallback 57.6k                    16 Factory Setup

-------------------------------------------------------------------

-------------------------------------------------------------------
ESC TO EXIT   ENTER SELECTION :
```

Quick Setup Menu

Figure 4-2
Terminal Interface Menu Screens (cont.)



Aux Configuration Menu

Figure 4-2
Terminal Interface Menu Screens (cont.)

USING ISDN BASIC RATE SWITCHED SERVICE

This section explains how to configure the ISU 128 Rackmount when using ISDN Basic Rate switched service. Figure 4-1 illustrates the entire **CONFIG** branch of the menu tree.

The following is a step-by-step procedure in configuring the unit for Dial operation, Switch type, Call type, Terminal ID, Dial options, and Auto answer.

Configuring the ADTRAN ISU 128 Rackmount for Dial Operation

To dial calls over the ISDN, the unit must be configured for **Dial Line**.

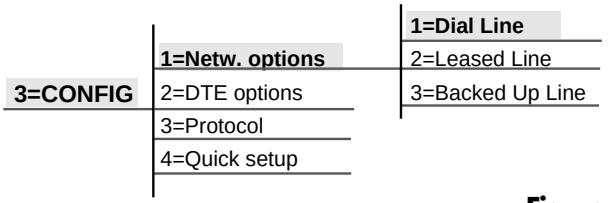


Figure 4-3
Dial Line Menu

Setting the Switch Type

Find out what kind of ISDN Switch your local CO is using by asking your telephone administrator or your telephone company representative. Configure your ISU 128 Rackmount for either a Northern Telecom DMS-100, AT&T 5ESS CO switch, or a switch conforming to the National ISDN-1 standard (usually an AT&T 5ESS, NTI DMS-100, or Siemens EWSD).

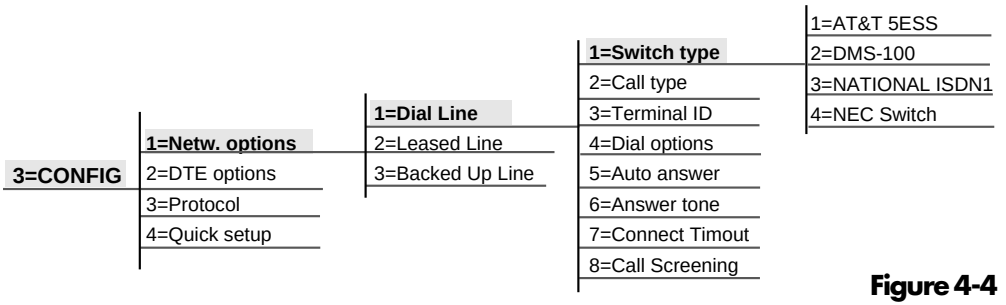


Figure 4-4
Switch Type Menu

Setting the Call Type

The Call type can be configured four different ways, depending on the type of service you are using.

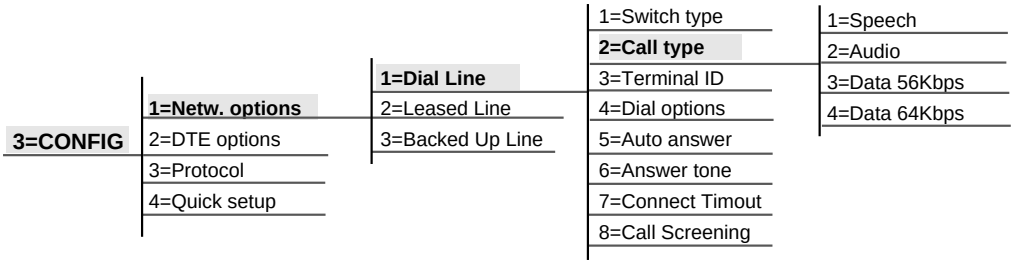


Figure 4-5
Call Type Menu

Speech

Speech directs the call control software to request a Mu-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 an **Audio** call type 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 56kbps 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 64kbps. This directs the call control software to request an unrestricted 64 kbps circuit.

Setting the Terminal ID

Terminal Identification is assigned by the local telephone company.

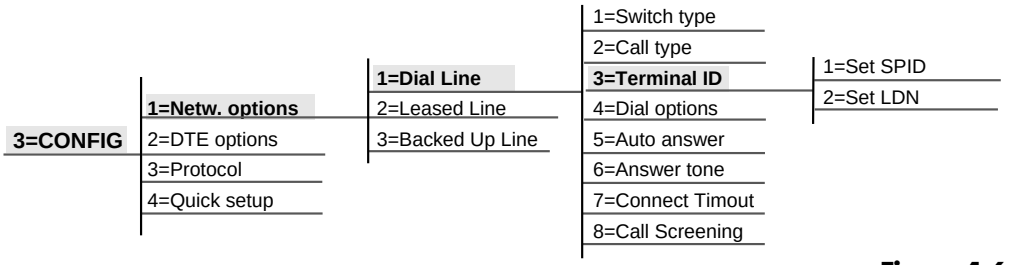


Figure 4-6
Terminal ID Menu

Setting the SPID

The Service Profile Identifier 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 it usually looks similar to the phone number. Obtain your SPIDs from your telephone administrator or local telephone representative.

The number of SPIDs required (0, 1, or 2) depends on how your ISDN line is configured. For instance, a point-to-point line has no SPID. Multipoint lines may have one or two SPIDs. The ISU 128 Rackmount uses the presence of SPID 1 to determine if the line is multipoint. If the line has only one SPID, then it must be entered in SPID 1.

When entering a SPID, use the **Up** and **Down** arrows to select between SPID1 and SPID2.

Press **Enter** to select the SPID and use the keypad to enter the SPID number. While keying/editing a SPID, the **Up** arrow key allows you to backspace through the number string to correct any mistake. The **Down** arrow key scrolls back to the last digit entered. To cancel a number, use the **Up** arrow to backspace through the number, then press **Enter**. After entering each SPID, press **Enter**.

Setting the LDN

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

When entering an LDN, use the **Up** and **Down** arrows to select between LDN1 and LDN2.

Press **Enter** to select the LDN and use the keypad to enter the LDN number. While keying/editing a LDN, the **Up** arrow key allows you to backspace through the number string to correct any mistake. The **Down** arrow scrolls back to the last digit entered. To cancel a number, use the **Up** arrow to backspace through the number, then press **Enter**. After entering each LDN, press **Enter**.

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

Setting the Dial Options

The ISU 128 Rackmount can be configured to dial three different ways as described below.

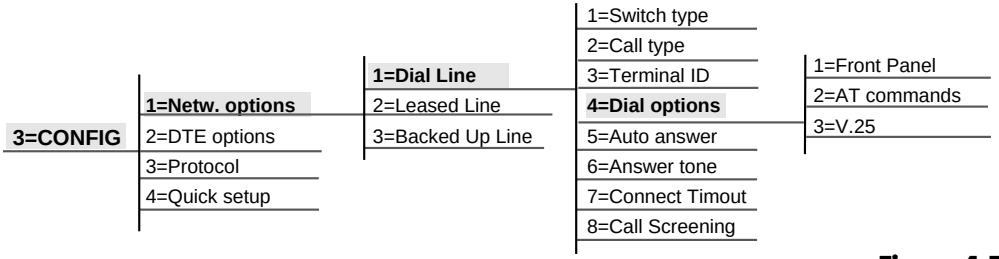


Figure 4-7
Dial Options Menu

Front Panel

To establish and disconnect calls from the DATAMATE or terminal keypad configure **Dial options** for **Front Panel**. Refer to *Front Panel Display Options*, for more details.

AT commands

Configuring the ISU 128 Rackmount for **AT commands** enables in-band dialing over DTE interface using asynchronous AT commands. **AT commands** can be used to set up the ISU 128 Rackmount as well as establish and end a call. Disconnecting calls can also be done from the DATAMATE or terminal (as described above) or from the far end unit. Refer to *Dialing a Call by the AT Command Processor* for more information.

V.25bis

Configuring the ISU 128 Rackmount for **V.25bis** enables in-band dialing over DTE interface using asynchronous or synchronous V.25bis commands. **V.25bis** can be used to establish and end a call. Disconnecting calls can also be done from the DATAMATE or terminal (as described above) or from the far end unit. Refer to *Configuring the ISU 128 Rackmount for V.25bis In-band Dialing* for more information.

Setting Auto Answer

The ISU 128 Rackmount can be configured to automatically answer in one of the following three ways.

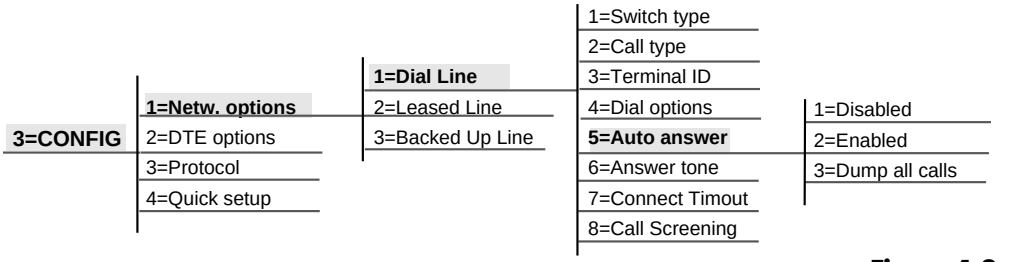


Figure 4-8
Auto Answer Menu

Disabled

When **Disabled** is selected, the ISU 128 Rackmount will not answer the call. The AT Answer Command (ATA) must be issued to the ISU 128 Rackmount for it to accept the incoming call. The ringing call can be dumped using the **Hang up line** command.

Enabled

When **Enabled** is selected, the ISU 128 Rackmount will accept an incoming call on the primary phone number (SPID1, LDN1). If that call is a BONDING call, then another incoming call will be accepted on the secondary phone number (SPID2, LDN2). If the unit is configured for a call that uses only one B-channel, such as 56 kbps or 64 kbps, then the ISU 128 Rackmount will not accept an incoming call on the secondary phone number (SPID2, LDN2).

Dump all calls

When **Dump all calls** is selected, the ISU 128 Rackmount will not accept any incoming calls. This keeps the line clear for outgoing calls.

Setting Answer Tone

The **Answer tone** option should be set to the default, No Answer tone. This option will be used in future releases of the ISU 128 Rackmount with the V.32 modem option.

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 and echo canceling 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.

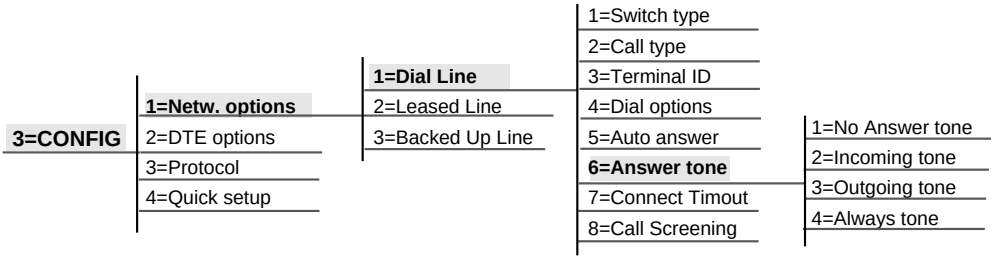


Figure 4-9
Answer Tone Menu

No Answer tone (Default)

This option disables the **Answer tone** on incoming 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 Timeout

Connect Timout sets the length of time that the ISU 128 Rackmount will wait for a far end unit to answer an outgoing call.

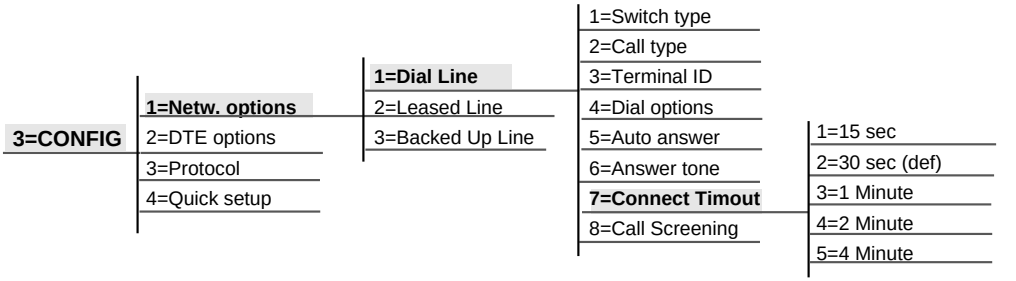


Figure 4-10
Connect Timeout Menu

Setting Call Screening

Call Screening allows the ISU 128 Rackmount 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. Refer to *Front Panel Dialing Options*, for reviewing and storing numbers.

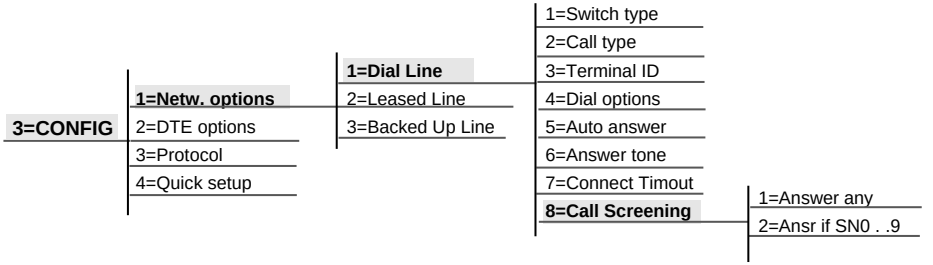


Figure 4-11
Call Screening Menu

When **Call Screening** is set to answer any numbers stored in SN0 through SN9, an incoming call will not be 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 128 Rackmount will display the Call ID for all dumped calls in the Status buffer. Refer to *The Status Buffer* for more information on the Status buffer.

Because different switches handle calls and Call ID differently, you must first find out if your switch uses a seven- or ten-digit Call ID format. Follow the procedure below to determine if you should store a seven- or ten-digit Call ID (phone number).

1. Select **Ansr if SN0. . .9** under **Call Screening**.
2. Store your seven-digit number in SN0.
3. Place a call to the ISU 128 Rackmount with the stored number to see if it answers properly.
4. If the ISU 128 Rackmount does not answer the call, refer to the Status buffer and look at the Call ID message. More than likely, the Call ID number will be a ten-digit number
5. Re-store the number in SN0 as it is displayed in the Call ID message and test **Call Screening** again.

Configuring the ISU 128 Rackmount for Leased Digital Service

This section explains how to configure the ISU 128 Rackmount when using a 2B1Q Leased Digital service or a service that provides a permanent connection between end points.

Follow this step-by-step procedure to configure the ISU 128 Rackmount for Leased Line Clock mode, Channel rate, and DDS loopbacks.

Selecting **Leased Line** configures the unit for leased line service or service that provides a permanent connection between end points such as Limited Distance Modem or LDM service.

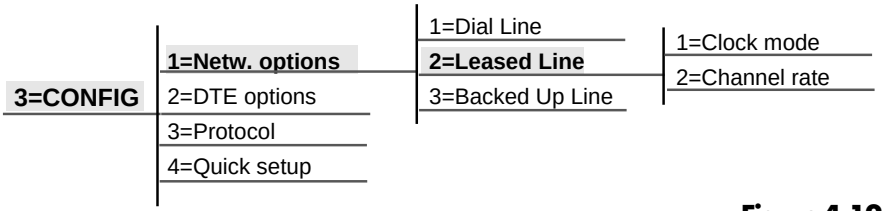


Figure 4-12
Leased Line Menu

NOTE

When this option is selected, the phone line should be connected to the RJ-45 jack marked LEASED on the rear panel of the ISU 128 Rackmount.

Clock mode: Slave/Master

By configuring the ISU 128 Rackmount for **Master** timing, the ISU 128 Rackmount 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 128 Rackmount units are directly connected without the use of channel banks. The far end unit should be configured for **Slave** and it will derive its clocking from the ISU 128 Rackmount configured as **Master** timing. If two ISU 128 Rackmount units are connected through channel banks, both units should be configured for **Slave** mode.

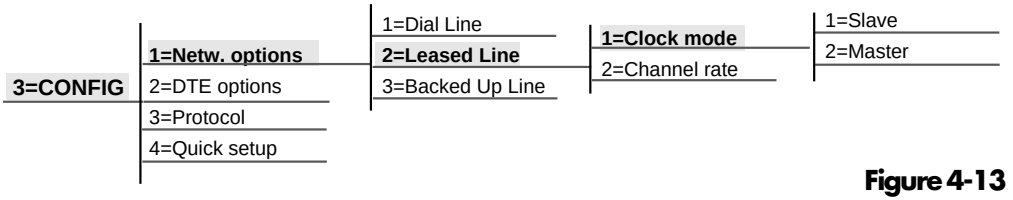


Figure 4-13
Clock Mode Menu

Channel rate

In **Leased Line** operation, the data rate for the ISU 128 Rackmount can be configured for 64 kbps or 128 kbps. When 64 kbps is selected, only one bearer channel (B1) is used. When 128 kbps is selected both bearer channels (B1 and B2) are used.

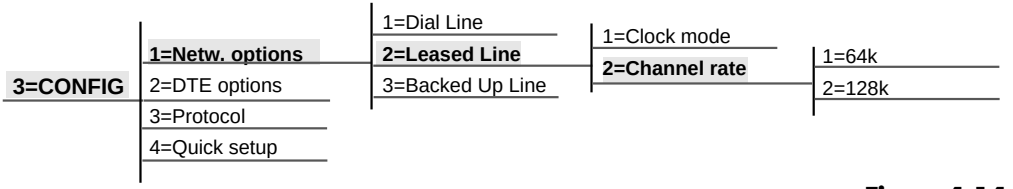


Figure 4-14
Channel Rate Menu

Configuring the ISU 128 Rackmount Using Quick Setup

To configure the DTE Options quickly and easily, the **Quick Setup** menu is available to automatically setup the nine most common DTE configurations. For fine-tuning your particular application and DTE settings, *Setting DTE Options for Asynchronous Operation* and *Setting DTE Options for Synchronous Operation* provide a step-by-step process for detailed configuration of the DTE Options.

Quick setup

To aid the user in configuring the DTE options for the ISU 128 Rackmount, nine common configurations are preset for **Quick Setup**. These include dial operation for 56 kbps, 64 kbps, 112 kbps, 128 kbps, 57.6 kbps, 115.2 kbps service, 128 kbps leased service, and 128 kbps Limited Distance Modem using **Master** clocking.

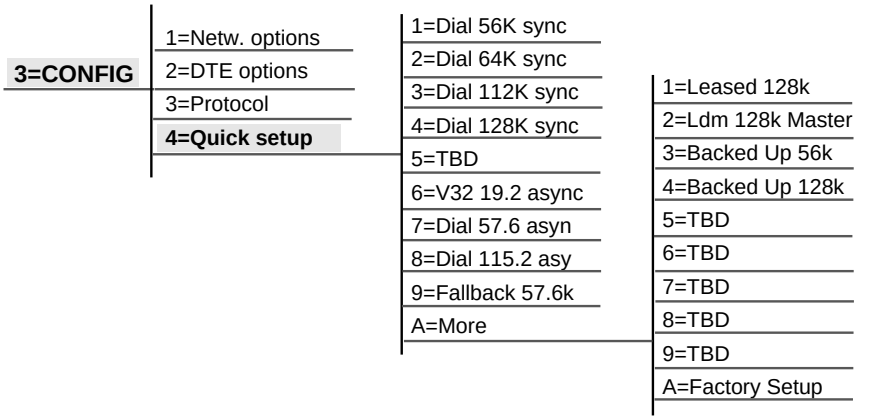


Figure 4-15
Quick Setup Submenus

NOTE

An asterisk (*) indicates a particular option still requires the end user to configure the ISDN Switch Type. Multipoint lines will also require SPID1 and LDN1. Refer to ***Setting the Dial Options.***

Dial 56K sync*

When the ISU 128 Rackmount is configured for **Dial 56K 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 msec delay
CTS line ..... Forced on
Transmit data clock ..... Normal clock source
V.54 Loopbacks ..... Accepted

Dial 64K sync*

When the ISU 128 Rackmount 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 msec delay
CTS line ..... Forced on
Transmit data clock ..... Normal clock source
V.54 Loopbacks ..... Accepted

Dial 112K sync*

When the ISU 128 Rackmount 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 msec 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
V.54 Loopbacks ..... Accepted

Dial 128K sync*

When the ISU 128 Rackmount 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 msec 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
V.54 Loopbacks ..... Accepted

V32 19.2 async*

When the ISU 128 Rackmount is configured for **V.32 19.2 async** the following parameters are automatically preset:

Service type ISDN dial line
ISDN call type ..... Audio
Data Protocol V.32bis
DTE mode ..... Asynchronous
Data Bits 8
Parity Bits ..... None
Stop Bits 1
DTE connector bit rate ..... 19.2 kbps
DTE flow control ..... Hardware
RTS line ..... 1 msec delay
CTS line ..... Follows RTS
Error Control ..... Auto-reliable MNP
Compression ..... Compress MNP5
MNP block size ..... 256 bytes

This option is only used with the ISU 128 Rackmount with V.32bis modem option (PNs 1200029L3 and 1200029L5).

Dial57.6 asyn

When the ISU 128 Rackmount is configured for **Dial57.6 asyn** the following parameters are automatically preset:

Service type ..... ISDN dial line
ISDN call type ..... 64 kbps data
Data Protocol ..... SAP
DTE mode ..... Asynchronous
Data Bits 8
Parity Bits ..... None
Stop Bits 1
DTE connector bit rate ..... 57.6 kbps
DTE flow control ..... None
RTS line ..... 1 msec delay
CTS line ..... Forced on

Dial115.2 asyn*

When the ISU 128 Rackmount is configured for **Dial115.2 asyn** the following parameters are automatically preset:

Service type ..... ISDN dial line
ISDN call type ..... 64 kbps data
Data Protocol ..... BONDING mode 1
DTE mode ..... Asynchronous
Data Bits 8
Parity Bits ..... None
Stop Bits 1
DTE connector bit rate ..... 115.2 kbps
DTE flow control ..... None
RTS line ..... 1 msec delay
CTS line ..... Forced on

Fallback 57.6k*

When the ISU 128 Rackmount is configured for **Fallback 57.6k** the following parameters are automatically preset:

Service type ..... Dial line
Automatic answering ..... yes
ISDN call type ..... 64 kbps data
Data Protocol ..... Fallback
DTE mode ..... Asynchronous
Data Bits 8
Parity Bits ..... None
Stop Bits 1
DTE connector bit rate ..... 57.6 kbps
DTE flow control ..... Hardware
RTS line ..... 1 msec delay
CTS line ..... Follows RTS

More

More takes the user into the following level of choices:

Leased 128K

When the ISU 128 Rackmount is configured for **Leased 128K** service the following parameters are automatically preset:

Service type ..... Leased Line
Network clock source ..... Slave
Channel rate 128K
Data Protocol ..... Clear Channel
DDS loopbacks enabled ..... Yes
DTE mode ..... Synchronous
DTE connector bit rate ..... 128 kbps
DTE flow control ..... none
RTS line ..... 1 msec delay
CTS line ..... Forced on
Transmit data clock ..... Normal clock source

Ldm 128 Master

When the ISU 128 Rackmount is configured for a point-to-point application such as a Limited Distance Modem arrangement, the **Ldm 128 Master** option automatically presets the following parameters:

Service type ..... Leased Line
Network clock source ..... Master
Channel rate 128K
Data Protocol ..... Clear Channel
DDS loopbacks enabled ..... Yes
DTE mode ..... Synchronous
DTE connector bit rate ..... 128 kbps
DTE flow control ..... none
RTS line ..... 1 msec delay
CTS line ..... Forced on
Transmit data clock ..... Normal clock source

Backup 56k*

When the ISU 128 Rackmount is configured for **Backup 56k** service, the following parameters are automatically preset.

Service type ..... Backed up line
Automatic answering ..... yes
ISDN call type ..... 56 kbps data
Channel Rate ..... 64 kbps (when leased)
Data Protocol ..... Clear Channel
DTE mode ..... Synchronous
DTE connector bit rate ..... 56 kbps
DTE flow control ..... none
RTS line ..... 1 msec delay
CTS line ..... Forced on
Transmit data clock ..... Internal clock source
DDS loopbacks enabled ..... yes
V.54 loopbacks enabled ..... yes

Backup 64k*

When the ISU 128 Rackmount is configured for **Backup 64k** service, the following parameters are automatically preset:

Service type ..... Backed up line
Automatic answering ..... yes
ISDN call type ..... 64 kbps data
Channel Rate ..... 64 kbps (when leased)
Data Protocol ..... Clear Channel
DTE mode ..... Synchronous
DTE connector bit rate ..... 64 kbps
DTE flow control ..... none
RTS line ..... 1 msec delay
CTS line ..... Forced on
Transmit data clock ..... Internal clock source
DDS loopbacks enabled ..... yes
V.54 loopbacks enabled ..... yes

Backup 128k

When the ISU 128 Rackmount is configured for **Backup 128k** service, the following parameters are automatically preset.

Service type ..... Backed up line
Automatic answering ..... yes
ISDN call type ..... 64 kbps data
Channel Rate ..... 128 kbps (when leased)
Data Protocol ..... Clear Channel on leased line
BONDING mode 1 when dial line
DTE mode ..... Synchronous
DTE connector bit rate ..... 128 kbps
DTE flow control ..... none
RTS line ..... 1 msec delay
CTS line ..... Forced on
Transmit data clock ..... Internal clock source
DDS loopbacks enabled ..... yes
V.54 loopbacks enabled ..... yes
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 TXID ..... 5 seconds

Factory Setup

This option restores the ISU 128 Rackmount to the factory default setup.

Service type ..... ISDN dial line
ISDN switch type ..... AT&T 5ESS
ISDN call type ..... 64 kbps data
Dialing Mode ..... Front Panel
Data protocol ..... Clear Channel
DTE connector bit rate ..... 64 kbps
DTE flow control ..... none
RTS line ..... Forced on
CTS line ..... Forced on 1 msec after RTS
CD line ..... Turned on when call is up
DSR line ..... Forced on
Transmit data clock ..... Internal 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
AT **Command Escape** character ..... **+**
AT **Command End-of-Line** character value **13**
AT **Command Line Feed** character value **10**
AT **Command Backspace** character value **8**
Transmit Data Clock ..... Normal clock source

Factory default erases all stored phone numbers, SPIDs, and LDNs.

Setting DTE Options for Asynchronous Operation

Follow the step-by-step process below to configure the DTE Options for asynchronous applications.

To select a DTE asynchronous interface, select **Asynchronous** from **DTE options**.

NOTE

Ensure your DTE equipment is set for asynchronous operation before attempting to make an asynchronous call. Failure to do so will cause the call attempt to fail.

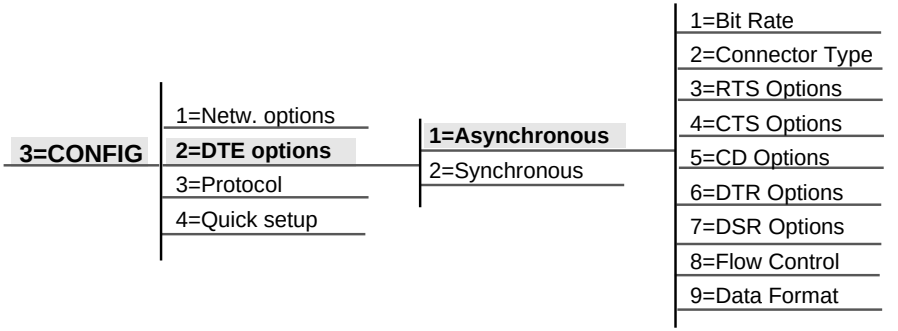


Figure 4-16
DTE Submenus

Bit Rate

The **Bit Rate** can be set asynchronously for 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 bps.

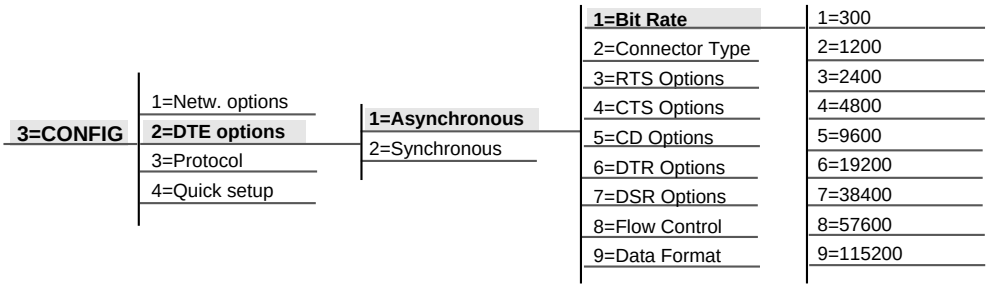


Figure 4-17
DTE, Asynchronous Submenus

Connector Type

The ISU 128 Rackmount can provide either an RS-232, RS-530, or a V.35 interface to a user's DTE by selecting the desired connector type. If using the RS-530A-to-RS232 Adapter, select RS-530.

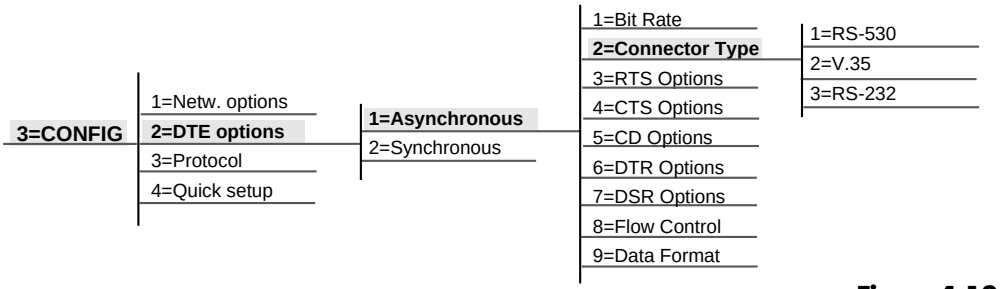


Figure 4-18

DTE Options, Asynchronous, Connector Type Menu

RTS Options

Selecting **1 MS delay** causes the Clear to Send signal to change state 1 millisecond after the DTE is Ready to Send signal changes state. The **18 MS delay** causes the Clear to Send signal to change state 18 milliseconds after the DTE is ready to send signal changes state.

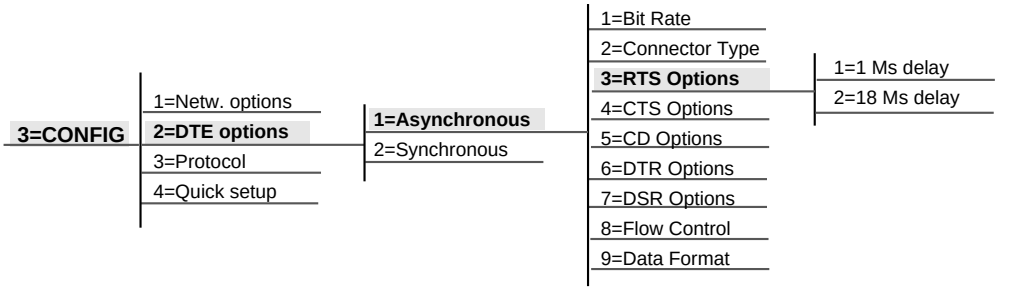


Figure 4-19

DTE Options, Asynchronous, RTS Options Menu

CTS Options

Selecting this option will cause the CTS signal on the DTE connector to be either continually asserted or to follow the state of the RTS lead.

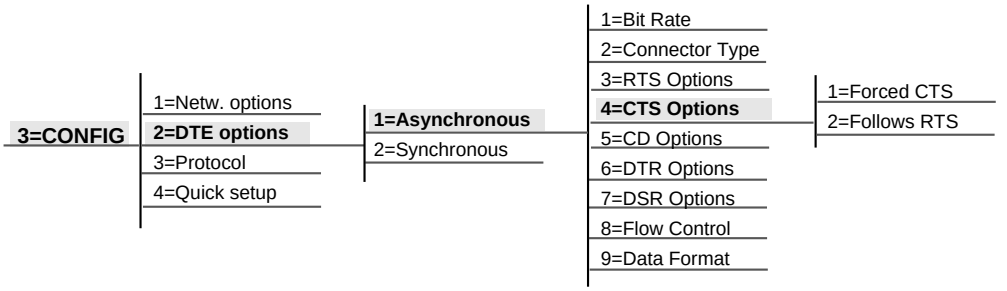


Figure 4-20

DTE Options, Asynchronous, CTS Options Menu

CD Options

Selecting **CD Forced on** causes the carrier detect signal to always be asserted. Selecting **Normal** causes the carrier detect signal to be asserted when a call has been successfully established. Selecting **Off with LOCD** causes the carrier detect signal to be disasserted for a period of 5 seconds, then reasserted at the termination of a call. Selecting **Off with Link Down** causes the carrier detect signal to be disasserted when the U-interface is not present.

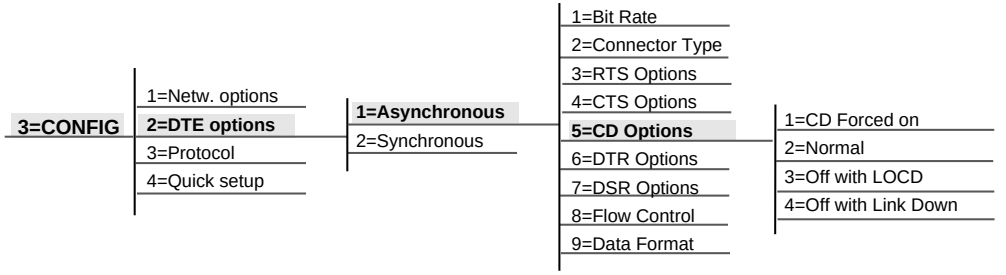


Figure 4-21

DTE Options, Asynchronous, CD Options Menu

DTR Options

Selecting **Ignore DTR** causes the ISU 128 Rackmount to disregard the state of the 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 refer to *Front Panel Dialing Options*. Selecting **Dial #0 if On** allows calls to be automatically established when the DTR signal is in the active state The unit will attempt to establish a call using SN0 until the call is established or DTR goes inactive. Selecting **Answer if On** only allows the unit to answer an incoming call if the DTR signal is asserted.

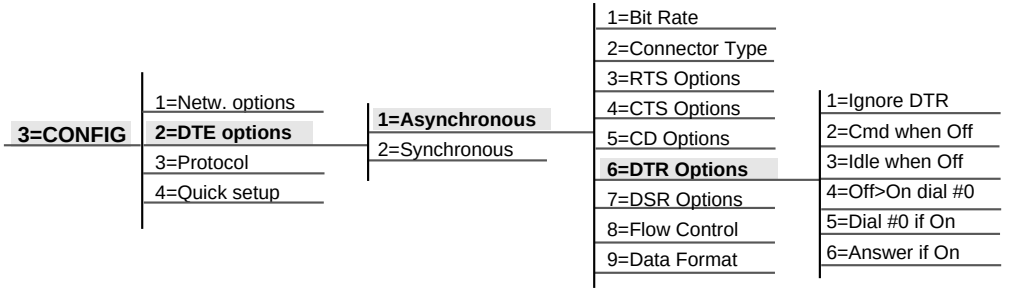


Figure 4-22

DTE Options, Asynchronous, DTR Options Menu

DSR Options

Selecting **DSR forced on** causes the DSR signal on the DTE connector to always be asserted. Selecting **OFF Idle+Test** causes DSR to be disasserted if the network interface is in test or there is not an active all. **OFF Link Down** causes DSR to be disasserted if the network interface is disrupted. **OFF Dial Up** causes the ISU 128 Rackmount when in dial backup mode, to disassert DSR when the leased line changes over to the dial line mode.

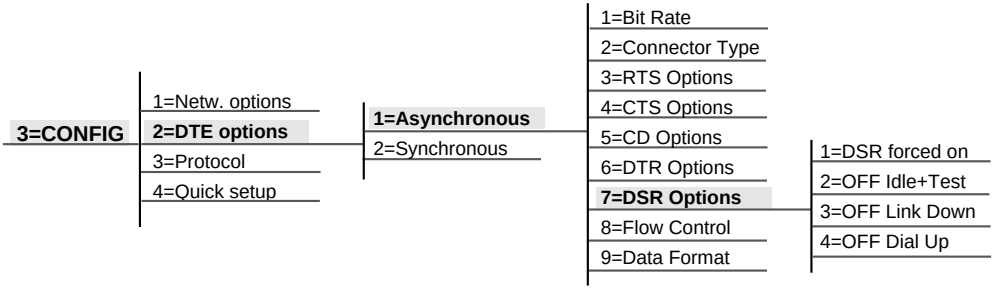


Figure 4-23

DTE Options, Asynchronous, DSR Options Menu

Flow Control

Selecting **Hardware Flow** causes the ISU 128 Rackmount to allow RX data to be presented to the DTE interface only when RTS is asserted. **Software Flow** control uses Xon/Xoff to control data transferred between the DTE and the ISU 128 Rackmount. Selecting **No Flow Ctrl** disables flow control.

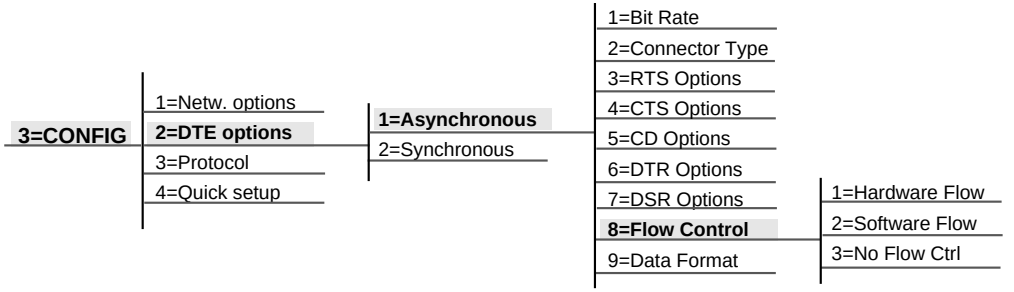


Figure 4-24

DTE Options, Asynchronous, Flow Control Menu

Data Format

The following options allow the user to select the format of the asynchronous data.

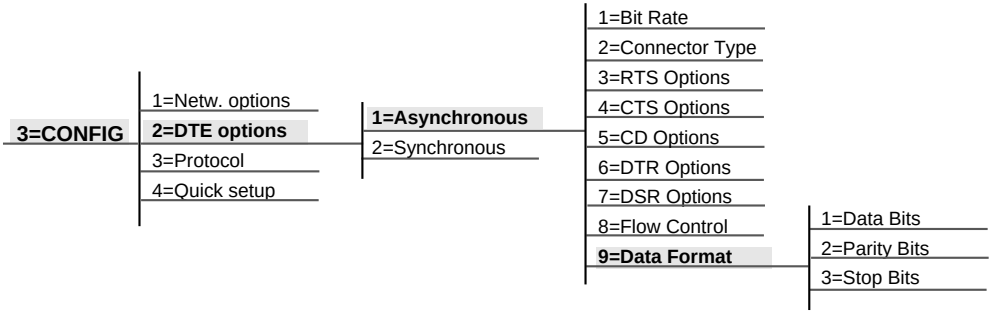


Figure 4-25
DTE Options, Asynchronous, Data Format Menu

Data Bits: These options select the number of data bits in each asynchronous frame. A frame consists of a start bit, 7 or 8 **Data bits**, 0 or 1 **parity bit**, and 1 to 2 **Stop bits**.

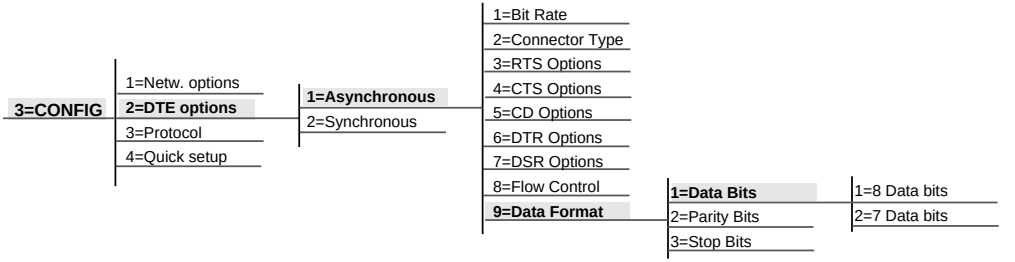


Figure 4-26
DTE Options, Asynchronous, Data Bits Menu

Parity Bits: The **None** option selects no parity bits in each asynchronous frame. A frame consists of a start bit, 7 or 8 data bits and 1 to 2 stop bits. The **Odd** option selects an odd parity bit in each asynchronous frame. The **Even** option selects an even parity bit in each asynchronous frame.

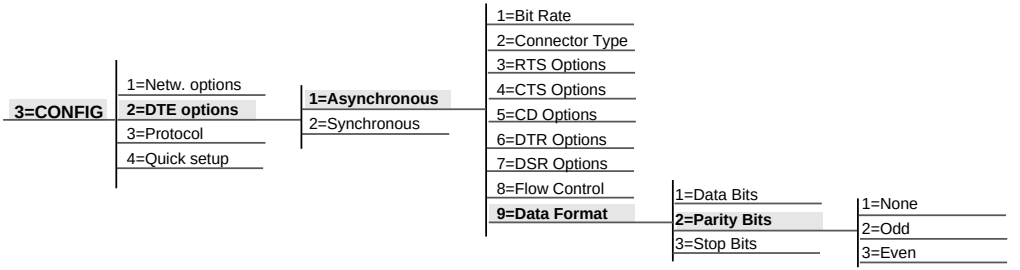


Figure 4-27
DTE Options, Asynchronous, Parity Bits Menu

Stop Bits: These options select the number of **Stop bits** sent in each asynchronous frame. A frame consists of a start bit, 7 or 8 data bits, 0 or 1 parity bits, and 1 to 2 stop bits.

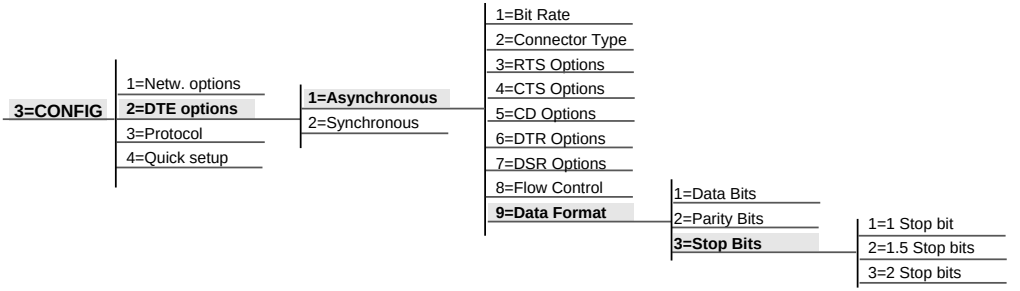


Figure 4-28
DTE Options, Asynchronous, Stop Bits Menu

Setting DTE Options for Synchronous Operation

Follow the step-by-step process below to configure the DTE Options for synchronous applications.

To select a DTE synchronous interface, select **Synchronous** from **DTE Options**.

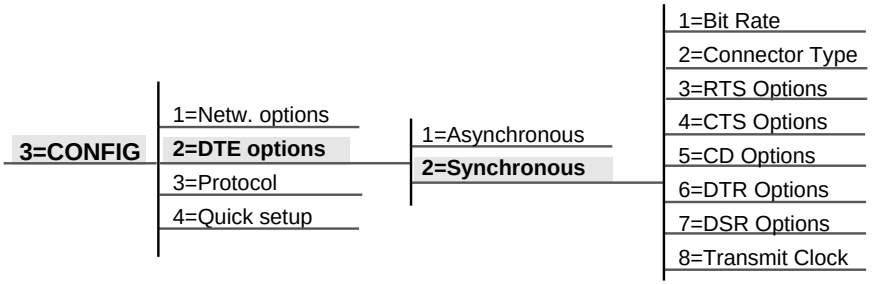


Figure 4-29
DTE Options, Synchronous Menu

Bit Rate

Selecting one of these menu items sets the default DTE bit rate to the indicated rate in bits per second.

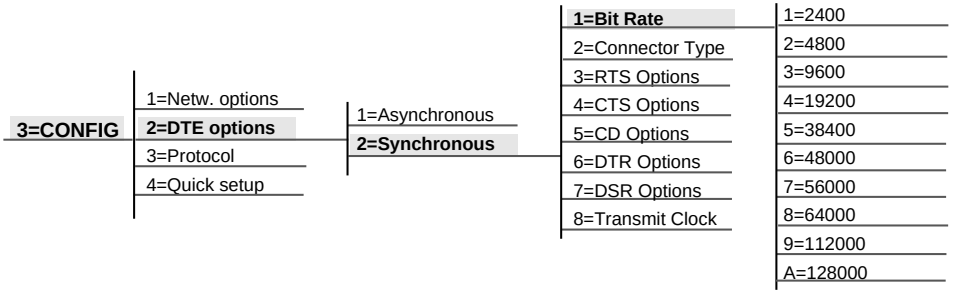


Figure 4-30
DTE Options, Synchronous, Bit Rate Menu

Connector Type

The ISU 128 Rackmount can provide either an RS-530, V.35, or RS-232 interface to a DTE device by selecting the desired connector type. If using the RS-530A-to-RS-232 adapter, select RS-530.

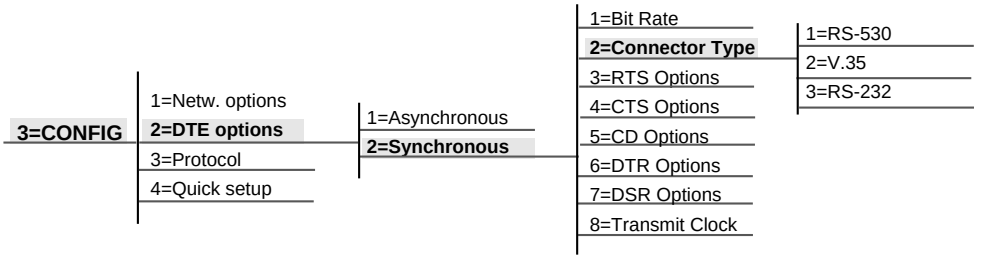


Figure 4-31
DTE Options, Synchronous, Connector Type Menu

RTS Options

Selecting **1 MS delay** causes the Clear-to-Send signal to change state 1 millisecond after the DTE's Ready-to-Send signal changes state. The **18 MS delay** causes the Clear-to-Send signal to change state 18 milliseconds after the DTE is ready to send signal changes state.

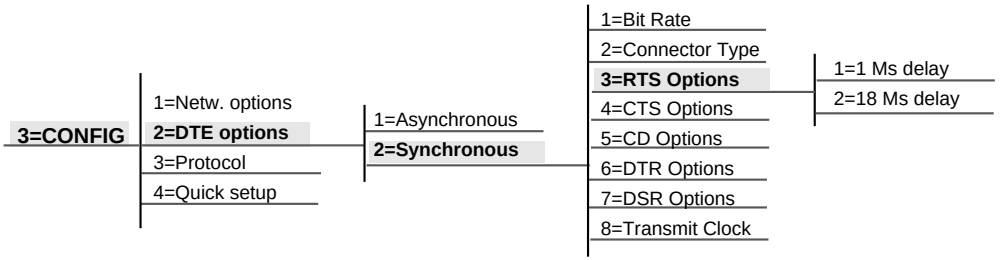


Figure 4-32
DTE Options, Synchronous, RTS Options Menu

CTS Options

Selecting this option will cause the CTS signal on the DTE connector to be either continually asserted or to follow the state of the RTS lead.

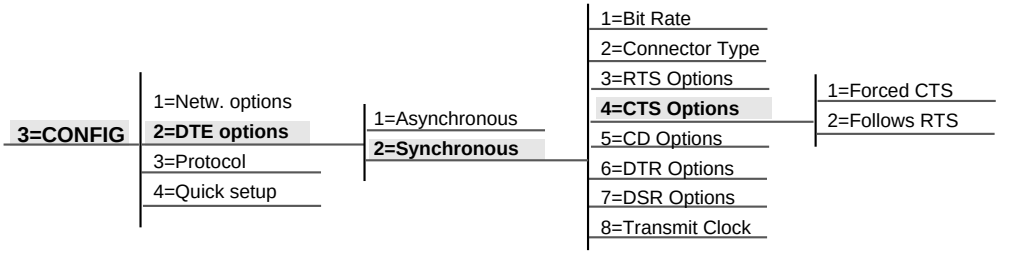


Figure 4-33
DTE Options, Synchronous, CTS Options Menu

CD Options

Selecting **CD Forced on** causes the carrier detect signal to always be asserted. Selecting **Normal** causes the carrier detect signal to be asserted when a call has been successfully established. Selecting **Off with LOCD** causes the carrier detect signal to be disasserted for a period of 5 seconds and then reasserted at the termination of a call. Selecting **Off Link Down** causes the carrier detect signal to be disasserted when the U-interface is not present.

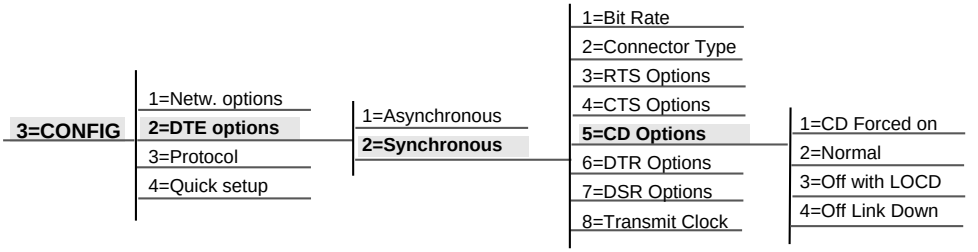


Figure 4-34
DTE Options, Synchronous, CD Options Menu

DTR Options

Selecting **Ignore DTR** causes the ISU 128 Rackmount to disregard the state of the 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.

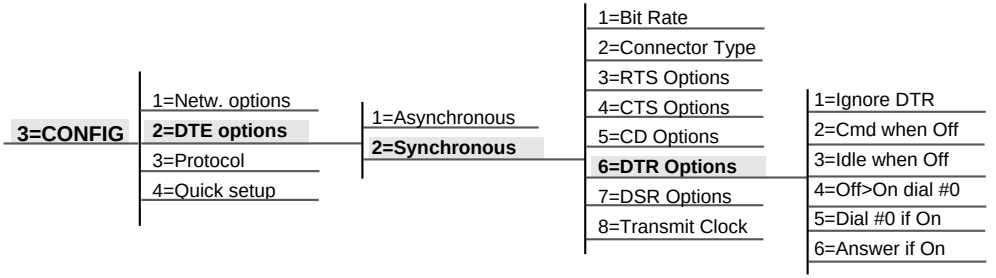


Figure 4-35
DTE Options, Synchronous, DTR Options Menu

To store a number for automatic dialing refer to *Front Panel Dialing Options*. Selecting **Dial #0 if On** allows calls to be automatically established when the DTR signal is in the active state. The unit will attempt to establish a call using SN0 until the call is established or DTR goes inactive. Selecting **Answer if On** allows the unit to answer an incoming call only if the DTR signal is asserted.

DSR Options

Selecting **DSR forced on** causes the DSR signal on the DTE connector to always be asserted. Selecting **OFF Idle + Test** causes DSR to be disasserted if the network interface is in test or there is not an active call. **OFF Link Down** causes DSR to be disasserted if the network interface is disrupted. **OFF Dial Up** causes the ISU 128 Rackmount to disassert DSR when the leased line changes over to the dial line in Backup mode.

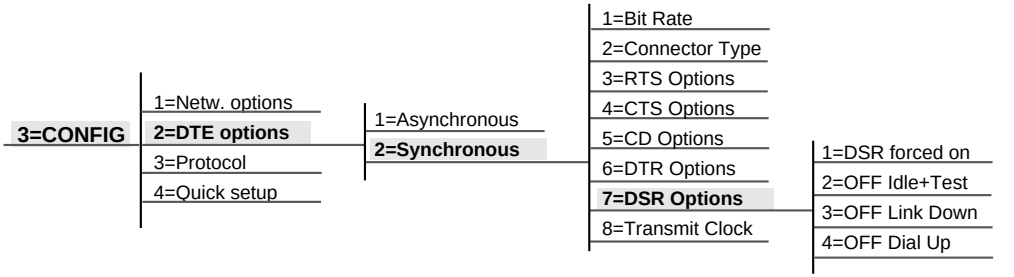


Figure 4-36
DTE Options, Synchronous, DSR Options Menu

Transmit Clock

Selecting the **Normal** option causes the ISU 128 Rackmount to be the synchronous DTE interface transmit timing source. Transmit data is timed from the transmit clock provided by the ISU 128 Rackmount on the DTE connector. **Normal** clock is the normal mode of operation for the ISU 128 Rackmount.

With the **External** option selected, the ISU 128 Rackmount slaves to an external transmit timing source. The external clock is provided to the ISU 128 Rackmount by the external transmit clock signal at the DTE connector. This signal is echoed by the ISU 128 Rackmount to the transmit clock signal on the DTE connector.

This option is provided for situations where equipment connected to the ISU 128 Rackmount DTE connector cannot slave to the ISU 128 Rackmount-provided clock. The ISU 128 Rackmount uses the U-interface as the frequency standard when it must provide a synchronous receive or transmit clock. The externally provided clock must be of the same average frequency as the clock that the ISU 128 Rackmount would provide if internal clock were selected. If this is not the case, then bit errors may occur.

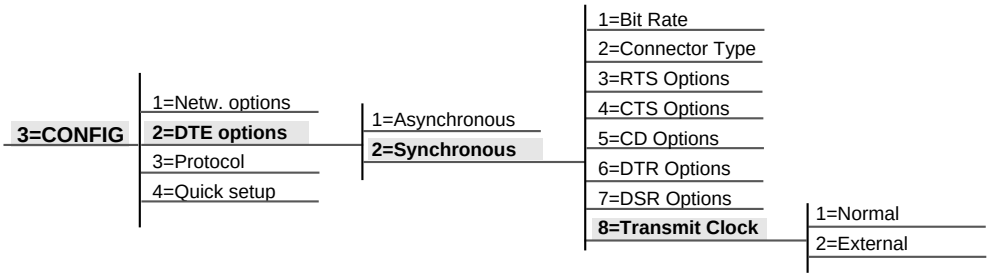


Figure 4-37
DTE Options, Synchronous, Transmit Clock Menu

Setting Protocol Options

The ISU 128 Rackmount communicates with many different types of telecommunication equipment including other ISU 128 Rackmounts, ISDN terminal adapters, Switched 56 DSUs, BONDING mode 1-compatible inverse multiplexers, and V.32bis-compatible analog modems (optional). Communicating between such diverse types of equipment requires the use of various rate adaptation protocols to support various bit rates and DTE settings. The ISU 128 Rackmount supports the following rate adaptation protocols:

- BONDING mode 1 (Bandwidth on Demand Interoperability Group)
- TLINK (Dial DDS DSU/CSU)
- SAP (Simple ADTRAN Protocol)
- Clear Channel (no rate adaption protocol)
- CCITT V.120
- DSU 56.7 Async (for communication with ADTRAN DSUs)
- V.32bis (for communicating with analog modems) (V.32bis is only available in PNs 1200029L3 and 1200029L5)

Refer to *Recommended Operating Protocols* for more information on recommended modes of operation.

The desired protocol may be selected with AT commands at the DTE port or from the ISU 128 Rackmount front panel. A description of protocols follows.

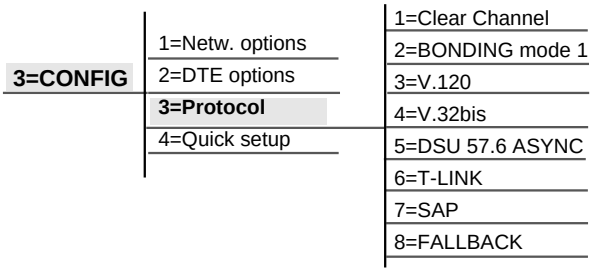


Figure 4-38
Protocol Menu

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 the dial line mode is for 56 kbps and 64 kbps synchronous. It is useful when the DTE performs its own internal synchronous protocol/rate adaptation or the ISU 128 Rackmount 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.

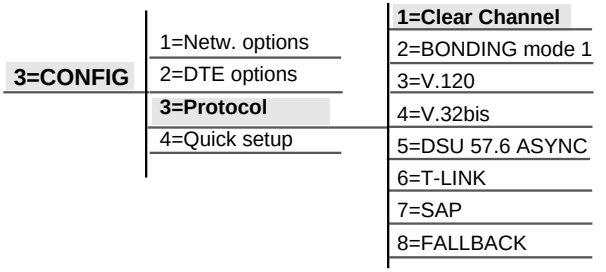


Figure 4-39
Protocol, Clear Channel Menu

BONDING mode 1

The BONDING mode 1 protocol allows the ISU 128 Rackmount to communicate at bit rates in excess of 64 kbps to a maximum of 128 kbps. BONDING provides high-speed communication between ISU 128 Rackmounts, 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 128 Rackmount 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 the BONDING mode 1 protocol. The 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 the BONDING mode 1 submenu.

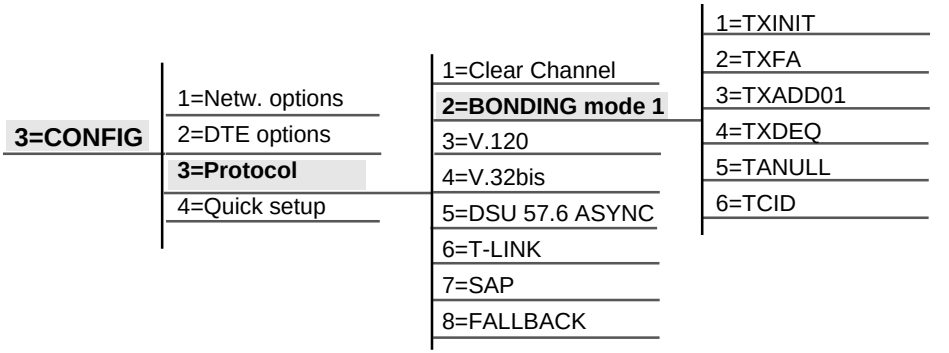


Figure 4-40
BONDING mode 1 Submenu

The timers are defined as follows:

TXINIT
This option specifies the length of time the originating endpoint will attempt to detect the BONDING negotiation pattern from the answering endpoint before deciding the BONDING call has failed. In general, this timer value should be left at the factory default setting of 10 seconds. The user may 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 will attempt to detect the BONDING frame pattern when a call is connected before deciding 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 so that it matches TXADD01. The user may select from values of 1, 2, 5, 10 (default), 20, 50, 100, and 200 seconds.

TXADD01
This option specifies the length of time both endpoints will wait for the additional call to be connected at the end of negotiation before deciding the BONDING call has failed. The factory default setting of 20 seconds will be 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. The user may select from values of 1, 2, 5, 10, 20, 50 (default), 100, and 200 seconds.

TXDEQ

This option specifies the length of time both endpoints will attempt to equalize the network delay between the bearer channels before deciding the BONDING call has failed. This timer default setting is 50 seconds. The user may select from values of 1, 2, 5, 10, 20, 50 (default), 100, and 200 seconds.

TANULL

This option specifies the length of time the answering endpoint will attempt 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. The user may select from values of 1, 2, 5, 10 (default), 20, 50, 100, and 200 seconds.

TCID

This option specifies the length of time both endpoints will attempt to negotiate an agreeable value for bearer channels and channel capacities before deciding the BONDING call has failed. This timer default setting is 5 seconds. The user may 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 adaption method which provides DTE service between the ISU 128 Rackmount and other V.120 compliant devices at rates less than the 64 kbps ISDN Bearer channel rate. V.120 supports synchronous and asynchronous DTE rates. See *Recommended Operating Modes* and Table 1-B for available V.120 rates.

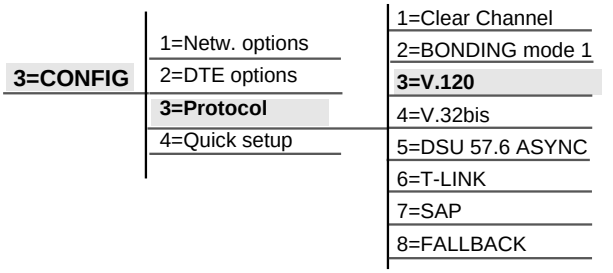


Figure 4-41
Protocol, V.120

V.32bis

The **V.32bis** protocol allows the ISU to make and receive calls to analog modems on POTS lines. The V.32bis modem only supports asynchronous DTE rates. To place an outgoing call to an analog modem, the call type must be changed to **Audio**. Refer to *Setting the Call Type* to change call types. The V.32bis modem operational parameters are defined below.

The ISU 128 Rackmount with optional V.32bis modem (PNs 1200029L3 and 1200029L5) must be used for operation of this protocol.

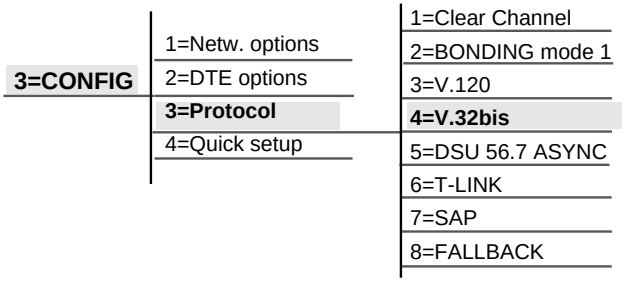


Figure 4-42
Protocol, V.32bis

Error Ctrl

This option sets the type of error control to be negotiated with the far end modem during train up. **Normal** turns all error control off and makes allowances for flow control. **Reliable MNP** uses MNP error control. If the far end does not support MNP then the call is terminated. When **Auto-Rel MNP** is selected, the ISU 128 Rackmount attempts to use MNP error control. If the far end does not use MNP then normal operation is used.

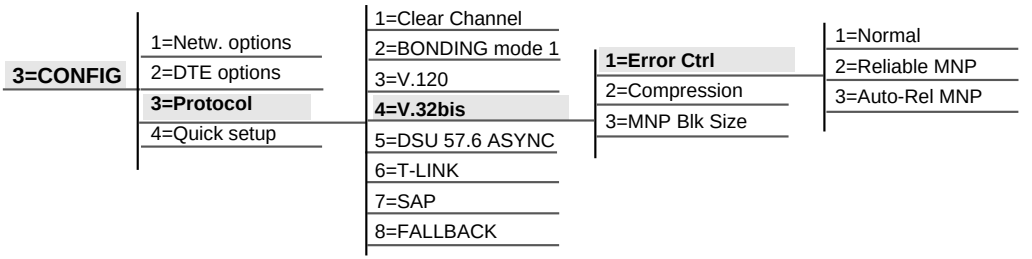


Figure 4-43
Protocol, V.32bis, Error Ctrl Menu

Compression

No Compression turns off the MNP5 compression algorithms in the ISU 128 Rackmount. Compress MNP5 enables the compression.

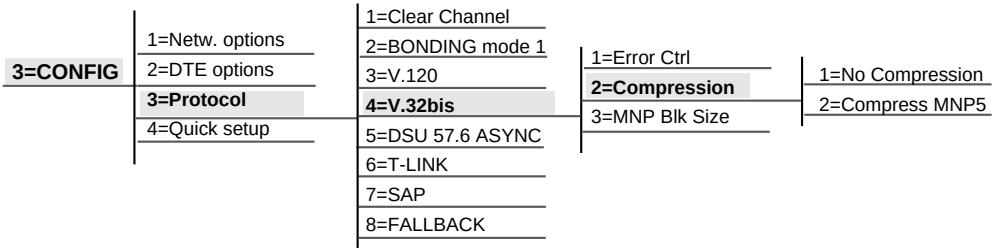


Figure 4-44
Protocol, V.32bis, Compression Menu

MNP Blk Size

When error control is enabled, this option sets the amount of data sent in a single packet during MNP error-controlled stream operation. Options available are 64 and 256 bytes.

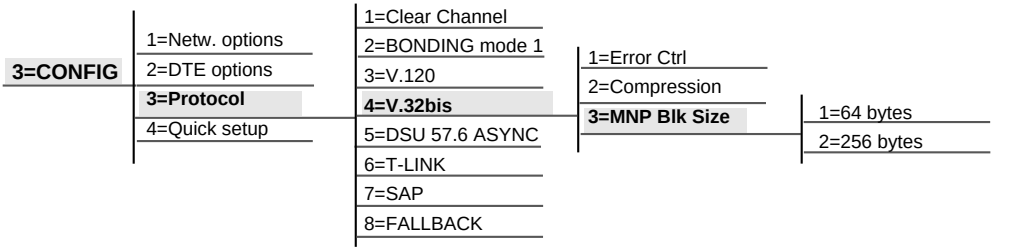


Figure 4-45
Protocol, V.32bis, MNP Blk Size Menu

DSU 57.6 ASYNC

The DSU 57.6 ASYNC protocol allows the ISU 128 Rackmount to communicate asynchronously at 57.6 kbps with ADTRAN 2- and 4-wire Switched 56 DSU products. In addition, the ISU 128 Rackmount communicates with other ISU Rackmounts over dial and leased connections using this protocol.

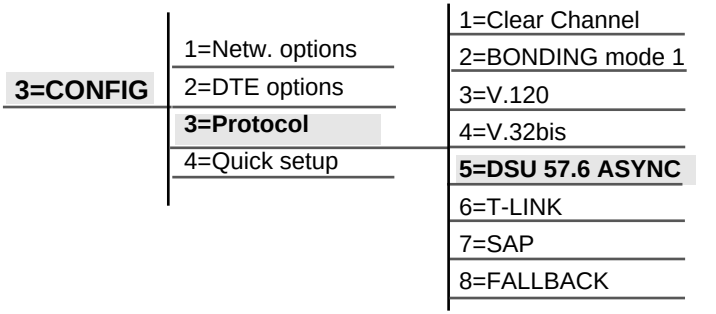


Figure 4-46
Protocol, DSU 57.6 ASYNC Menu

T-Link

The T-Link protocol allows the ISU 128 Rackmount 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 asynchronous and 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 128 Rackmount will communicate with any other device that uses the T-Link protocol.

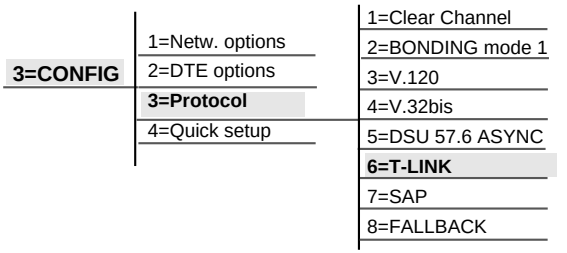


Figure 4-47
Protocol, T-Link Menu

SAP

The Simple ADTRAN Protocol (SAP) is a rate adaption method which provides DTE service between ISU 128 Rackmount units at a lower than the 64 kbps ISDN bearer channel rate. Selecting this menu item causes the ISU 128 Rackmount to use SAP protocol.

The primary usage for SAP is general purpose asynchronous rate adaption in a dial-up or leased environment.

NOTE

SAP only operates on a 64 kbps data link.

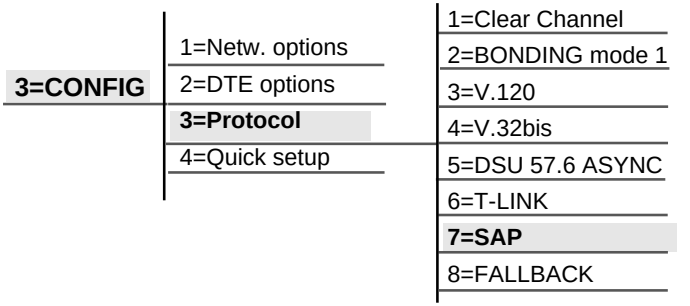


Figure 4-48
Protocol, SAP Menu

FALLBACK

The FALLBACK asynchronous rate adaption protocol provides the capability to automatically establish calls with other ISDN Terminal Adapters, Switched 56 DSUs, V.32bis modems (optional), as well as other ISUs using a single configuration.

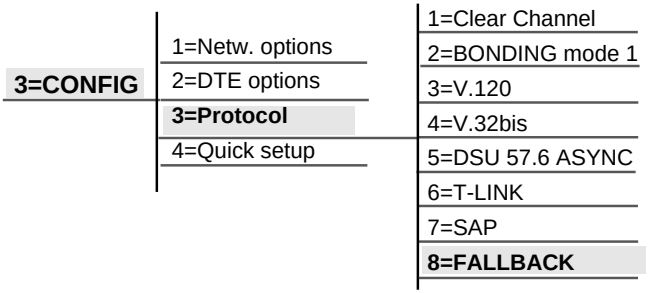


Figure 4-49
Protocol, FALLBACK Menu

To communicate with analog modems, the ISU 128 Rackmount with V.32bis modem option, PN 1200029L3 or 1200029L5 must be used.

The ISU 128 Rackmount must be optioned as follows for FALLBACK operation:

1. Any asynchronous bit rate up to 115.2 kbps which is supported by the DTE.
2. Flow control must be enabled and supported by the DTE.

FALLBACK supports the following protocols based on the Call Type: BONDING Mode 1, V.120, T-Link, and V.32bis.

When answering calls, the ISU 128 Rackmount uses the incoming Call Type to determine which rate adaption protocols to support. See Table 4-A.

Table 4-A
Rate Adaption Protocols

Call Type	Rate Adaption Protocols Supported	Typical Units Supported
Data 64k	BONDING mode 1 V.120	ISUs ISDN TAs
Data 56k	V.120 T-Link	ISDN TAs 2-wire Switched-56 DSUs
Speech or Audio	V.32 bis	V.32bis-compatible modems

When originating calls to unknown units, the ISU begins its protocol selection based on its local Call Type. (Data 64k is used for FALLBACK selected from Quick Setup menu.) Upon connection at 64k Call Type, BONDING and V.120 are attempted. If connection is not made at 64k, the ISU 128 Rackmount attempts another call at 56k Call Type. If connection is made at 56k, V.120 and T-Link are attempted. If connection is not made at 56k, then an AUDIO Call Type is attempted, provided the ISU 128 Rackmount with the V.32bis modem option is used. If the ISU Rackmount connects the AUDIO call Type, the V.32bis protocol is attempted for V.32bis-compatible modems. Once a call connects, if the protocol cannot be negotiated, the ISU Rackmount will hang up the call.

Front Panel Dialing Options

Selecting **4=DIAL** or pressing the # (pound) from the top of the menu tree displays the front panel dialing options available to the user. The dial options are only available when the ISU 128 Rackmount is configured for **Dial Line** operation (not **Leased Line**). The dial options are as follows.

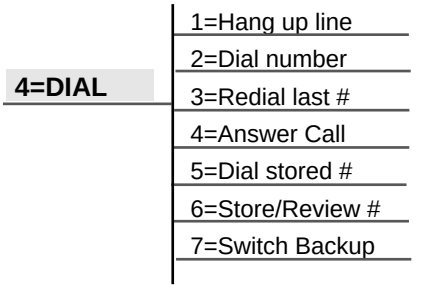


Figure 4-50
Dial Menu

Hang up line

Terminates current call.

Dial number

Allows the user to enter and dial a number from the key pad. If an error is made while entering a number, pressing **Cancel** allows the user to erase the current number and start over. Pressing the **Cancel** key twice consecutively will exit this menu item without dialing a number. Pressing **Enter** after entering a number will cause the ISU 128 Rackmount to dial the number and save the dialed number stored number 9 for redialing purposes.

Redial last

Allows the user to redial the last number called (or attempted). This number was saved as stored number 9 from the last attempted phone call.

Answer Call

Allows the user to selectively answer incoming calls when the Auto Answer is configured for disable (Auto Answer is described in *Setting Auto Answer*.)

Dial stored

Allows the dialing of one of ten stored phone numbers. Upon entering this menu, the **Up** and **Down** arrows permit the user to view/select a stored number. Pressing **Enter** causes the number to be dialed (and also for a copy of that number to be saved as stored number 9 (SN9) for redial purposes).

Store/Review

Permits the user to enter and review stored numbers. Pressing the **Up** and **Down** arrow keys scrolls through the 10 stored numbers (SN0 - SN9). To store a number, the user scrolls to the desired stored number location, enters the number to be stored, and presses **Enter** to save the number. If a mistake is made, pressing **Cancel** clears the line and lets the user try again. Pressing **Cancel** twice in succession exits this menu item without changing the selected stored number.

How to Use AT Commands

When AT commands are selected, the DTE port becomes dual purpose. First, while a call is not established, the port will accept AT commands. During this time, the CD signal will be inactive. Second, when a call is established, the port is used for data. This data mode is indicated by the CD signal active. See Table 4-B for a listing of the supported AT commands and their functions. In addition to the front panel, the ISU 128 Rackmount can be configured and controlled with in-band AT commands from an asynchronous DTE port just as modems are.

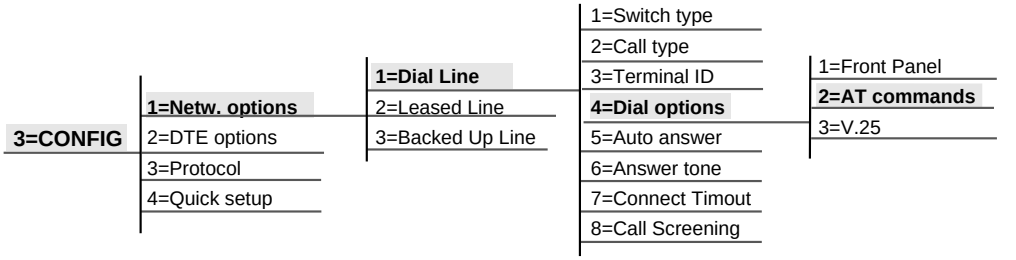


Figure 4-51
Dial Options, AT Commands

To exit the data mode and enter the command mode, the asynchronous DTE device must transmit a proper escape sequence to the ISU 128 Rackmount. A specified time delay must occur between the last data character and the first escape sequence character. This is the guard time delay, and it can be changed by writing a value to the S12 register. The default value for the guard time is one second. For a valid escape sequence to occur, the DTE must transmit the escape code character three times in succession with delay between each character being less than the guard time. The default escape sequence is +++.

Once the command mode is entered, AT commands can be transmitted to the ISU 128 Rackmount to configure most of the options, dial remote DSUs, or initiate tests to check both the ISU 128 Rackmount and the network connections. All command lines must begin with the AT character set in either capital or lower case letters. A command line can be terminated at any time by transmitting the CTRL-X (ASCII 018) after the AT attention code. The ISU 128 Rackmount will ignore this command line and issue an OK response.


NOTE

In Sync mode, without a call present, the AT commands can be changed with a Async terminal set to 9600,8,1,N.

The command line may contain a single command or a series of commands after the AT attention code. When a series of commands is used, the individual commands may be separated with spaces for readability. The maximum length for a command line is 40 characters. Each command line is executed by the ISU 128 Rackmount upon receipt of a terminating character. The default terminating character is a carriage return (ASCII 013), but it can be changed by writing a different value to register S3. Before the terminating character is transmitted, the command line can be edited by using the backspace character (ASCII 008) to erase errors so the proper commands can be entered. To use the ISU 128 Rackmount AT command processor, the unit must be optioned as follows.

To Use an AT Command

Type **AT** followed by the letter of the command and numeric value of the setting desired and then press **Enter**.

Example: ATI1 returns the software version of the unit.

Using the S Registers

The configuration of the ISU 128 Rackmount can be changed or reviewed with S registers. See Appendix A, Current Status Messages, for a description of each S register and its corresponding range of values.

To read an S Register

Type **ATS** followed by the number of the S register to be read followed by a question mark and press **Enter**.

Example: ATS0?

To Read an S Register String

The ISU 128 Rackmount uses S register strings to store strings of digits for stored phone numbers, SPIDs, etc. Type **ATSS** followed by the number of the string S register to be read followed by a question mark and press **Enter**.

Example: ATSS80?

To Change an S Register

Type **ATS** followed by the number of the S register to be changed, an equal sign, the numeric value to be assigned to the register, then press **Enter**.

Example: ATS0=2

To Change a String S Register

Type ATSS followed by the number of the string S register to be changed, an equal sign, the numeric string to be assigned to the register, then press **Enter**.

Example: ATSS80=5551212

Dialing a Call by the AT Command Processor

To dial a call using the DTE terminal and AT commands type **ATD** and the telephone number on one line and press **Enter**.

Example: ATD5551212

When the dialing process begins, the front panel will read **Dialing 5551212**. If the call is successful **Connect** will be displayed on the unit's front panel, followed by the rate adaption protocol in use and the bit rate. If the call is not successful, the front panel will display **Disconnect** followed by **Ready**. At this point the unit is ready for another call. The status buffer can be examined to find the reason for an unsuccessful call.

To end an active call with the AT command processor press the break in key sequence ,+++ or the redefined key, then type **ATH** and press **Enter** to hang up the line.

Table 4-B
AT Commands

Command	Function
A	Answer. Puts the ISU 128 in answer mode.
D	Dial. Precedes the telephone access number [ATD5551212]
E1	Echo off. Does not allow command characters typed to be displayed on the screen.
E0	Echo on. Determines if the command characters typed are displayed on the screen.
H	Hang up. Disconnects the current call.
I0	Identify unit. Commands the unit to display model number.
I1	Identify software. Commands the unit to display software version.
O	On line. Commands the unit to go back on line.
Q0	Response on. Response messages on.
Q1	Response off. Response messages off.
S	S Register
SS	S String register
V0	Numeric. Response message codes.
V1	Verbal. Response message words.
X0	Connect. Connect message displayed when far end answers.
X1	Connect with bit. Connect message with bit rate displayed when far end answers.
Z	Reset. Resets the AT command processor.
&F0...9	Factory. Copy factory configuration to RAM. 0 through 9 correspond to the available predefined setup options found in the quick settings menu.
&N0	Number 1. Read far end phone number 1 if service subscribed from telephone company.
&N1	Number 2. Read far end phone number 2 if service subscribed from telephone company.

Table 4-B
AT Commands (cont.)

Command	Function
&R	Ram. Copy EEPROM configuration to RAM.
&W	Save. Save current configuration to EEPROM.
+++	Break in. Break in AT command processor during an active call. The break in key can be defined in S2.
Carrier Detect (CD) Control Line Options	
&C0	CD forced On
&C1	CD normal
&C2	CD Off with local disconnect (LOCD)
&C3	Off with Link Down
Data Terminal Ready (DTR Control Line Options)	
&D0	Ignore DTR
&D1	Cmd when Off
&D2	Idle when Off, DTR Off forces idle (On allows auto answer)
Generic Unit Configurations	
&F0	Reset all S-registers
&F1	Configures unit for Dial 56K sync
&F2	Configures unit for Dial 64K sync
&F3	Configures unit for Dial 112K sync
&F4	Configures unit for Dial 128K sync
&F5	Configures unit for Leased 128K
&F6	Configures unit for Ldm 128K master
&F7	Configures unit for Dial 57.6k async
&F8	Configures unit for Dial 115.2k async
&F10	Configures unit for Dial V32 19.2 async
&F11	Configures unit for FALLBACK 57.6k async
Network Options	
&L0	DIAL network
&L1	LEASED network
&L2	LEASED, backed up by DIAL network

Table 4-B
AT Commands (cont.)

Command	Function
DTE Data Type Options	
&Q0	DTE is async
&Q1	DTE is sync
Clear-To-Send (CTS) Control Line Options	
&R0	Follows RTS
&R1	Forced CTS
Data Set Ready (DSR) Control Line Options	
&S0	DSR forced On
&S1	DSR if call up Off Idle+Test
&S2	DSR Off if link down
&S3	DSR Off if Dial Up
DTE Connector Data Synchronous Data Clocking Options	
&X0	Internal transmit clock
&X1	External transmit clock
Accessing Stored numbers for Dialing Options*	
&Z0	Stored number 0
&Z1	Stored number 1
&Z2	Stored number 2
&Z3	Stored number 3
&Z4	Stored number 4
&Z5	Stored number 5
&Z6	Stored number 6
&Z7	Stored number 7
&Z8	Stored number 8
&Z9	Stored number 9
	** These presets are invoked by &Z0 thru &Z9 AT commands. They access the stored numbers used for dialing.*

Table 4-B
AT Commands (cont.)

Command	Function
Local Echo Options	
E0	Enable local echo
E1	Disable local echo
AT Command Response Message Options	
Q0	Response messages on
Q1	Response messages off
AT Command Response Message Types	
V0	Response messages codes
V1	Response messages words
At Command Connect Message Options	
X0	Simple connect message
X1-7	Connect messages with bit rate
Ready-To-Send (RTS) Control Line Options	
_D0	1 mS delay
_D1	18 mS delay
Service Profile Identification (SPID) Access Options	
_I1=	Access SPID 1
_I2=	Access SPID 2
Local Directory Number (LDN) Access Options	
_N0=	Access LDN1
_N1=	Access LDN2
ISDN Switch Type Options	
_S0	5ESS
_S1	DMS-100
_S2	National ISDN-1
_S3	NEC

Table 4-B
AT Commands (cont.)

Command	Function
ISDN U-Interface Operational Mode Options	
_X0	ISU timing slaves to network (NT)
_X1	ISU is U-interface timing master (LT)
Data Flow Control Options	
\Q0	No flow control
\Q1	Software
\Q2	CTS only
\Q3	Hardware
\Q4	Software from modem only (requires optional V.32 modem board).
The following AT commands require that the optional V.32 modem board be installed:	
MNP Compression Options	
%C0	MNP no compression
%C1	MNP use compression
MNP Compression Block Size Options	
\A0	MNP 64 byte blocks
\A1	MNP 128 byte blocks
\A2	MNP 192 byte blocks
\A3	MNP 256 byte blocks
MNP Operational Mode Options	
\N0	MNP Normal
\N1	MNP Direct
\N2	MNP Reliable
\N3	MNP Auto-reliable

Configuring the ISU 128 Rackmount for V.25bis In-band Dialing

V.25bis dialing is used primarily by data terminal equipment with synchronous interfaces (HDLC/SDLC or BSC/BISYNC) not supporting the AT command set, which is commonly used by asynchronous devices. The ISU 128 Rackmount supports V.25bis in-band dialing in accordance with Fascicle VIII.I - V.25bis (Malaga-Torremolinos 1984, Melbourne 1988).

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 128 Rackmount supports the following V.25bis 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.25bis accesses stored numbers 1 through 9 used by front panel dialing. See ***Placing a Call from the Front Panel.***

The following configuration for Auto answer should be selected if V.25bis is in control of answering incoming calls with the CIC/DIC commands, since the other setting for Auto answer will override V.25 control of the answer function.

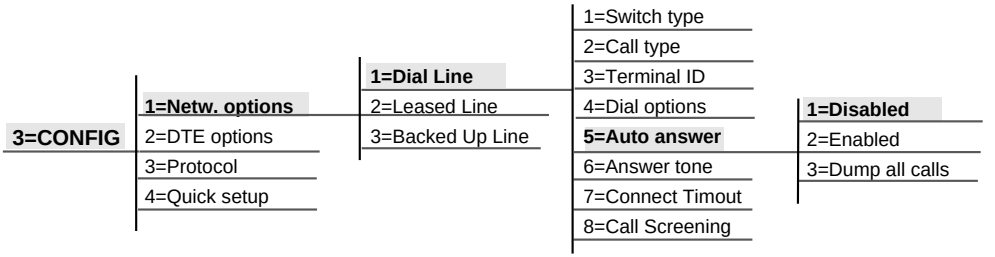


Figure 4-52
Auto Answer Menu

Configuring for ASYNC V.25 Dialing

V.25bis specifies that the characters should be ASCII, 7 bits, even parity and one stop bit. However, for versatility the ISU 128 Rackmount allows the data bits, parity, and stop bits as defined under **Data bits**.

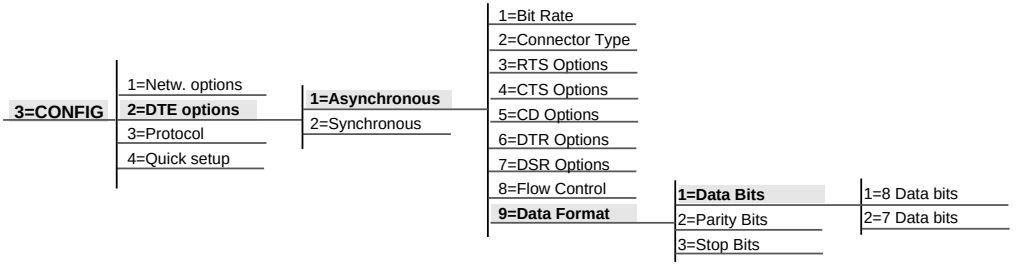


Figure 4-53
Asynchronous, Data Bits Menu

This setting allows for V.25bis messages in asynchronous (start/stop) data format:

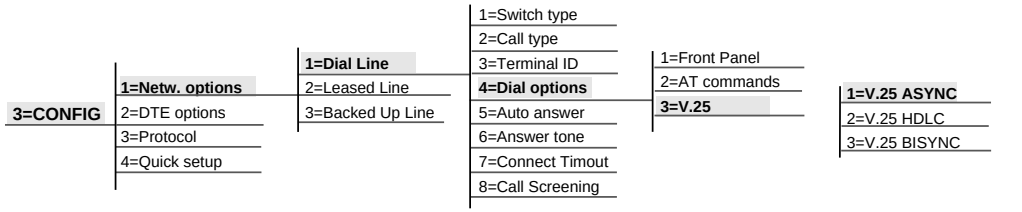


Figure 4-54
Dial Options, V.25 Menu

Configuring for SYNC V.25 HDLC Dialing

Although V.25bis allows asynchronous data format, asynchronous data terminal equipment is more likely to support the AT command set than V.25bis.

This setting provides V.25bis messages in bit-synchronous format (i.e. HDLC, SDLC, X.25). The bit-synchronous format is the most commonly used by V.25bis.

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 will contain all one bits (A = FF HEX), and the second byte of each packet (the C byte) will be either 13 HEX or 03 HEX if not the final packet.

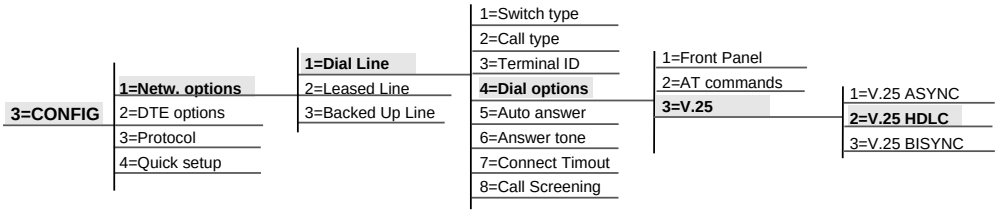


Figure 4-55
Dial Options, V.25 HDLC

Configuring for SYNC V.25 BISYNC Dialing

This setting allows for V.25bis messages in byte synchronous format (BISYNC). V.25bis 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 in-band dialing.

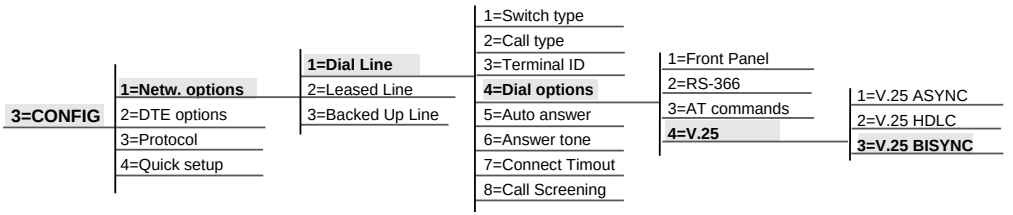


Figure 4-56
Dial Options, V.25 BISYNC

The Status Buffer

Selecting **1=STATUS** from the top of the menu tree displays the contents of the status buffer. The **Up** and **Down** arrows allow the viewing of the last twenty status messages generated during the operation of the unit. (An explanation of Status Buffer Messages can be found in Appendix B, Status Buffer Messages.) Pressing **Cancel** returns you to the top of the menu.

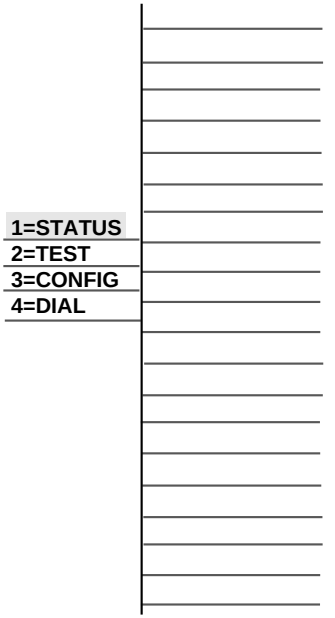


Figure 4-57
Status Buffer

Test Options

Selecting **2=TEST** from the top of the menu tree displays local testing options available to the user. These options are as follows:

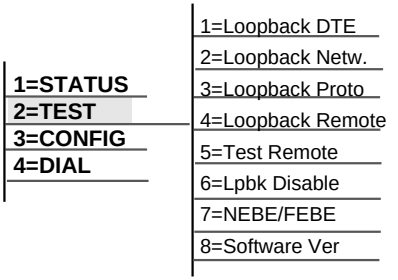


Figure 4-58
Test Menu

Loopback DTE

Causes the DTE port to loopback toward user equipment. This allows the user to perform a Bit Error Rate Test (BERT) between the ISU 128 Rackmount and end user equipment to verify proper cable connection, etc.

Loopback Netw.

Forces the ISU 128 Rackmount to loopback both the B1 and B2 channels toward the network. This can be used to allow a far end user to perform BERT test all the way through network.

Loopback Proto

Allows data to be looped back toward the network after passing through a selected protocol such as T-Link or BONDING. See Figure 4-58 for loopback points.

Loopback Remote

Allows the ISU 128 to issue a V.54 in-band loopback command to a far end unit while still accepting data from the DTE connector. This allows bit error rate testing of an entire link using an external BERT tester. 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. Refer to *Setting Protocol Options* to option the unit for Clear Channel operation. Pressing **Cancel** will end the test.

Test Remote

Allows the ISU 128 to issue a V.54 in-band loopback command to a far end unit and BERT test the link using a built-in 2047 pattern generator/checker. This allows for testing a circuit 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. Refer to *Setting Protocol Options* to option 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 **Cancel** will end the test.

Lpbk Disable

No Remote Loopbacks: The ISU will ignore all V.54 and DDS loopback commands.

NEBE/FEBE

Allows the user to determine the quality of the network connection by viewing the number of Near End Block Errors (NEBE) and Far End Block Errors (FEBE) occurring on the ISDN U-interface. A large count indicates problems with network equipment.

Software Ver

Allows the user to determine the software version in use on the ISU 128 Rackmount.

Pressing **Cancel** will exit any of these options.

Figure 4-59
ISU 128 Rackmount Loopback Points

Chapter 5
Troubleshooting the ADTRAN ISU 128 Rackmount

When the ISU 128 Rackmount powers up, it performs an internal self test. This takes about 10 seconds.

What to do if the ISU 128 Rackmount does not read *Ready*

When the ISU 128 Rackmount has been setup, connected to a line, and the terminal or DATAMATE does not read **Ready** after a few minutes, follow the troubleshooting procedure outlined below. Call ADTRAN Technical Support for assistance, if needed; see the inside back cover of this manual for ph one numbers.

1. Remove the ISU 128 Rackmount from the Smart 16 shelf and reinstall the unit in the same slot. This cycles the power to the unit.

2. Disconnect the ISU 128 Rackmount from the line. From a functioning voice phone, call the local directory number(s) which were provided with your line. Calling a good ISDN line with nothing connected will usually result in a ring or fast busy tone. If someone answers or you get a not-in-service intercept, then there is probably something wrong with the translation of the line. The phone service provider should be able to help.

3. If the ISU 128 Rackmount continues to read **Link Down**, then there is a physical problem with the phone line (more than likely, a problem with the Layer 1 setup). The problem is one or more of the places listed below:
   - The ISU 128 Rackmount software setup
   - The ISU 128 Rackmount hardware itself
   - Your wiring
   - 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 line is plugged into the ISU 128 Rackmount connector marked **DIAL** on the back of the ISU 128 Rackmount.

B. Make sure the ISU 128 Rackmount is configured for Dial Line service. Check that **CONFIG**, **Netw. options, Dial Line**, is selected on the menu.

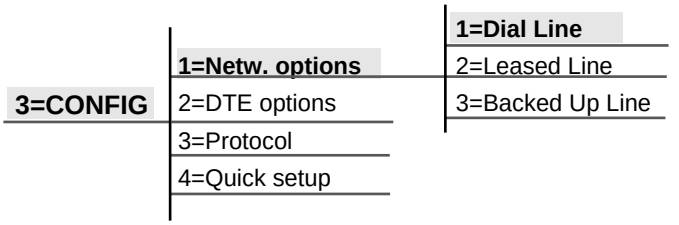


Figure 5-1
Network Options

C. If you have another piece of functioning ISDN equipment with a U-interface, try that on the line.

D. Talk to your 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 your phone line is connected to the actual telephone line (U-interface) provided by your telephone company. Make sure your line is not connected thru another piece of equipment such as an NT1 in a wiring closet somewhere.

F. Make sure nothing else is bridged across the line pair.

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

H. With the ISU 128 Rackmount connected to the 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. Tell them that you have an NT1-like device a the end of the line.

4. If the ISU 128 Rackmount continues to read **Getting TEI #1**, then the ISU 128 Rackmount is physically connected to your local telephone service provider but is unable to establish Logical Layer 2. The problem is in one or more of places listed below:
   - The ISU 128 Rackmount software setup
   - The telephone service provider's software setup
   - Hardware configuration if the line is extended from the switch

To isolate the problem, perform the following procedure:

A. Ensure the ISU 128 Rackmount is setup for the correct switch type by selecting **CONFIG**, **Netw. options, Dial Line**, **Switch type**.

B. Ensure that the quality of your line is satisfactory by checking for Near and Far End Block Errors (NEBEs and FEBEs). To do this, select **Test**, **NEBE/FEBE**. If the counts are non-zero, you may have a physical link problem described under **Link Down (Step 3)**.

C. If you have another piece of functioning ISDN equipment with a U-interface, try that on the line.

D. With the ISU 128 Rackmount connected to the line and powered up, talk to your service provider's repair group and tell them you have an ISDN basic rate line that appears physically OK but has no Terminal Endpoint Identifier (TEI). Ask them to check the line translation and ensure that the line supports *Dynamic* TEI allocation. Tell them that you have an NT1 and Terminal Adapter device connected to the line.

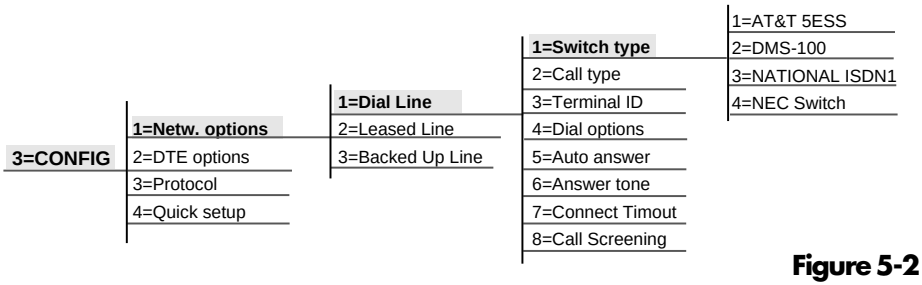


Figure 5-2
Switch Type

5. If the ISU 128 Rackmount continues to read **Register SPID #1**, then the ISU 128 Rackmount is physically connected to your local telephone service provider and has established Logical Layer 2. The ISU 128 Rackmount is unable to establish layer 3. The problem is in one or more of the following places:
   - The ISU 128 Rackmount software setup
   - The telephone service provider's software setup

To isolate the problem, perform the following procedure:

A. Ensure the ISU 128 Rackmount is setup for the correct switch type by selecting **CONFIG**, **Netw. options, Dial Line**, **Switch type**.

B. Make sure the line is multipoint.

C. Make sure that the ISU 128 Rackmount is setup with the correct SPID and LDN by selecting **CONFIG Netw. options, Dial Line**, **Terminal ID**, **SPID/ LDN**.

D. If you have another piece of functioning ISDN equipment with a U-interface, try that on the line.

E. With the ISU 128 Rackmount connected to the line and powered up, talk to your service provider's repair group and tell them you have an ISDN basic rate line that appears physically OK but has no Terminal Endpoint Identifier (TEI). Ask them to check the line translation and ensure that the line supports *Dynamic* TEI allocation. Tell them that you have an NT1 and Terminal Adapter device connected to the line.

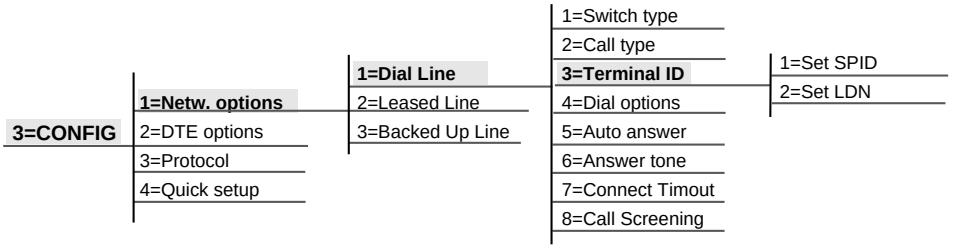


Figure 5-3
Terminal ID

6. If the ISU 128 Rackmount continues to read **Getting TEI #2**, the ISU 128 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 more of the following places:
   - The ISU 128 Rackmount software setup
   - The telephone service provider's software setup

To isolate the problem, perform the following procedure:

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

B. Ensure that the ISU 128 Rackmount is setup with the correct SPID and LDN by selecting **CONFIG**, **Netw. options, Dial Line**, **Terminal ID**, **SPID/ LDN**.

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. If you have another piece of functioning ISDN equipment with a U-interface, try that on the line.

E. With the ISU 128 Rackmount connected to the line and powered up, talk to your service provider's repair group and tell them you have an ISDN basic rate line that appears physically OK but has no Terminal Endpoint Identifier (TEI). Ask them to check the line translation and ensure that the line supports *Dynamic* TEI allocation. Tell them that you have an NT1 and Terminal Adapter device connected to the line.

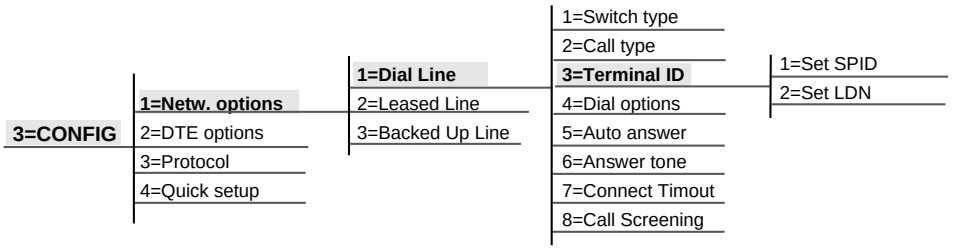


Figure 5-4
Terminal ID

7. If the ISU 128 Rackmount continues to read **Register SPID #2**, the ISU 128 Rackmount 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 128 Rackmount software setup
   - The telephone service provider's software setup.

To isolate the problem, perform the following procedure:

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

B. Ensure that the ISU 128 Rackmount is setup with the correct SPID and LDN by selecting **CONFIG**, **Netw. options, Dial Line**, **Terminal ID**, **SPID/ LDN**.

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. If you have another piece of functioning ISDN equipment with U-interface, try that on the line.

E. With the ISU 128 Rackmount connected to the line and powered up, talk to your service provider's repair group and tell them you have an ISDN basic rate line that appears physically OK but has no Terminal Endpoint Identifier (TEI). Ask them to check the line translation and ensure that the line supports *Dynamic* TEI allocation. Tell them that you have an NT1 and Terminal Adapter device connected to the line.

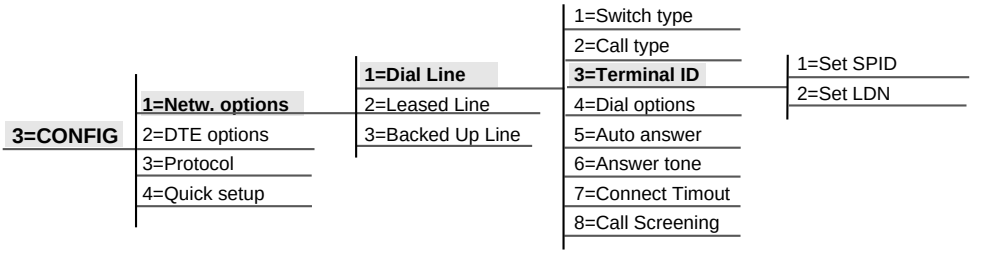


Figure 5-5
Terminal ID

What to do if you can't place calls

Refer to Table 5-A for corrective actions if you cannot place calls.

Table 5-A
Troubleshooting Calls

Condition	Corrective Action
The DATAMATE reads **Ready** but calls can't be placed.	There is most likely a problem in the software setup (translation) at the CO switch, or the network setup in the ISU 128 Rackmount.
Local voice calls can be transmitted, but data calls to the same exchange cannot.	The line is probably not set up to support data calls.
Local data calls go through, but long distance data calls don't.	Ensure the far end is working. If you are not already doing so, place the call explicitly specifying the prefix of the long distance service (i.e., 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 can't.	There is most likely a problem in the software setup (translation) at the CO switch, or the network setup in the ISU 128 Rackmount. 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 128 Rackmount. Check with the local service provider to make sure that the line supports two data calls. Looking at the ISU 128 Rackmount status log buffer will tell you what sequence of events occurred. What you need to know is which piece of equipment first caused the BONDING process to terminate. The status logs from both ends may be necessary to determine this.

Chapter 6
ADTRAN ISU 128 Rackmount Specifications

Table 6-A lists the ADTRAN ISU 128 Rackmount specifications.

Table 6-A
ADTRAN ISU 128 Rackmount Specifications

Network Interface	RJ-45 for ISDN Basic Rate U-Interface, RJ-45 for Leased 2B1Q service
DTE Interface	RS-530A, V.35, or RS-232 on DTE connector card.
Dialing Selections	In-band Dialing: V.25bis, or AT commands. Manual or Automatic Stored Number Dialing
Data Rates	Network: 64 kbps (1 B channel), 128 kbps (2 B channels) DTE: 300 bps to 115.2 kbps asynchronous 2400 bps to 128 kbps synchronous
Rate Adaption	T-Link
Interoperability	Various BONDING mode 1-compatible Inverse Multiplexers, Switched-56 DSUs, ISDN TAs
D Channel Switch Compatibility	AT&T 5ESS, NTI DMS-100, National ISDN-1, NEC
B Channel Aggregation	BONDING mode 1 Protocol
Display	None, available through terminal or Datamate interface
Environmental	Operating Temperature: 0 - 50°C Storage Temperature: 20 - 70°C Relative Humidity: Up to 95%, non-condensing
Physical	Dimensions: 6.75" W x 10.5" L Weight: 3 lbs.
Power	Powered through Smart 16 power supply

Appendix A
Current Status Messages

Table A-A
Current Status Messages

Status Line Message	Definition
Call Connect B1	Bearer channel 1 has been connected and is now active.
Call Connect B2	Bearer channel 1 has been connected and is now active.
DDS Net LOOPBACK	The ISU is performing a DDS latching loopback toward the network.
DISCONNECTING	The current phone call is being disconnected (hung up).
DTE LOOPBACK	The DTE connector is looped back in the DTE direction.
Getting TEI #1	The ISU is getting its first Terminal Endpoint Identifier from the network.
Getting TEI #2	The ISU is getting its second TEI from the network.
Link down	The network interface is not active.
Network LOOPBACK	The ISU has been commanded to perform an ISDN loopback toward the network.
Ready	The unit is ready to make or accept a call.
Register SPID #1	The ISU is registering its first SPID with the network.
Register SPID #2	The ISU is registering its second SPID with the network.

Table A-A
Current Status Messages (ccont.)

Status Line Message	Definition
RINGING	The phone number just dialed is ringing.
xxxx nnnn	A rate adaption is running at the bit rate specified by nnnn.
xxxxx Quitting	A rate adaption protocol is turning off.
xxxxx Ready	A rate adaption protocol is ready.
xxxxx Setup	A rate adaption protocol is setting up.
YYYY	ISDN switch-type selected
xxxxx can be any of the following:	
BONDING	Bandwidth on Demand Industry users Group protocol.
CLEAR CHAN	No rate adaption protocol (allows use of maximum bandwidth).
SAP	Simple ADTRAN Protocol.
TLINK	TLINK rate adaption protocol.
V110	V.110 rate adaption protocol.
V120	V.120 rate adaption protocol.
V32	V.32bis modem board (optionally installed hardware).

Appendix B
Status Buffer Messages

Table B-A
Status Buffer Messages

Message	Meaning
Answer 1/2	The ISU Rackmount answered a call on either the first or second channel. The calling phone number is displayed if available.
Back to online	ISU 128 Rackmount went back on line.
Bad async BPS	The BONDING protocol determined that the selected asynchronous bit rate is not supported.
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 128 Rackmount placed a call with an improper call type.
Bad DTE bps	Bonding negotiation determined that the chosen DTE bit rate is invalid; BONDING mode 1 only allows 56K, 64K, 112K, 128K bit rates.
BAD_INFO_ELEM	Call control error.
Bad phone number	ISU 128 Rackmount attempt to call an invalid phone number.
Bad TLK Version	Invalid TLINK parameters found during end-to-end negotiations.
BaudRate	ISU does not support the negotiated TLINK baud rate.

Table B-A
Status Buffer Messages (cont.)

Message	Meaning
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 128 Rackmount 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 128 Rackmount tried to place a call using SPID 1 though SPID 1 was already in use.
CallID 2 in use.	ISU 128 Rackmount tried to place a call using SPID 2 though 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.
Can't go online	ISU 128 Rackmount cannot go back on line. Unknown AT cmd User issued an unknown AT command.
CHAN_DOES_NOT_EXIST	The user asked for a bearer channel that is not present.
CHAN_NOT_IMPLEMENTED	The bearer channel requested by the user has not been implemented.
CHANNEL_UNACCEPTABLE	The user is asking for a channel that has not been subscribed.
CID>0 rcvd	Received an incoming call from a third party during negotiations with a far end BONDING unit on the use of the second Bearer channel.

Table B-A

Status Buffer Messages (cont.)

Message	Meaning
DEST NOT ISDN	The number called is not ISDN (warning only).
Dial1/2	The called number is out of order.
DEST_OUT_OF_ORDER	The ISU 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.
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 128 Rackmount for V.25bis dialing.
DTR not up	ISU 128 Rackmount 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 128 Rackmount 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_SUBSCRIBED	The channel type requested has not been subscribed by the user.
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. The far end phone number is also displayed.

Table B-A
Status Buffer Messages (cont.)

Message	Meaning
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.
INVALID_CALL_REF	Call control error.
INVALID_ELEM_CONTENTS	Call control error.
INVALID_NUMBER_FORMAT	The dialed number has an invalid format.
L1 not up.	The network interface is not active.
L2 not up.	The data link layer interface is not active.
L3 not up.	The call control interface is not active.
L2 #2 not up.	The data link layer interface for a second call (BONDING) is not active.
L3 #2 not up.	The call control layer interface for a second call (BONDING) is not active.
LDN TOO LONG	The entered Local Directory Number has too many digits.
Need 2 B chan	Trying to run a DTE bit rate that requires the BONDING protocol.
Need 64K call	The BONDING protocol requires the ISU 128 Rackmount to be configured for a 64k data call type.
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 does not support 48 kbps TLINK. DTE Setup Error. Local DTE setup error.
NO_CIRCUIT_AVAILABLE	The requested bearer channel is not available.
No Sreg number	User attempted to access an S register but did not specify a specific S register (example: ATS=1).

Table B-A
Status Buffer Messages (cont.)

Message	Meaning
No Sreg value	User attempted to change an S register but did not specify 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 128 Rackmount (asynchronous rates can only be supported between two ADTRAN ISU 128 Rackmounts).
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 service requested by the user is not available.
SOURCE NOT ISDN	The incoming calling party is not ISDN (warning only).
SReg SetError	Local DTE invalid S-register setting.
Sync BPS < 56K	The synchronous bit rate selected is too slow for the BONDING protocol.
Synch Mismatch	Both ends Bad Sync
TAINIT expired	Bonding timer TAINIT expired.

Table B-A
Status Buffer Messages (cont.)

Message	Meaning
TANULL expired	Bonding timer TANULL expired, non BONDING equipment attempted to call into the ISU 128 Rackmount 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 vendors BONDING equipment did not operate properly.
TXFA2 expired	Bonding timer TXFA1 expired, other vendors BONDING equipment did not operate properly.
TXINIT expired	Bonding timer TXINIT expired, called non-BONDING equipment.
UNASSIGNED_NUMBER	The phone number dialed does not exist.
Unknown AT & cmd	User issued an unknown AT command.
Unsupported baud	The ISU 128 Rackmount does not support the negotiated baud rate.
USER_BUSY	The dialed number is busy.
WRONG_MESSAGE	Call control error.
WRONG_MSG_FOR_STATE	Call control error.

Appendix C
ISU 128 Rackmount, Version 1.0 S-Register List

S0 ..... AUTO ANSWER ..... Determines how the ISU 128 Rackmount answers an incoming call.

0 = Disable (ISU 128 Rackmount does not answer call).
1 = Enable (ISU 128 Rackmount answers all calls).
2 = Dump all calls.

S2 ..... BREAK IN CHARACTER ..... Determines which key or character (in ASCII code) defines the escape command. The standard escape character is a **+** sign (ASCII value of 43 decimal). To change the character set, set S2 to the desired ASCII value.

Range = 0-127

S3 ..... END OF LINE CHARACTER ..... Determines which key or character (in ASCII code) ends a command line. The standard end-of-line character is the carriage return (ASCII value of 13 decimal).

Range = 0-127

S4 ..... LINE FEED CHARACTER ..... Determines which key or character (in ASCII code) advances the cursor to the next line after ending a command line or after an ISU 128 Rackmount message. The standard character is the is the line feed (ASCII value of 10 decimal).

Range = 0-127

S5 ..... BACK SPACE CHARACTER ..... Determines which key moves the cursor back one space to erase a character. The standard character is the backspace (ASCII value of 8 decimal).

Range = 0-127

S7 ..... CONNECT TIME ..... Determines how long the ISU 128 Rackmount will wait for an outgoing call to be answered.

15 = 15 seconds
30 = 30 seconds
60 = 1 minute
120 = 2 minutes
240 = 4 minutes

S12 .... ESCAPE TIME ..... Determines the delay required immediately before and after entering the escape command for the ISU 128 Rackmount to recognize and execute the command.

Range = 0-127

S14 .... MISC BITS ..... Miscellaneous bits (bit 8 is most significant bit) .

Bit 2 = 1: Enables on screen echo of AT commands.
Bit 2 = 0: Disables on screen echo of AT commands.
Bit 3 = 0: Enables AT responses from the ISU 128 Rackmount.
Bit 3 = 1: Disables AT responses from the ISU 128 Rackmount.
Bit 4 = 1: Enables AT responses to be displayed in text form.
Bit 4 = 0: Enables AT responses to be displayed in numeric form.

S22 .... MSG BITS ..... Miscellaneous message bits (bit 8 is most significant bit).

Bit 5 = bit 6 = bit 7 = 1 allows connect message with baud rate.
Bit 5 = bit 6 = bit 7 = 0 connect message without baud rate.

S30 .... DTE CTS ..... Controls the operation of the DTE connector CTS line.

0 = Follows RTS
1 = Force CTS

S31 ..... DTE RTS ..... Controls operation of the RTS line.

0 = 1 ms delay
17 = 18 ms delay

S32 .... DTE DSR ..... Controls the operation of the Data Set Ready signal on the DTE connectors.

0 = Force DSR on always
1 = DSR off OOS + Test
2 = DSR off Link Down
3 = DSR off Dial Up

S33 .... DTE CD ..... Controls the operation of the Carrier Detect line on the DTE connectors.

0 = Force CD on always
1 = CD is active during a call
2 = LOCD

S34 .... DTE DTR ..... Determines how the ISU 128 Rackmount responds to changes in DTR.

0 = Ignore DTR.
1 = Force AT command mode when DTR is off
2 = Dump incoming call when DTR is off
4 = Hangup incoming call when DTR is off
8 = Hangup outgoing call when DTR is off

S35 .... DTE CONN ..... Determines which is the current operating DTE connector.

0 = RS-530 connector
1 = V.35 connector

NOTE

S registers 36 through 38 require that the option V.32 modem board be installed.

S36 .... ERROR CORRECTION ..... Sets the type of error control to be negotiated with the far end modem.

0 = Normal operation no error control. Allows speed matching, buffering, and flow control.
1 = Direct error control, no error control. Does not allow the terminal and ISU 128 Rackmount to operate at different speeds or use flow control.
2 = Reliable MNP error control. If the far end does not use MNP error control then the call is ended.
3 = Auto-reliable MNP error control the ISU 128 Rackmount attempts to use MNP error control. If the far end does not use MNP, then normal operation is used.

S37 .... V32 COMPRESSION ..... Enables compression in the V.32 modem.

0 = No compression
1 = MNP5 compression

S38 .... V32 BLOCK SIZE ..... Sets the amount of data sent in a single packet during MNP error controlled stream operation.

0 = Block size of 64 bytes
1 = Block size of 128 bytes
2 = Block size of 192 bytes
3 = Block size of 255 bytes

S40 .... BONDTXINIT ..... Specifies the number of seconds the originating endpoint will attempt to detect the BONDING negotiation pattern from the answering endpoint before deciding the BONDING call has failed.

0 to 255, 10 sec is default.

S41 .... BONDTXFA ..... Specifies the number of seconds both endpoints will attempt to detect the BONDING frame pattern when a call is connected before deciding the BONDING call has failed. When operating with other manufacturers BONDING equipment it may be necessary to lengthen this timer so that it matches TXADD01.

0 to 255, 10 sec is default.

S42 .... BONDTXADD01 ..... The number of seconds both endpoints will wait for the additional call to be connected at the end of negotiation before deciding the BONDING call has failed. When dialing overseas it may be necessary to lengthen this timer to allow for lower call routing.

0 to 255, 50 sec is default.

S43 .... BONDTXDEQ ..... The number of seconds both endpoints will attempt to equalize the network delay between the bearer channels before deciding the BONDING call has failed.

0 to 255, 50 sec is default.

S44 .... BONDTANULL ..... The number of seconds the answering endpoint will attempt to detect the BONDING negotiation pattern from the originating endpoint before aborting to clear channel mode. It may be necessary to shorten this timer if the DTE equipment connected to the ISU 128 Rackmount also has timer constraints for completing non-BONDING parameter negotiation.

0 to 255, 10 sec is default.

S45 .... BONDTCID ..... The number of seconds both endpoints will attempt to negotiate agreeable values for bearer channels and channel capacities before deciding the BONDING call has failed.

0 to 255, 5 sec is default.

S46 .... V25MODE ..... Selects the type of V.25bis dialing used.

0 = Asynchronous V.25
1 = HDLC V.25
2 = BISYNC V.25

S47 .... RS366TIME ..... Determines the amount of time the RS-366 port will wait for EON or inactivity to terminate a dial string before dialing a number.

0 = Wait for EON only
10 = Wait for 1 second or EON
20 = Wait for 2 seconds or EON
50 = Wait for 5 seconds or EON
100 = Wait for 10 seconds or EON
200 = Wait for 20 seconds or EON

S50 .... LINEMODE ..... Selects the operating mode of the ISU 128 Rackmount.

0 = Dial service (switched service)
1 = Leased service (non-switched service)

S51 .... LINECLOCK ..... Selects the clock mode in leased mode.

0 = Slave (default)
1 = Master (Leased line only, limited distance MODEM application only).

S52 .... SWITCHTYPE ..... Selects the network switch type for dial service.

0 = AT&T 5ESS
1 = Northern Telecom DMS-100
2 = National ISDN-1
3 = NEC

S53 .... CALLTYPE ..... Call type (Dial service only)

0 = Speech
1 = Audio
2 = 56 Kbps data
3 = 64 Kbps data

**S54 .... PROTOCOL TYPE ..... ** Rate adaption protocol type.

1 = Clear Channel (no rate adaption)
2 = BONDING mode 1
3 = SAP (Simple ADTRAN Protocol)
4 = T-link
6 = V.120
7 = V.32
9 = DSU 57.6 kbps asynchronous
11 = FALLBACK

**S55 .... DIAL MODE ..... ** Selects dialing interface.

0 = Front panel only (dialing from front panel is always available)
1 = AT commands
2 = V.25bis dialing

**S56 .... ECHO TONE ..... ** Enables and echo tone which will suppress the echo cancellers in a voice circuit. Can be used to trick the switch to allow sending data over a line optioned for voice ISDN service.

0 = None
1 = Answer
2 = Originate
3 = Both

**S57 ..... DDS TEST ..... ** Allows an ISU 128 Rackmount optioned as a leased line unit to respond to DDS in-band Latching Loopback or V.54 loopback commands.

0 = No checking
1 = Check for DDS Latching Loopbacks
2 = Check for V.54 loopbacks
3 = Check for V.54 and DDS Latching Loopbacks

**S58 ..... CALL SCREENING ..... ** Allows the ISU 128 Rackmount to screen incoming calls.

0 = Answer any call
1 = Answer only calls from numbers matching those stored in SN0 through SN9.

**S59 ..... CHANNEL RATE ..... ** Sets the available network bandwidth when the ISU 128 Rackmount is in leased mode.

3 = 64 kbps
5 = 128 kbps

S60 ... SPID1 LOC ..... Primary SPID string location.

S61 .. SPID2 LOC ..... Secondary SPID string location.

S62 .. LDN1 LOC ..... Primary Local Directory Number string location.

S63 .. LDN2 LOC ..... Secondary Local Directory Number string location.

S70 .... DTE MODE ..... Selects Asynchronous or Synchronous mode on the DTE connector.

0 = Asynchronous
1 = Synchronous

S71 .... DTE RATE ..... Selects the DTE connector bit rate.

1 = 300
3 = 1200
6 = 2400
8 = 4800
11 = 9600
15 = 19200
17 = 38400
18 = 48000
19 = 56000
20 = 57600
21 = 64000
22 = 112000
23 = 115200
24 = 128000

S72 .... DATA BITS ..... Selects the number of asynchronous data bits.

0 = 8 bits
1 = 7 bits

S73 .... DTE PARITY ..... Selects the number of asynchronous parity bits.

0 = None
1 = Odd
2 = Even

S74 .... DTE STOP ..... Selects the number of asynchronous stop bits

0 = 1 stop bit
1 = 1.5 stop bits
2 = 2 stop bits

S75 .... DTE FLOW ..... Selects asynchronous flow control

0 = None
1 = XON/OFF from DTE controls DCE
2 = XON/OFF from DCE controls DTE
3 = Hardware
12 = Software

S76 .... DTE CLOCK ..... Selects DTE connector transmit clock timing source.

0 = Internal (ISU 128 Rackmount supplies timing)
1 = External (DTE supplies timing)

The following are the string locations for stored numbers 0 - 9.

SS80 ... SN0 LOC ..... Stored number 0 string
SS81 ... SN1 LOC ..... Stored number 1 string
SS82 ... SN2 LOC ..... Stored number 2 string
SS83 ... SN3 LOC ..... Stored number 3 string
SS84 ... SN4 LOC ..... Stored number 4 string
SS85 ... SN5 LOC ..... Stored number 5 string
SS86 ... SN6 LOC ..... Stored number 6 string
SS87 ... SN7 LOC ..... Stored number 7 string
SS88 ... SN8 LOC ..... Stored number 8 string
SS89 ... SN9 LOC ..... Stored number 9 string

Appendix D
Connector Pinouts

Table D-A
RS-232 Interface

Pin	Name	I/O	Description
1	Shield	I/O	Shield for cable
2	TD-A	I	Transmitted Data
3	RD-A	O	Received Data
4	RTS-A	I	Request to Send
5	CTS-A	O	Clear To Send
6	DSR-A	O	Data Set Ready
7	SG	I/O	Signal Ground
8	CD-A	O	Carrier Detect
9	NC	N/A	No Connection
10	NC	N/A	No Connection
11	NC	N/A	No Connection
12	NC	N/A	No Connection
13	NC	N/A	No Connection
14	NC	N/A	No Connection
15	TC	O	Transmit Clock
16	NC	N/A	No Connection
17	RC	O	Receive Clock
18	NC	N/A	No Connection
19	NC	N/A	No Connection
20	DTR	I	Data Terminal Ready
21	NC	N/A	No Connection
22	NC	N/A	No Connection
23	NC	N/A	No Connection
24	ETC-A	I	External Transmit Clock
25	NC	N/A	No Connection

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

Table D-B
RS-530A Interface

Pin	Name	I/O	Description
1	Shield	I/O	Shield for cable
2	TD-A	I	Transmitted Data
3	RD-A	O	Received Data
4	RTS-A	I	Ready To Send
5	CTS-A	O	Clear To Send
6	DSR-A	O	Data Set Ready
7	SG	I/O	Signal Ground
8	CD-A	O	Carrier Detect
9	RC-B	O	Receive Clock (return)
10	CD-B	O	Carrier Detect (return)
11	ETC-B	I	External Transmit Clock (return)
12	TC-B	O	Transmit Clock (return)
13	CTS-B	O	Clear To Send (return)
14	TD-B	I	Transmit Data (return)
15	TC-A	O	Transmit Clock
16	RD-B	O	Receive Data (return)
17	RC-A	O	Receive Clock
18	NC	N/A	No Connection
19	RTS-B	I	Ready To Send (return)
20	DTR-A	I	Data Terminal Ready
21	NC	N/A	No Connection
22	DSR-B	O	Data Set Ready (return)
23	DTR-B	I	Data Terminal Ready (return)
24	ETC-A	I	External Transmit Clock
25	NC	N/A	No Connection

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

Table D-C
V.35 Interface

Pin	Name	I/O	Description
A	Shield	I/O	Shield for cable
B	SG	I/O	Signal Ground
C	RTS	I	Ready 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

RJ-45 Dial Line Connector

Pin 4..... Ring
Pin 5..... Tip

RJ-45 Leased Line Connector

Pin 4..... Ring
Pin 5..... Tip

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

Appendix E
Ordering ISDN From Your Telephone Company

This appendix will guide you and your telephone company to specify and obtain your ISDN service requirements.

A general description of requirements from the telephone service providers to support most of the features in the ISU 128 Rackmount follows. Depending on your actual data service requirements, some of the features may be deleted. It may be the case that some features are not available in your area. In addition, features may be deleted for economic reasons depending on your requirements and local tariffs. The first step is to talk to your telephone company to find out which of the following services they provide.

Local Interface Requirements

Physical Interface Requirements

- 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 supporting one of the protocols:

Switch	Protocol
AT&T 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 shall provide the ability to allocate one Dynamic Terminal Endpoint Identifier (TEI) per phone number.

Local Service Requirements

The following bearer capabilities shall be provided:

- 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 shall be supported on the interface. Any mix of the above bearer capabilities and incoming and outgoing shall be supported for both calls.

Service shall be provided inside the LATA for the above bearer capabilities.

Long distance access shall be provided for the above bearer capabilities to and from the long distance providers of choice.

Long Distance Service Requirements

If suitable facilities are available, subscribe to long distance service that supports the above bearer capabilities. If that is not available, request service that supports circuit-switched 64 kbps or 56 kbps access. It is recommended to use the same long distance carrier end-to-end throughout your network.

Deciding What Services to Order

If you are new to ISDN, a good plan is to first get the features listed above. Refer to *ISDN Service Ordering Information* as a basic guide to ordering ISDN service. It will be easier to get running on a full featured line because you will have more options available to you. This also lowers your chances of not running because a particular service is turned off. Later, features not actually used can be deleted.

If all of the above listed features are not available in your area, you will have to compare your actual data service requirements with that which is available. A likely problem is the lack of a clear trunk to provide 64 kbps unrestricted data service. A solution to this might be 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 128 Rackmount 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 128 Rackmount supports the following configurations on 5ESS custom lines:

- Point-to-point with 1 phone number (recommended configuration)
- Multipoint with 1 phone number
- Multipoint with 2 phone numbers

The requirements for the 5ESS point-to-point line are defined in *Local Interface Requirements* and in the table below. Feel free to fax them to your local phone company.

Table E-A
5ESS Features

B1 Service	On-Demand (DMD)
B2 Service	On-Demand (DMD)
Data Line Class	Point-to-point (PP)
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	Any
Terminal Type Data Bearer Channels	Type A

Multipoint lines require the phone company to create a multidigit number called a Service Profile Identifier (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 further complications. However, if a multipoint line is needed, 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 128 Rackmount may not support. Enabling these features may have undesirable consequences. A list of features to avoid are:

- Packet Mode Data
- Multiline Hunt Groups
- Multiple Call Appearances
- 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 128 Rackmount 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 128 Rackmount supports the following configurations on DMS-100 lines:

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

The requirements for the DMS-100 multipoint line are defined in *Local Interface Requirements*, *Local Service Requirements,* and in the table below. Feel free to fax them to your local phone company. The line should have two service profiles with the parameters below to support BONDING.

Table E-B
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 Your Service is Installed

When the line installed, the local phone service provider should provide you with the following information:

- A 7-digit Local Directory Number (LDN) for the line. If the line is multipoint with two phone numbers, then two local directory numbers will be provided.
- If the line is multipoint then you will get a multidigit number called a Service Profile Identifier (SPID) for each local directory number.
- Dialing information which includes the area code for the line. It should also include any special instructions for dialing outside lines, dialing 4-digit local extension numbers, and prefixes for using the desired long distance providers.

To setup the ISU 128 Rackmount for a new line

1. Disconnect the phone line from the ISU 128 Rackmount.
2. Power up the ISU 128 Rackmount, verify that it passes self test.
3. Reset the ISU 128 Rackmount to a known basic factory default by selecting **CONFIG**, **Quick Setup**, **Factory Setup**.

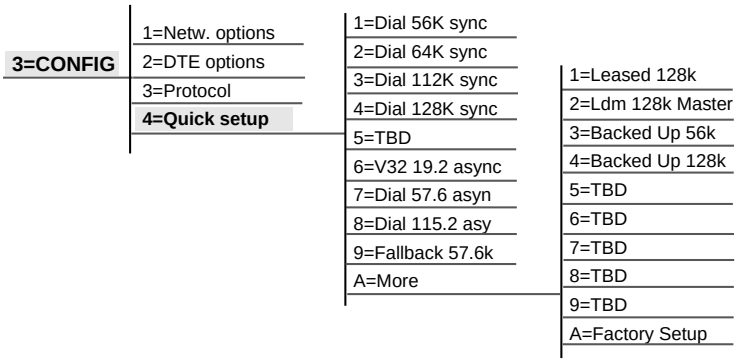


Figure E-1
Quick Setup Menu

4. The ISU 128 Rackmount is now setup for 5ESS Custom. If this is not the line-type you have then select **CONFIG**, **Netw. Options**, **Dial Line**, **Switch Type**, and the desired switch type.

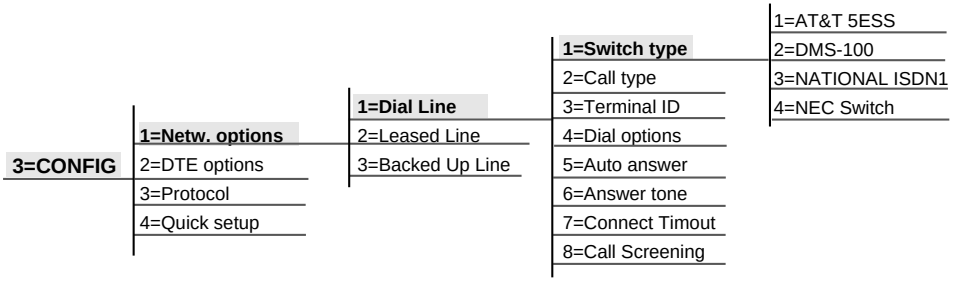


Figure E-2
Switch Type Menu

5. The ISU 128 Rackmount is now setup for a point to point line. If this is not the line-type you have, then select **CONFIG Netw. Options**, **Dial Line**, **Terminal ID**, **Set SPID/Set LDN** and enter the SPIDs and LDNs. If you have one SPID and LDN put them in SPID1 and LDN1. If you have two of each then make sure that SPID1 corresponds to LDN1 and SPID2 corresponds to LDN2.

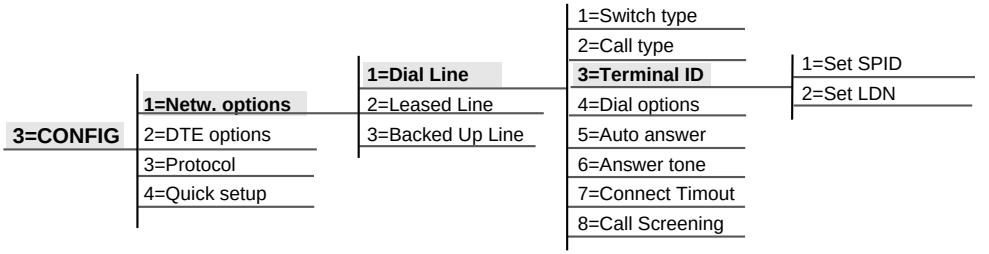


Figure E-3
Terminal ID Menu

6. Power the ISU 128 Rackmount off and then back on. This is required after changing any of the above settings. The ISU 128 Rackmount should now be setup for the line you have. You may wish to verify the settings.

7. Connect the phone line to the dial connector on the ISU 128 Rackmount. Watch the ISU 128 Rackmount front panel top level menu. The status line should start at **Link Down** and progress to **Ready** as the ISU 128 Rackmount and switch cooperate to bring the line up. This process may take a minute.

At this point, if the ISU 128 Rackmount does not read **Ready**, refer to the troubleshooting procedure entitled *What to do if the ISU 128 Rackmount Does Not Read Ready.*

Acronyms

ACD ..... Automatic Call Distribution
AMA ..... Automatic Message Accounting
AMI ..... Alternate Mark Inversion
ANI ..... Automatic Number Identification
ANSI ..... American National Standards Institute
B (Channel) ..... A 64 kbps digital information channel
BONDING ..... Bandwidth On Demand Interoperability Group
bps ..... Bits per second
BRI ..... Basic Rate Interface
CA ..... Call Appearance
CAS ..... Channel Associated Signalling
CCITT ..... Consultative Committee for International Telegraphy and Telephony
CCS ..... Common Channel Signalling
CD ..... Carrier Detect
CIC ..... Carrier Identification Code
CLID ..... Calling Line Identification
CMD ..... Circuit-Mode-Data
CMOS ..... Complimentary Metal-Oxide Semiconductor
CND ..... Calling Number Delivery
CPE ..... Customer Premises Equipment
CPU ..... Central Processing Unit
CR ..... Call Reference
CRC4 ..... Cyclic Redundancy Check 4
CTS ..... Clear to Send

DCE ..... Data Communications Equipment
DMA ..... Direct Memory Access
DMS ..... Digital Multiplex Switching
DN ..... Directory Number
DNIC ..... Data Network Identification Code
DSP ..... Display Station Protocol
DSR ..... Data Set Ready
DTE ..... Data Terminal Equipment
EIA ..... Electronic Industries Association
EID ..... Endpoint Identifier
EKTS ..... Electronic Key Telephone Service
ES ..... Errored Seconds
ESS ..... Electronic Switching System
ETSI ..... European Telecommunications Standards Institute
FAX ..... Facsimile
FEBE ..... Far End Block Errors
FTP ..... File Transfer Protocol
FX ..... Foreign Exchange
HDB3 ..... High Density Bipolar of order 3
HLC ..... High Layer Compatibility
ID ..... Identification
I/O ..... Input/Output
I^2L ..... Integrated Injected Logic
IEC ..... Inter-Exchange Carrier
IMUX ..... Inverse Multiplexer
INIC ..... ISDN Network Identification Code
IOF ..... Inter Office Facility
ISDN ..... Integrated Services Digital Network
ISO ..... International Standardization Organization
kbps ..... Kilobits per second
kHz ..... Kilohertz
LAN ..... Local Area Network
LATA ..... Local Access and Transport Area
LEC ..... Local Exchange Carrier

LLC ..... Logical Link Control (LAN)
LLC ..... Low Layer Compatibility (ISDN)
Mbps ..... Megabits per second
MF ..... Multi-Frequency Signalling
MLHG ..... Multiline Hunt Group
MOS ..... Metal-Oxide Semiconductor
MTBF ..... Mean Time Between Failure
NEBE ..... Near End Block Errors
NI-1 ..... National ISDN-1
NI-2 ..... National ISDN-2
NIST ..... National Institute of Science and Technology
NIUF ..... North American ISDN Users' Forum
NT ..... Network Termination
OSI ..... Open Systems Interconnection
PBX ..... Private Branch Exchange
PC ..... Personal Computer
PHF ..... Packet Handling Function
PMD ..... Packet-Mode Data
PPSN ..... Public Packet Switched Network
PRI ..... Primary Rate Interface
PSTN ..... Public Switched Telephone Network
PVC ..... Permanent Virtual Circuit
RAM ..... Random Access Memory
ROM ..... Read Only Memory
SPCS ..... Stored Program Controlled Switching System
SPID ..... Service Profile Identifier
SS7 ..... Signalling System 7
TA ..... Terminal Adapter
TE ..... Terminal Equipment
TEI ..... Terminal Endpoint Identifier
TTL ..... Transistor-Transistor Logic
UART ..... Universal Asynchronous Receiver
UAS ..... Unavailable Seconds
USART ..... Universal Synchronous or Asynchronous Receiver
WAN ..... Wide Area Network

Glossary

A and B signalling

Procedure used in most T1 transmission facilities currently operated by telephone companies, where one bit *robbed* from each of the 24 subchannels in every sixth frame, is used for carrying dial and control information. A type of in-band signalling used in T1 transmission.

Accunet

Data-oriented digital services from AT&T Communications, including Accunet T1.5, terrestrial wideband at 1.544 Mbps (formerly called T1). Accunet Reserved T1.5 satellite based channels at 1.544 Mbps primarily for video teleconferencing applications. Accunet Packet Services, packet switching services. Accunet Dataphone Digital Service (DDS) private line digital circuits at 2.4, 4.8, 9.6, and 56 kbps.

Accupulse

BellSouth trademark name for Switched-56 services.

A/D

Analog-to-Digital conversion.

adaptive interframe transform coding

A class of compression algorithms commonly used in video codecs to reduce the data transmission rate.

analog transmission

A way of sending voice, video, and data signals in which the transmitted signal is *analogous* to the original signal. For example, if you spoke into a microphone and saw your voice on an oscilloscope, then took the same voice as it was transmitted on the phone line and threw that signal onto the oscilloscope, the two signals would look essentially the same, the only difference being that the electrically transmitted signal would be at a higher frequency.

ANSI

American National Standards Institute.

ASCII

American National Standard Code for Information Interchange. The standard and predominant 7-bit (8-bit with parity) character code used for data communications and data processing.

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.

attenuation

The loss of volume during transmission. The received signal is lower in volume than the transmitted signal due to losses in the transmission medium (resistance in the cable). Attenuation is measured in decibels. The opposite of Gain. Some electrical components are listed as with attenuation which means they will compensate for irregular electrical supply (surges).

B-Channel

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

back-haul

Routing of a call that appears to take an illogical path through a network. Also, a link between a Central Office and a main microwave of multiplex station.

back to back channel bank

The connection of voice frequency and signalling leads between channel banks to allow dropping (removing) and inserting (adding) of channels.

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.

bipolar

The predominant signalling method used for digital transmission services, such as DDS and T1. In this method the signal carrying the binary value successively alternates between positive and negative. Zero and one values are presented by the signal amplitude at either polarity, which no-value spaces are at zero amplitude.

bipolar violation

The presence of two consecutive 1 bits of the same polarity on the T-carrier line.

bit

A binary digit. The representation of a signal, wave, or state as either a binary 0 or 1.

bit robbing

The use of the least significant bit per channel in every sixth frame for signalling.

bits per second

The number of bits passing a specific point per second. A Kilobit is one thousand bits per second, Megabit one million bits per second (thousands of kilos), Gigabit one billion bits per second (thousands of millions), and Terabit one trillion bits per second (thousands of billions).

bit stuffing

Process, in bit-oriented data communications protocols, where (i.e.,) a string of 1 bits is broken by an inserted 0, added by the sender and removed by the receiver. Adding of 0 bits is done to prevent user data containing a series of 1 bits from being interpreted as a flag control character.

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).

bridged tap

Any section of a cable pair that is not on the direct electrical path between the Central Office and user premises that introduces unwanted impedance and unbalance.

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.

broadband

A transmission facility that has a bandwidth (capacity) greater than a voice grade line of 4 kHz. It may carry numerous voice, video, and data channels simultaneously. Each channel will take up a different frequency on the cable. Guardbands (empty spaces) will exist between the channels to ensure each channel does not interfere with its neighbor. A coaxial CATV cable is the classic broadband channel. Simultaneously it carries many TV channels.

byte

Generally, an 8-bit quantity of information, used mainly in referring to parallel data transfer, semiconductor capacity, and data storage. Also, generally referred to in data communications as an octet or character.

call reference

Information element that identifies to which call a Layer 3 message pertains.

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 phone company switching facility or center, usually a Class 5 end office, at which subscribers local loops terminate. Handles a specific geographic area, identified by the first three digits of the local telephone number. Usually the facilities of the local BOC. See Class X Office.

channel bank

Equipment in a telephone Central Office that performs multiplexing of lower speed digital channels into a higher speed composite channel. The channel bank also detects and transmits signalling information for each channel, transmitting framing information so that time slots allocated to each channel can be identified by the receiver.

channel identification

Information element that requests or identifies the channel to be used for a call.

circuit mode

Type of switching that causes a one-to-one correspondence between a call and a circuit. That is, a circuit or path is assigned for a call between each switching node, and the circuit or path is not shared with other calls.

class X office

Designation of a phone company switching facility in the telephone hierarchy, where Class 5 is an end office, Class 4 a toll center, Class 3 a primary center, Class 2 a sectional center, and Class 1 a regional center.

clear channel

A channel in which all the 64 kbps are used for transmission. To achieve this bit robbing signalling must be eliminated.

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.

conditioning

Extra cost options that users may apply to leased or dedicated voice grade 3002-type Telco data circuits, where line impedance is carefully balanced. Allows for higher-quality or speed data transmission. Allows improved line performance in frequency response and delay distortion.

CPE

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

crosstalk

Unwanted transference of electrical energy from one transmission medium to another medium (usually adjacent). General in, but not restricted to, the voice grade frequency range and typical of unshielded twisted pair wires in telephony and more recently, data applications.

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 Central Office. Also ensures proper 1s density in transmitted bit stream and performs bipolar violation correction. See DSU.

DACS

Digital Access and Cross-Connect System. New generation of AT&T manufactured Central Office switching equipment. Allows a T1 carrier facility or any of the subchannels (nominally at 64 kbps) to be switched or cross-connected to another T1 carrier. Originally designed to allow access to individual T1 channels for diagnostics, the equipment is expected to support switched digital services at up to T1 rates.

dB

Decibel. Signal strength unit of measure. Usually the relation between a transmitted signal and a standard signal source. Therefore, 6 dB of loss would mean that there is 6 dB difference between what arrives down a communications circuit, and what was transmitted by a standard signal generator.

D-channel

The ISDN channel that carriers 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.

De-Marc or De-Mark

The demarcation point between local telephone company wiring and CPE wiring. A De-Marc could be an RJ-11C jack (one trunk), an RJ-14C (two trunks), an RJ-21X (up to 25 trunks), or a 66-block.

demarcation strip

The terminal strip or block (typically 66-block) which is the physical interface between phone company lines and line going directly to CPE.

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.

digital hub

Designated office where DDS channels are interconnected and where synchronous network timing, testing access and additional service features are provided.

digital loopback

Technique for testing the digital processing circuitry of a communications device. May be initiated locally or remotely via a telecommunications circuit. Device being tested will echo back a received test message after first decoding and then encoding it. The results are compared with the original message (compare with analog loopback).

DS0

Digital signal level 0. Telephony term for a 64 kbps the worldwide standard speed for digitizing one voice conversation.

DS1

Digital Service, level 1. In North America, 1.544 Mbps (Bell System standard, 24 voice conversations), 2.048 Mbps (CCITT standard, 30 conversations) elsewhere.

DS3

44,736 Mbps or 28 T1 lines.

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 RS-232.

duplex

The transmission of communications in both directions simultaneously.

E&M leads

The pair of wires carrying signals between trunk equipment and a separate signalling equipment unit. The M lead transmits a ground or battery condition to the signalling equipment. The E lead receives open or ground signals from the signalling equipment. These leads are also known as Ear and Mouth leads. The Ear lead typically means to receive and the Mouth lead typically means to transmit. Changes of voltages on these leads convey such information as seizure of circuit, recognition of seizure, release of circuit, dialed digits, etc.

echo canceller

A device used in a transmission line to reduce echo. It operates by putting a signal on the return transmission path equal and opposite to the echo signal.

envelope delay (phase distortion)

Distortion of the transmitted signal from the different transmission speed characteristics of frequency components of the signal.

far-end crosstalk

Crosstalk that travels along a circuit in the same direction as the signals in that circuit. See Near-End Crosstalk.

fast select

X.25 facility indicating an extended user data field is being used on some packet types (i.e., 128 octets in a call request packet). May also indicate restricted response. If requested and the called user subscribes to Unconditional Notification, it is mapped into the Packet Layer Binary Parameters information element.

FDM

Frequency Division Multiplexing. Technique for sharing a transmission channel where carrier signals of different frequencies are transmitted simultaneously.

FDX

Full Duplex. Operation of a data communications link where transmissions are possible in both directions at the same time.

flow control parameter negotiation facility

X.25 facility that allows the negotiation of packet and window sizes in both directions of transmission.

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.).

framing

A control procedure used with multiplexed digital channels, such as T1 carriers, where bits are inserted so the receiver can identify time slots allocated to each subchannel. Framing bits may also carry alarm signals indicating specific alarm conditions.

four-wire circuits

Telephone lines using two wires for transmitting and two wires for receiving offering much higher quality than a 2-wire circuit. All long distance circuits are 4-wire. Almost all local phone lines and analog phones are 2-wire.

group 4

A high-speed (56 kbps) facsimile protocol specific to ISDN.

HDX (Half Duplex)

Operational mode of a communications line where transmission occurs in both directions, in one direction at a time. Transmission directions may be alternately switched to accommodate two-way data flow.

hub

(1) Communications center, (2) Major routing station for connecting channels, (3) DDS connecting center.

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.

interexchange carrier

Since divestiture, any carrier registered with the FCC authorized to carry customer transmissions between LATAs interstate, or if approved by a state public utility commission, intrastate. Includes carriers such as AT&T Communications, Satellite Business Systems, GTE Telenet, GTE Sprint, and MCI.

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 Services Digital Network. A totally new concept in the world telephone system. According to AT&T, public switched phone network has the following limitations: (1) Each voice line is only 4 kHz, which is very narrow; (2) Most signalling is in-band signalling, which is very consuming of bandwidth (expensive and inefficient); (3) The little out-of-band signalling that exists runs on line separate to the network (including signalling for PBX attendants and Centrex); (4) Most users have separate voice and data networks (inefficient,

expensive, and limiting); (5) Premises telephone and data equipment must be separately administered from the network it runs on; and (6) There is a wide and growing variety of voice, data, and digital interface standards, many of which are incompatible.

ISDN's vision is to overcome these deficiencies in four ways: (1) By providing an internationally-accepted standard for voice, data, and signalling; (2) By making all transmission circuits end-to-end digital; and (3) By adopting a standard out-of-band signalling system; and (4) By bringing significantly more bandwidth to the desk top.

An ISDN Central Office will deliver to the user office or factory four basic ISDN services, also called interfaces. One, The 2B+D S interface (also called the T interface) called Basic Rate Interface (BRI). The S interface uses four unshielded normal telephone wires (two twisted wire pairs) to deliver two bearer 64 kbps channels and one data signalling channel of 16 kbps. An S-interfaced phone can be located up to one kilometer from the Central Office switch driving it. Each of the two 64 kbps bearer or B channels can be used to carry a voice conversation, or one high speed data, or several data channels, which are multiplexed into one 64 kbps high speed data line. The D channel of 16 kbps will carry control and signalling information to set up and break down the voice and data calls. The D channel can also carry data up to 9600 bits per second in addition to the control and signalling information.

Secondly, the 2B+D U-interface. This U-interface delivers the same two 64 kbps bearer channels and one 16 kbps data channels using 2-wire (one pair) and can work at 5-10 kilometers from the Central Office switch driving it.

And thirdly, the 23B+D or 30B+D. This is called the Primary Rate Interface (PRI). At 23B+D, it is 1.544 megabits per second. At 30B+D, it is 2.048 megabits per second. The first 23B+D is the standard T1 line in the U.S. which operates on two pairs. The second 30B+D is the standard T1 line in Europe, which also operates on two pairs.

jitter

The slight movement of a transmission signal in time or phase that can introduce errors and loss of synchronization for high-speed synchronous communications. See phase jitter.

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.

local loop

In telephony the wire pair that connects a subscriber to a phone company end office, typically containing two wires. Four-wire local loops are common, however, especially with leased voice grade circuits.

logical channel

X.25 concept referring to a virtual connection operated over a physical connection that can support one or more virtual connections simultaneously.

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.

multidrop

A communications arrangement where multiple devices share a common transmission channel, though only one may transmit at a time.

multiplexing

The combining of multiple data channels onto a single transmission medium. Any process through which a circuit normally dedicated to 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.

narrowband ISDN

A collective term for BRA and PRA at speeds up to 1.544 Mbps.

NCTE

Network Channel Terminating Equipment. Equipment considered necessary for terminating a telephone circuit or facility at the customer premise on the regulated side of the demarcation. Recent FCC decisions have established that most NCTE is CPE and may therefore be supplied by third-party vendors.

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.

NRZ

Non-Return to Zero. A binary encoding and transmission scheme where 1s and 0s are represented by opposite and alternating high and low voltages where there is no return to a reference (zero) voltage between encoded bits.

NRZ

Non-Return to Zero Inverted. A binary encoding scheme that inverts the signal on a 1 and leaves the signal unchanged for a 0. A change in the voltage state signals a 1 bit, and the absence of a change denotes a 0 bit value. Also, transition coding.

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.

NT2

Network Termination 2. A unit that provides switching and concentration of subscriber lines at the S-interface. This unit performs the functions of a Customer Premises switch or multiplexer to multiplex B-Channel(s) and D-Channel(s) onto one physical path and to route calls to the appropriate B or D Channel.

OSI

Open Systems Interconnection. An international 7-layer protocol standard for the open exchange of data between unlike equipment.

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.

pair gain

The multiplexing of x phone conversations over a lesser number of physical facilities than x. Pair gain usually refers to electronic systems used in an outside plant (from the Central Office to the subscriber premises). In pair gain you might do something as simple as take one pair of wires and carry two conversations on it. You might also take two pairs and carry 128 conversations. AT&T Technologies has various subscriber pair gain devices called SLC. T1 is a type of subscriber pair gain equipment.

PCM

Pulse Code Modulation. Digital transmission technique that involves sampling of an analog information signal at regular time intervals and coding the measure amplitude value into a series of binary values, which are transmitted by modulation of a pulsed or intermittent carrier. A common method of speech digitizing using 8-bit code words or samples, and a sampling rate of 8 kHz (typically).

phase jitter

In telephony, the measurement in degrees out-of-phase that an analog signal deviates from the reference phase of the main data-carrying signal. Often caused by alternating current components in a telecommunications network.

PHF

Packet Handling Function. The SPCS capability that processes and routes X.25 virtual calls.

PRA

Primary Rate Access. Connects high-capacity CPE, such as PBXs, to the network. In the US, this is composed of twenty-three 64 kbps channels and one 64 kbps D-Channel. Also known as Primary Rate Interface (PRI).

point-to-point

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

POP

Point of Presence. Since the AT&T divestiture, the physical-access location within a LATA of a long distance and interLATA common carrier. The point to which the local telephone company terminates subscriber circuits for long distance dial-up or leased line communications.

repeater

A device inserted at intervals along a circuit to boost, amplify, and regenerate the signal being transmitted. A repeater is needed because the quality and strength of a signal decays over distance. See Regenerate.

regenerate

To restore a signal to original shape. Signals need to be restored because they become distorted and acquire noise as they travel, or are transmitted. Analog signals cannot be regenerated because it is very hard for telecommunications equipment to distinguish between unwanted noise and wanted noise. Digital signals can be more easily regenerated since they consist of 1s and 0s. If digital signals are flattened or distorted, a simple logic circuit can restore the signal to the original clean squared shape.

R-reference point

Non-ISDN (TE2) terminal equipment connects to ISDN at the R-Reference point through a terminal adaptor.

RS-232-C

An EIA-specified physical interface with associated electrical signalling between DCE and DTE. The most commonly employed interface between computer devices and modems.

RS-422-A

Electrical characteristic of balanced-voltage digital interface circuits.

RS-423-A

Electrical characteristics of unbalanced-voltage digital interface circuits.

RS-449

General purpose 37-position and 9-position interface for data terminal equipment and data circuit-terminating equipment employing serial binary data interchange.

RS-449-1

Addendum 1 to RS-449.

serving area

Region surrounding a broadcasting station where signal strength is at or above a stated minimum. The geographic area handled by a telephone Central Office facility. Generally equivalent to a LATA.

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.

signalling system 7 (SS7)

Fast common channel signalling, normally using a transmission rate of 64 kbps and occupying one time slot in a PCM system. Designed for digital networks. A standard for digital out-of-band signalling between Central Offices.

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

switching center rank

One of the six levels in the switching center hierarchy in the North American nationwide toll switching and direct distance dialing plan. The six levels according to rank are as follows.

Class 1 - Regional Center
Class 2 - Sectional Center
Class 3 - Primary Center
Class 4C - Toll Center
Class 4P - Toll Point
Class 5 - End Office (wire center)

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.

SLC-96

Subscriber Loop Carrier - 96. Pronounced SLICK 96. A product of AT&T Technologies, it is a short haul multiplexing device enabling up to 96 telephone customers to be served on three pairs of wires.

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 effect 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.

T1C

3.152 Mbps. Capable of handling 48 voice conversations. T1C is further up the North American digital carrier hierarchy.

T2

6.312 Mbps. Capable of handling 96 voice conversations. T2 is four times the capacity of T1.

T3

44.736 Mbps. Commonly referred to as 45 Mbps. Capable of handling 672 voice conversations. T3 runs on fiber optic and is typically called FT3.

TA

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

TE1

Terminal Equipment Type 1. ISDN-compatible terminals.

TE2

Terminal Equipment Type 2. Non-ISDN terminal equipment linked at the RS-232, RS-449, or V.35 interfaces.

tandem

The connection of networks or circuits in series. The connection of the output of one circuit to the input of another.

tandem office

A phone company's major switching center for the switched telephone network. Serves to interconnect Central Offices when direct interoffice trunks are not available. A high-level switching center in the local exchange or serving area. A tandem exchange or switch. Interconnects local Central Offices as a Central Office interconnects individual subscriber lines.

TDM

Time-Division Multiplexing. Interleaving digital data from many users onto one or two serial communications links by dividing channel capacity into time slices.

T-interface

T-Reference point. Performs the same function as the S-Interface but uses an NT1, rather than an NT2.

tip and ring

An old fashioned way of saying plus and minus or ground and positive in electrical circuits. They derive their names from the operator's cordboard plug. The tip wire was connected to the tip of the plug, and the ring wire was connected to the slip ring around the jack. A third conductor on some jacks was called the sleeve.

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).

T-span

A telephone circuit or cable through which a T-carrier runs.

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.

23B+D

In ISDN, also known as the Primary Rate Interface. A circuit with a wide range of frequencies that is divided in twenty-three 64 kbps paths for carrying voice, data, video, or other information simultaneously. It bears a remarkable similarity to today's T1 link, except that T1 carries 24 voice channels. In ISDN, 23B+D gives twenty-three channels and one D channel for out of band signalling. However, in T1, signalling is handled in band. See ISDN.

two-wire circuit

A transmission circuit composed of two wires, signal and ground, used to both send and receive information. In contrast, a 4-wire circuit consists of two pairs. One pair is used to send. One pair is used to receive. All trunk circuits (long distance) are 4-wire. A 4-wire circuit delivers better reception, but also costs more. All local loop circuits (those coming from a Class 5 Central Office to the subscriber's phone system) are 2-wire, unless a 4-wire circuit is requested.

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.

video teleconferencing

The real-time, usually two-way, transmission of digitized video images between two or more locations. Teleconferencing 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 6 MHz for analog, full-motion, full-color, commercial grade TV to 56 kbps for digitally-encoded freeze-frame to 1.544 kbps for very good quality, full-color, full-motion TV.

virtual circuit

Refers to a logical connections between two points. Many virtual circuits may be present over a physical connection between two points. The destination of each virtual circuit may bear no relationship to the physical connection traversed on a segment of the call.

wideband

Generally, a communications channel offering a transmission bandwidth greater than a voice grade channel. Data transmission speeds on wideband facilities are typically in excess of 9.6 kbps and often at rates such as 56 kbps and 1.544 Mbps.

wire center

The building in which one or more local switching systems are installed and where the outside cable plant is connected to the Central Office equipment.

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.

zero code suppression

The insertion of a 1 bit to prevent the transmission of eight or more consecutive 0 bits. Used primarily with digital T1 and related telephone company facilities which require a minimum 1s density in order to keep the individual subchannels of a multiplexed, high-speed facility active, several different schemes are currently employed to accomplish this, while proposals for a standard are being evaluated by the CCITT.

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