ISDN TA 128K

CUSTOMER
SUPPORT
INFORMATION

Order **toll-free** in the U.S. 24 hours, 7 A.M. Monday to midnight Friday: **877-877-BBOX**
FREE technical support, 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**
Mail order: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
Web site: **www.blackbox.com** • E-mail: **info@blackbox.com**

**FEDERAL COMMUNICATIONS COMMISSION
and CANADIAN DEPARTMENT OF COMMUNICATIONS
RADIO FREQUENCY INTERFERENCE STATEMENT**

Class B Digital Device. This equipment has been tested and found to comply with the limits for a Class B computing device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or telephone reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

• Reorient or relocate the receiving antenna.

• Increase the separation between the equipment and receiver.

• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

• Consult an experienced radio/TV technician for help.

Caution:

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

To meet FCC requirements, shielded cables and power cords are required to connect this device to a personal computer or other Class B certified device.

This digital apparatus does not exceed the Class B limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe B prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.

2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.

3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.

4. Todas las instrucciones de operación y uso deben ser seguidas.

5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..

6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.

7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.

8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.

9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objetos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

   A: El cable de poder o el contacto ha sido dañado; u

   B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

   C: El aparato ha sido expuesto a la lluvia; o

   D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

   E: El aparato ha sido tirado o su cubierta ha sido dañada.

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

1. If your ISDN TA 128K 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 have trouble with your ISDN TA 128K, call your supplier for repair and warranty information. The telephone company may ask you to disconnect this equipment from the network until the problem is corrected, or until you are sure the equipment is not malfunctioning.

4. This unit contains no user-serviceable parts.

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- 2=Loopback Netw.
- 3=Loopback Proto
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- 5=Test Remote
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- 7=NEBE/FEBE → 2=DDS Accepted
- 8=Software Ver → 3=V54 Accepted
- 4=DDS + V54 Accepted

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- 2=Call Type → 1=Speech / 2=Audio / 3=Data 56kbps / 4=Data 64kbps
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- 2=BONDING Mode 1
- 3=V.120
- 4=V.34
- 5=V.110
- 6=DSU 57.6 ASYNC
- 7=T-LINK
- 8=SAP
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	2=4800	7=56000
	3=9600	8=64000
	4=19200	9=112000
	5=38400	0=128000

2=Connector Type	1=RS-530
	2=V.35
	3=RS-232

| 3=RTS Options | 1=1 Ms Delay |
| | 2=18 Ms Delay |

| 4=CTS Options | 1=Forced CTS |
| | 2=Follows RTS |

5=CD Options	1=CD Forced On
	2=Normal
	3=Off with LOCD
	4=Off with Link Down

6=DTR Options	1=Ignore DTR
	2=Cmd When Off
	3=Idle When Off
	4=Off>On Dial #0
	5=Dial #0 if On
	6=Answer if On
	7=Dial/Ans if On

7=DSR Options	1=DSR Forced On
	2=OFF Idle+Test
	3=OFF Link Down

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| | 2=External |

1. Specifications

Network Interface — (1) RJ-45 for ISDN Basic Rate U-interface

DTE Interface — RS-530A, RS-232, or V.35

Dialing Selections — In-Band Dialing: V.25 bis or AT commands, manual or automatic stored-number dialing; Dial Interface: RS-366

Speed — Network: 64 Kbps (one B channel), 128 Kbps (two B channels); DTE: 300 bps to 115.2 Kbps asynchronous, 2400 bps to 128 Kbps synchronous

Rate Adaptation — T-Link, CCITT V.120, SAP, DSU 57.6 Async, BONDING, Multilink PPP

Interoperability — Various inverse multiplexors, Switched-56 DSUs, ISDN TAs (see Section 2.3)

D Channel Switch Compatibility — AT&T® 5ESS, NTI DMS-100, National ISDN-1, NEC

B Channel Aggregation — BONDING protocol Mode 1

Display — 2-line × 16-character LCD

Temperature Tolerances — Operating: 32° to 122° F (0° to 50° C); Storage: -4° to 158° F (-20° to 70° C)

Relative Humidity Tolerance — 5 to 95%, noncondensing

Connectors — (1) RJ-45 (network); (1) DB25 (RS-232 or RS-530, user-selectable via menus), (1) DB25 (RS-366/Maintenance); (1) M-block (V.35)

Power — UL® listed: 115 VAC, 60 Hz, or 220 VAC, 50 Hz; 8 watts maximum dissipation

Acceptable sources of power are as follows if the ISDN Terminal Adapter 128K is to be powered from a centralized DC power closet:

1. Telephone power supplies identified as having Level C outputs.

2. Listed custom-built telecommunication equipment with output CODE C.

NOTE

Use only LISTED CLASS II power sources with a rated output of -48 VDC.

Size — 2.3"H × 8.8"W × 11"D (5.8 × 22.4 × 27.9 cm)

Weight — 3 lb. (1.4 kg)

2. Introduction

2.1 What Is ISDN?

The Integrated Services Digital Network (ISDN) is a public or private switched digital network. In ISDN, one telephone wire carries the full range of services—voice, data, and image applications. Since ISDN is an international standard, subscribers can exchange data worldwide.

2.2 Overview of the ISDN TA 128K

To connect non-ISDN equipment to ISDN service, you need an ISDN Service Unit like the ISDN TA 128K. It connects your Data Terminal Equipment (DTE) to the ISDN network, or to a leased digital network. In that way, it's like a modem—but a modem that lets you transmit data at speeds up to 128 Kbps.

The ISDN TA 128K connects directly to the ISDN through a single two-wire 2B1Q U-interface. Since the ISDN TA 128K provides ISDN network termination, you don't need a separate NT1. (The ISDN TA 128K itself responds to NT1 network-testing commands from the telephone company's central office.)

The "ISDN IFC" jack on the back panel is for connecting to the network. There are two ways to use it:

- For **Basic Rate ISDN**, which divides an ISDN line into three channels that can transmit voice and data simultaneously. The three channels comprise two Bearer (B) channels at 64 Kbps and one Data (D) channel at 16 Kbps. (This arrangement is also called "2B+D.")

- For a **leased digital connection**. A leased digital line—sometimes called a dedicated connection, a private circuit, a nailed-up connection, or a limited-distance-modem connection—is a permanent connection between end points. With a leased line, the ISDN TA 128K can transfer data at up to 128 Kbps over a 2-wire line.

For the data connection, you can use RS-232, RS-530A, or V.35. A single DB25 connector is used for either RS-232 or RS-530A; you choose.

The ISDN TA 128K runs at synchronous data-transfer rates from 2400 bps to 128 Kbps, and asynchronous rates from 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.
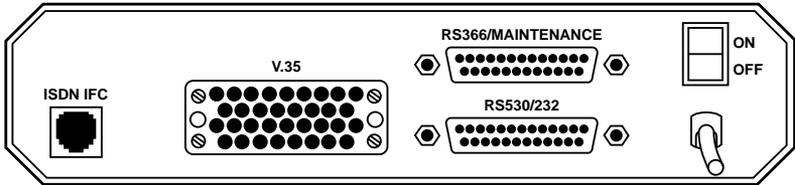
Figure 2-1. The Rear Panel.

There are several different ways to dial from the ISDN TA 128K:

• Manually from the keypad on the front panel.

• Automatically from up to ten stored numbers.

• Automatically through an RS-366 dial port—used in fax and videoconferencing.

• Over the DTE interface, using the AT command set.

• With V.25 bis in-band dialing—used in applications like LAN/WAN bridging.

• Automatically when DTR is raised. Some bridge/routers raise DTR when the data to transmit exceeds the bandwidth on their dedicated lines. The ISDN TA 128K can be set to dial out when the bridge/router raises DTR, so you have an extra 128 Kbps of bandwidth on demand.

Seven LEDs monitor data flow and display the status of key DTE interface leads:
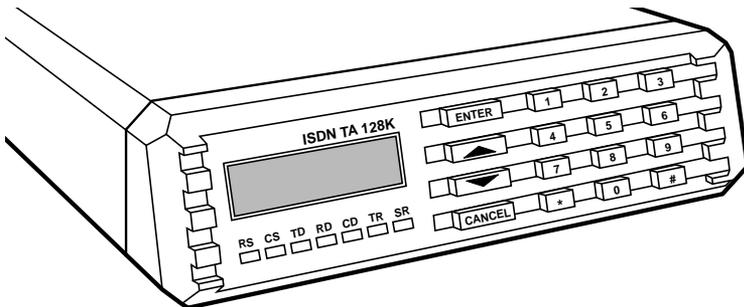
Figure 2-2. The Front Panel.

LED	*Definition*
RS	Request to Send.
CS	Clear to Send.
TD	Transmit Data. On when the DTE is transmitting to the ISDN TA 128K.
RD	Receive Data. On when the ISDN TA 128K is receiving data from the far end.
CD	Carrier Detect. On when the ISDN TA 128K is ready to transmit data.
TR	Terminal Ready from DTE. On when DTR is active at the DTE interface.
SR	Data Set Ready.

Besides the LEDs, there's also a two-line-by-sixteen-character LCD, and a keypad that you can use for dialing, configuration, or testing.

2.3 Interoperability: Using the ISDN TA 128K with Current and Future Equipment

Telephone networks are evolving from analog technologies to digital technologies like ISDN. But the evolution is slow, since it takes a lot of time and money for the telephone companies to make the change.

The ISDN TA 128K is designed to see you through this transitional period by supporting communications with both present and future networks. It works with Switched-56 service and Switched-56 DSUs (two-wire and four-wire), as well as various ISDN terminal adapters and BONDING-compatible inverse multiplexors.

Figure 2-3 shows how the ISDN TA 128K can work in various switched networks.

2.4 Recommended Operating Protocols

With the ISDN TA 128K, you can select many combinations of circuit type, protocol, and data rate. However, only the combinations shown in the table on the next page are recommended. As noted in the table, all asynchronous data rates will support flow control, but 57,600 bps or 115,200 bps (only with SAP and a 64K circuit type) requires flow control.

The table shows that you can get a given data rate from more than one protocol/rate-adaptation selection. The table is organized so that selections with lower throughput delay are nearer the top of the table for any given circuit type.

For your circuit type, choose a protocol and rate as near as you can to the top of the protocol rate list.
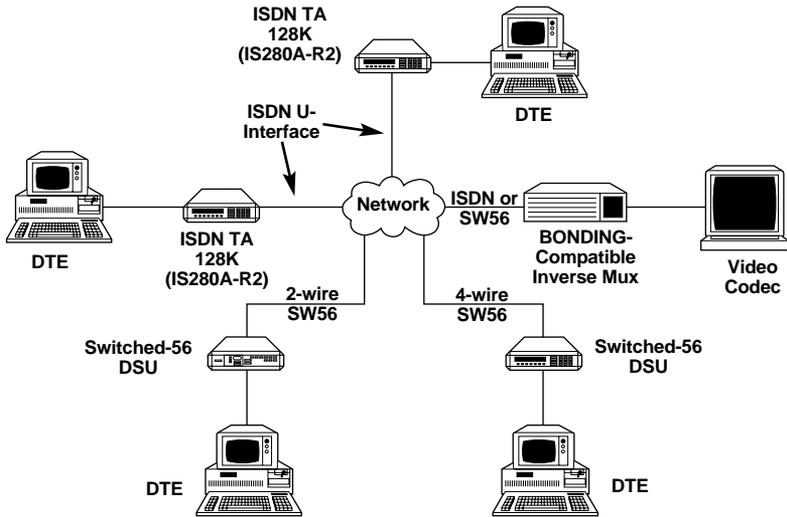
Figure 2-3. Interoperability—How the ISDN TA 128K Can Work with Different Networks.

Recommended Operating Modes

Dial—64K	BONDING	SYNC	56,000, 64,000
	CLEAR CHAN	SYNC	48,000, 56,000, 64,000
	TLINK	SYNC	2400, 4800, 9600, 19,200, 56,000, 64,000
	SAP	SYNC	38,400
	BONDING	ASYNC	300,1200,2300,4800,9600, 19200, 38400, 57600
	TLINK	ASYNC	300, 1200, 2300, 4800, 9600, 19,200
	SAP	ASYNC	38,400, 57,600*, 115,200*
Dial—56K	BONDING	SYNC	56,000
	CLEAR CHAN	SYNC	48,000, 56,000
	TLINK	SYNC	2400, 4800, 9600, 19,200, 56,000
	TLINK	ASYNC	300, 1200, 2300, 4800, 9600, 19,200
Dial—64K×2	BONDING	SYNC	128,000
	BONDING	ASYNC	115,200
Dial—56K×2	BONDING	SYNC	112,000
	BONDING	ASYNC	115,200
Leased—64K	CLEAR CHAN	SYNC	48,000, 56,000, 64,000
	SAP	SYNC	2400, 4800, 9600, 19,200, 38,400
	SAP	ASYNC	300, 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600*, 115,200*
Leased—128K	CLEAR CHAN	SYNC	128,000

*Requires flow control.

Notes:

1. All asynchronous rates support flow control.

2. All dialup modes support front-panel, DTR, RS-366, AT command, and V.25 dialing methods.

2.5 Ordering ISDN Service from Your Telephone Company

The ISDN TA 128K is designed to work with all the most common kinds of service from different telephone companies. Nevertheless, ordering ISDN service can be a complicated business. To make it simpler, fill out the form on these two pages—then you'll have all the information you need handy when you order. It might help to copy the form and fax it directly to your telephone company.

See **Appendix E** for more information about ordering ISDN.

ISDN Service Ordering Information for the ISDN TA 128K

The ISDN TA 128K includes NT1 and terminal-adapter functions, and supports data rates up to 128 Kbps.

Name _____

Company _____

Address _____

City _____State_____ZIP_____

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 ISDN TA 128K 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)

ISDN TA 128K

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

For service offered from a **Northern Telecom DMS-100**, request a Point-to-Multipoint line with the following features:

Feature...*Value*
Line Type ....Basic Rate, Functional
Electronic Key Telephone Sets...No
Call Appearance Handling ....No
Non-Initializing Terminal ....No
Circuit-Switched Service...Yes
Packet-Switched Service ....Yes
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 carrier _____

Make sure the telephone company provides you with the following information for configuring the ISDN TA 128K:

- 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)

3. Installation

As soon as you unpack the ISDN TA 128K, inspect it for shipping damage. Damage is rare, but if you do find anything, call the shipping carrier immediately, then call Black Box.

Make sure everything was included in the box. Besides the ISDN TA 128K and this manual, you should have received:

- One 8-foot (2.4-m) RJ-45-to-RJ-45 cable

3.1 Connecting to the Network

The ISDN TA 128K works on either dialup or leased lines.

For either type of line, connect the line from the telephone company to the RJ-45 jack marked "ISDN IFC."

See **Appendix E** for a pinout of each network connection.

3.2 Connecting to the DTE

You can connect the DTE through either the RS-530A or RS-232 interface or the V.35 interface. These are the maximum recommended cable lengths:

- RS-530A: 50 feet (15.2 m)

- V.35: 30 feet (9.1 m)

- RS-232: 15 feet (4.6 m)

See **Appendix E** for a pinout of each DTE connection.

NOTE

Make sure you have only one DTE cable connected to the ISDN TA 128K. For example, if a cable is plugged into the RS-530A connector, make sure nothing is plugged into the V.35 connector.

To prevent possible radio-frequency interference, you must use a shielded V.35 cable for a V.35 connection.

3.3 Connecting to the Dial Interface

If you need out-of-band RS-366 dialing—for video conferencing or fax machines, for example—connect the dialing interface of the host DTE to the port marked "RS-366" on the ISDN TA 128K.

See **Appendix E** for a pinout of the RS-366 connector.

3.4 Connecting to the Maintenance Interface

The maintenance interface is available at 9600 bps, 8 data bits, no parity, asynchronous format, through the RS-366/Maintenance port. See **Appendix E, Connector Pinouts**, for maintenance-port pin assignments. You can connect a VT100 terminal or null modem to the RS-366/maintenance port using an RS-232 cable. You can use this interface to set internal S-registers, dial ISDN connections, and disconnect calls. This port also allows Black Box Technical Support personnel to retrive vital information from the unit if you encounter problems during initial configuration of the ISDN TA 128K. However, you can solve most problems without resorting to this port for help.

To activate the maintenance port, make sure the dial mode is either **Front Panel** or **AT commands**. When the dial mode is set for RS-366, the maintenance port is disabled.

NOTE

You cannot use the maintenance port to pass data or to remotely configure another ISDN TA 128K using the Configure Remote Unit option.

AT commands sent to the maintenance port are not preceded by "AT." For example, to display the unit model number, enter: I0.

4. Getting Started with the ISDN TA

4.1 How to Use the Menus

You can configure the ISDN TA 128K directly from the front-panel menus. There are four function keys on the front panel:

- **Enter** selects a displayed item.

- The **up arrow** moves up in a menu.

- The **down arrow** moves down in a menu.

- **Cancel** exits (moves back one level) from the current branch of the menu tree.

To choose an item, press the number that corresponds to it on the front-panel keypad. The item will blink on and off to show that it is the currently selected choice. Pressing either Up or Down will deselect the current choice (the item will stop blinking). Pressing Enter will select the item.

Some features on the configuration menus don't take effect immediately when you select them:

- Features like **Leased/Dial Line** and **ISDN Switch Type** take effect only after the power is turned off and back on, or after the U-interface is "bounced"—the connection is broken and restored. That way, you can't accidentally reconfigure the ISDN TA during a call.

- Features like **Bit Rate**, **Protocol**, and **Call Type** take effect only at the beginning of a new call.

4.2 Getting Started

At power-up, the front-panel display is in the Current Status mode. You'll probably want to leave the display in this mode when you're not configuring the ISDN TA. Wherever you are in the menus, you can always keep pressing **Cancel** until you come back to this display.

If the ISDN TA is connected to the network and working properly, it will display the ready message. See **Appendix B** for a list of current-status messages.

From this screen, press any key to change the display to the top of the menu tree. The tree has four main branches:

- STATUS

- TEST

- CONFIG

- DIAL

Each one of these branches leads to sub-branches with more configuration options.

4.3 Quick Setup

To get started quickly, you can choose one of the Quick Setup options. Each Quick Setup automatically configures all the options for one of several common applications. Later, you can fine-tune your setup with the other menu options.

To use one of the quick setups:

1. Choose **3=Config** from the main menu.

2. Choose **4=Quick Setup**.

3. Choose one of the Quick Setup options.

Each of the Quick Setup options is designed for a common application. The charts that follow list all the configuration settings that are automatically made when you choose one of the options.

| **3=Config** | 1=Netw Options
2=DTE Options
3=Protocol
4=Quick Setup
5=Remote Config | 1=Dial 56K sync
2=Dial 64K sync
3=Dial 112K sync
4=Dial 128K sync
5=Dial PPP
6=V.34 115.2 async
7=DIal 57.6 async
8=Dial 115.2 async
9=Fallback 57.6K
0=More | 1=Leased 128K
2=LDM 128 Master
3=TBD
4=TBD
5=TBD
6=TBD
7=TBD
8=TBD
9=TBD
0=Factory setup |
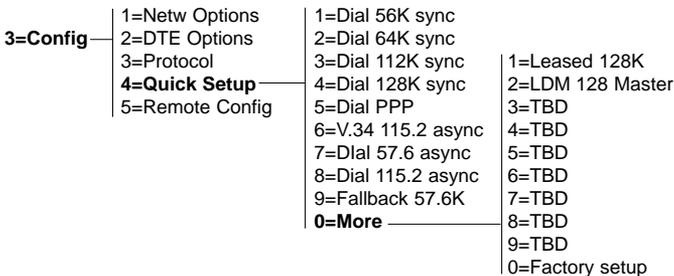
1=DIAL 56K SYNC

Option	Automatically set to…
Service type	ISDN dial line
Automatic answering	Enabled
ISDN call type	56-Kbps data
Data protocol	Clear Channel
DTE mode	Synchronous
DTE connector bit rate	56 Kbps
DTE flow control	None
RTS line	1-ms delay
CTS line	Forced on
Transmit data clock	Normal clock source
V.54 Loopbacks	Accepted

NOTE: When you choose the "Dial 56K sync" option, you'll still have to configure the ISDN Switch Type. Multipoint lines will also require SPID1 and LDN1. See Section 5.2.3.

2=DIAL 64K SYNC

Option	Automatically set to…
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	64 Kbps
DTE flow control	None
RTS line	1-ms delay
CTS line	Forced on
Transmit data clock	Normal clock source
V.54 Loopbacks	Accepted

NOTE: When you choose the "Dial 64K sync" option, you'll still have to configure the ISDN Switch Type. Multipoint lines will also require SPID1 and LDN1. See Section 5.2.3.

3=DIAL 112K SYNC

Option	Automatically set to...
Service type	ISDN dial line
Automatic answering	Enabled
ISDN call type	56-Kbps data
Data protocol	BONDING mode 1
DTE mode	Synchronous
DTE connector bit rate	112 Kbps
DTE flow control	None
RTS line	1-ms delay
CTS line	Forced on
Transmit data clock	Internal clock source
BONDING timer TXINIT	10 seconds
BONDING timer TXFA	10 seconds
BONDING timer TXADD01	50 seconds
BONDING timer TXDEQ	50 seconds
BONDING timer TANULL	10 seconds
BONDING timer TCID	5 seconds
V.54 Loopbacks	Accepted

NOTE: **When you choose the "Dial 112K sync" option, you'll still have to configure the ISDN Switch Type. Multipoint lines will also require SPID1 and LDN1, and SPID2 and LDN2 if the line is set up for two SPIDs. See Section 5.2.3.**

4=DIAL 128K SYNC

Option	Automatically set to…
Service type	ISDN dial line
Automatic answering	Enabled
ISDN call type	64-Kbps data
Data protocol	BONDING mode 1
DTE mode	Synchronous
DTE connector bit rate	128 Kbps
DTE flow control	None
RTS line	1-ms delay
CTS line	Forced on
Transmit data clock	Internal clock source
BONDING timer TXINIT	10 seconds
BONDING timer TXFA	10 seconds
BONDING timer TXADD01	50 seconds
BONDING timer TXDEQ	50 seconds
BONDING timer TANULL	10 seconds
BONDING timer TCID	5 seconds
V.54 Loopbacks	Accepted

NOTE: **When you choose the "Dial 128K sync" option, you'll still have to configure the ISDN Switch Type. Multipoint lines will also require SPID1 and LDN1, and SPID2 and LDN2 if the line is set up for two SPIDs. See Section 5.2.3.**

5=DIAL PPP

Option	Automatically set to…
Service type	ISDN dial line
ISDN call type	64-Kbps data
Data protocol	PPP async-sync
DTE mode	Asynchronous
Data bits	8
Parity bits	None
Stop bits	1
DTE connector bit rate	Hardware
DTE flow control	None
RTS line	1-ms delay
CTS line	Follow RTS

NOTE: **When you choose the "Dial PPP" option, you'll still have to configure the ISDN Switch Type.**

6=V.34 115.2 ASYNC

This option has no effect. It's built into the software to allow for future upgrades.

7=DIAL 57.6 ASYNC

Option	**Automatically set to…**
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-ms delay
CTS line	Forced on

NOTE: When you choose the "Dial 57.6 async" option, you'll still have to configure the ISDN Switch Type. Multipoint lines will also require SPID1 and LDN1. See Section 5.2.3.

8=DIAL 115.2 ASYNC

Option	**Automatically set to…**
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	115.2 Kbps
DTE flow control	None
RTS line	1-ms delay
CTS line	Forced on

NOTE: When you choose the "Dial 115.2 async" option, you'll still have to configure the ISDN Switch Type. Multipoint lines will also require SPID1 and LDN1, and may require SPID2 and LDN2 if the line is set up for two SPIDs. See Section 5.2.3.

9=FALLBACK 57.6K

Option	Automatically set to...
Service type	Dial line
Automatic answering	Yes
ISDN call type	64-Kbps data
Data protocol	Fallback
DTE mode	Asynchronous
DTE flow control	Hardware
RTS line	1-ms delay
CTS line	Forced on
Transmit data clock	Normal clock source

NOTE: When you choose the "Fallback 57.6K" option, you'll still have to configure the ISDN Switch Type. Multipoint lines will also require SPID1 and LDN1. See Section 5.2.3.

0=MORE....

  1=LEASED 128K

Option	Automatically set to...
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-ms delay
CTS line	Forced on
Transmit data clock	Normal clock source

2=LDM 128 MASTER

This setup is for a point-to-point application, such as an installation with limited-distance modems.

Option	Automatically set to...
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-ms delay
CTS line	Forced on
Transmit data clock	Normal clock source

5. Menus

If you need more precise configuration than one of the Quick Setups, you can configure any option with the front-panel menus. Follow the step-by-step instructions in this section to configure the ISDN TA 128K for ISDN Basic Rate switched service.

5.1 VT100 Terminal Menu Support

When connected to an asynchronous VT100 terminal or VT100 terminal emulator, you can access the menus via in two ways: via the maintenance port using the !V command, or via the RS-232/RS-530 port using an AT command, **AT!V Enter**.

NOTE

Make sure the baud rate and flow control for the VT100 terminal are set the same as for the ISDN TA 128K.

NOTE

If you use AT commands with the RS-232/RS-530 port, you have to set the unit via the front panel for AT commands.

```
                                                    1=Switch Type
                                                    2=Call Type          1=Front Panel
                                  1=Dial Line ────   3=Terminal ID        2=RS-366
                1=Netw Options ─┤ 2=Leased Line      4=Dial Options ────  3=AT commands
3=Config ──────  2=DTE Options                       5=Auto answer        4=V.25
                 3=Protocol                          6=Answer tone        5=Disabled
                 4=Quick Setup                        7=Connect timeout
                 5=Remote Config                     8=Call screening
```
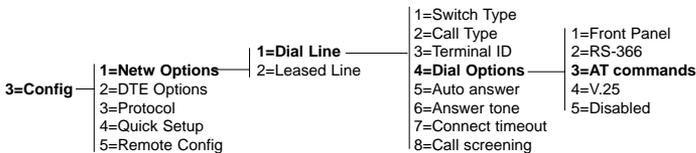
To go to a particular menu, simply press the hot keys for that menu. The main branches of the menu tree and their hot keys are:

- STATUS (Ctrl-V)

- TEST (Ctrl-T)

- CONFIG (Ctrl-C)

- DIAL (Ctrl-D)

STATUS SCREEN

To determine the current status of the unit, press Ctrl-V to access the status screen (see **Figure 5-1**). The status screen displays unit information such as the loop status, software revision, the result of the initial self test, and the status buffer

messages. The most recent message always appears as Status Buffer 1. **Appendix C** contains a list of status buffer messages.

```
                              Status Menu

     UNIT/LOOP STATUS                      STATUS BUFFER
     Loop Rate            =Data 64kbps     1=MaintPort Setup
     DTE Rate             =2400            2=EMPTY
     DTE Format           =Asynchronous    3=EMPTY
     Test Status          =No Test         4=EMPTY
     Self Test            =Passed          5=EMPTY
     Software Rev         =ISU Ver A.00    6=EMPTY
     Checksum             =ebfc            7=EMPTY
     Loop Status          =Link down       8=EMPTY
     Num Dialed           =No Call         9=EMPTY
     RTS                  =ON              10=EMPTY
     CTS                  =ON              11=EMPTY
     TD                   =OFF             12=EMPTY
     RD                   =OFF             13=EMPTY
     DCD                  =OFF             14=EMPTY
     DTR                  =OFF             15=EMPTY
     DSR                  =ON              16=EMPTY
                          =ON_            17=EMPTY
                                           18=EMPTY
                                           19=EMPTY
                                           20=EMPTY

     Ctrl-V STATUS   Ctrl-T TEST   Ctrl-C CONFIG   Ctrl-D DIAL        Ctrl-X Exit
```

Figure 5-1. ISDN TA 128K Status Menu.

5.2 Configuring for Dial Operation

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

```
               1=Netw Options── 1=Dial Line
3=Config─ 2=DTE Options     2=Leased Line
               3=Protocol
               4=Quick Setup
               5=Remote Config
```

When using a VT100™ terminal, press CTRL-C to access the Configuration screen, then set the **Line type** option to **Dial Line**. The Configuration screen appears as shown below.

```
                        ISU 128 Configuration Menu
 1) Netw. options = dial line           17) CD Options = Normal
 2) Switch Protocl = AT&T 5ESS          18) DTR Options = Ignore DTR
 3) Call type = Data 64Kbps             19) DSR Options = DSR forced on
 4) SPID1 = 0192255360                  20) Flow Control = Hardware Flow
 5) SPID2 = 0192255370                  21) Data Bits = 8 Data bits
 6) LDN 1 = 9225536                      22) Parity Bits = None
 7) LDN 2 = 9225537                      23) Stop Bits = 1 Stop bit
 8) Auto answer = Enabled               24) Protocol = Clear Channel
 9) Answer tone = No Answer tone        25) Quick Setup
10) Connect Timeout = 30 sec (def)      26) Cfg. Rmt. Unit
11) Call Screening - Answer any         27) Set Password
12) DTE options = Asynchronous          28) Lpbk remote 1B
13) Bit Rate = 9600                     29) Lpbk remote 2B
14) Connector Type = RS-232
15) RTS options = 1 ms delay
16) CTS Options = Follows RTS

Select =                                Enter SELECT    Esc NO CHANGE


 Ctl-U STATUS    Ctl-T TEST    Ctl-C CONFIG    Ctl-D DIAL    Ctl-X EXIT
```

5.2.1 SETTING THE SWITCH TYPE
Find out what kind of ISDN switch your telephone company is using (ask your telephone administrator or telephone-company representative). Configure your ISDN TA for either a Northern Telecom® DMS-100, an 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). In the Far East, use "NEC Switch."

```
                                                              1=AT&T 5ESS
                                                              2=DMS-100
                                            1=Switch Type ─── 3=National ISDN-1
                                            2=Call Type       4=NEC Switch
                          1=Dial Line ───   3=Terminal ID
          1=Netw Options ─┤ 2=Leased Line   4=Dial Options
3=Config ─ 2=DTE Options                    5=Auto answer
           3=Protocol                       6=Answer tone
           4=Quick Setup                    7=Connect timeout
           5=Remote Config                  8=Call screening
```
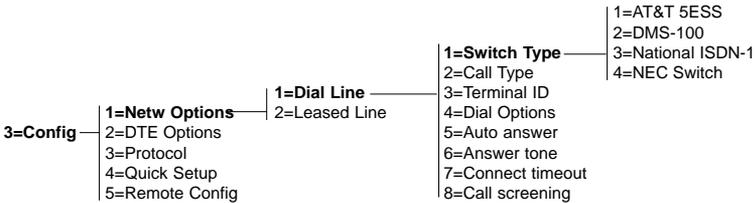
5.2.2 SETTING THE CALL TYPE

The **call type** can be configured four different ways, depending on the type of service you're using. The default is **Data 64Kbps**.

```
                                                              1=Speech
                                                              2=Audio
                                         1=Switch Type        3=Data 56Kbps
                                         2=Call Type          4=Data 64Kbps
                         1=Dial Line ──── 3=Terminal ID
         1=Netw Options ─┤ 2=Leased Line  4=Dial Options
3=Config ─ 2=DTE Options                  5=Auto answer
           3=Protocol                     6=Answer tone
           4=Quick Setup                  7=Connect timeout
           5=Remote Config                8=Call screening
```
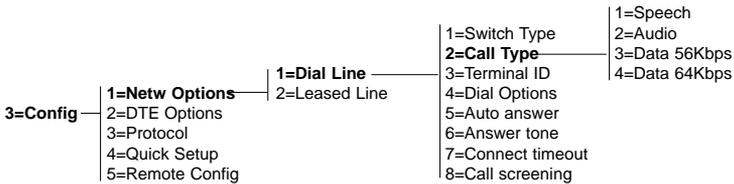
Speech directs the call-control software to request a Mu-law speech circuit as the bearer capability for outgoing calls. The Speech option is used with an ISDN line configured for voice service, which in some areas is less expensive than data service.

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.

Data 56Kbps directs the control software to request a 64-Kbps data circuit that is rate-adapted to 56 Kbps. This option is intended for circumstances where you need interoperability with Switched-56 service.

Data 64Kbps is the default call type for ISDN service. It directs the call-control software to request an unrestricted 64-Kbps circuit.

5.2.3 SETTING THE TERMINAL ID

```
                                         1=Switch Type
                                         2=Call Type          1=Set SPID
                         1=Dial Line ──── 3=Terminal ID ──── 2=Set LDN
         1=Netw Options ─┤ 2=Leased Line  4=Dial Options
3=Config ─ 2=DTE Options                  5=Auto answer
           3=Protocol                     6=Answer tone
           4=Quick Setup                  7=Connect timeout
           5=Remote Config                8=Call screening
```
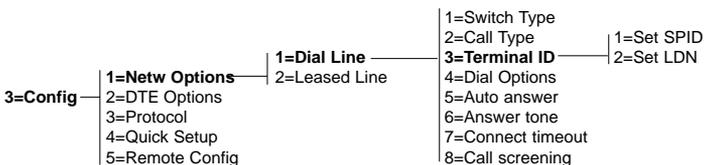
Setting the SPID. The SPID (Service Profile Identifier) is a sequence of digits used to identify ISDN terminal equipment to the ISDN switch. The SPID is assigned by the local phone company when the ISDN line is installed; it usually looks like the phone number. Get your SPIDs from your telephone administrator 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 ISDN TA 128K uses the presence of SPID1 to determine whether the line is multipoint. If the line has only one SPID, the SPID must be entered in SPID1.

Disconnect the network interface before changing the SPID. Use the **up** and **down** arrow keys to select between SPID1 and SPID2. Use the **Cancel** key to clear the displayed number. Press **Enter** after entering each SPID.

Setting the LDN. This option allows you to enter 0, 1, or 2 LDNs. The LDN—the 7-digit local phone number assigned to the line—is used when placing or receiving BONDING calls.

Disconnect the network interface before changing the LDN. Use the **up** and **down** arrow keys to select between LDN1 and LDN2. Use the **Cancel** key to clear the displayed number. Press **Enter** after entering each LDN.

5.2.4 SETTING THE DIAL OPTIONS

The ISDN TA 128K can be configured to dial six different ways.

```
                                        1=Switch Type        1=Front Panel
                                        2=Call Type          2=RS-366
                         1=Dial Line ── 3=Terminal ID        3=AT commands
            1=Netw Options─┤ 2=Leased Line   4=Dial Options ── 4=V.25
3=Config ── 2=DTE Options                   5=Auto answer        5=Disabled
            3=Protocol                      6=Answer tone
            4=Quick Setup                   7=Connect timeout
            5=Remote Config                 8=Call screening
```
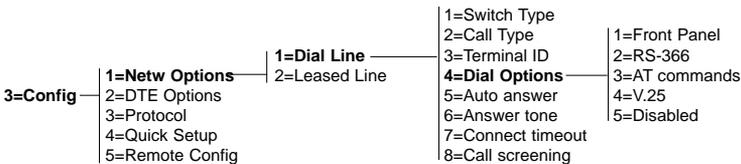
Front Panel lets you establish and disconnect calls from the front-panel keypad. See **Section 5.7** for more detail.

RS-366 enables the RS-366 port on the back panel for RS-366 dialing.

Whenever this dialing mode is enabled, DTR must be active before a call is placed. The call may be disconnected by dropping DTR, or from the front panel by selecting the # (pound) key to go directly to the Dial menu, then **1=Hang up line**, then **Enter**.

DTE RS-366 dialers can end their string of dialed numbers in two different ways:

1. By sending the End Of Number (EON), which tells the ISDN TA that the entire number has been sent.

2. By letting the ISDN TA time out after the last digit of the number. You can set the timeout to suit your application:

```
                                                                                    1=1 sec or EON
                                                                                    2=2 sec or EON
                                        1=Switch Type                               3=5 sec (default)
                            1=Dial Line— 2=Call Type        1=Front Panel           4=10 sec or EON
            1=Netw Options— 2=Leased Line 3=Terminal ID     2=RS-366 ————————————   5=20 sec or EON
3=Config — 2=DTE Options                 4=Dial Options———  3=AT commands           6=Wait for EON
            3=Protocol                   5=Auto answer      4=V.25
            4=Quick Setup                6=Answer tone      5=Disabled
            5=Remote Config              7=Connect timeout
                                         8=Call screening
```
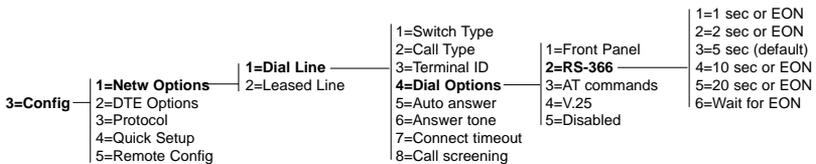
The first five options set the timeout. Until the timeout is reached, the ISDN TA assumes that the dial string is incomplete unless it receives an EON command. With the last option, **6=Wait for EON**, the ISDN TA will never time out, and will not assume the dial string is complete until it receives the EON command.

AT commands enables in-band dialing over the DTE interface with asynchronous AT commands. AT commands can be used to set up the ISDN TA as well as to establish or end a call. Calls can also be disconnected from the front panel or from the far-end unit. See **Section 5.8**.

V.25 enables in-band dialing over the DTE interface with asynchronous or synchronous V.25 bis commands. V.25 bis can be used to establish or end a call. Calls can also be disconnected from the front panel or from the far-end unit. See **Section 5.9**.

5.2.5 SETTING AUTO ANSWER

You can configure the ISDN TA 128K for automatic answering two different ways, or you can disable automatic answering altogether.

```
                                                    1=Switch Type
                                                    2=Call Type
                                    1=Dial Line     3=Terminal ID
                   1=Netw Options   2=Leased Line   4=Dial Options     1=Disabled
3=Config           2=DTE Options                    5=Auto answer      2=Enabled
                   3=Protocol                       6=Answer tone      3=Dump all calls
                   4=Quick Setup                    7=Connect timeout
                   5=Remote Config                  8=Call screening
```
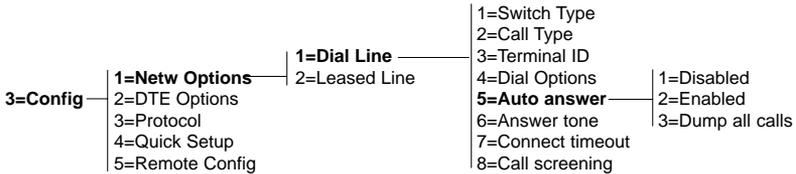
Disabled prevents the ISDN TA from answering the call automatically. If you want the call to be answered, you must send the answer command (**ATA**) to the ISDN TA. The ringing call can be dumped with the **hang up line** command.

Enabled allows the ISDN TA to accept an incoming call on the primary phone number (SPID1 or LDN1). If the call is a BONDING call, then another incoming call will be accepted on the secondary phone number (SPID2 or LDN2). If the ISDN TA is configured for a call that uses only one B-channel, such as 56 Kbps or 64 Kbps, then the ISDN TA will not accept a call on the secondary phone number.

Dump all calls tells the ISDN TA not to accept any incoming calls. That keeps the line clear for outgoing calls.

5.2.6 THE ANSWER TONE OPTION

The **Answer tone** option tells the ISDN TA to send a modem answer tone at the start of voice and data calls. The tone disables echo suppression and echo canceling on the circuit in order to get a clear digital circuit, which might be necessary on some long-distance circuits. The tone is 4 seconds in duration, 2100 Hz at a -10 dB level, with pase reversals every 475 ms.

No answer tone (default) disables answer tone on all calls.

Incoming tone enables answer tone on incoming calls.

Outgoing tone enables answer tone on outgoing calls.

Always tone enables answer tone on all calls, incoming or outgoing.

5.2.7 SETTING THE CONNECT TIMEOUT

Connect timout sets how long the ISDN TA will wait for a far-end unit to answer an outgoing call.

```
                                        1=Switch Type
                                        2=Call Type
                       1=Dial Line ──── 3=Terminal ID
           1=Netw Options─┤  2=Leased Line  4=Dial Options      1=15 sec
3=Config ─┤ 2=DTE Options               5=Auto answer         2=30 sec (default)
           3=Protocol                   6=Answer tone          3=1 Minute
           4=Quick Setup                7=Connect timeout─ 4=2 Minutes
           5=Remote Config              8=Call screening      5=4 Minutes
```
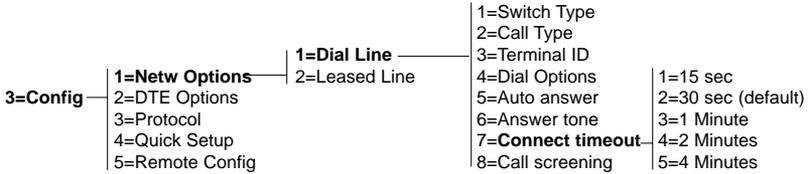
5.2.8 SETTING CALL SCREENING

Call screening allows the ISDN TA to answer either all incoming calls (the default) or only calls originating from phone numbers stored in the **Dial** menu as stored numbers SN0 through SN9. For information on storing numbers, see **Section 5.7**.

```
                                        1=Switch Type
                                        2=Call Type
                       1=Dial Line ──── 3=Terminal ID
           1=Netw Options─┤  2=Leased Line  4=Dial Options
3=Config ─┤ 2=DTE Options               5=Auto answer
           3=Protocol                   6=Answer tone
           4=Quick Setup                7=Connect timeout   1=Answer any
           5=Remote Config              8=Call screening ── 2=Ansr if SN0…0
```
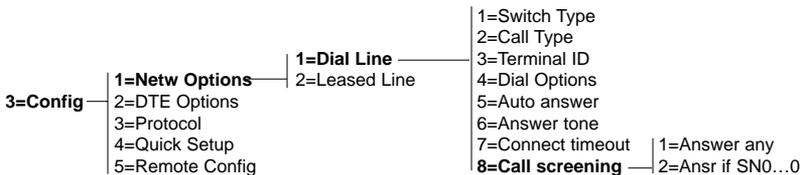
When **Call Screening** is set to answer only numbers stored in SN0 through SN9, an incoming call will not be answered if the Call ID received from the switch does not match a stored number. Depending on the switch type, the Call ID may be presented in either a seven- or a ten-digit format. The ISDN TA will display the Call ID for all dumped calls in the Status buffer.

Because different switches handle calls and Call IDs differently, you must find out whether your switch uses a seven- or ten-digit Call ID format:

1. From the **Call Screening** menu, select **Ansr if SN0…9**.

2. Store your seven-digit number in SN0. (See **Section 5.7**.)

3. Place a call to the ISDN TA with the stored number to see whether the ISDN answers properly.

4. If the ISDN TA 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. Store the number again in SN0 as it is displayed in the Call ID message and test Call Screening again.

5.3 Configuring for Leased Digital Service

This section explains how to configure the ISDN TA 128K for a 2B1Q Leased Digital service or a service that provides a permanent connection between end points.

NOTE: **When you select "Leased Line," make sure the phone line is connected to the RJ-45 jack marked "LEASED."**

```
                                 1=Dial Line         1=Clock mode
                 1=Netw Options  2=Leased Line       2=Channel rate
3=Config         2=DTE Options
                 3=Protocol
                 4=Quick Setup
                 5=Remote Config
```

5.3.1 SETTING THE CLOCK MODE

There are two clock modes you can configure: **Master** and **Slave**.

```
                              | 1=Dial Line   | 1=Clock mode ———— | 1=Master
                | 1=Netw Options | 2=Leased Line ———— | 2=Channel rate   | 2=Slave
3=Config ———— | 2=DTE Options
                | 3=Protocol
                | 4=Quick Setup
                | 5=Remote Config
```
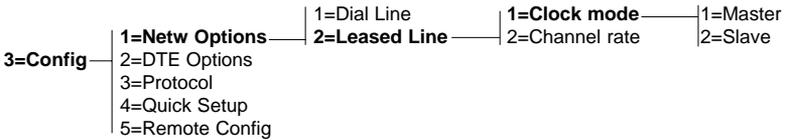
Master sets the ISDN TA up to provide clocking for both ends of the phone line. This option is intended to be used at one end of a limited-distance-modem application, where two ISDN TAs are directly connected without the use of channel banks. The ISDN TA at the other end of the connection should be set for Slave.

Slave tells the ISDN TA to derive its clocking from an outside source. If two ISDN TAs are connected through channel banks, both ISDN TAs should be configured for **Slave** mode.

5.3.2 SETTING THE CHANNEL RATE

In leased-line operation, that data rate for the ISDN TA 128K can be configured for 64 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.

```
                              | 1=Dial Line   | 1=Clock mode    | 1=64K
                | 1=Netw Options | 2=Leased Line ———— | 2=Channel rate ———— | 2=128K
3=Config ———— | 2=DTE Options
                | 3=Protocol
                | 4=Quick Setup
                | 5=Remote Config
```
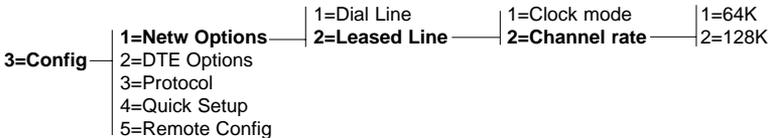
5.4 Setting DTE Options for Asynchronous Operation

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

```
                                                         1=Bit Rate
                                                         2=Connector Type
                                                         3=RTS options
                                                         4=CTS options
            1=Netw Options      1=Asynchronous           5=CD options
3=Config —  2=DTE Options —————  2=Synchronous           6=DTR options
            3=Protocol                                   7=DSR options
            4=Quick Setup                                8=Flow control
            5=Remote Config                              9=Data format
```

5.4.1 SETTING THE BIT RATE

```
                                                              1=300
                                                              2=1200
                                                              3=2400
                                                              4=4800
                                         1=Bit Rate ————————— 5=9600
                                         2=Connector Type     6=19200
                                         3=RTS options        7=38400
            1=Netw Options      1=Asynchronous                8=57600
3=Config —  2=DTE Options —————  2=Synchronous   4=CTS options 9=115200
            3=Protocol                           5=CD options
            4=Quick Setup                        6=DTR options
            5=Remote Config                      7=DSR options
                                                 8=Flow control
                                                 9=Data format
```

Choose one of the bit rates in the menu.

5.4.2 CONNECTOR TYPE
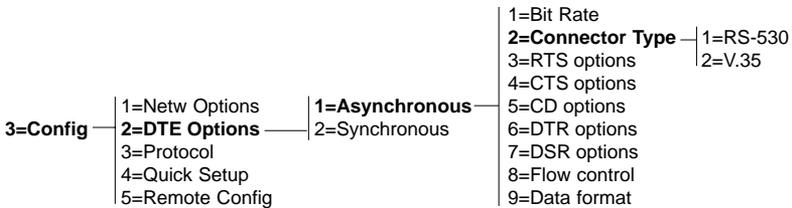
```
                                         1=Bit Rate
                                         2=Connector Type — 1=RS-530
                                         3=RTS options       2=V.35
                                         4=CTS options
            1=Netw Options      1=Asynchronous   5=CD options
3=Config —  2=DTE Options —————  2=Synchronous   6=DTR options
            3=Protocol                           7=DSR options
            4=Quick Setup                        8=Flow control
            5=Remote Config                      9=Data format
```

RS-530 selects RS-530 on the DB25 connector.

V.35 selects the V.35 connector.

RS-232 selects RS-232 on the DB25 connector.

5.4.3 RTS OPTIONS
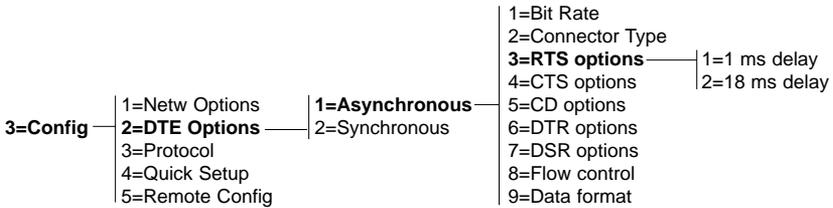
```
                                                          1=Bit Rate
                                                          2=Connector Type
                                                          3=RTS options ——— 1=1 ms delay
                                                          4=CTS options      2=18 ms delay
                            1=Netw Options   1=Asynchronous 5=CD options
                            2=DTE Options ——— 2=Synchronous 6=DTR options
         3=Config ——————————3=Protocol                     7=DSR options
                            4=Quick Setup                  8=Flow control
                            5=Remote Config                9=Data format
```

1ms delay causes the Clear to Send signal to change state one millisecond after the DTE's Ready to Send signal changes state.

18ms delay causes the Clear to Send signal to change state 18 milliseconds after the DTE's Ready to Send signal changes state

5.4.4 CTS OPTIONS
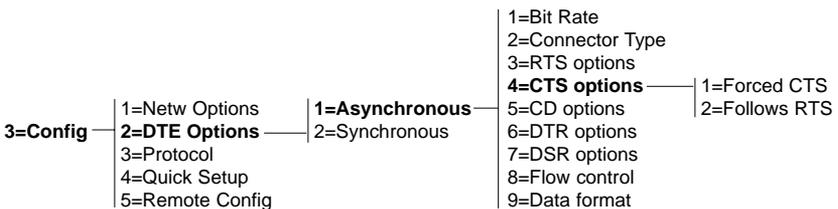
```
                                                          1=Bit Rate
                                                          2=Connector Type
                                                          3=RTS options
                                                          4=CTS options ——— 1=Forced CTS
                            1=Netw Options   1=Asynchronous 5=CD options      2=Follows RTS
                            2=DTE Options ——— 2=Synchronous 6=DTR options
         3=Config ——————————3=Protocol                     7=DSR options
                            4=Quick Setup                  8=Flow control
                            5=Remote Config                9=Data format
```

Forced CTS continuously asserts the CTS signal on the DTE connector.

*Follows RTS* causes CTS to follow the state of the RTS lead.

5.4.5 CD OPTIONS
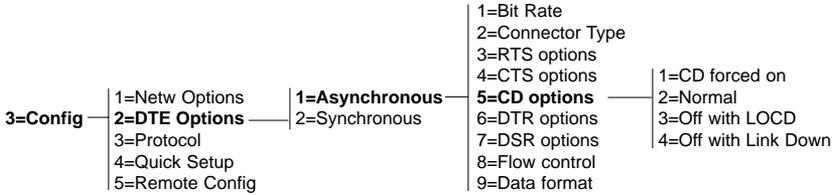
```
                                          1=Bit Rate
                                          2=Connector Type
                                          3=RTS options
                                          4=CTS options          1=CD forced on
           1=Netw Options   1=Asynchronous  5=CD options    ——  2=Normal
3=Config — 2=DTE Options —— 2=Synchronous   6=DTR options        3=Off with LOCD
           3=Protocol                       7=DSR options        4=Off with Link Down
           4=Quick Setup                    8=Flow control
           5=Remote Config                  9=Data format
```

CD forced on causes the Carrier Detect signal on the DTE connector to be always asserted.

Normal causes the Carrier Detect signal to be asserted when a call has been successfully established.

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.

Off with Link Down causes the Carrier Detect signal to be disasserted when the U-interface is not present.

5.4.6 DTR OPTIONS

```
                                          1=Bit Rate
                                          2=Connector Type
                                          3=RTS options
                                          4=CTS options          1=Ignore DTR
           1=Netw Options   1=Asynchronous  5=CD options    ——  2=Cmd when Off
3=Config — 2=DTE Options —— 2=Synchronous   6=DTR options        3=Idle when Off
           3=Protocol                       7=DSR options        4=Off>On dial #0
           4=Quick Setup                    8=Flow control       5=Dial #0 if On
           5=Remote Config                  9=Data format        6=Answer if On
                                                                 7=Dial/Ans if On
```

Ignore DTR causes the ISDN TA to disregard the state of the DTR pin.

Cmd when off forces the ISDN TA 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 ISDN TA to end the current call when DTR is no longer asserted.

Off>On dial #0 allows one call attempt (to the number stored in stored-number register 0) 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. (To store a number for automatic dialing, see **Section 5.7**.)

Dial #0 if on allows calls to be automatically established when the DTR signal is active. The ISDN TA will attempt to establish a call to stored number 0 until the call is established or DTR goes inactive.

Answer if on allows the ISDN TA to answer an incoming call only if the DTR signal is active.

5.4.7 DSR OPTIONS
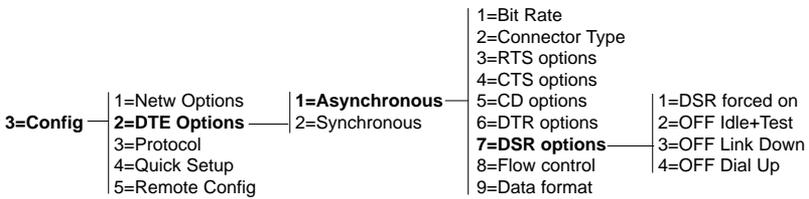
	1=Bit Rate	
	2=Connector Type	
	3=RTS options	
	4=CTS options	
1=Netw Options	**1=Asynchronous** 5=CD options	1=DSR forced on
3=Config **2=DTE Options**	2=Synchronous 6=DTR options	2=OFF Idle+Test
3=Protocol	**7=DSR options**	3=OFF Link Down
4=Quick Setup	8=Flow control	4=OFF Dial Up
5=Remote Config	9=Data format	

DSR forced on causes the DSR signal on the DTE connector to be always asserted.

OFF Idle+Test causes DSR to be disasserted if the network interface is in test mode or there is not an active call.

OFF Link Down causes DSR to be disasserted if the network interface is disrupted.

5.4.8 FLOW CONTROL

	1=Bit Rate	
	2=Connector Type	
	3=RTS options	
	4=CTS options	
1=Netw Options	**1=Asynchronous** 5=CD options	
3=Config **2=DTE Options**	2=Synchronous 6=DTR options	
3=Protocol	7=DSR options	1=Hardware flow
4=Quick Setup	**8=Flow control**	2=Software flow
5=Remote Config	9=Data format	3=No flow ctrl
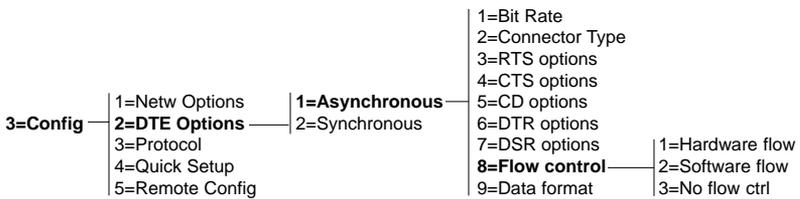
Hardware flow causes the ISDN TA to allow RX data to be presented to the DTE interface only when RTS is asserted.

*Software flow* uses X-ON/X-OFF to control data transferred between the DTE and the ISDN TA.

No flow ctrl disables flow control.

5.4.9 DATA FORMAT

```
                                              1=Bit Rate
                                              2=Connector Type
                                              3=RTS options
                                              4=CTS options
                  1=Netw Options  1=Asynchronous  5=CD options
        3=Config  2=DTE Options ──  2=Synchronous  6=DTR options
                  3=Protocol                    7=DSR options
                  4=Quick Setup                 8=Flow control   1=Data bits
                  5=Remote Config               9=Data format ── 2=Parity bits
                                                                 3=Stop bits
```
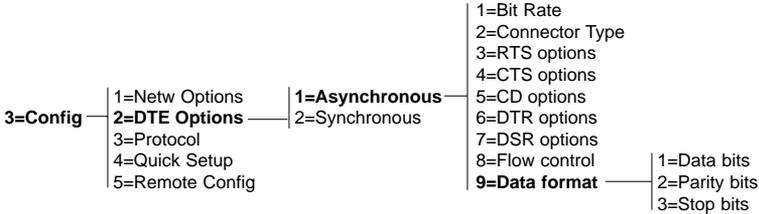
The Data Format options specify the format of the asynchronous data.

DATA BITS

```
                                              1=Bit Rate
                                              2=Connector Type
                                              3=RTS options
                                              4=CTS options
                  1=Netw Options  1=Asynchronous  5=CD options
        3=Config  2=DTE Options ──  2=Synchronous  6=DTR options
                  3=Protocol                    7=DSR options
                  4=Quick Setup                 8=Flow control   1=Data bits ──  1=8 data bits
                  5=Remote Config               9=Data format ── 2=Parity bits   2=7 data bits
                                                                 3=Stop bits
```
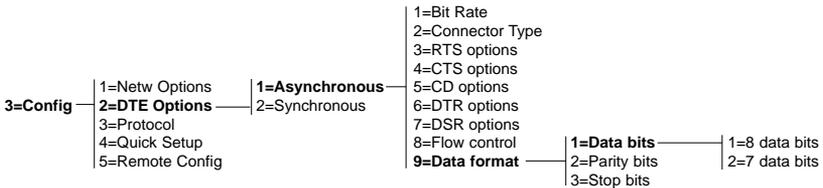
These options select the number of data bits in each asynchronous frame. (A frame consists of a start bit, 7 or 8 data bits, 0 or 1 parity bit, and 1 to 2 stop bits.)

PARITY BITS

```
                                              1=Bit Rate
                                              2=Connector Type
                                              3=RTS options
                                              4=CTS options
                  1=Netw Options  1=Asynchronous  5=CD options
        3=Config  2=DTE Options ──  2=Synchronous  6=DTR options
                  3=Protocol                    7=DSR options
                  4=Quick Setup                 8=Flow control   1=Data bits    1=None
                  5=Remote Config               9=Data format ── 2=Parity bits ── 2=Odd
                                                                 3=Stop bits    3=Even
```
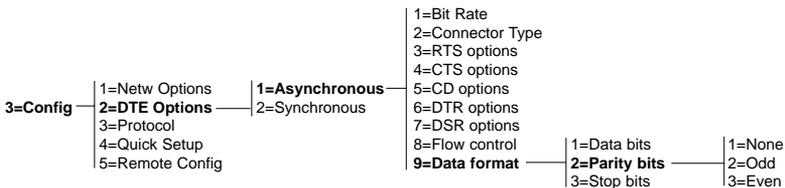
None selects no parity bits in each asynchronous frame, so that a frame consists of a start bit, 7 or 8 data bits, and 1 to 2 stop bits.

Odd selects an odd parity bit in each asynchronous frame, so that a frame consists of a start bit, 7 or 8 data bits, the odd parity bit, and 1 to 2 stop bits.

Even selects an even parity bit in each asynchronous frame, so that a frame consists of a start bit, 7 or 8 data bits, the even parity bit, and 1 to 2 stop bits.

STOP BITS

```
                                          1=Bit Rate
                                          2=Connector Type
                                          3=RTS options
                                          4=CTS options
              1=Netw Options   1=Asynchronous  5=CD options
3=Config ─── 2=DTE Options ─┬─               6=DTR options
              3=Protocol      2=Synchronous   7=DSR options
              4=Quick Setup                   8=Flow control  1=Data bits
              5=Remote Config                 9=Data format ─┬─2=Parity bits   1=1 stop bit
                                                             3=Stop bits ──── 2=1.5 stop bits
                                                                              3=2 stop bits
```
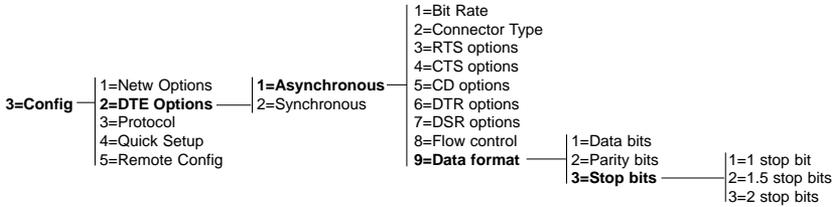
These options select the number of stop bits sent in each asynchronous frame. (A frame consists of a start bit, 7 or 8 data bits, 0 or 1 parity bit, and 1 to 2 stop bits.)

5.5 Setting DTE Options for Synchronous Operation

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

```
                                                  1=Bit Rate
                                                  2=Connector Type
                                                  3=RTS options
                                                  4=CTS options
              1=Netw Options     1=Asynchronous   5=CD options
3=Config ─── 2=DTE Options ─── 2=Synchronous ─── 6=DTR options
              3=Protocol                          7=DSR options
              4=Quick Setup                       8=Transmit clock
              5=Remote Config
```

5.5.1 SETTING THE BIT RATE

```
                                                  1=2400
                                                  2=4800
                                                  3=9600
                                1=Bit Rate        4=19200
             1=Netw Options   1=Asynchronous   2=Connector Type  5=38400
3=Config     2=DTE Options    2=Synchronous    3=RTS options     6=48000
             3=Protocol                         4=CTS options     7=56000
             4=Quick Setup                      5=CD options      8=64000
             5=Remote Config                    6=DTR options     9=112000
                                                7=DSR options     0=128000
                                                8=Transmit clock
```

Select one of the bit rates in the menu.

5.5.2 CONNECTOR TYPE
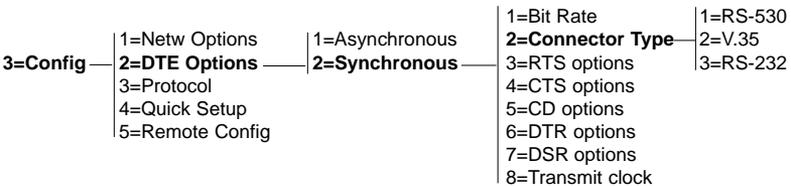
```
                                                1=Bit Rate        1=RS-530
             1=Netw Options   1=Asynchronous   2=Connector Type  2=V.35
3=Config     2=DTE Options    2=Synchronous    3=RTS options     3=RS-232
             3=Protocol                         4=CTS options
             4=Quick Setup                      5=CD options
             5=Remote Config                    6=DTR options
                                                7=DSR options
                                                8=Transmit clock
```

RS-530 selects RS-530 on the DB25 connector.

V.35 selects the V.35 connector.

RS-232 selects RS-232 on the DB25 connector.

5.5.3 RTS OPTIONS
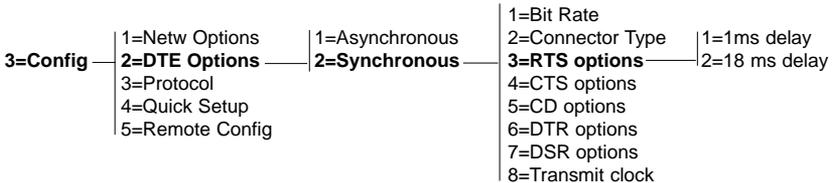
```
                                                1=Bit Rate
             1=Netw Options   1=Asynchronous   2=Connector Type  1=1ms delay
3=Config     2=DTE Options    2=Synchronous    3=RTS options     2=18 ms delay
             3=Protocol                         4=CTS options
             4=Quick Setup                      5=CD options
             5=Remote Config                    6=DTR options
                                                7=DSR options
                                                8=Transmit clock
```

1 ms delay causes the Clear to Send signal to change state one millisecond after the DTE's Ready to Send signal changes state.

18 ms delay causes the Clear to Send signal to change state 18 milliseconds after the DTE's Ready to Send signal changes state.

5.5.4 CTS OPTIONS
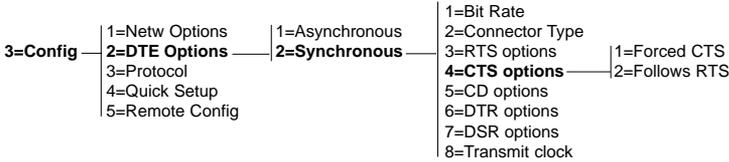
```
                                          1=Bit Rate
            1=Netw Options   1=Asynchronous   2=Connector Type
3=Config — 2=DTE Options —— 2=Synchronous —— 3=RTS options      1=Forced CTS
            3=Protocol                        4=CTS options ——— 2=Follows RTS
            4=Quick Setup                     5=CD options
            5=Remote Config                   6=DTR options
                                              7=DSR options
                                              8=Transmit clock
```

Forced CTS continuously asserts the CTS signal on the DTE connector.

Follows RTS causes CTS to follow the state of the RTS lead.

5.5.5 CD OPTIONS
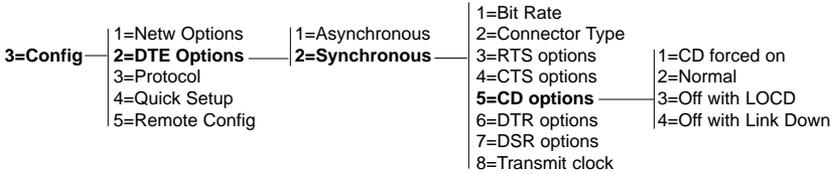
```
                                          1=Bit Rate
            1=Netw Options   1=Asynchronous   2=Connector Type
3=Config — 2=DTE Options —— 2=Synchronous —— 3=RTS options      1=CD forced on
            3=Protocol                        4=CTS options      2=Normal
            4=Quick Setup                     5=CD options ——— 3=Off with LOCD
            5=Remote Config                   6=DTR options      4=Off with Link Down
                                              7=DSR options
                                              8=Transmit clock
```

CD forced on causes the Carrier Detect signal on the DTE connector to be always asserted.

Normal causes the Carrier Detect signal to be asserted when a call has been successfully established.

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.

Off with Link Down causes the Carrier Detect signal to be disasserted when the U-interface is not present.

5.5.6 DTR OPTIONS

```
                                              1=Bit Rate
            1=Netw Options    1=Asynchronous  2=Connector Type
3=Config — 2=DTE Options —— 2=Synchronous — 3=RTS options
            3=Protocol                        4=CTS options      1=Ignore DTR
            4=Quick Setup                     5=CD options       2=Cmd when Off
            5=Remote Config                   6=DTR options —— 3=Idle when Off
                                              7=DSR options      4=Off>On dial #0
                                              8=Transmit clock   5=Dial #0 if On
                                                                 6=Answer if On
                                                                 7=Dial/Ans if On
```

Ignore DTR causes the ISDN TA to disregard the state of the DTR pin.

Cmd when off forces the ISDN TA 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 ISDN TA to end the current call when DTR is no longer asserted.

Off>On dial #0 allows one call attempt (to the number stored in stored-number register 0) 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. (To store a number for automatic dialing, see **Section 5.6**.)

Dial #0 if on allows calls to be automatically established when the DTR signal is active. The ISDN TA will attempt to establish a call to stored number 0 until the call is established or DTR goes inactive.

Answer if on allows the ISDN TA to answer an incoming call only if the DTR signal is active.

5.5.7 DSR OPTIONS
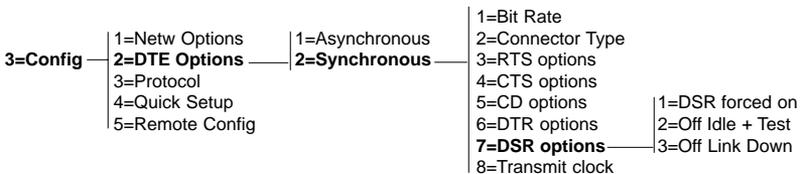
```
                                              1=Bit Rate
            1=Netw Options    1=Asynchronous  2=Connector Type
3=Config — 2=DTE Options —— 2=Synchronous — 3=RTS options
            3=Protocol                        4=CTS options
            4=Quick Setup                     5=CD options      1=DSR forced on
            5=Remote Config                   6=DTR options     2=Off Idle + Test
                                              7=DSR options —— 3=Off Link Down
                                              8=Transmit clock
```

DSR forced on causes the DSR signal on the DTE connector to be always asserted.

OFF Idle+Test causes DSR to be disasserted if the network interface is in test mode 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 ISDN TA, when it's in dial-backup mode, to disassert DSR when the leased line changes over to the dial-line mode.

5.5.8 TRANSMIT CLOCK

```
                                                    1=Bit Rate
                    1=Netw Options   1=Asynchronous  2=Connector Type
    3=Config——  2=DTE Options —— 2=Synchronous —— 3=RTS options
                    3=Protocol                      4=CTS options
                    4=Quick Setup                   5=CD options
                    5=Remote Config                 6=DTR options
                                                    7=DSR options
                                                    8=Transmit clock—— 1=Normal
                                                                        2=External
```
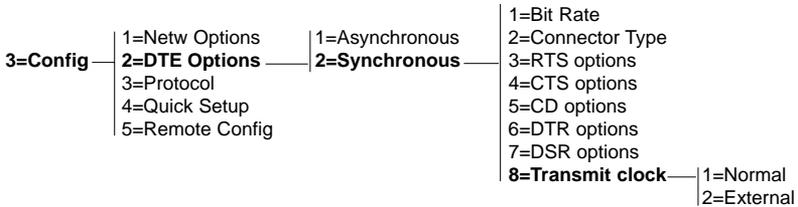
Normal causes the ISDN TA to be the synchronous DTE transmit timing source. Transmit data is timed from the transmit clock provided by the ISDN TA on the DTE connector. This is the normal mode of operation for the ISDN TA.

External sets up the ISDN TA as a slave to an external transmit timing source. The external clock is provided to the ISDN TA by the external transmit timing clock at the DTE connector. This signal is echoed by the ISDN TA to the Transmit Clock signal on the DTE connector.

The "External" option is provided for situations where equipment on the ISDN TA's DTE connector cannot slave to the clock provided by the ISDN TA. The ISDN TA uses the U-interface as the frequency standard when it must provide a synchronous transmit or receive clock. The externally provided clock must be of the same average frequency as the clock that the ISDN TA would provide if "Normal" (internal) transmit clock were selected. If it is not of the same average frequency, bit errors might occur.

5.6 Setting Protocol Options

The ISDN TA 128K communicates with many different types of telecommunication equipment, including other ISDN TA 128Ks, ISDN terminal adapters, Switched-56 DSUs, and BONDING-compatible inverse multiplexors. In order to work with so many kinds of equipment, the ISDN TA has to use various rate-adaptation protocols:

- BONDING (Bandwidth On Demand Interoperability Group) mode 1

- TLINK (Dial DDS DSU/CSU)

- SAP (Simple ADTRAN Protocol)

- Clear Channel (no rate-adaptation protocol)

- CCITT V.120

See **Section 2.4** for more about recommended operating protocols.

```
                                       1=Clear Channel
                    1=Netw Options     2=BONDING mode 1
     3=Config —— 2=DTE Options        3=V.120
                    3=Protocol————     4=V.34
                    4=Quick Setup      5=V.110
                    5=Remote Config    6=DSU 57.6 async
                                       7=T-LINK
                                       8=SAP
                                       9=Fallback
                                       0=PPP asyn-sync
```
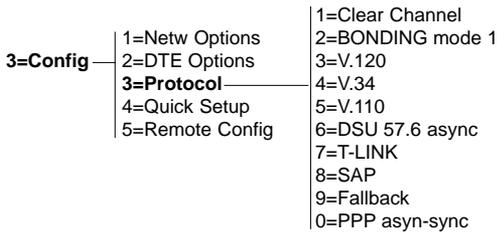
You can choose the protocol with AT commands or from the front panel of the ISDN TA.

5.6.1 CLEAR CHANNEL

```
                                       1=Clear Channel
                    1=Netw Options     2=BONDING mode 1
     3=Config —— 2=DTE Options        3=V.120
                    3=Protocol————     4=V.34
                    4=Quick Setup      5=V.110
                    5=Remote Config    6=DSU 57.6 async
                                       7=T-LINK
                                       8=SAP
                                       9=Fallback
                                       0=PPP asyn-sync
```
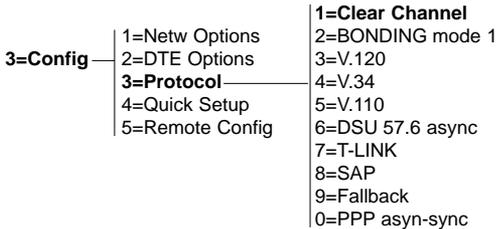
Clear Channel provides the entire bearer channel to the DTE without regard to data format or protocol. This provides a rate adaptation at or near the ISDN circuit rate.

The primary use 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 and rate adaptation, or when the ISDN TA 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.

5.6.2 BONDING MODE 1

The BONDING mode 1 protocol allows the ISDN TA to communicate at bit rates in excess of 64 Kbps to a maximum of 128 Kbps. BONDING provides high-speed communication between ISDN TA 128Ks, ISDN THE/TAs, and inverse multiplexing equipment supporting the BONDING protocol. The protocol allows for the use of both synchronous and asynchronous bit rates. When the ISDN TA 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 delays between the two bearer channels and presents a single high-speed data channel to the DTE. For successful high-speed operation, both the near-end and far-end DCEs 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 from the **BONDING mode 1** submenu:

```
                                               1=TXINIT
                          1=Clear Channel      2=TXFA
                          2=BONDING mode 1 ——— 3=TXADD01
          1=Netw Options  3=V.120              4=TXDEQ
3=Config— 2=DTE Options   4=V.34               5=TANULL
          3=Protocol ———— 5=V.110              6=TCID
          4=Quick Setup   6=DSU 57.6 async
          5=Remote Config 7=T-LINK
                          8=SAP
                          9=Fallback
                          0=PPP asyn-sync
```
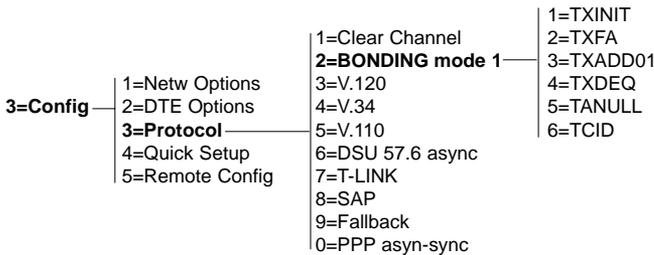
TXINIT specifies how long the originating endpoint will attempt to detect the BONDING negotiation pattern from the answering endpoint before deciding the BONDING call has failed. In general, this timer value should be left at the factory-default setting of 10 seconds. The possible values are 1, 2, 5, 10 (default), 20, 50, 100, and 200 seconds.

TXFA specifies how long both endpoints will attempt to detect the BONDING frame pattern when a call is 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 interoperating with other manufacturers' BONDING equipment it may be necessary to lengthen this timer so that it matches TXADD01. The possible values are 1, 2, 5, 10 (default), 20, 50, 100, and 200 seconds.

TXADD01 specifies how long both endpoints will wait for the additional call to be connected at the end of negotiation before deciding that 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 possible values are 1, 2, 5, 10, 20, 50 (default), 100, and 200 seconds.

TXDEQ specifies how long both endpoints will attempt to equalize the network delay between the bearer channels before deciding the BONDING call has failed. The possible values are 1, 2, 5, 10, 20, 50 (default), 100, and 200 seconds.

TANULL specifies how long 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 time if the DTE equipment connected to the ISDN TA also has timer constraints for completing non-BONDING parameter negotiation. The possible values are 1, 2, 5, 10 (default), 20, 50, 100, and 200 seconds.

TCID specifies how long both endpoints will attempt to negotiate an agreeable value for bearer channels and channel capacities before deciding the BONDING call has failed. The default setting is 5 seconds. The possible values are 1, 2, 5 (default), 10, 20, 50, 100, and 200 seconds.

5.6.3 V.120

```
                                      1=Clear Channel
                                      2=BONDING mode 1
                      1=Netw Options  3=V.120
       3=Config —— 2=DTE Options    4=V.34
                      3=Protocol ———— 5=V.110
                      4=Quick Setup   6=DSU 57.6 async
                      5=Remote Config 7=T-LINK
                                      8=SAP
                                      9=Fallback
                                      0=PPP asyn-sync
```

The V.120 protocol is a CCITT-compliant rate-adaptation method; it provides DTE service between the ISDN TA 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 **Section 2.4** for
recommended V.120 rates.

5.6.4 V.34

```
                                  1=Clear Channel
                                  2=BONDING mode 1
                                  3=V.120
           1=Netw Options        4=V.34 ─────────   1=Error Ctrl ──  1=Normal
3=Config ─ 2=DTE Options         5=V.110            2=Compression    2=Direct
           3=Protocol ─────────  6=DSU 57.6 ASYNC   3=MNP Blk Size   3=Reliable MNP
           4=Quick Setup         7=T-LINK                            4=Auto-Rel MNP
           5=Remote Config       8=SAP                               5=Force LAPM
                                  9=FALLBACK                          6=Force MNP
                                  0=PPP asyn-sync
```
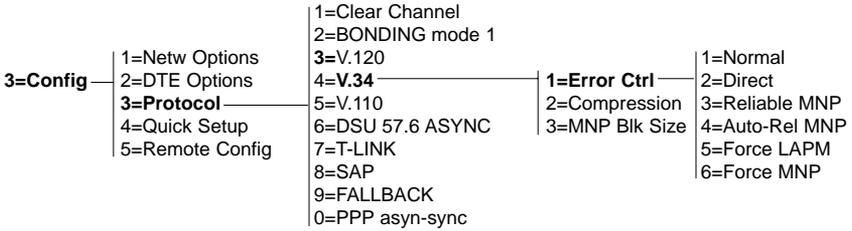
The **V.34** option has no effect in this version of the ISDN TA. It's included
to make room for future upgrades.

5.6.5 DSU 57.6 ASYNC

```
                                 1=Clear Channel
                                 2=BONDING mode 1
                                 3=V.120
            1=Netw Options       4=V.34
3=Config ─  2=DTE Options        5=V.110
            3=Protocol ───────   6=DSU 57.6 async
            4=Quick Setup        7=T-LINK
            5=Remote Config      8=SAP
                                 9=Fallback
                                 0=PPP asyn-sync
```
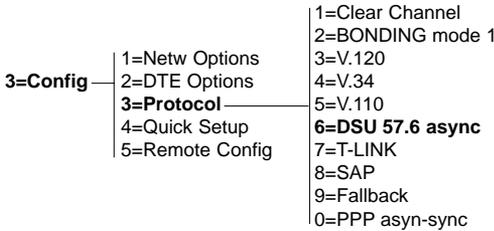
The DSU 57.6 Async protocol allows the ISDN TA to communicate
asynchronously at 57.6 Kbps with certain 2 and 4-wire Switched-56 DSUs
(our product codes MT136A and MT137C). The ISDN TA will also
communicate with other ISDN TAs over dial and leased connections with
this protocol.

5.6.6 T-LINK

```
                                    1=Clear Channel
                                    2=BONDING mode 1
                 1=Netw Options     3=V.120
     3=Config — 2=DTE Options       4=V.34
                 3=Protocol ——————— 5=V.110
                 4=Quick Setup      6=DSU 57.6 async
                 5=Remote Config    7=T-LINK
                                    8=SAP
                                    9=Fallback
                                    0=PPP asyn-sync
```
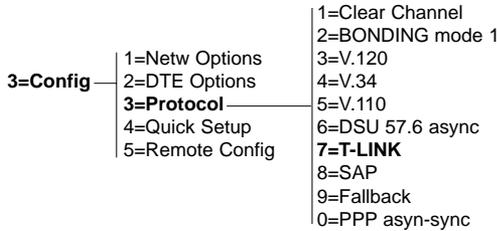
The T-LINK protocol allows the ISDN TA to communicate with 2-wire Switched-56 devices that use the T-LINK protocol. It performs two functions:

- 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.

5.6.7 SAP

```
                                    1=Clear Channel
                                    2=BONDING mode 1
                 1=Netw Options     3=V.120
     3=Config — 2=DTE Options       4=V.34
                 3=Protocol ——————— 5=V.110
                 4=Quick Setup      6=DSU 57.6 async
                 5=Remote Config    7=T-LINK
                                    8=SAP
                                    9=Fallback
                                    0=PPP asyn-sync
```
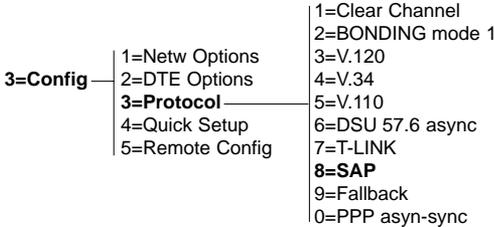
The proprietary protocol (SAP) is a rate-adaptation method that provides DTE service between ISDN TAs at lower than the 64-Kbps bearer-channel rate. Selecting this menu item causes the ISDN TA to use SAP protocol.

The primary use for SAP is for general-purpose rate adaptation in a dialup or leased-line environment.

5.6.8 FALLBACK

```
                                        1=Clear Channel
                                        2=BONDING mode 1
                     1=Netw Options     3=V.120
                     2=DTE Options      4=V.34
         3=Config —  3=Protocol ———————— 5=V.110
                     4=Quick Setup      6=DSU 57.6 async
                     5=Remote Config    7=T-LINK
                                        8=SAP
                                        9=Fallback
                                        0=PPP asyn-sync
```
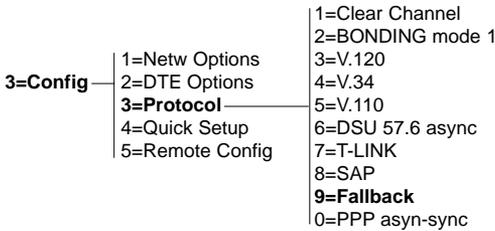
This protocol provides the capability to establish calls automatically with other ISDN TAs and Switched-56 DSUs, with a single configuration. The ISDN TA must be set up as follows for Fallback operation:

1. Any asynchronous bit rate, up to 115.2 Kbps, that 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

When *answering* calls, the ISDN TA uses the incoming Call Type to determine which rate-adaptation protocols to support.

Call Type	Rate-Adaptation Protocols Supported	Typical Units Supported
Data 64 Kbps	BONDING Mode 1	ISDN TA 128K
	V.120	Any ISDN TA
Data 56K	V.120	Any ISDN TA
	T-LINK	2-wire Switched-56 DSUs

When *originating* calls to unknown units, the ISDN TA begins its protocol selection based on its local Call Type. (If you select **Fallback** from the Quick Setup menu, the Call Type is Data 64K.) Upon connection at 64K call type, BONDING and V.120 are attempted. If connection is not made at 64K, the ISDN TA attempts another call at 56K Call Type. If connection is made at 56K, V.120 and T-LINK are attempted. Once a call connects, if a protocol cannot be negotiated, the ISDN TA hangs up the call.

5.6.9 PPP

```
                                          1=Clear Channel
                                          2=BONDING mode 1
                    1=Netw Options        3=V.120
                    2=DTE Options         4=V.34
     3=Config ──── 3=Protocol ──────────  5=DSU 57.6 ASYNC
                    4=Quick Setup         6=T-LINK
                    5=Remote Config       7=SAP
                                          8=FALLBACK
                                          9=PPP asyn-sync ──── 1=METHOD ──── 1=PPP
                                                                             2=Multilink PPP
                                                                             3=PPP w/Comp
```
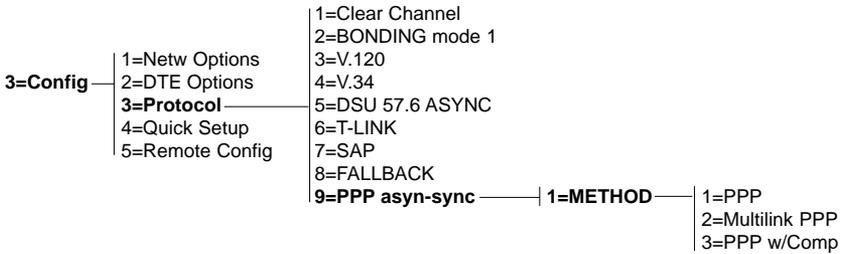
The PPP async protocol lets the ISDN TA, and a PC or Macintosh® running PPP software, communicate with a PPP-compatible bridge or router. The PPP async-sync protocol complies with Internet Engineering Task Force (IETF) RFC 1662.

PPP is the standard PPP protocol. Setting S-register 27 to 0 also selects PPP.

Multilink PPP, an extension of PPP, is a method for splitting and recombining data packets across multiple logical data links. Setting S-register 27 to 1 also selects Multilink PPP.

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

PPP with compression (PPP w/Comp) tells the ISDN TA to negotiate the compression-control protocol (CCP) with the network PPP peer. If STAC compression is successfully negotiated with the peer, data packets from the DTE are compressed before being sent out through the network. Likewise, compressed packets from the network are decompressed before being transmitted through the DTE.

NOTE: For the Quick Setup menu, see Chapter 4.

5.7 Front-Panel Dialing Options

Selecting **4=Dial** or pressing the **#** (pound) key from the top of the menu tree displays the front-panel dialing options. Dialing options are available only when the ISDN TA is configured for **Dial Line** operation (not **Leased Line**).

If you're using a terminal, the Dial Menu will look like this:

```
                        ISU 128 Dial Menu
1) Hang up line
2) Dial number
3) Redial last #
4) Answer call
5) Dial stored #
6) Store/Review #
Menu option:




 Ctl-U STATUS   Ctl-T TEST   Ctl-C CONFIG   Ctl-D DIAL   Ctl-X EXIT
```

From the front panel, this is the menu tree:

```
                         1=Hang up line
                         2=Dial number
                         3=Redial last #
            4=Dial ───── 4=Answer call
                         5=Dial stored #
                         6=Store/Review #
```
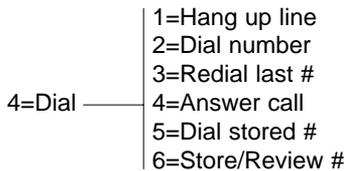
Hang up line terminates the current call.

Dial number lets you enter and dial a number from the keypad. If you make a mistake when you enter the number, press the **Cancel** key to start over. Press the **Cancel** key twice to exit this menu item without dialing a number. Pressing the **Enter** key will cause the ISDN TA to dial the number and save the dialed number as stored number 9 for redialing.

Redial last # lets you redial the last number dialed. This number was saved as stored number 9 from the last attempted phone call.

Answer call lets you answer an incoming call when Auto Answer is disabled (see **Section 5.1.5**).

Dial stored # lets you dial one of ten stored phone numbers. Use the **Up** and **Down** arrow keys to select a stored number. When you've selected the

number you want, press **Enter** to dial it. A copy of that number will be saved as stored number 9 for redialing.

Store/Review **#** lets you enter and review stored numbers. Use the **Up** and **Down** arrow keys to scroll through the numbers. To store a number, scroll to the number location where you want to store it, enter the number, and press **Enter**. If you make a mistake, press **Cancel** to clear the line and try again. Press **Cancel** twice in a row to exit this menu item without changing the selected number.

5.8 How to Use AT Commands

Besides the front-panel menus, the ISDN TA can use the same standard AT commands ordinary modems use. Select **AT commands** from the **Dial options** menu.

```
                                          1=Switch type
                                          2=Call Type        1=Front panel
                                          3=Terminal ID      2=RS-366
                      1=Dial Line ───────  4=Dial Options ── 3=AT commands
        1=Netw Options ─┤                  5=Auto answer     4=V.25
                      2=Leased Line        6=Answer tone     5=Disabled
3=Config ─ 2=DTE Options                   7=Connect timeout
          3=Protocol                       8=Call screening
          4=Quick Setup
          5=Remote Config
```
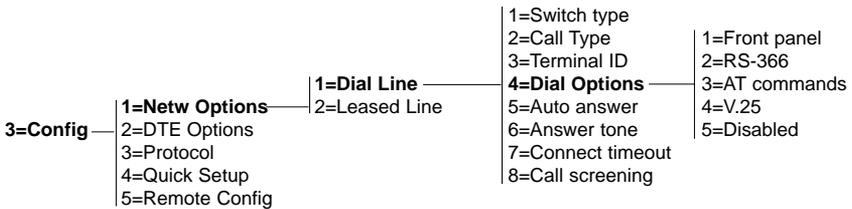
While a call is not established, the DTE port will accept AT commands. During this time, the CD signal will be inactive.

Once a call is established, the DTE port is used for data, and CD is active. To exit the data mode and return to the command mode, enter the *escape sequence,* which is the escape-code character entered three times in a row, with a delay between characters not greater than the *guard time.* The default for the escape character is +, and the default for the guard time is one second; so the default escape sequence is +++. You can change the defaults if you like—see Register S2 in **Appendix D**.

When you've entered the command mode, you can use AT commands to configure most of the options, dial remote DSUs, or initiate tests. All command lines must begin with "AT" in either capital or lower-case letters. A command line can be terminated at any time by transmitting CTRL-X (ASCII 018) after the "AT" attention code. The ISDN TA will ignore this command line and send the response "OK."

You can put one command or a series of commands on the command line after the "AT." If you like, you can use spaces to separate the commands on a command line; the ISDN TA will ignore the spaces. The maximum length for a command line is 40 characters. You can use the backspace character (ASCII 008) to edit the line.

The command line is executed as soon as the ISDN TA receives a *terminating character*. The default for the terminating character is a carriage return (ASCII 013), but you can change it by writing a different value to register S3.

The table that follows shows the AT commands that the ISDN TA 128K supports.

To use an AT command, type **AT**, then the command, then **Enter**. Example: **ATI1** returns the software version of the ISDN TA.

S-Registers hold configuration information for the ISDN TA. You can review or change the configuration by reviewing or changing the S-registers.

To read an S-register, type **ATS**, then the number of the S-register to be read, then a question mark. Example: **ATS0?** reads the contents of register 0.

To change an S-register, type **ATS**, then the number of the S-register to be changed, then **=**, then the new numeric value to be assigned to the register. Example: **ATS0=2** changes the value of S0 to 2.

S-String Registers work the same way as S-registers, except that they hold whole strings instead of just numeric values. Example: **ATSS62=5551212** stores the number 555-1212 in SS-register 62.

To dial a call with AT commands, type **ATD**, then the telephone number, and press **Enter**. Example: **ATD5551212** dials the number 555-1212.

When the dialing begins, the front panel will read "Dialing 5551212." If the call is successful, it will read "Connect," followed by the rate-adaptation protocol and the bit rate. If the call is not successful, it will read "Disconnect," then "Ready." At this point the ISDN TA is ready for another call. You can look at the status buffer to find out why the call was unsuccessful.

To end a call with AT commands, send the escape sequence (**+++**, or your own redefined sequence), then send the command **ATH**.

5.9 How to Use V.25 bis In-Band Dialing

```
                                      1=Switch type
                                      2=Call Type        1=Front panel
                                      3=Terminal ID      2=RS-366
                     1=Dial Line ──── 4=Dial Options ─── 3=AT commands
      1=Netw Options─┤2=Leased Line   5=Auto answer      4=V.25
3=Config ─┤2=DTE Options              6=Answer tone      5=Disabled
          │3=Protocol                 7=Connect timeout
          │4=Quick Setup              8=Call screening
          │5=Remote Config
```
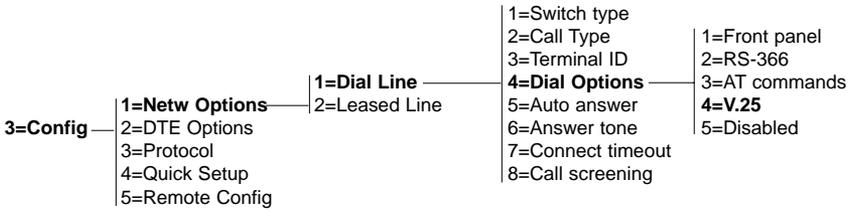
V.25 bis dialing is used primarily by data terminal equipment with synchronous interfaces (HDLC/SDLC or BSC/Bisync) not supporting the AT command set. The ISDN TA 128K supports V.25 bis in-band dialing in accordance with Fascicle VIII.I—V.25 bis (Malaga-Torremolinos 1984, Melbourne 1988).

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 102/8
>
> Calling indicator ....Circuit 125

The ISDN TA 128K supports the following V.25 bis commands to control automatic calling and answering:

> CRN.......................Call request (number in command)
>
> CRS.......................Call request (using stored number)
>
> PRN ....Program stored number
>
> RLN..List stored number
>
> CIC ....Connect incoming call
>
> DIC ....Disconnect incoming call

NOTE: For stored numbers, V.25 bis accesses stored numbers 1 through 9—the same ones used by front-panel dialing. See Section 5.6.

Disable **Auto answer** if V.25 bis is in control of answering incoming calls with the CIC and DIC commands, since any other setting for **Auto answer** will override V.25 control of the answer function.

```
                                                          1=Switch type
                                                          2=Call Type
                                                          3=Terminal ID      1=Disabled
                                   1=Dial Line            4=Dial Options     2=Enabled
              1=Netw Options       2=Leased Line          5=Auto answer      3=Dump all calls
              2=DTE Options                               6=Answer tone
3=Config      3=Protocol                                  7=Connect timeout
              4=Quick Setup                               8=Call screening
              5=Remote Config
```
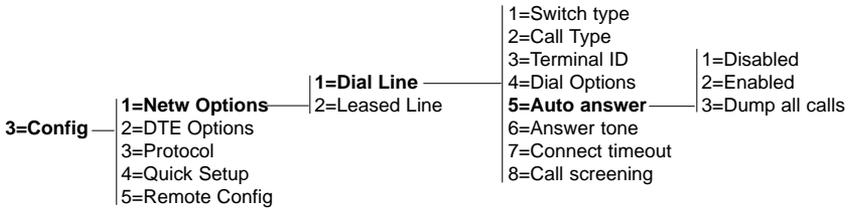
5.9.1 ASYNC V.25 DIALING

This setting allows for V.25 bis messages in asynchronous format.

```
                                                   1=Switch type
                                                   2=Call Type
                                                   3=Terminal ID    1=Front Panel
                              1=Dial Line           4=Dial Options   2=RS-366
              1=Netw Options  2=Leased Line         5=Auto answer    3=AT commands    1=V.25 HDLC
              2=DTE Options                          6=Answer tone    4=V.25           2=V.25 Async
3=Config      3=Protocol                             7=Connect timeout 5=Disabled      3=V.25 Bisync
              4=Quick Setup                          8=Call screening                  4=V.25 HDLC FLAG
              5=Remote Config
```
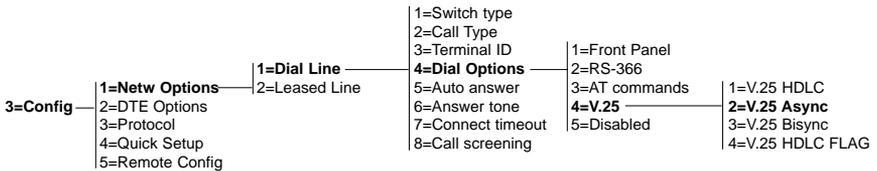
V.25 bis specifies that the characters should be ASCII, 7 bits, even parity, and one stop bit. However, for versatility, the ISDN TA 128K allows whatever data bits, parity, and stop bits you've defined under **Data Bits**.

```
                                                   1=Bit Rate
                                                   2=Connector Type
                                                   3=RTS options
                                                   4=CTS options
                                                   5=CD options
              1=Netw Options   1=Asynchronous       6=DTR options
3=Config      2=DTE Options    2=Synchronous        7=DSR options
              3=Protocol                             8=Flow control    1=Data bits     1=8 data bits
              4=Quick Setup                          9=Data format     2=Parity bits   2=7 data bits
              5=Remote Config                                          3=Stop bits
```
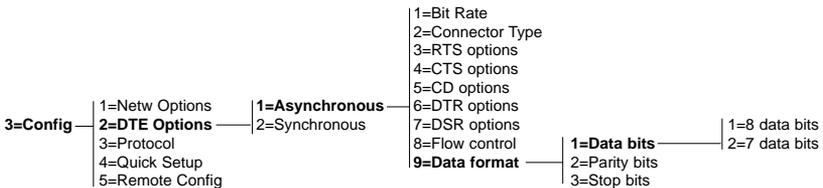
5.9.2 SYNC V.25 HDLC DIALING

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

```
                                                   1=Switch type
                                                   2=Call type
                                                   3=Terminal ID    1=Front Panel
                    1=Netw Options   1=Dial Line   4=Dial options   2=RS-366          1=V.25 HDLC
 3=Config           2=DTE Options    2=Leased Line 5=Auto answer    3=5AT commands    2=V.25 ASYNC
                    3=Protocol                     6=Answer tone    4=V.25            3=V.25 BISYNC
                    4=Quick Setup                  7=Connect timeout 5=Disabled       4=V.25 HDLC FLAG
                    5=Remote Config                8=Call screening
```
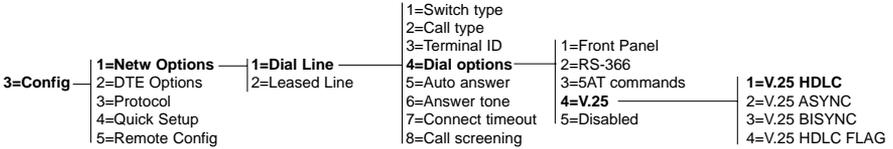
This option specifies that the characters should be 7-bit ASCII, with the 8th bit ignored (it may be either 0 or 1).

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 it isn't the final packet.

5.9.3 SYNC V.25 BISYNC DIALING

This setting allows for V.25 bis messages in byte-synchronous format (Bisync). V.25 bis specifies that the characters should be ASCII, 7 bits, and odd parity. This setting allows synchronous data terminal equipment that does not use HDLC to support serial in-band dialing.

```
                                                   1=Switch type
                                                   2=Call type
                                                   3=Terminal ID    1=Front Panel
                    1=Netw Options   1=Dial Line   4=Dial options   2=RS-366          1=V.25 HDLC
 3=Config           2=DTE Options    2=Leased Line 5=Auto answer    3=5AT commands    2=V.25 ASYNC
                    3=Protocol                     6=Answer tone    4=V.25            3=V.25 BISYNC
                    4=Quick Setup                  7=Connect timeout 5=Disabled       4=V.25 HDLC FLAG
                    5=Remote Config                8=Call screening
```
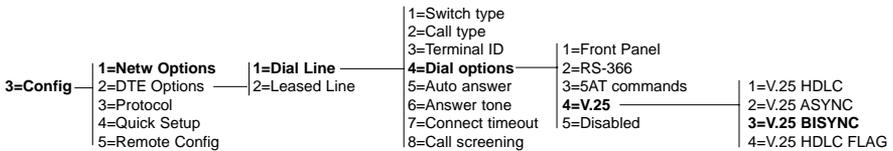
5.10 The Status Buffer

Choose **1=Status** from the top of the menu tree to see the contents of the status buffer. The **Up** and **Down** arrow keys scroll through the last fifty status messages. (See **Appendix C** for an explanation of the status messages.) Pressing the **Cancel** key returns you to the top of the menu.

5.11 Test Options

Selecting **2=Test** from the top of the menu tree brings up a menu of local testing options.

```
                          | 1=Loopback DTE
                          | 2=Loopback Netw
                          | 3=Loopback Proto
          2=Test ———————— | 4=Loopback Remote
                          | 5=Test Remote
                          | 6=Lpbk Disable
                          | 7=NEBE/FEBE
                          | 8=Software Ver.
```

Loopback DTE loops the DTE port back toward your equipment, so you can perform a Bit Error Rate Test (BERT) between the ISDN TA 128K and your equipment to verify proper cable connection and so on.

Loopback Netw loops both the B1 and B2 channels back toward the network. This can be used to allow a far-end user to perform a BERT test all the way through the network.

Loopback Proto allows data to be looped back through the network after passing through a selected protocol, such as T-LINK or BONDING.

Loopback Remote allows the ISDN TA to issue a V.54 inband loopback command to a far-end unit, while still accepting data from the DTE connector. That allows bit-error-rate testing of an entire link with an external BERT tester. To use this feature, both units must be configured for Clear Channel operation (see **Section 5.6.1**), and the far-end unit must be able to respond to V.54 commands. Pressing **Cancel** will end the test.

Test Remote allows the ISDN TA to issue a V.54 inband loopback command to a far-end unit and BERT-test the unit with a built-in 2047 pattern generator/checker. Thus you can test a circuit without any extra test equipment. To use this feature, both units must be configured for Clear Channel operation (see **Section 5.6.1**), and the far-end unit must be able to respond to V.54 loopback commands. The built-in 2047 pattern generator/checker displays the number of bytes transmitted (on the top line of the front-panel display) 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:

```
                        1=Loopback DTE
                        2=Loopback Netw
                        3=Loopback Proto
        2=Test ─────────4=Loopback Remote │ 1=No Rem Lpbks
                        5=Test Remote       2=DDS Accepted
                        6=Lpbk Disable──────3=V54 Accepted
                        7=NEBE/FEBE         4=DDS + V54 Accept
                        8=Software Ver.
```

- *No Rem Lpbks:* The ISDN TA will ignore all V.54 and DDS loopback commands.

- *DDS Accepted:* The ISDN will respond to DDS Latching Loopback commands. This option takes effect only if the ISDN TA is in leased-line mode.

- *V54 Accepted:* The ISDN TA will respond to V.54 loopback commands.

- *DDS+V54 Accept:* The ISDN TA will respond to both DDS Latching Loopback commands (leased-line mode only) and V.54 loopback commands.

NEBE/FEBE lets you 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. returns the version number of the software in the ISDN TA 128K.

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

6. Troubleshooting

6.1 What to Do If the Self-Test Fails

When the ISDN TA 128K powers up, it performs an internal self-test. At the end of the test, the front panel displays "Self Test Passed."

If "Self Test Passed" is not displayed:

1. Make sure that the ISDN TA is plugged in and switched on. Make sure there is power in the outlet.

2. Turn off the ISDN TA. Hold the 0 key down and turn it on again. Keep holding the 0 key down for 15 more seconds. This will reset all the internal settings to factory defaults.

3. If the ISDN TA still doesn't pass the self-test, call for technical support.

6.2 What to Do If the ISDN TA Does Not Read "Ready"

When the ISDN TA has been set up and connected to a line, the front panel should read "Ready" after a few minutes. If it doesn't:

1. Turn the power off and leave it off for at least two seconds, then turn it back on again. Wait at least a full minute to see whether "Ready" appears.

2. Disconnect the ISDN TA from the line. From a working voice phone, call the local directory number or numbers of the line the ISDN TA was connected to. 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 telephone company that provided your line should be able to help.

3. If the ISDN TA continues to read "Link Down," then there is a physical problem with the phone line (probably a problem with the Layer 1 setup). The problem is in one or more of these places:

• The ISDN TA software setup.

• The ISDN TA hardware itself.

• Your wiring.

• The telephone company's wiring.

- The telephone company's hardware.

- The telephone company's software setup.

To isolate the problem:

- Make sure the line is plugged into the connector marked "DIAL" on the back of the ISDN TA.

- Make sure the ISDN TA is configured for dial-line service. Choose 3=Config from the Main menu, then 1=Netw. Options, then 1=Dial Line.

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

- Talk to your service provider and make sure you have an ISDN Basic Rate U-Interface with 2B1Q line coding (not an S or T interface or AMI coding).

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

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

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

- With the ISDN TA connected to the line and powered up, talk to your service provider's repair group and inform them that your ISDN basic-rate link has a Physical Layer 1 problem. Ask them to check the line. Tell them that you have an NT1-like device at the end of the line.

  4. If the ISDN TA continues to read "Getting TEI#1," then it is physically connected to your local telephone-service provider, but unable to establish Logical Layer 2. The problem is in one or more of these places:

- The ISDN TA software setup

  The telephone company's software setup

- Hardware configuration, if the line is extended from the switch.

  To isolate the problem:

- Make sure the ISDN TA is set up for the correct switch type. From the Main Menu, choose 3=Config, then 1=Netw Oprinos, then 1=Dial Line, then 1=Switch type, then the correct switch type.

- Make sure that the quality of your line is satisfactory by checking for Near-End and Far-End Block Errors (NEBEs and FEBEs). From the Main Menu, choose 2=Test, then 7=NEBE/FEBE. If the counts are non-zero, you may have a physical-link problem. See Step 3, "If the ISDN TA continues to read 'Link Down.'"

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

- With the ISDN TA connected to the line and powered up, talk to your service provider's repair group and inform them that you have an ISDN basic-rate line that appears to be physically okay, but has no Terminal Endpoint Identifier (TEI). Ask them to check the line translation and make sure that the line supports Dynamic TEI allocation. Tell them you have an NT1 and Terminal Adapter device connected to the line.

5. If the ISDN TA continues to read Register SPID #1, then it is physically connected to your local telephone company and has established Logical Layer 2, but is unable to establish Layer 3. The problem is in one or both of these places:

- The ISDN TA software setup.

- The telephone company's software setup.

  To isolate the problem:

- Make sure the ISDN TA is set up for the correct switch type. From the Main Menu, choose 3=Config, then 1=Netw. options, then 1=Dial Line, then 1=Switch type, then the correct switch type.

- Make sure the line is multipoint.

- Make sure that the ISDN TA is set up with the correct SPID and LDN. From the Main Menu, choose 3=Config, then 1=Netw Options, then 1=Dial Line, then 3=Terminal ID; then set the SPID and LDN.

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

- With the ISDN TA connected to the line and powered up, talk to your service provider's repair group and inform them that you have an ISDN basic-rate line that appears to be physically okay, but has no Terminal Endpoint Identifier (TEI). Ask them to check the line translation and make sure that the line supports Dynamic TEI allocation. Tell them you have an NT1 and Terminal Adapter device connected to the line.

6. If the ISDN TA continues to read "Getting TEI #2," the ISDN TA has completely initialized the first phone number but is unable to establish Logical Layer 2 for the second phone number. The problem is in either or both of these places:

- The ISDN TA software setup.

- The telephone company's software setup.

  To isolate the problem:

- Make sure that the line is multipoint, with two phone numbers.

- Make sure that the ISDN TA is set up with the correct SPID and LDN. From the Main Menu, choose 3=Config, then 1=Netw Options, then 1=Dial Line, then 3=Terminal ID; then set the SPID and LDN.

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

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

- With the ISDN TA connected to the line and powered up, talk to your service provider's repair group and inform them that you have an ISDN basic-rate line that appears to be physically okay, but has no Terminal Endpoint Identifier (TEI). Ask them to check the line translation and make sure that the line supports Dynamic TEI allocation. Tell them you have an NT1 and Terminal Adapter device connected to the line.

7. If the ISDN TA continues to read "Register SPID #2, the ISDN TA has completely initialized the first phone number, but is unable to establish Logical Layer 3 for the second phone number. The problem is in either or both of these places:

- The ISDN TA software setup.

- The telephone company's software setup.

To isolate the problem:

- Make sure that the line is multipoint, with two phone numbers.

- Make sure that the ISDN TA is set up with the correct SPID and LDN. From the Main Menu, choose 3=Config, then 1=Netw Options, then 1=Dial Line, then 3=Terminal ID; then set the SPID and LDN.

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

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

- With the ISDN TA connected to the line and powered up, talk to your service provider's repair group and inform them that you have an ISDN basic-rate line that appears to be physically okay, but has no Terminal Endpoint Identifier (TEI). Ask them to check the line translation and make sure that the line supports Dynamic TEI allocation. Tell them you have an NT1 and Terminal Adapter device connected to the line.

6.3 What to Do If You Can't Place Phone Calls

The display reads "Ready," but calls can't be placed.

There is probably a problem in the software setup (translation) at the telephone company's central-office switch, or in the network setup in the ISDN TA.

Local voice calls can be transmitted, but data calls to the same exchange can't.

The line is probably not set up to support data calls.

Local data calls go through, but long-distance data calls don't.

Make sure the far end is working. If you are not already doing so, place the call explicitly specifying the prefix of the long-distance service (for example, 10288 for AT&T). If this does not work, then most likely the problem is with 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 BONDING data calls can't.

There is probably a problem in the software setup (translation) at the telephone company's central-office switch, or in the network setup in the ISDN TA.

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 ISDN TA.

Check with the local service provider to make sure that the line supports two data calls. Looking at the ISDN TA's 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. You might have to look at the status logs from both ends.

Appendix A: AT Commands

This appendix lists the supported AT commands and describes their functions.

Command	**Function**
A	Answer. Puts the ISDN TA 128K in answer mode.
D	Dial. Precedes the telephone access number [ATD5551212].
H	Hang up. Disconnects the current call.
O	On-line. Commands the unit to go back online.
S	S Register.
SS	S String register.
Z	Reset. Resets the AT command processor.
&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.
&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.

Command   Function

Carrier Detect (CD) Control Line Options

Command	Function
&C0	CD forced on
&C1	CD normal
&C2	CD off with local disconnect (LOCD)
&C3	CD off with link down

Data Terminal Ready (DTR Control Line Options)

Command	Function
&D0	Ignore DTR
&D1	DTR off forces command
&D2	Idle when off, DTR off forces idle (on allows auto answer)

Generic Unit Configurations

Command	Function
&F0	Reset all S-registers to factory preset values
&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 57.6 async

Command   Function

Generic Unit Configurations (continued)

Command	Function
&F8	Configures unit for Dial 115.2K async
&F9	Configures unit for Dial PPP
&F10	Configures unit for Dial V34 115.2 async
&F11	Configures unit for Fallback 57.6 async

Network Options

Command	Function
&L0	Dial network
&L1	Leased network

Calling Number Identifiers

Command	Function
&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.

DTE Data Type Options

Command	Function
&Q0	DTE is async
&Q1	DTE is sync

Clear-to-Send (CTS) Control Line Options

Command	Function
&R0	Follows RTS
&R1	Forced CTS

Command   **Function**

Data Set Ready (DSR) Control Line Options

&S0   DSR forced on

&S1   DSR if call up

&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

Command	Function
Local Echo Options	
E0	Echo off. Does not allow command characters typed to be displayed on the screen.
E1	Echo on. Determines if the command characters typed are displayed on the screen.
Unit Identification	
I0	Identify unit. Commands the unit to display model number.
I1	Identify software. Commands the unit to display software version.
AT Command Response Message Options	
Q0	Response messages on
Q1	Response messages off
AT Command Response Message Types	
V0	Numeric response messages
V1	Verbal response messages words
AT Command Connect Message Options	
X0	Simple connect message
X1-7	Connect messages with bit rate

Command   **Function**

Ready-to-Send (RTS) Control Line Options

Command	Function
_D0	1 ms delay
_D1	18 ms delay

Service Profile Identification (SPID) Access Options

Command	Function
_I1	Access SPID 1
_I2	Access SPID 2

Local Directory Number (LDN) Access Options

Command	Function
_N0	Access LDN1
_N1	Access LDN2

ISDN Switch Protocol Options

Command	Function
_S0	5ESS
_S1	DMS-100
_S2	National ISDN-1
_S3	NEC

ISDN U-Interface Operational Mode Options

Command	Function
_X0	ISDN TA 128K timing slaves to network (NT)
_X1	ISDN TA 128K is U-interface timing master (LT)

Command   Function
Data Flow Control Options

\Q0   No flow control

\Q1   Software

\Q2   CTS only

\Q3   Hardware

\Q4   Software from DCE only

V.34 Compression Options

%C0	No compression
%C1	Use MNP compression
%C2	Use V.42 bis compression
%C3	Use V.42 bis/MNP compression

V.34 Compression Block Size Options

\A0	MNP 64 byte blocks
\A1	MNP 128 byte blocks
\A2	MNP 192 byte blocks
\A3	MNP 256 byte blocks

V.34 Operational Mode Options

\N0	MNP Normal
\N1	MNP Direct
\N2	Reliable
\N3	Auto-reliable
\N4	Force LAPM
\N5	Force MNP

Appendix B: Current-Status Messages

These are messages that appear on the front panel.

AT&T-5ESS Ready: The ISDN TA 128K is connected to an AT&T 5ESS switch and is ready to place/receive calls.

Call Connect B1: Bearer channel 1 has been connected and is now active.

Call Connect B2: Bearer channel 2 has been connected and is now active.

CALL xxxxxx: The ISDN TA is calling phone number xxxxxxx.

DDS Net LOOPBACK: The ISDN TA is performing a DDS latching loopback toward the network.

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

DMS-100 Ready: The ISDN TA is connected to a DMS-100 switch and is ready to place/receive calls.

DTE LOOPBACK: The DTE connector is looped back in the DTE direction.

Getting TEI #1 The ISDN is getting its first Terminal Endpoint Identifier from the network.

Getting TEI #2 The ISDN is getting its second Terminal Endpoint Identifier from the network.

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

Link down: The network interface is not active.

LPBK DTE Port: The DTE connector is looped back in the DTE direction.

LPBK Protcl Net: The ISDN TA has been commanded to perform a loopback in the network direction after letting the incoming data pass through the current protocol.

NEC Ready: The ISDN TA is connected to an NEC switch and is ready to place/receive calls.

NET EOC LOOPBACK: The ISDN TA has been commanded to perform an ISDN loopback toward the network.

NET REM LOOPBACK: The ISDN TA is performing a V.54 or DDS latching loopback toward the network.

Ready: The ISDN TA is ready to make or accept a call.

Register SPID #1: The ISDN TA is registering its first SPID with the network.

Register SPID #2: The ISDN TA is registering its second SPID with the network.

RINGING: The phone number just dialed is ringing.

XXXX nnnn: A rate-adaptation protocol is running at the bit rate specified by nnnn.

XXXXX Quitting: A rate-adaptation protocol is turning off.

XXXXX Ready: A rate-adaptation protocol is ready.

XXXXX Setup: A rate-adaptation protocol is setting up.

YYYY: ISDN Switch type selected.

XXXXX can be any of the following protocols:

- BONDING: Bandwidth On Demand Interoperability Group protocol.

- CLEAR CHAN: No rate-adaptation protocol (allows use of maximum bandwidth).

- DSTOP: DSU 57.6 async rate adaption protocol.

- FALLBACK: Fallback rate adaption protocol.

- PPP: Point-to-point protocol.

- SAP: Simple Asynchronous Protocol.

- TLINK: TLINK rate-adaptation protocol.

- V110: V.110 rate-adaptation protocol.

- V120: V.120 rate-adaptation protocol.

- V.34: V.34 modem

Appendix C: Status-Buffer Messages

These are mesages that appear in the status buffer. You can view the status buffer by choosing 1=Status from the Main Menu.

Answer 1/2: The ISDN TA answered a call on either the first or the second channel. The calling phone number is displayed if available.

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

Back to online: The ISDN TA went back on line.

Bad async BPS: The BONDING protocol determined that the selected asynchronous bit rate is not supported.

Bad AT bit field: An AT command had an argument that was out of range.

Bad B channel: BONDING negotiation determined that the delay in one of the Bearer channels was uncorrectable.

Bad call type: The ISDN TA placed a call with an improper call type.

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

Bad DTE bps: BONDING negotiation determined that the chosen DTE bit rate is invalid; BONDING mode 1 allows only 56, 64, 112, or 128 Kbps.

BAD_INFO_ELEM: Call-control error.

Bad phone number: The ISDN TA attempted to call an invalid phone number.

Bad TLK version: Invalid TLINK parameters were found during end-to-end negotiation.

BaudRate: The ISDN TA does not support the negotiated TLINK baud rate.

BEAR_CAP_NOT_AVAIL: The bearer channel requested is not available.

Bearer mode: Incoming call is not of a type the ISDN TA can accept.

Bearer info mode: Incoming call-information transfer capability is not known.

BONDING (+/-XXX): The number 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: The user sent the escape sequence (+++ by default).

Break ignored: The user sent an extra escape sequence.

BUSY: The called number is busy.

CallID 1 in use: The ISDN TA tried to place a call using SPID1, but SPID1 was already in use.

CallID 2 in use: The ISDN TA tried to place a call using SPID2, but SPID2 was already in use.

Call not ringing: The user sent an answer command (ATA), but there was no call present.

CALL_REJECTED: The call has been rejected.

Can't go online: The ISDN TA can't go back on line.

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

CHANNEL_UN ACCEPTABLE: The channel requested has not been subscribed.

CHAN_DOES_NOT_EXIST: The user asked for a bearer channel that is not present.

CHAN_NOT_IMPLEMENTED: The bearer channel requested has not been implemented.

CHANNEL_UNACCEPTABLE: The user is asking for a channel that has not been subscribed to.

CID>0 rcvd: The ISDN TA received an incoming call from a third party during negotiations with a far-end BONDING unit on the use of a second bearer channel.

DEST NOT ISDN: The number called is not ISDN. (The call will go through, but it will not be entirely digital.)

DEST_OUT_OF_ORDER: The called number is out of order.

Dial1/2: The ISDN TA placed a call on either the first or the second channel. The number called is displayed following the message.

Discon1/2: The call on either the first or the second channel was disconnected from the network. The far-end phone number is displayed if available.

Disconnect Req: The far-end unit disconnected during BONDING negotiation.

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

DTE must be SYNC: For the protocol chosen, the DTE connector must be configured as synchronous.

DTE not set V25: The DTE equipment is not configured for the same bit rate as the ISDN TA for V.25 bis dialing.

DTE Setup Error: Local DTE setup error.

DTR not up: DTR is not active, and the ISDN TA tried to place a call in a dialing mode that requires DTR to be in an active state.

Dump call: The ISDN TA could not accept an incoming call because it was already involved in a call.

Dump1/2: An incoming call on either the first or the second channel was discarded by the ISDN TA. The calling number is displayed if available.

FACILITY_NOT_IMPLEMENT: The network does not support the requested supplementary service.

FACILITY_REJECTED: A facility requested cannot be provided by the network.

FACILITY_NOT_SUBSCRIBED: The channel type requested has not been subscribed.

FALLBACK ERROR: Attempt to fallback to normal mode failed.

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

FlowCtl mismatch: BONDING negotiation found a flow-control mismatch.

FlowCtl required: BONDING negotiation determined that flow control needs to be turned on.

Hangup1/2: The call on either the first or the second channel was disconnected by the ISDN TA. The far-end phone number is also displayed.

InCmptblFound: TLINK end-to-end negotiations found a configuration incompatibility between the two end units.

INCOMING_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_MSG_UNSPEC: Invalid message, protocol 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: That data-link-layer interface for a second call (BONDING) is not active.

L3 #3 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.

MANDATORY_IE_LEN_ERR: Mandatory information element length error.

MANDATORY_IE_MISSING: Mandatory information element missing.

Need 2 B chan: The DTE bit rate you're trying to run requires the BONDING protocol.

Need 64K call: The BONDING protocol requires the ISDN TA to be configured for a 64K data-call type.

Negotiation fail: The BONDING negotiation has failed.

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

NETWORK_CONGESTION: The phone network is currently congested.

NETWORK_OUT_OF_ORDER: The phone network is out of order.

No 48K support: The ISDN TA does not support 48-Kbps TLINK.

NO_CIRCUIT_AVAILABLE: The requested bearer channel is not available.

NO_CARRIER: The V.34 modem board did not detect a modem carrier at the far end.

No Sreg number: The user attempted to access an S-register, but did not specify a specific S-register (example: "ATS=1").

No Sreg value: The 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. (This message is for information only; no action is required.)

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 that the far-end unit was not an identical ISU (ISDN Service Unit). Asynchronous rates can be supported only between two ISDN TA 128s.

RESP_TO_STAT_ENQ: Response to status enquiry.

Ring 1/2: An incoming call on either the first or the second channel entered the Ring state. The calling phone number is displayed if available.

S cmd not = or ?: There was a syntax error in an S-register command.

SAP idle timeout: The unit at the far end is not configured to use the SAP protocol.

SERVICE_NOT_AVAIL: The service requested is not available.

SOURCE NOT ISDN: The incoming calling party is not ISDN. (This message is for information only; no action is required.)

SReg SetError: An invalid S-register setting was received from the local DTE.

Sync BPS <56K: The synchronous bit rate selected is too slow for the BONDING protocol.

Synch Mismatch: Both ends are using different data rates, so the connection cannot be synchronized.

TAINIT expired: BONDING timer TAINIT expired.

TANULL expired: BONDING time TANULL expired; non-BONDING equipment attempted to call into the ISDN TA while it was configured 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 because you were making a long-distance call to a foreign country. Adjust the timer value.

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

TXFA2 expired: BONDING timer TXFA2 expired; other vendor's BONDING equipment did not operate properly.

TX FLOW ERROR: Flow control needs to be enabled.

TXINIT expired: BONDING timer TXINIT expired, because the ISDN TA called non-BONDING equipment.

UNASSIGNED_NUMBER: The phone number dialed does not exist.

Unknown AT cmd: The user sent an unknown AT command.

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

Unsupported baud: The ISDN TA does not support the negotiated baud rate.

USER_BUSY: The dialed number is busy.

V120 timeout: The far-end unit is not set up for V.120.

V120 connected: The V.120 rate adaption successfully connected to the far-end unit.

WRONG_MESSAGE: Call-control error.

WRONG_MSG_FOR_STATE: Call-control error.

Appendix D: The S-Registers

This appendix is a list of all the S-registers supported by the ISDN TA 128K. See **Section 5.8** for instructions on using S-registers.

Register	Name	What it does...
S0	Auto Answer	Determines how the ISDN TA answers an incoming call:
		0=Disable (ISDN TA does not answer call).
		1=Enable (ISDN TA answers all calls).
		2=Dump all calls.
S2	Escape Character	Determines which character (in ASCII code) is used for the escape command. The standard escape character is + (ASCII 43 decimal). To change the escape command, set S2 to the desired ASCII value. Range: 0 to 127.
S3	End-of-Line Character	Determines which character (in ASCII code) ends a command line. The default is the carriage return (ASCII 13 decimal). Range: 0 to 127.
S4	Line-Feed Character	Determines which character (in ASCII code) advances the cursor to the next line after ending a command line or after an ISDN AT message. The default is the line feed (ASCII 10 decimal). Range: 0 to 127.
S5	Backspace Character	Determines which key moves the cursor back one space to erase a character. The default is the backspace (ASCII 8 decimal). Range: 0 to 127.
S7	Connect Time	Determines how long the ISDN TA will wait for an outgoing call to be answered.
		15=15 seconds
		30=30 seconds
		60=1 minute
		120=2 minutes
		240=4 minutes

Register	Name	What it does…
S11	Fallback Default	Determines how the ISDN TA answers an incoming call if all of the protocols in Fallback failed.
		1=Clear Channel
		2=BONDING Mode 1
		3=SAP
		4=T-link
		5=V.110
		6=V.120
		7=V.34
		8=DSU 57.6 Async (default)
		9=PPP asyn-syn
S12	Escape Time	Determines the delay required immediately before and after entering the escape character for the ISDN TA to recognize and execute the escape command. Range: 0 to 127.
S14	Misc Bits	Miscellaneous bit-mapped options (Bit 8 is the 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 ISDN TA 128K.
		Bit 3=1: Disables on-screen responses from the ISDN TA 128K.
		Bit 4=1: Displays AT responses in text form.
		Bit 4=0: Displays AT responses in numeric form.
		Bit 7=1: Disables PPP ACCM spoofing.
		Bit 7=0: Enables PPP ACCM spoofing.
		Bit 8=1: Ring indicator uses cadence.
		Bit 8=0: Ring indicator remains on.
S15	Async BONDING	0=Proprietary (for use with another ISDN TA 128K).
		1=Multi-vendor.

Register	Name	What it does…
S22	Msg Bits	Miscellaneous bit-mapped message options (Bit 8 is the most significant bit).
		Bits 5, 6, 7=1: Allows connect message with baud rate.
		Bits 5, 6, 7=0: Connect message without baud rate.
S24	V.120 Low-Layer Compatibility	Determines whether the V.120 bit is set in setup message for V.120 calls. Some termial adapters require that this bit be set to connect V.120 calls.
		0=Set V.120 bit in call-setup message (default).
		1=Do not set V.120 bit in call-setup message.
S27	PPP Mode	Determines whether PPP is a single-link or multilink connection.
		0=Single-link operation (default).
		1=Multilink operation.
		2=Use compression.
S30	DTE CTS	Controls the operation of the CTS line on the DTE connector.
		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 active only during a call.
		2=DSR active only when network interface is on.
S33	DTE CD	Controls the operation of the Carrier Detect line on the DTE connectors.
		0=Force CD on always.
		1=CD active during a call (normal operation).
		2=Off with LOCD.

Register	Name	What it does...
S34	DTE DTR	Determines how the ISDN TA 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=Hang up incoming call when DTR is off.
		8= Hang up 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.
		2=RS-232 connector.
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 ISDN TA 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 ISDN TA attempts to use MNP error control. If the far end does not use MNP, then normal operation is used.
		4=Force LAPM. Force the modem to connect only if V.42 (LAPM) error correction can be used.
		5=Force MNP. Force the modem to connect only if MNP 2–4 error correction can be used.
S37	V.34 COMPRESSION	Enables compression in the V.34 modem.
		0=No compression
		1=MNP5 compression
		2=V.42 compression
		3=MNP5 or V.42 compression

Register	Name	What it does...
S38	V34 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 256 bytes
S40	BOND TXINIT	Specifies how long (in seconds) the originating endpoint will attempt to detect the BONDING negotiation pattern from the answering endpoint before deciding the BONDING call has failed. Range: 0 to 256. Default: 10.
S41	BOND TXFA	Specifies how long (in seconds) both endpoints will attempt to detect the BONDING negotiation pattern from the answering endpoint 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. Range: 0 to 256. Default: 10.
S42	BOD TXADD01	Specifies how long (in 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 slower call routing. Range: 0 to 256. Default: 50.
S43	BOND TXDEQ	Specifies how long (in seconds) both endpoints will attempt to equalize the network delay between the bearer chanels before deciding that the BONDING call has failed. Range: 0 to 256. Default: 5.
S44	BOND TANULL	Specifies how long (in 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 ISDN TA also has timer constraints for completing non-BONDING parameter negotiation. Range: 0 to 256. Default: 10.

Register	Name	What it does…
S45	BOND TCID	Specifies how long (in seconds) both endpoints will attempt to negotiate agreeable values for bearer channels and channel capacities before deciding the BONDING call has failed. Range: 0 to 255. Default: 5.
S46	V25 Mode	Selects the type of V.25 bis dialing used.
		0=Asynchronous V.25.
		1=HDLC V.25.
		2=Bisync V.25.
		3=HDLC with Flags V.25.
S47	RS-366 Time	Determines how long 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	Line Mode	Selects the operating mode of the ISDN TA.
		0=Dial service (switched service).
		1=Leased service (non-switched service).
S51	Line Clock	Selects the clock mode in leased mode.
		0=Slave (default).
		1=Master (leased line only, limited-distance modem application only).
S52	Switch Type	Selects the network switch type for dial service.
		0=AT&T 5ESS.
		1=Northern Telecom DMS-100.
		2=National ISDN-1.
		3=NEC.
S53	Call Type	Call type .
		0=Speech.
		1=Audio.
		2=56-Kbps data.
		3=64-Kbps data.

Register	Name	What it does...
S54	Protocol Type	Rate-adaptation protocol type.
		1=Clear Channel (no rate adaptation).
		2=BONDING mode 1.
		3=SAP (Simple Asynchronous Protocol).
		4=T-lINK.
		6=V.120.
		7=V.34.
		9=DSU 57.6 Kbps asynchronous.
		11=Fallback.
		12=PPP async-to-sync.
S55	Dial Mode	Selects the dialing interface.
		0=Front panel only (dialing from front panel is always available).
		1=RS-366 dialing port.
		2=AT commands.
		3=V.25 bis dialing.
S56	Echo Tone	Enables an echo tone, which will suppress the echo cancelers in a voice circuit. Can be used to trick the switch into allowing data to be sent over a line configured for voice ISDN service.
		0=None.
		1=Answer.
		2=Originate.
		3=Both.
S57	DDS Loopback	Allows an ISDN TA configured as a leased-line unit to respond to in-band DDS latching loopbacks.
		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	Sets the ISDN TA to screen incoming calls.
		0=Answer any call.
		1=Answer only calls from numbers matching those stored in SN0 through SN9.

Register	Name	What it does…
S59	Channel Rate	Sets the available network bandwidth when the ISDN TA is in leased-line mode.
		3=64 Kbps.
		5=128 Kbps.
SS60	SPID1 Loc	Primary SPID string location.
SS61	SPID2 Loc	Secondary SPID string location.
SS62	LDN1 Loc	Primary Local Directory Number string location.
SS63	LDN2 Loc	Secondary Local Directory Number string location.
S70	DTE Mode	Selects Asynchronous or Synchronous mode on the DTE connector.
		0=Asynchronous.
		1=Synchronous.

Register	Name	What it does…
S71	DTE Rate	Selects the bit rate for the DTE connector.
		1=300
		2=600
		3=1200
		4=800
		5=2000
		6=2400
		7=3600
		8=4800
		9=7200
		10=8000
		11=9600
		12=12,000
		13=14,400
		14=16,000
		15=19,200
		17=38,400
		18=48,000
		19=56,000
		20=57,600
		21=64,000
		22=112,000
		23=115,200
		24=128,000
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.

Register	Name	What it does...
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=Hardware: X-ON/X-OFF from DTE controls DCE.
		2=Hardware: X-ON/X-OFF from DCE controls DTE.
		3=Hardware: RTS and CTS flow control.
		12=Software: X-ON/X-OFF controls DTE and DCE.
S76	DTE Clock	Selects transmit-clock timing source for the DTE connector.
		0=Internal (ISDN TA supplies timing).
		1=External (DTE supplies timing).

The next ten registers are the string locations for stored numbers 0 through 9.

Register	Name	What it does...
SS80	SN0 Loc	Stored Number 0.
SS81	SN1 Loc	Stored Number 1.
SS82	SN2 Loc	Stored Number 2.
SS83	SN3 Loc	Stored Number 3.
SS84	SN4 Loc	Stored Number 4.
SS85	SN5 Loc	Stored Number 5.
SS86	SN6 Loc	Stored Number 6.
SS87	SN7 Loc	Stored Number 7.
SS88	SN8 Loc	Stored Number 8.
SS89	SN9 Loc	Stored Number 9.

Appendix E: Connector Pinouts

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	RI	O	Ring Indicator
23	NC	N/A	No Connection
24	ETC-A	I	External Transmit Clock
25	NC	N/A	No Connection

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
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

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

RS-366 Interface

Pin	Name	I/O	Description
1	Shield	I/O	Shield for Cable
2	DPR	I	Digit PResent
3	ACR	O	Abandon Call and Retry
4	CRQ	I	Call ReQuest
5	PND	O	Present Next Digit
6	PWI	O	PoWer Indication
7	SG	I/O	Signal Ground
13	DSC	O	Distant Station Connect
14	NB1	I	Digit LSB
15	NB2	I	Digit bit 2
16	NB4	I	Digit bit 3
17	NB8	I	Digit bit MSB
22	DLO	O	Data Line Occupied
8–12	NC	N/A	No Connection
18–21	NC	N/A	No Connection
23–25	NC	N/A	No Connection

RJ-45 Interface

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

Maintenance Port

Pin 2	TD-A	I	Transmitted Data
Pin 3	RD-A	O	Received Data

Appendix F: Ordering ISDN Service

This appendix guides you and your telephone company in specifying what you need for ISDN service.

The list below is a general description of what is required from the telephone service in order to support most of the features of the ISDN TA 128K. Depending on your actual data-service requirements, you may not need all the features. Some features might not be available in your area. The first step is to talk to your telephone company to find out which of the features in the list are available.

F.1 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 switches supporting the listed 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 must provide the ability to allocate one Dynamic Terminal Endpoint Identifier (TEI) per phone number.

F.2 Local Service Requirements

The following bearer capabilities must be provided:

- Circuit-mode voice service for speech and 3.1-kHz audio.

- Circuit-mode data service for 56-Kbps and 64-Kbps unresticted data.

The interface must support two simultaneous calls. Any mix of the above bearer capabilities and incoming and outgoing must be supported for both calls.

Service must be provided inside the LATA of the bearer capabilities above.

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

F.3 Long-Distance Service Requirements

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

F.4 Deciding What Services to Order

If you are new to ISDN, a good plan is to get the features listed above first. See Section 2.5 for 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 none of the features listed above are available, you'll have to compare your actual data-service requirements with what is available. A likely problem is the lack of a clear trunk to provide 64-Kbps unrestricted data service. A solution to that problem might be to use 56-Kbps service. Sometimes voice circuits are suitable for data service at a reduced bit rate.

F.5 Additional Parameters for 5ESS Custom Lines

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 ISDN TA 128K configured for switch type AT&T 5ESS will work with lines providing this protocol on 5ESS switches with software version 5E6 or later. It supports the following configurations on Custom lines:

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

- Multipoint with one phone number

- Multipoint with two phone numbers.

The requirements for the 5ESS point-to-point line line are defined in **Sections F.1** and **F.2,** and in the table below. You might want to fax them to your local telephone company.

5ESS Features

```
B1 Service.................................................................On Demand (DMD)
B2 Service.................................................................On Demand (DMD)
Maximum B-Channels..............................................................................2
Number of Circuit-Switched Voice (CSV) calls ........................................2
Circuit-Switched Voice Bearer Channels .............................................Any
Number of Circuit-Switched Data (CSD) calls..........................................2
Circuit-Switched Data Bearer Channels ..............................................Any
Terminal Type.................................................................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. Except for the ability to spread two calls across two phone numbers, multipont lines offer no special features, and they make the network more complicated. However, if you do need multipoint lines, the parameters are similar to the point-to-point line except for the SPIDs.

The 5ESS switch can provide a variety of supplementary features that the ISDN TA 128K might not support. Enabling these features might have undesirable consequences. Avoid these features:

- Packet-Mode Data

- Multiline Hunt Group

- 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

F.6 Additional Parameters for a DMS-100 Protocol Version 1 Line

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 ISDN TA 128K configured for switch-type DMS-100 works on lines providing this protocol on DMS-100 switches with software version BCS-32 or later. The ISDN TA supports the following configurations on DMS-100 lines:

• Multipoint with one phone number (for 1B+D service).

• Multipoint with two phone numbers (for 2B+D service).

The requirements for the DMS-100 multipoint line are defined in **Section F.1** and **Section F.2**, and in the table on the next page. You might want to fax them to your telephone company. The line should have two service profiles with the parameters below to support BONDING.

DMS Features

Line Type ....Basic Rate, Functional

Electronic Key Telephone Set (EKTS) ....No

Call Appearance Handling...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 Pvc1

TEI..Dynamic

F.7 After Your Service Is Installed

When the line is installed, the local phone-service provider should give you the following information:

- A seven-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, a 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 four-digit local extension numbers, and prefixes for using the desired long-distance providers.

To set up the ISDN TA 128K for a new line:

1. Disconnect the phone line from the ISDN TA.

2. Power up the ISDN TA, and verify that it passes the self-test.

3. Reset the ISDN TA to its factory defaults. From the Main Menu, choose 3=Config, then 4=Quick Setup, then 0=More, then 0=Factory Setup.

```
                                 1=Dial 56K sync
                                 2=Dial 64K sync
                 1=Netw Options  3=Dial 112K sync
                 2=DTE Options    4=Dial 128K sync
3=Config ——————— 3=Protocol       5=Dial PPP
                 4=Quick Setup ——— 6=V.34 115.2 async
                 5=Remote Config  7=Dial 57.6 sync    1=Leased 128K
                                  8=Dial 115.2 async  2=LDM 128 Master
                                  9=Fallback 57.6K    3=TBD
                                  0=More ———————————— 4=TBD
                                                      5=TBD
                                                      6=TBD
                                                      7=TBD
                                                      0=Factory Setup
```
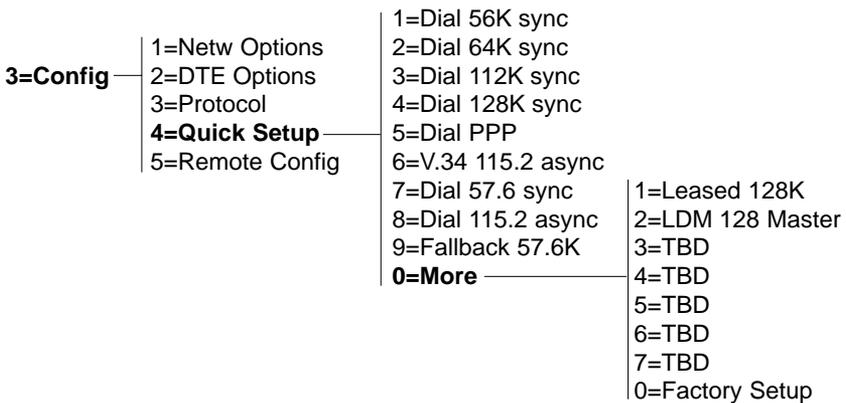
4. The ISDN TA is now set up for 5ESS Custom. If that is not the line type you have, choose the correct switch type. From the Main Menu, choose 3=Config, then 1=Netw Options, then 1=Dial Line, then 1=Switch Protocol, then the switch type.

3=Config	**1=Netw Options**	**1=Dial line**	**1=Switch Protocol**	1=AT&T 5ESS
	2=DTE Options	2=Leased line	2=Call Type	2=DMS-100
	3=Protocol		3=Terminal ID	3=National ISDN1
	4=Quick Setup		4=Dial Options	4=NEC Switch
	5=Remote Config		5=Auto Answer	
			6=Answer Tone	
			7=Connect Timeout	
			8=Call Screening	

5. The ISDN TA is set up by default for a point-to-point line. If that is not the line type you have, you'll need to set SPIDs and LDNs. From the Main Menu, choose 3=Config, then 1=Netw Options, then 1=Dial Line, then 3=Terminal ID, then set the SPID nd LDN. 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 to LDN2.

6. Power the ISDN TA off and back on again to put the changes into effect. The ISDN TA should now be set up for the line you have. You may wish to verify the settings.

7. Connect the phone line to the DIAL connector on the ISDN TA. Watch the front panel; the status line should start at Link Down and progress to Ready as the ISDN TA and switch cooperate to bring the line up. This process may take a minute.

If the ISDN TA does not read Ready after a minute, see Section 6.2.

Glossary

This glossary explains terms you'll see when you read about ISDN. Some of them appear in this manual; others will appear in ISDN literature or when you order your ISDN service.

23B+D: The PRI in ISDN.

2B+D: The BRI in ISDN.

A and B Signaling: A type of in-band signaling used in T1 transmission. One bit "robbed" from each of the 24 subchannels in every sixth frame (see "bit robbing") is used for carrying dial and control information.

A/D: Analog-to-digital conversion.

Accunet®: A group of data-oriented digital services from AT&T, including Accunet T1.5, terrestrial wideband at 1.544 Mbps (formerly called T1).

Accupulse®: A BellSouth trademark for Switched-56 services.

ACD: Automatic Call Distribution.

Adaptive Interframe Transform Coding: A class of compression algorithms commonly used in video codecs, so that video signals can be sent over slower lines.

AMA: Automatic Message Accounting.

AMI: Alternate Mark Inversion.

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 put that signal on the oscilloscope, the two signals would look essentially the same. The only difference would be that the electrically transmitted signal would be at a higher frequency.

ANI: Automatic Number Identification.

ANSI: American National Standards Institute.

ASCII: American Standard Code for Information Interchange.

Asynchronous Transmission: A method of data transmission that 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. Most small computers (such as PCs) use asynchronous transmission to communicate with one another and with mainframes.

Attenuation: The loss of signal strength during transmission. The received signal is lower in volume than the transmitted signal because of losses in the transmission medium (resistance in the cable, for example). Attenuation is measured in decibels.

B-channel: Bearer channel. A 64-Kbps digital information channel.

Back-Haul: 1. Routing of a call that appears to take an illogical path through a network. 2. A link between a Central Office and a main microwave of multiplex station.

Back-to-Back Channel Bank: The connection of voice-frequency and signaling 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 communication can be carried on it. For example, a wideband circuit can carry a TV channel. A wideband circuit that can carry one video channel can carry 1200 voice telephone channels.

Bearer service: A type of telecommunication service (defined by CCITT standards) that allows transmission of information between user-to-network interfaces. Bearer services defined for ISDN are circuit mode and packet mode.

Bipolar Signaling: The most common signaling method for digital services, such as DDS and T1. The signal carrying the binary value successively alternates between positive and negative. Zero and one values are represented by the signal amplitude at either polarity, and 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 Robbing: The use of the least significant bit per channel in every sixth frame for signaling.

Bit Stuffing: A process in bit-oriented data-communications protocols where a string of 1 bits is broken by an inserted 0, added by the sender, and removed by

the receiver. The 0 bits are added to prevent user data that contains a series of 1 bits from being interpreted as a flag-control character.

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

BONDING: Bandwidth On Demand Interoperability Group—developer of the BONDING protocol, an industry-standard B-channel protocol.

bps: Bits per second. A measurement of the speed of data transmission.

BRI: Basic Rate Interface. The BRI includes two 64-Kbps B-channels and one 16-Kbps D-channel. Also known as Basic Rate Access (BRA).

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

Bridging: A technique by which additional stations can be serviced from a two-point facility by extending the facility from a bridge at one of the facilities' terminating points.

Broadband: A transmission facility that has a bandwidth greater than that of a voice-grade line at 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) between channels ensure that each channel does not interfere with its neighbor. Coaxial cable TV, which carries many channels on one cable, is a good example of broadband transmission.

Byte: A group of 8 bits.

CA: Call Appearance.

CCIS: Common Channel Interoffice Signaling—a signaling system developed for use between stored-program switching systems. All the signaling 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 signaling.

CCITT: Consultative Committee for International Telegraphy and Telephony. A group that set some of the most common telecommunications standards.

CD: Carrier Detect.

Central Office (CO): The phone-company switching facility or center, usually a Class 5 end office (see "Class X Office"), at which subscribers' local loops

terminate. Handles a specific geographic area, identified by the first three digits of the local telephone number.

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 signaling information for each channel, transmitting framing information so that time slots allocated to each channel can be identified by the receiver.

Channel Identification: An information element that requests or identifies the channel to be used for a call.

CIC: Carrier Identification Code.

Circuit Mode: A type of switching that causes a one-to-one correspondence between a call and a circuit. A circuit or path is assigned for a call between each pair of switching nodes, and the path is not shared with other calls.

Class X Office: The designation of a phone-company switching facility in the telephone hierarchy. 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. Bit-robbing signaling must be eliminated.

CLID: Calling Line Identification.

CMD: Circuit-Mode Data.

CND: Calling Number Delivery.

Conditioning: Extra-cost options that users can apply to leased or dedicated voice-grade 3002-type telco data circuits. With conditioning, line impedance is carefully balanced. Conditioning allows improved line performance in frequency response and delay distortion.

CPE: Customer Premises Equipment—a generic term for communications terminal equipment owned by the customer rather than by the telephone company.

CPU: Central Processing Unit.

CR: Call Reference—an information element that identifies which call a Layer 3 message pertains to.

CRS: Call Request (using stored number).

CRN: Call Request (number in command).

Crosstalk: Unwanted transference of electrical energy from one transmission medium to another (usually adjacent). Often a problem with unshielded twisted-pair wires.

CSU: Channel Service Unit. A component of CPE used to terminate a digital circuit, such as DDS or T1, at the customer site. It performs certain line-conditioning functions, ensures network compliance per FCC rules, and responds to loopback commands from the Central Office. It also ensures proper ones density in a transmitted bit stream, and performs bipolar-violation correction. See also "DSU."

CTS: Clear To Send.

D-channel: The ISDN channel that carries signaling information to control the call setup, teardown, or invocation of any supplementary services. The D-channel can also be used to provide PMD service.

DACS: Digital Access and Cross-connect System—Central Office switching equipment made by AT&T. It 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 may also support switched digital services at T1 rates.

dB: Decibel—a measurement of signal strength. Usually the relation between a transmitted signal and a standard signal source. 6 dB of loss, for example, would mean that there is a 6-dB difference between what is transmitted by a standard signal generator at one end of a circuit and what is received at the other.

DCE: Data Communications Equipment—the part of a data terminal that provides the interface to the network.

DDS: Dataphone Digital Service. An 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 tones of various frequencies, as with traditional analog transmission 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 21 trunks), or a 66-block.

Demarcation: See "De-Marc."

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

Digital Hub: A designated office where DDS channels are interconnected, and where synchronous network timing, testing access, and other service features are provided.

Digital Loopback: A technique for testing the digital processing circuitry of a communications device. May be initiated locally or remotely via a telecommunications circuit. The 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.

Digital: In communications, transmitted as binary ones and zeros. Contrast with "Analog transmission."

DMA: Direct Memory Access.

DMS: Digital Multiplex Switching.

DN: Directory Number.

DNIC: Data Network Identification Code.

DS0: Digital Signal Level 0. A telephony term for 64 Kbps—the worldwide standard speed for digitizing one voice conversation.

DS1: Digital Service Level 1. In North America, 1.544 Mbps (the Bell standard for 24 voice conversations). Elsewhere, 2.048 Mbps (the CCITT standard for 30 voice conversations).

DS3: 44,736 Mbps, or 28 T1 lines.

DSP: Display Station Protocol.

DSR: Data Set Ready.

DSU: Data Service Unit—a device that provides an interface between a data terminal or other data-communications device and a digital access line. See also "CSU."

DTE: Data Terminal Equipment—the part of a data terminal that interfaces with the end user's equipment. The main difference between DTE and DCE is that Pins 2 and 3 are reversed on the RS-232 interface.

Duplex: Short for "full duplex" (FDX)—transmitting in both directions simultaneously.

E&M Leads: Ear and Mouth leads—the pair of wires carrying signals between trunk equipment and a separate signaling-equipment unit. The M lead transmits a ground or battery condition to the signaling equipment. The E lead receives open or ground signals from the signaling equipment. Changes of voltage on these leads convey such information as seizure of circuit, recognition of seizure, dialed digits, and so on. They are called "ear" and "mouth" because the E lead receives and the M lead transmits.

Echo Canceler: 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.

EID: Endpoint Identifier.

EKTS: Electronic Key Telephone Service.

Envelope Delay (Phase Distortion): The distortion that occurs when the propagation of a signal in a pair of wires varies with frequency.

ESS: Electronic Switching System.

Far-End Crosstalk: Crosstalk that travels along a circuit in the same direction as the signals in that circuit. Compare "NEXT."

Fast select: An X.25 facility indicating that an extended user data field is being used on some packet types (for example, 128 octets in a call-request packet). It may also indicate restricted response. If Fast Select is requested and the user subscribes to Unconditional Notification, Fast Select is mapped into the Packet layer Binary Parameters information element.

FDM: Frequency-Division Multiplexing—a technique for sharing a transmission channel where carrier signals of different frequencies are transmitted simultaneously.

FDX: Full Duplex. Transmitting in both directions at the same time.

FEBE: Far End Block Errors.

Flow-Control Parameter Negotiation Facility: An X.25 facility that allows the negotiation of packet and window sizes in both directions of transmission.

Four-wire circuits: Telephone lines that use two wires for transmitting and two for receiving, offering much higher quality than a two-wire circuit. All long-distance circuits are four-wire. Almost all local phone lines and analog phones are two-wire.

Frame: 1. 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.

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

FTP: File-Transfer Protocol.

FX: Foreign Exchange.

Group 4: A high-speed facsimile protocol specific to ISDN.

HDX: Half-Duplex. Transmitting in both directions, but only one direction at a time.

HLC: High-Layer Compatibility.

Hub: 1. Any communications center. 2. A major routing station for connecting channels. 3. A DDS connecting center.

ID: Identification.

IEC: InterExchange Carrier.

IMUX: Inverse Multiplexor.

In-Band Signaling: Signaling made up of tones that pass within the voice-frequency band and are carried along the same circuit as the talk path being established by the signals. Virtually all signaling (request for service, dialing, disconnect, and so on) in the U.S. is in-band signaling. Most of that signaling is MF (Multi-Frequency) dialing. The more modern form of signaling is out-of-band.

Information Element: One of the data fields in an ISDN Layer 3 message.

INIC: ISDN Network Identification Code.

Interexchange Carrier: Any carrier registered with the FCC as authorized to carry customer transmissions between LATAs interstate—or, if approved by a state public utility commission, within the state. Includes such carriers as AT&T Communications, Satellite Business Systems, GTE® Telenet®, GTE Sprint®, and MCI®.

Interface: A common boundary or point of connection between two systems, over which the communication between the systems occurs.

Internetworking: Communication between two types of network or end equipment. It may or may not involve a difference in signaling or protocol elements supported.

IOF: InterOffice Facility.

ISDN: Integrated Services Digital Network.

ISO: International Standards Organization.

Jitter: The slight movement of a transmission signal in time or phase that can introduce errors and loss of synchronization in high-speed synchronous communications. See also "Phase Jitter."

Kbps: Kilobits (thousands of bits) per second.

kHz: Kilohertz.

LAN: Local Area Network.

LATA: Local Access and Transport Area. One of the local telephone serving areas in the U.S., generally encompassing the largest metropolitan areas. Circuits with both end-points within the LATA ("intraLATA") are generally the sole responsibility of the local telephone company, while circuits that go beyond the LATA ("interLATA") are passed on to an interexchange carrier.

LEC: Local Exchange Character.

LLC: 1. (In LANs) Logical Link Control. 2. (In ISDN) Low-Layer Compatibility.

Local Loop: In telephony, the set of wires that connect a subscriber to a phone-company end office—most often two wires, but four-wire local loops are common, especially with leased voice-grade circuits.

Logical Channel: In X.25, a virtual connection operated over a physical connection that can support one or more virtual connections simultaneously.

Loopback: A diagnostic test. Data is sent to the device being tested, and the output of the device is fed directly back to its input. The returning data is checked against the data that was sent.

Master Clock: The source of timing signals, or the signals themselves, that all network stations use for synchronization.

Mbps: Megabits (millions of bits) per second.

Message: The Layer 3 information that is passed between the CPE and the SPCS for signaling.

MF: Multi-Frequency signaling.

MLHG: Multi-Line Hunt Group.

Multidrop: A communication arrangement where multiple devices share a command transmission channel, though only one may transmit at a time.

Multiplexing: Combining multiple data channels on a single transmission medium. Any process through which a circuit normally dedicated to a single user can be shared by multiple users. Signals are usually interleaved either on a bit or byte basis (time-division multiplexing) or separated by different carrier frequencies (frequency-division multiplexing).

Multipoint Circuit: A circuit consisting of three or more directly connected stations.

Narrowband ISDN: A collective term for BRI and PRI at speeds up to 1.544 Mbps.

NCTE: Network Channel Terminating Equipment—equipment considered necessary for terminating a telephone circuit at the customer premises on the phone company's side of the demarcation. The FCC has decided that NCTE is CPE and therefore may be supplied by third-party vendors.

NEBE: Near End Block Errors.

NEXT: Near-end crosstalk—unwanted energy transferred from one circuit to an adjoining circuit. Occurs at the end of the transmission where the signal source is. 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. Compare "Far-End Crosstalk."

NI-1: National ISDN-1.

NI-2: National ISDN-2.

NIST: National Institute of Science and Technology.

NIUF: North American Users' Forum.

Non-ISDN Line: Any connection from a CPE to an SPCS that is not served by D-channel signaling.

Non-ISDN Trunk: Any trunk not served by either SS7 or D-channel signaling.

NRZ: Non-Return-to-Zero—a binary encoding scheme that inverts the signal for a 1 and leaves the signal unchanged for a 0. Also called "transition coding."

NT1: Network Termination 1—A device that provides physical and electromagnetic termination of the U-interface two-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 device that provides switching and concentration of customer lines at the S-interface. It performs the functions of a Customer Premises switch or multiplexor to multiplex B-channels or D-channels onto one physical path and to route calls to the appropriate B- or D-channel.

NT: Network Termination.

OSI: Open System Interconnect—an international seven-layer protocol standard for the open exchange of data between unlike equipment.

Packet Mode: A system of switching 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 a number of phone conversations over a smaller number of physical facilities. Pair gain usually refers to electronic systems used in an outside plant (from the Central Office to the customer premises). AT&T has various subscriber pair-gain devices called SLCs (pronounced "slicks").

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).

PBX: Private Branch Exchange.

PCM: Pulse-Code Modulation—a digital-transmission technique that involves sampling an analog information signal at regular intervals and coding the measured 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 usually a sampling rate of 8 MHz.

Phase Jitter: In telephony, the number of degrees out-of-phase by which an analog signal deviates from the reference phase of the main data-carrying signal.

PHF: Packet-Handling Function—the SPCS capability that processes and routes X.25 virtual calls.

PMD: Packet-Mode Data.

Point-to-Point Circuit: A circuit that connects two points directly, with no intermediate processing nodes or computers (although there could be switching facilities). A type of connection that links two logical entities. A phone-line circuit is a point-to-point circuit.

POP: Point Of Presence—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 dialup or leased-line communications.

PPSN: Public Packet-Switched Network.

PRI: Primary Rate Interface—connects high-capacity CPE, such as a PBX, to the network. In the U.S., PRI is made up of 23 64-Kbps channels and one 64-Kbps D-channel. Also known as "Primary Rate Access" (PRA).

PRN: Program Stored Number.

PSTN: Public Switched Telephone Network.

PVC: Permanent Virtual Connection.

R-Reference Point: The point at which non-ISDN equipment connects to ISDN through a terminal adapter.

Regenerate: To restore a signal to its original shape. Analog signals cannot be regenerated (it's hard for telecommunications equipment to distinguish signal from noise), but digital signals can be regenerated, since they consist of ones and zeros. If digital signals are flattened or distorted, a simple logic circuit can restore the signal to the original clean squared shape.

Repeater: A device that boosts, amplifies, and regenerates the signal being transmitted. Since the quality and strength of a signal decay over distance, repeaters are inserted at intervals along a circuit.

RS-232C: An EIA-specified physical interface with associated electrical signaling between DTE and DCE. The most commonly used interface between computers and modems.

RS-422A: An EIA standard for the electrical characteristics of balanced-voltage digital circuits.

RS-423A: An EIA standard for the electrical characteristics of unbalanced-voltage digital circuits.

RS-449: A general-purpose 37-position and 9-position interface for DTE and DCE using serial binary data interchange.

S-interface: The interface that connects an ISDN terminal (THE1) or Terminal Adapter (TA) to the NT2 reference point, as defined in the I.411 Recommendation.

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.

Serving Area: 1. The region surrounding a broadcasting station where signal strength is at or above a stated minimum. 2. The geographical area handled by a telephone Central Office facility; generally equivalent to a LATA.

SLC-96: Subscriber Loop Carrier–96 (pronounced "slick 96")—a short-haul multiplexor from AT&T that enables up to 96 telephone customers to be served on three pairs of wires.

SPCS: Stored-Program-Controlled Switching System.

SPID: Service Profile Identifier.

SS7: Signaling System 7—fast common-channel signaling, 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 signaling between Central Offices.

Switching Center Rank: One of the six levels in the switching-center hierarchy in the North American toll switching and direct distance dialing plan. The six levels according to rank:

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)

Sync Bits: Framing or synchronizing bits in synchronous transmission.

Synchronous Transmission: A method of data transmission requiring the transmission of timing pulses to keep the sender and receiver synchronized in their communication. Synchronous data transmission is used in high-speed data circuits because there is less overhead than in asynchronous transmission.

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

T1: A digital transmission link with a capacity of 1.544 Mbps. T1 uses two pairs of normal twisted wires. It can normally handle 24 voice conversations, each conversation 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 the next step up the North American digital carrier hierarchy from T1.

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

T3: 44.736 Mbps (commonly described as 45 Mbps). Capable of handling 672 voice conversations. T3 runs on fiberoptic lines.

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

Tandem: The connection of the output of one circuit to the input of another, so that the circuits are connected in series.

Tandem Office: A phone company's major switching center for the switched telephone network. It interconnects local Central Offices the way a Central Office interconnects individual subscriber lines.

TDM: Time-Division Multiplexing. See "multiplexing."

THE: Terminal Equipment.

THE1: Terminal Equipment Type 1—ISDN-compatible terminals.

THE2: Terminal Equipment Type 2—Non-ISDN terminal equipment linked at the RS-232, RS-449, or V.35 interface.

Teardown: The disconnection of a circuit. When you hang up a phone, for example, the circuit that was being used is "torn down" so that it can be used for another connection.

TEI: Terminal Endpoint Identifier.

Tip and Ring: Traditional telephone terms for plus and minus in electrical circuits. In old-fashioned switchboards, the tip wire connected to the tip of the plug, and the ring wire connected to the slip ring around the jack.

Transition Coding: See "NRZI."

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

Transmission: The sending of a signal from one point to another through some kind of medium.

Twisted Pair: A pair of wires twisted around each other to reduce interference from one wire to the other. Several sets of twisted pairs may be enclosed in a single cable. Twisted pair is the normal wiring between a Central Office and your home or office, or from your PBX to your office phone. It comes in various thicknesses; generally, the thicker the cable, the better the quality of the transmission. (However, the thicker it is, the more it costs.)

Two-Wire Circuit: A transmission circuit made up of two wires, signal and ground, used both to send and to receive information. Compare "Four-Wire Circuits."

U-Interface: A twisted-pair subscriber loop that connects the NT1 reference point to the ISDN network, as defined in the I.411 Recommendation. It provides Basic Rate Access with an operating speed of 160 Kbps and an information speed of 144

Mbps. Under U.S. recommendations, it also marks the line of demarcation between customer-owned equipment and the public network.

V.32: A 9600-bps two-wire duplex modem standard.

Video Teleconferencing: The use of television equipment to transmit real-time video images between two (or more) locations. Bandwidth requirements range from 56 Kbps for digitally encoded freeze-frame, to 1.544 Mbps for very good quality, full-color, full-motion TV, to 6 MHz for analog, full-motion, full-color, commercial-grade TV.

Virtual Circuit: A logical connection 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: Offering transmission bandwidth greater than that of a voice-grade channel.

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 DTE and DCE for terminals operating in the packet mode and connected to public data networks by dedicated circuits.

Zero Code Suppression: A technique that inserts a 1 bit to prevent the transmission of eight or more consecutive 0 bits. Used primarily with digital T1 and related telephone-company facilities that require a minimum ones density in order to keep the individual subchannels of a multiplexed high-speed facility active.

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BLACK BOX
NETWORK SERVICES