



Productivity Series 500 TA
ISDN Terminal Adapter

Reference Manual
34-00236
1st Edition

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Reorder # 34-00236

1st Edition, March 1996

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FCC Requirements

This equipment uses, generates, and can radiate radio frequency energy interfering with radio communications if not installed and used according to the instruction manual. It has been tested and complies with the limits for a Class B computing device according to FCC Rules, Part 15. Operation of this equipment in a residential area may cause interference. If it does, you must correct the cause of the interference. Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate equipment.

Shielded DTE cables should be used with this unit to ensure compliance with Class B limits.

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GENERAL

The TxPORT Productivity Series 500 ISDN Terminal Adapter connects an existing PC or Data Terminal Equipment (DTE) to the Integrated Services Digital Network (ISDN) using the ISDN Basic Rate Interface which consists of two bearer (B) channels for data and voice, and one delta (D) channel for signaling. The 500 TA has one standard telephone connector and one PC (DTE) connector which have access to the 56 kbps / 64 kbps ISDN B channels. In this mode, the 500 TA functions are similar to a standard modem.

FEATURES

The Productivity Series 500 TA includes the following features:

- Compatible with most ISDN central office switches
- Integral NT1 device
- Compatible with a standard telephone for voice operation
- Simultaneous voice and data operation
- Status display LEDs
- Nonvolatile storage of 10 dial strings
- Operating parameters saved in nonvolatile memory
- 56/64 kbps synchronous operation (112/128 kbps using BONDING)
- V.120 asynchronous/synchronous rate adaptation
- PPP async-to-sync conversion
- ISDN AT command set
- Menu driven configuration and on screen help

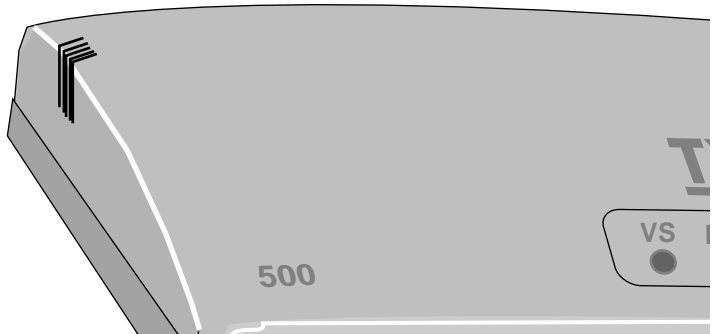
NOTE: *The 500 TA does not support electronic key telephone service (EKTS) or any supplementary data services.*

NOTE: *A high speed serial port is required on the PC in order to use the maximum speeds available for ISDN equipment. High speed ports are available from most PC suppliers.*

PHYSICAL DESCRIPTION

The 500 TA is highly functional, yet it requires little space. The front of the unit contains status display LEDs (see [Figure 1](#) on the following page). LED functions are described in the table.

Figure 1 500 TA Top View

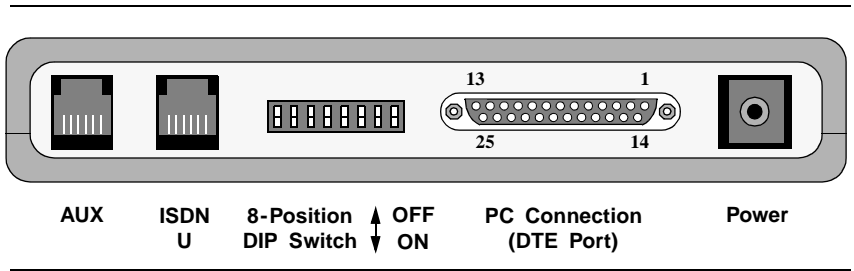


LED	Name	Description
VS	Power/ Voice Status	Indicates the ISDN voice channel status. It is red when power is applied and the voice port is not ready for voice calls. It is solid green when the voice port is ready for voice calls to be placed and received.
DS	Data Status	Indicates the ISDN data channel status. It is off when the data port is not ready for data calls. It is solid green when the data port is ready for data calls to be placed and received.
CS	Call Status	This indicator is off when no call in progress. It blinks while a data call is being connected. It is on when the data call is connected.
TR	DTR	Indicates the Data Terminal Ready status.
RD	Receive Data	This indicator flashes when the PC is receiving data.
TD	Transmit Data	This indicator flashes when the PC is sending data.

The rear panel (see **Figure 2**) houses a 25-pin connector for connection to the user's PC or DTE. It also houses a jack for connection to a standard telephone (AUX), a jack for the ISDN U interface connection, an 8-position switch, and a jack for the power adapter.

***NOTE:** An NT1 device is not required, and should not be used.*

Figure 2 500 TA Rear Panel



***NOTE:** This equipment is powered by a Class 2 power source. You must use the supplied **three wire grounding type plug-in adapter** or equivalent with the following ratings.*

Input: 120 VAC, 60 Hz, 0.18 Amps

Output: ± 12 VDC, 0.12 Amps, + 5 VDC, 0.5 Amps

GENERAL

Installation is simple and straightforward. The 500 TA is designed for easy connection to the user's PC and to the ISDN network. Several easy configuration options are described in later sections.

RECEIPT INSPECTION

Check the contents against the packing list, and inspect carefully for damage. If there is damage or material shortage, contact the shipping agent and TxPORT for advice and assistance. We suggest you retain the shipping container and packing material for possible future shipment.

TELEPHONE WIRING

If your installation requires that you install or modify telephone wiring then keep the following in mind:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the telephone interface.
- Use caution when installing or modifying telephone lines.

INSTALLATION PROCEDURE

Installation requires only a screwdriver and the necessary connections to the PC, the telephone, and the ISDN network. A typical installation is illustrated in [Figure 3 on page 16](#).

PC Connection

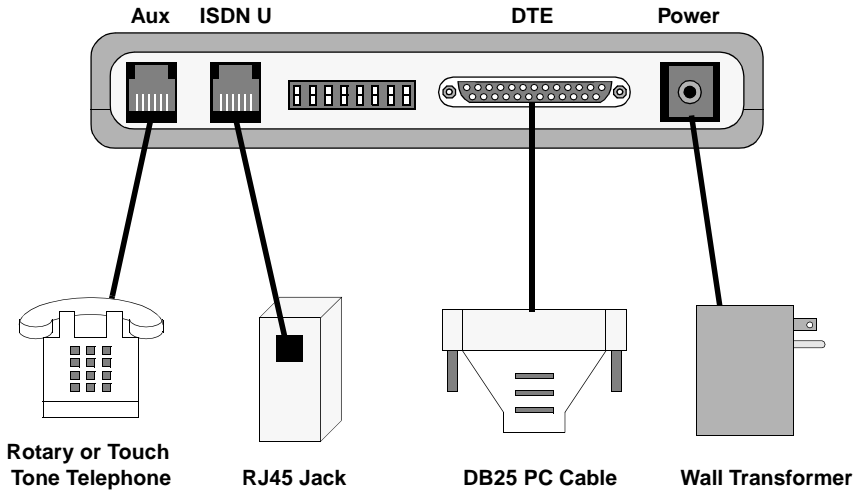
The PC interface to the 500 TA is through an EIA-232E, 25-pin, D-type connector. Insert the PC cable into the PC connection (DTE port) of the 500 TA. Insert the opposite end into the PC serial port. Secure the connect screws, if used, to complete the connection.

To use the unit's built-in AT command set or built-in LocalMenu configuration feature, connect the 500 TA to a PC installed with terminal emulation software

(such as Windows Terminal) or to an asynchronous terminal (must be VT100 compatible to use *LocalMenu*).

NOTE: The PC cable should not be longer than 9 feet if you are using an unshielded cable or 15 feet if you are using a shielded cable. Longer cables may cause transmission errors.

Figure 3 Typical Installation



DIP Switch Settings

An 8-position DIP switch is located on the rear of the 500 TA. Position 1, when placed in the ON position, forces the 500 TA into the AT command mode the next time power is applied to the unit and until the switch is placed in the OFF position. Configuration options associated with the AT command mode will also be forced to their default values. This switch is necessary in the event that a configuration parameter change causes the AT command processor to be disabled. This could happen, for example, if the **@P1=N** command were issued. The remaining switch positions are reserved for future use.

Telephone Connection

The 500 TA provides a voice interface for connection to a standard telephone. Simply connect the telephone to the AUX jack. A modem or facsimile machine may also be connected to this jack, allowing analog calls to a non-ISDN number or to an ISDN number with similar equipment.

Power Connection

Insert the AC adapter cord into the adapter jack labeled PWR on the 500 TA, then insert the wall transformer end of the AC adapter into a grounded 115 VAC outlet. The 500 TA is now ready to be configured for operation.

This equipment is powered by a Class 2 power source. You must use the supplied *three wire grounding type plug-in adapter* or equivalent with the following ratings:

Input: 120 VAC, 60 Hz, 0.18 Amps

Output: ± 12 VDC, 0.12 Amp, + 5 VDC, 0.5 Amps

CONFIGURATION

The 500 TA is now ready to be configured for operation with the ISDN network and your application. At this point you will need to negotiate your requirements for an ISDN installation at your site if you have not already done so. TxPORT has made an effort to simplify this process by providing you with forms you can fax to your telephone service provider. They contain descriptions of the services you will and will not need in order to have your ISDN line configured for the capabilities of the 500 TA. The forms and instructions are included with the unit and duplicated with instructions in [Appendix B](#) of this manual. Once the line has been installed, the 500 TA may be configured.

By giving you several choices, the 500 TA offers flexibility in the method of configuration. If you wish to use the AT command set to configure the unit, skip the rest of this section and proceed to *Network Setup* ([page 19](#)) and *Application Examples* ([page 23](#)). *Network Setup* gives step by step instructions to configure the unit for specific ISDN network parameters. *Application Examples* describes the use of the Quick Setup factory defaults and provides examples to help configure the 500 TA for any application.

The 500 TA also has a built-in feature called *LocalMenu*. Advice on how to invoke and use the *LocalMenu* feature is found on [page 33](#).

ISDN Connection

The ISDN connection should not be made until the 500 TA has been configured properly for operation on the ISDN network. Refer to [page 41](#) for details. To connect the 500 TA to the ISDN line, insert one end of the supplied cable into the ISDN U jack. Insert the other end into the RJ45 ISDN jack.

NOTE: *An NT1 device is not required, and should not be used.*

The VS (Voice Status) and DS (Data Status) lights will blink green and then remain on but unblinking if the unit is properly configured. After approxi-

mately 20 seconds, if the VS and DS lights are not on, recheck the configuration and compare it with the information provided by the telephone service provider. If you have made an error, reenter the parameters correctly, then save and restart the network.

Placing an ISDN Call

To place a voice call using your telephone, first verify that the VS indicator is on, but not blinking. This indicates that the 500 TA is synchronized with the ISDN network on the voice channel. Now simply place a call as you would if the phone were connected to a standard telephone line.

To place an ISDN data call, first verify that the DS indicator is on, but not blinking. This indicates that the 500 TA is synchronized with the ISDN network on the data channel. To place a data call, use the AT dial command (D). For example, to dial the number 555-1212, enter the following from the PC terminal: `ATD555-1212`

The call will be placed. If successful, the connect message will be displayed and the 500 TA will transition to the data mode. If you are using a communications package, it will typically send the dial command for you.

NOTE: *Even though the 500 TA operates much like a modem, it cannot communicate with a modem from the data port. The device at the remote end (the one you are calling) must also be a compatible digital device (e.g. terminal adapter, Switch 56, etc.) configured to communicate using the clear channel, V.120 protocol, or async to sync PPP protocol.*

Answering an ISDN Call

To answer an ISDN voice call when the phone rings, simply answer the phone as you would on a normal phone line. To manually answer an ISDN data call, use the AT answer command (A). A RING message will appear on your PC indicating an incoming call is present. If the 500 TA is set to automatically answer (Rings to Answer is not 0), then the call is answered automatically; otherwise, type ATA to manually accept the call and transition to the data mode.

NOTE: *Most data communication packages automatically answer data calls as part of normal operation.*

For more information concerning the placing of ISDN data calls, refer to 'Call Placement' on [page 57](#). If you cannot get your 500 TA operating properly at this point, refer to the *Troubleshooting Guide* on [page 79](#).

NOTE: *Using ISDN in this configuration, it is possible to have both a voice call and data call active simultaneously if your line supports it.*

GENERAL

The 500 TA unit can be configured to work with a variety of Central Office switches. This configuration must be done before connection to the ISDN network. Configuration can be accomplished via the standard AT command set or the *LocalMenu*. This section gives step by step instructions on how to configure the network parameters in the 500 TA using the AT command set. If you wish to use *LocalMenu*, see [page 33](#) for details.

NETWORK SETUP

The following subsections explain how to set up the 500 TA for use with the ISDN network. You will need certain information from your telephone service provider before configuring the 500 TA. Follow the instructions on the ISDN Ordering Information sheets included with your unit (also duplicated in [Appendix B](#) of this manual) to obtain the necessary information from your telephone service provider.

Network Setup Using the AT Command Set

In order to use the AT command set, either a PC with terminal emulation software installed (such as Windows Terminal) or an asynchronous terminal must be connected to the PC (DTE) port on the rear of the 500 TA. The 500 TA is configured from the factory to operate with AT commands. For more information about AT commands refer to [page 27](#).

The setting of your 500 TA switch options will depend upon the configuration of your ISDN line. If you ordered your ISDN service using the ISDN Ordering Codes (Form #1 in [Appendix B](#)), use [Table 1 on page 20](#) as a guide for setting the 500 TA switch options. If you ordered your ISDN service using the alternate method (Form #2 in [Appendix B](#)) then use [Table 2](#) as a guide for setting the switch options. [Table 3](#) lists the AT commands necessary to configure the switch options. Use these commands along with [Table 1](#) or [Table 2](#) to set the switch options.

The *Application Examples* section ([page 23](#)) provides step by step configuration sequences for some common applications. Follow the instructions to configure your 500 TA for proper operation with your particular application.

NOTE: Always set the Switch Type first. When the Switch Type is changed, the Switch Version, SPIDs, DNs, and TEIs will be reset to default values.

Table 1 Switch Configuration for ISDN Ordering Codes

ISDN Ordering Code	Provider	500 TA Switch Options
CAPABILITY C	1 SPID 1 DN	<ol style="list-style-type: none"> 1) Set the Switch Type to National ISDN-1 2) Set Data TEI to Auto 3) Set Data SPID and DN to provider supplied SPID and DN 4) Set Voice TEI to Disabled 5) Set Voice SPID and DN to provider supplied SPID and DN
Motorola Access 2 CAPABILITY I	1 SPID 1 DN	<ol style="list-style-type: none"> 1) Set the Switch Type to National ISDN-1 2) Set Data TEI to Auto 3) Set Data SPID and DN to provider supplied SPID and DN 4) Set Voice TEI to Disabled 5) Set Voice SPID and DN to provider supplied SPID and DN
Generic Data K Motorola Access 2 CAPABILITY I	2 SPIDs 2 DNs	<ol style="list-style-type: none"> 1) Set the Switch Type to National ISDN-1 2) Set Data TEI to Auto 3) Set Data SPID and DN to provider supplied SPID and DN 4) Set Voice TEI to Auto 5) Set Voice SPID and DN to provider supplied SPID and DN

Table 2 Switch Configuration by Switch Type

Provider Switch Type	Provider Supplied Info	500 TA Switch Options
AT&T Multi-Point	1 SPID 1 DN	<ol style="list-style-type: none"> 1) Set Switch Type to AT&T 2) Set Switch Version to AT&T Multi-Point 3) Set Data TEI to Auto 4) Set Data SPID and DN to provider supplied SPID and DN 5) Set Voice TEI to Disabled 6) Set Voice SPID and DN to provider supplied SPID and DN

Provider Switch Type	Provider Supplied Info	500 TA Switch Options
AT&T Multi-Point	2 SPIDs 2 DNs	<ol style="list-style-type: none"> 1) Set Switch Type to AT&T 2) Set Switch Version to AT&T Multi-Point 3) Set Data TEI to Auto 4) Set Data SPID and DN to provider supplied SPID and DN 5) Set Voice TEI to Auto 6) Set Voice SPID and DN to provider supplied SPID and DN
AT&T Point-to-Point	1 DN	<ol style="list-style-type: none"> 1) Set Switch Type to AT&T 2) Set Switch Version to AT&T 3) Point-to-Point 4) Set Data TEI to Auto 5) Set Data DN to provider supplied DN 6) Set Voice TEI to Disabled
Northern Telecom DMS100 PVC IC-0 DMS100 PVC IC1 (simultaneous voice and data)	2 SPIDs 2 DNs	<ol style="list-style-type: none"> 1) Set Switch Type to Northern Telecom DMS100 2) Set Switch Version to PVC IC-0 or PVC IC-1 (depending on information supplied to you) 3) Set Data TEI to Auto 4) Set Data SPID and DN to provider supplied Data SPID and DN 5) Set Voice TEI to Auto 6) Set Voice SPID and DN to provider supplied Voice SPID and DN
Northern Telecom DMS100 PVC IC-0 DMS100 PVC IC1 (voice or data, not simultaneous)	1 SPID 1 DN	<ol style="list-style-type: none"> 1) Set Switch Type to Northern Telecom DMS100 2) Set Switch Version to PVC IC-0 or PVC IC-1 (depending on information supplied to you) 3) Set Data SPID and DN to provider supplied SPID and DN 4) Set Voice TEI to Disabled 5) Set Voice SPID and DN to provider supplied SPID and DN
National ISDN	-----	Same as Table 1

Table 3 Switch Configuration Steps

0	AT>F	Set Switch and Global parameters to factory default.
1	AT!C0= <i>n</i>	This is the switch type. For <i>n</i> , enter 0 for AT&T 5ESS, 1 for Northern Telecom DMS-100, or 2 for National ISDN.
2	AT!C1= <i>n</i>	This is the switch version. For <i>n</i> , enter 0 AT&T Point-to-Point 1 AT&T Multi-Point 2 DMS100 PVC IC-0 3 DMS100 PVC IC-1 4 National ISDN 1 <default>
3	AT!D3= <i>ttt</i>	This is the data TEI. For <i>ttt</i> , enter 255 (auto <default>) 127 (disabled) 0-63 (value from 0 to 63 if you are using a fixed TEI value)
4	AT!C6= <i>x...x</i>	This is the data SPID. For <i>x...x</i> , enter the SPID value up to 20 digits in length. <i>default is null</i>
5	AT!N1= <i>x...x</i>	This is the data directory number (DN). For <i>x...x</i> , enter the DN value up to 20 digits in length. <i>default is null</i>
6	AT*!D3= <i>ttt</i>	This is the voice TEI. For <i>ttt</i> , enter 255 (auto <default>) 127 (disable) 0-63 (value from 0 to 63 if you are using a fixed TEI value)
<i>If the Voice SPID and DN are not required, then skip steps 7 and 8.</i>		
7	AT*!C6= <i>x...x</i>	This is the voice SPID. For <i>x...x</i> , enter the SPID value up to 20 digits in length. <i>default is null</i>
8	AT*!N1= <i>x...x</i>	This is the voice directory number (DN). For <i>x...x</i> , enter the DN value up to 20 digits in length. <i>default is null</i>
<i>Step 9 is required for proper operation.</i>		
9	AT>W>Z	Save switch parameters to stored profile and restart the network.

You may enter the **AT>V=C** command if you wish to view all of the SPID, TEI, and DNs you have entered. You may enter the **AT!C0?** and **AT!C1?** commands to review the switch configuration.

GENERAL

The 500 TA is suited for a variety of applications. Among other uses, the unit can be configured to operate with a low-speed DTE using rate adaption or a high-speed video-conferencing system using automatic DTR dialing.

This chapter describes common applications for which the 500 TA might be used along with the AT command set programming steps necessary to properly configure the unit. At the end of the chapter there is a call placement example. If you wish to use *LocalMenu*, refer to [page 33](#).

CONFIGURATION WITH 'AT' COMMAND SET

In order to use the AT command set, an asynchronous DTE (terminal) must be connected to the EIA-232E serial port on the rear of the 500 TA. The unit is factory configured to operate with AT commands. For more information about AT commands refer to [page 27](#).

The AT sequence of commands provided for each example must be entered from your DTE in order to complete the configuration. The comment column may indicate alternative choices for the parameter. You must press the ENTER key after each command is entered. If ERROR is returned, check that you have entered the correct syntax and value for the indicated parameter.

NOTE: *The value of any parameter can be viewed by typing the AT syntax for the parameter followed by a '?'. For example, the DTE Speed can be viewed by typing AT@P2?*

Using the Quick Setup Factory Profiles

To simplify the configuration process, the 500 TA has several built-in quick setup factory profiles designed to meet a variety of applications. Find the Quick Setup factory profile in [Appendix D](#) which most resembles your application, load it, modify specific options to customize the 500 TA to your application, and then save the configuration to the stored profile. You will then be ready to use your application if you have followed the instructions in the Network Setup section to configure your unit with the proper network settings. The following steps are all that are needed to accomplish this process.

Step	AT Command	Comment
1		Look up the Quick Setup factory profile most suited for your application in Appendix D of the User's Guide.
2	AT&Fn	Load the Quick Setup factory profile you have selected by replacing n in the command by the number corresponding to the profile.
3	AT <any cmd>	Configure any options required to customize the 500 TA for your application. Chapter 7 (<i>Option Configuration</i>) describes the options and their corresponding AT commands.
4	AT&W	Save port configuration parameters.

APPLICATION EXAMPLES

The following examples provide a guide to configuring your 500 TA for operation with your particular application. You may find that your application is similar to one of the following except for a few parameters.

Application 1: Asynchronous, 9600 bps, Rate Adaption

This is one of the more simple uses of the 500 TA for the user who has typically used a low-speed application with a modem. The following table describes how to configure the 500 TA for asynchronous 9600 bps, 8 data bits, no parity with V.120 rate adaption.

Step	AT Command	Comment
1	AT&F	Loads the port parameters with factory default values. Note: V.120 protocol is a factory default.
2	AT&W	Save port configuration parameters

NOTE: *The speed, parity, and data bits will automatically be set when the AT command is entered. This example assumes you have a PC communicating at 9600 bps, 8 data bits, and no parity.*

Application 2: Synchronous, Clear Channel, DTR Dialing

This is a configuration that might be used for a Video Conferencing application. The following table describes how to configure the 500 TA for synchronous 64 kbps, clear channel (no rate adaption), with DTR dialing.

Step	AT Command	Comment
1	AT&F2	Loads the port parameters with factory default values.
2	AT&M2	Set the sync mode to synchronous 2 operation (DTR dialing)
3	AT&W	Save port configuration parameters

The configuration is complete at this point since the factory defaults for the other parameters are correct.

PLACING A DATA CALL

To place a data call on the 500 TA, use the AT dial command (D). First verify that the DS indicator is on (green), but not blinking. This indicates that the 500 TA is synchronized with the ISDN network on the data channel and ready for you to place a data call. To place the call, type **ATD** followed by the number you wish to dial and press the ENTER key.

For example, to dial the number 555-1212 enter:

ATD555-1212

You may use spaces, hyphens, parentheses, or other punctuation to make the command line easier to read. If you press any key at any time before the call connects, then the dialing aborts. This feature is called *any key abort*. If the call is successful, you will see a connect message such as CONNECT 9600 if you are using V.120 with a 9600 bps DTE.

GENERAL

This chapter provides information on how to use the AT commands to operate and configure the 500 TA via the PC connection (DTE port). The entire 500 TA AT Command Set is contained in [Appendix C](#). "PC" as used in this chapter refers both to PCs with terminal emulation software (such as Windows Terminal) and terminals themselves.

AT COMMAND STATEMENT

The 500 TA communicates with a PC asynchronously any time the DTE port is configured for AT command mode. When the 500 TA is powered up, and if the DTE port is configured for AT commands, the 500 TA enters the AT command mode. AT commands can then be used to configure and control the 500 TA. The command statement is typed using the PC keyboard.

The command statement must be typed in a specific form for the 500 TA to recognize and follow the instruction. The command statement begins with the letters AT, is followed by one or more commands which can each consist of a sequence of keyboard symbols such as & and %, letters, numbers, and is then followed by a return or end-of-line character.

AT COMMAND MODE

AT commands can be issued only when the DTE port is configured for the AT command mode. Normally, the DTE port is in the AT command mode whenever it is off-line. After the 500 TA connects with another TA and goes into the online data mode, characters sent to the 500 TA by the PC are interpreted as data (not as commands) and are transmitted to the remote TA.

ESCAPE SEQUENCE

+++

If the 500 TA is in the asynchronous data mode the escape sequence can be sent to return the 500 TA to the command mode and remain online. The escape sequence consists of a pause (normally 1 second), three escape characters, and then another pause. The default escape sequence characters are '+ + +'.

The escape sequence character is set by the S2 command and can be changed if necessary. The escape sequence can also be disabled to prevent any possibility of false escapes into the command mode.

After entering the escape sequence, the 500 TA will return to the AT command mode, but will not hang up or break the connection with the remote unit. AT commands can now be entered to the 500 TA. The ATO command returns the 500 TA to the data mode.

CREATING A COMMAND STATEMENT

AT

To create a command statement use the following steps:

- Type AT (the ATtention code telling the unit a command statement follows).
- Type the command.
- Press the return key to send the command statement to the 500 TA.

An example of a command statement using the dial command (D) follows.

```
ATD555-1212
```

This statement can be read as:

```
ATtention: Dial 555-1212
```

Another example: Enter

```
AT>Z
```

This means

```
"Attention: reload switch parameters and restart the ISDN network."
```

After entering a command line the 500 TA returns a response message indicating whether or not the command was accepted or by giving the data requested by the command line. The AT command also sets some of the unit's PC data parameters, namely the PC speed, parity, and bits per character to match the PC. This process is repeated each time the AT prefix is typed.

COMMAND STATEMENT GUIDELINES

When typing command statements, the following rules apply:

- The attention code 'AT' may be upper or lower case, but not a combination both, such as 'aT'.

- The ENTER key must be pressed to execute (or enter) a command.
- The command buffer can hold 128 characters including spaces.
- Use the backspace or delete key to erase the last character (depending on your terminal).

PC CHARACTER ECHO

E

As commands are typed they normally appear on the PC monitor so the operator can verify the input. This is called local character echo. To determine if echo is set properly, type AT. If the terminal displays AT, echo is set correctly. If it displays AATT, then echo should be disabled by typing ATE. If the terminal does not display the AT at all, echo should be enabled by typing ATE1. The echo option only affects command mode operation.

COMMAND STATEMENT BUFFER

The 500 TA temporarily stores up to 128 characters in a buffer. If more than 128 characters are entered before the end-of-line characters, the 500 TA ceases to echo and waits for the end of line character. To correct this condition, retype the command using 128 characters or less.

The characters used by the AT command interpreter to represent end-of-line, line feed, and backspace are set respectively by the S3, S4, and S5 commands and can be changed if necessary.

The punctuation used in telephone numbers takes up space in the buffer, as do blank characters used as spaces to help increase readability.

BACKSPACE KEY

Use the backspace key to change the command statement or correct errors. The backspace key allows the cursor to be moved back to the character(s) in error. The command can then be retyped from that point.

Example: ATD5551211 has been typed. To change the last 1 to 2, press the backspace key once, type 2, and press return to execute the command.

REPEATING A COMMAND

A/

This command tells the 500 TA to repeat the last command stored in its buffer. The command is automatically executed without any need to retype the command or press the return key.

Example: The ATD5551212 command has been executed, and the phone is busy. To repeat the instruction type A/, but do not use AT before this command as AT would empty the buffer and there would be no command to repeat.

DISPLAYING AN OPTION VALUE

?

To display the value of a configuration option, follow the command with a question mark. For example, to display the PC speed, enter:

```
AT@P2?
```

Or you may enter AT@P2=? which is equivalent to the above command.

NUMBERED COMMANDS

Commands starting with the same letter are distinguished by a number following the letter.

For example, the E0 command selects echo off, and E1 selects echo on.

GROUP COMMANDS

A group of commands can be typed in a single command statement. Pressing the return key sends the entire command string to the 500 TA, which executes each command individually in the order it appears in the command statement reading from left to right.

For example, the command statement 'ATQ0V1D5551212' means:

- AT Attention
- Q0 Allow status messages to be sent
- V1 Select verbose messages
- D5551212 Dial 555-1212

The 500 TA executes the AT command followed by the Q, V, and D commands. The unit returns the status message corresponding to the last command

on the line. If an error is encountered in a command line, subsequent commands on the same line are ignored.

Some commands use special formats or have special rules concerning their use. For example, the dial D command initiates the dial process so that only dial modifier commands can follow the D command.

DISPLAYING HELP

&H

The 500 TA contains an AT Command Help feature which can be accessed by using the &H command. The &H command has two forms. If &H is entered without an = sign, help is displayed for all AT commands. If &H is entered with an = followed by a list of AT commands separated by commas, help will be displayed for each command listed. For example, to display help for the &V, !C0, and !C1 commands enter:

```
AT&H=&V,!C0,!C1
```

If the display of help information requires more than one screen then the following message will be displayed:

```
--- SPACE to continue, A to abort, or C for continuous display ---
```

If the space bar is pressed the next screen of information will be displayed. If the `A' key is pressed then the display of help information will be aborted and an OK will be returned. If the `C' key is pressed then help information will be displayed continuously without prompting at the end of each screen full of information.

COMMAND SCOPE

The scope of a command refers to the extent of its affect on the 500 TA. All AT commands have a scope of Global, Channel, or Port.

Global commands affect the 500 TA as a whole, potentially disrupting operation on all of the ports and channels. Use a global command with caution (or not at all) if there are active calls on any port.

Channel commands affect only of the B1, B2, or D-Channels of the 500 TA. Use a channel command with caution if there are active calls on any port.

Port commands affect only the operation of the PC or voice port.

GENERAL

You can configure the 500 TA via the standard AT command set or through the *LocalMenu*. This chapter describes how to use the built-in *LocalMenu* feature to configure your 500 TA.

LocalMenu OPERATION

In order to use the *LocalMenu* feature, an asynchronous VT100 compatible terminal or a PC with VT100 terminal emulation software must be connected to the DTE port on the rear of the 500 TA. The *LocalMenu* feature is invoked using an AT command. To return to the AT command interpreter you simply exit *LocalMenu* and the 500 TA returns to the AT command mode.

To invoke the *LocalMenu* function type the following AT command and press ENTER:

```
AT@MENU
```

The *LocalMenu* function will display the *LocalMenu* screen on the VT100 terminal. The general format for the *LocalMenu* screen is shown in [Figure 4](#).

NOTE: The 500 TA will "poll" your terminal to verify if it is VT100 compatible. If it is not, *LocalMenu* will not be invoked and the 500 TA will remain in the AT command mode.

NOTE: If you are using a terminal emulation package on your personal computer, the arrow keys may not function with *LocalMenu* unless you configure the package to allow the arrow keys to "pass through" to the application (*LocalMenu* in this case).

The screen is divided up into four distinct regions. The topmost region is called the Banner region. It contains system identification/revision information and identifies the device being configured. The user has no access to this region.

The region second from the top is the Menu region and contains menu items which may be manipulated by the user. The menu items will typically be configuration options. For specific information about a particular configuration option, refer to [page 37](#), *Option Configuration*. Each menu item is displayed with a description field followed by the current value field. The Menu region will have a title displayed in inverse video which describes the particular menu. For example, if you have previously selected the switch type to be AT&T and

are in the process of selecting the switch version, the menu title will be AT&T POINT TO POINT MENU. This will aid you in selecting the correct options.

Figure 4 LocalMenu Screen

```
LocalMenu           Device: 500 TA
Copyright 1995      Revision: xx
Motorola, Inc.

                                NATIONAL ISDN MENU
Network Switch Type  NT1           Network Switch Version NI-1
Save Switch/Global Profile (Execute)  Restart Network Link (Execute)
Data TEI                AUTO
Data SPID                2054647757
Data Directory Number    4647757
Voice TEI                AUTO
Voice SPID                2054647755
Voice Directory Number    4647755

                                MENUS
RESET MENU  HELP  CALL OPTS  PROTOCOLS  CMDS/MSGS  DIAGNOSTIC
EXIT MENU   NETWORK  STORED NOS  PORT OPTS  LOAD/SAVE
```

The highlighted field may be interrogated. The arrow keys move the field highlight to other fields for examination or change. To change the current value for a menu item, press the ENTER key. Pressing the ENTER key causes all of the possible values for the menu item to be displayed in the Parameter region. The SPACEBAR allows the user to leave the parameter region without changing any values.

The region third from the top is the Parameter region and contains the possible values for items selected in the Menu region. The arrow keys move the highlight from value to value within the Parameter region. Pressing the ENTER key changes the parameter value to the highlighted value. Pressing the SPACEBAR returns control to the Menu region without changing the value of the menu item selected.

If the menu item selected requires text entry, a text field will be displayed and text can be entered into the field. The UP and DOWN arrow keys move the highlighter from the text edit field to the CANCEL command. Pressing the ENTER key while the text edit field is highlighted will cause the parameter to be set to value in the text edit field. Pressing the ENTER key while the CANCEL command is highlighted returns control to the Menu region without changing the value of the menu item selected.

The region at the bottom is the Option region. It contains selections for the additional screens which are available to the user. To select the option region

press the SPACEBAR. Use the arrow keys to highlight the desired screen and press ENTER to complete the selection. In most cases, the Menu region will be updated with a new set of menu items for manipulation.

If you select RESET MENU in the Option region then the screen will be re-displayed. If you select EXIT MENU then you will exit *LocalMenu* and return to the AT command mode.

Incoming Data Calls

The 500 TA will not answer an incoming data call while you are using *LocalMenu*, even if the Auto Answer option is enabled (S0 is not set to 0). This prevents you from unexpectedly being transitioned into the data mode. The 500 TA will, however, notify you of the incoming call by flashing the Call Status (CS) LED. When this happens, you may answer the data call by exiting *LocalMenu*. If the Auto Answer option is enabled, the call will be answered immediately. If the Auto Answer option is disabled (S0=0), the 500 TA will return to the AT command mode. The call may then be answered by typing ATA. When the data call is connected, the connect message will be displayed and the CS LED will remain on.

GENERAL

This chapter explains how to configure 500 TA parameters to fit your application. Each configuration option is grouped by function; associated commands are provided to the far right of the headings.

CONFIGURATION COMMANDS

Configuration commands are issued either by the *LocalMenu* or AT commands. If you need more information about the format and operation of AT commands refer to [page 27](#). If you wish to use *LocalMenu* to configure your 500 TA then refer to [page 33](#) for details.

CONFIGURATION OPTIONS

The 500 TA supports a number of configuration options. The parameter values of each option can be saved in nonvolatile memory (stored profiles) and retained even when the unit is powered off. The nonvolatile memory contains the unit's stored profiles and holds the stored telephone numbers.

CONFIGURATION PROFILES

The 500 TA contains three sets of configuration options: *factory defaults* are stored permanently in the 500 TA, *active settings* are temporarily stored in the 500 TA, and *custom settings* are stored in nonvolatile memory. These three option storage methods are called profiles. To prevent accidental changes, the ISDN network options are stored separately from the other options and can only be saved, loaded, and reset by using special commands.

Active Profile

The active profile holds the current option settings and is used by the 500 TA for all operations and functions. When options are changed, the active profile is changed.

NOTE: *The active profile is lost when the 500 TA is unplugged or loses power. The stored profile is loaded into the active profile according to the &Y setting when the 500 TA is plugged in.*

Stored Profiles

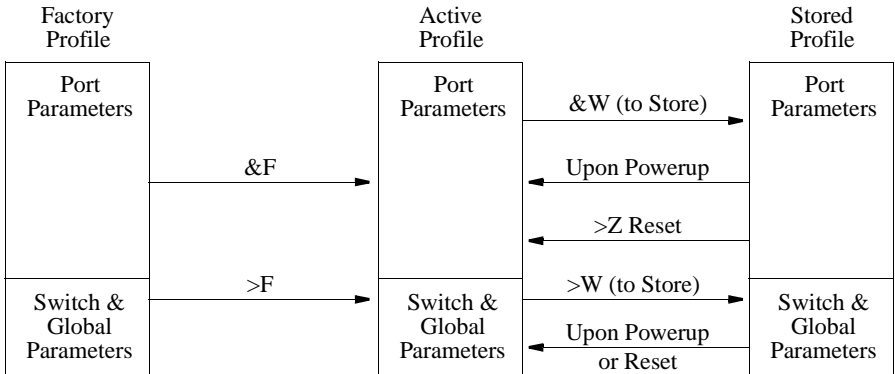
When the most suitable active configuration is established, it can be saved in a stored profile to be recalled on power up or loaded back into the active profile

at any time. There are two stored profiles available, referred to as *stored profile 0* and *stored profile 1*.

Factory Profile

The factory profiles are permanently stored in the 500 TA, and can be loaded into the active configuration. **Figure 5** illustrates how the active, stored, and factory profiles interact.

Figure 5 Profile Storage and Recall



Changing the Configuration While Online

The value of any configuration option can be changed while the 500 TA is online. However, changes to switch options do not take effect until the new configuration is saved and the network is reset using the `>Z` command.

LOADING AND SAVING PROFILES

The active, stored, and factory profiles can be loaded or saved in order to change the unit's operating configuration.

Power up Stored Profile

Use the `&Y` command to instruct the 500 TA which stored profile to load when power is applied, or when the DTR reset (`&D3`) option is in effect.

Command	Operation
<code>&Yn</code>	Load active from stored profile upon power up or DTR reset.

Loading Stored Profile

Z and >Z

Use the Z command to load the port options or the >Z to load the switch options from the stored profile.

Command	Operation
Zn	Restores the 500 TA options from stored profile n (except switch options).
>Z	Restores switch options from the stored profile and restarts the network.

Loading Factory Profile

&F and >F

Use the &F and >F commands to load the active profile from the Quick Setup factory profile.

Command	Operation
&Fn	Load factory default port options from Quick Setup Factory profile n (except switch and global options).
>F	Load factory default switch and global options.

The Quick Setup factory default profiles are industry standard for compatibility with most PCs and communications links. They are stored permanently in the 500 TA and cannot be modified by the user. The Quick Setup factory default profiles are listed in [Appendix D](#).

Saving the Active Profile

&W and >W

The 500 TA performs many functions based on configuration values located in the active profile. Selected active profile values can be changed with AT commands to meet current system requirements.

Some active profile values can be changed and then saved in the stored profile using the &W command. When power is applied to the 500 TA it automatically loads the stored profile into the active profile. This can save time once a proven configuration is established.

Command	Operation
&Wn	Save active profile to stored profile 0 or 1 (except switch and global options).
>W	Save switch and global options to stored profile.

DISPLAYING CONFIGURATION AND INFORMATION

The port, switch, and global configuration can be viewed using view commands. This is a convenient way to review the 500 TA configuration without having to display the value for each individual option.

Display Port Configuration

&V

To display the current port configuration use the &V command. This command is helpful in determining if the 500 TA is configured properly for your PC or terminal.

Command	Operation
&V	Display Port Configuration Options (except for V.120 and stored dial strings)
&V=E	Display V.120 Configuration Options
&V=Z	Display stored dial strings

Display Global Configuration

>V=G

To display the current global configuration options, use the >V=G command. This will display the switch configuration as well as parameters relating to provisioning. This command is helpful in determining if the 500 TA is configured properly for the network.

Display DN, SPID, and TEI

>V=C

To display the current DN, SPID, and TEI values, use the >V=C command. This command is helpful in determining if the 500 TA is configured properly for the network.

Display Product Information

Use the I command to display product information.

Command	Operation
I0	Product ID ("960")
I1	ROM checksum
I2	ROM checksum verification
I3	Firmware revision
I4	Numeric capability string
I8	Verbose capability string
I9	Plug-and-Play ID

CONFIGURATION OPTIONS

The following sections describe each of the configuration options. For each section, the AT commands associated with the option are provided to the far right of the option heading name.

ISDN Network Options

To program the ISDN network options, you must have the Terminal Endpoint Identifiers (TEI), if used, the Service Profile Identifiers (SPID), and the Directory Number (DN) strings agreed upon with the telephone company at subscription time. Refer to [Appendix B](#) for instructions on how to order your ISDN service if you have not already done so.

Ideally, you should first set the network options to a known state (factory default settings). This can be done by using the >F command to reload all of the network options or by the !C0 command to set the network switch type and reload the rest of the network options. If the >F command is used, the network switch type should be set. The 500 TA does not use network options that are changed until the options are saved to the stored profile (>W) and the network has been restarted (>Z). This means that at the end of setup (i.e., changing any of the network options) the >W command should be issued to save the network options to the stored profile and the >Z command should be issued to restart the network using the new network options.

Network Switch Type

!C0=

To make voice or data calls with the 500 TA, the unit must be configured to match the central office switch type of the ISDN line that is being used.

Changing the switch type causes all of the other switch options to be set to their factory default settings.

Command	Operation
!C0=0	AT&T 5ESS.
!C0=1	Northern Telecom DMS-100
!C0=2	National ISDN-1 (NI-1) (default)

Switch Software Version

!C1=

These commands select the software version that the central office switch is using when the network switch type is set for AT&T 5ESS (AT!C0=0).

Command	Operation
!C1=0	AT&T Point-to-Point
!C1=1	AT&T Multi-Point (default)

These commands select the software version that the central office switch is using when the network switch type is set for Northern Telecom DMS100 (AT!C0=1).

Command	Operation
!C1=2	DMS100 PVC IC-0
!C1=3	DMS100 PVC IC-1 (default)

These commands select the software version that the central office switch is using when the network switch type is set for National ISDN (AT!C0=2).

Command	Operation
!C1=4	National ISDN-1 (default)

Voice SPID

***!C6=**

The voice SPID is provided to the user at subscription time. The voice SPID is used to identify a particular service profile, or set of service or feature parameters, with which an endpoint is to be associated.

The voice SPID can be a string with up to 20 characters. If the SPID is entered on a command line with other commands, it should be isolated or set apart by matching single or double quotation marks, for example '1234' or "1234". Quotation marks are not required if the command is on a line by itself.

For Northern Telecom switches, the valid characters are any ASCII digit except for the underline character (_). For National ISDN and AT&T switches, only digits (0-9) are allowed.

Data SPID

!C6=

The data SPID is provided to the user at subscription time. The data SPID is used to identify a particular service profile, set of service or feature options, with which an endpoint is to be associated.

The data SPID can be a string with up to 20 characters. If the SPID is entered on a command line with other commands, it should be isolated or set apart by matching single or double quotation marks, for example '1234' or "1234". Quotation marks are not required if the command is on a line by itself.

For Northern Telecom switches, the valid characters are any ASCII digit except for the underline character (_). For National ISDN and AT&T switches, only digits (0-9) are allowed.

TEI Values

A terminal endpoint identifier (TEI) is a number assigned to a terminal adapter at subscription time. The central office switch uses this number to identify the different terminal adapters that may be connected to the ISDN network. The values 0 to 63 are called *Manual* or *Fixed* TEIs. These values are agreed upon at subscription time and the terminal adapter must use the number to communicate with the central office switch. If TEI assignment is automatic (dynamic), the central office switch will dynamically assign a TEI each time that the terminal adapter is connected to the ISDN interface and the unit power is on.

Voice TEI

*!D3=

Command	Operation
*!D3=0-63	Set TEI to any value from 0-63
*!D3=127	Disables the voice channel
*!D3=255	Sets the voice channel for dynamic TEI negotiation. (default)

Data TEI

!D3=

Command	Operation
!D3=0-63	Set TEI to any value from 0-63
!D3=127	Disables data channel
!D3=255	Sets the data channel for dynamic TEI negotiation. (default)

Directory Numbers

!N1= and *!N1=

The directory number (DN) is the phone number assigned to the terminal adapter. This number is supplied to the user at subscription time.

The directory number is a string with up to 24 characters. If the DN is entered on command line with other commands, it should be isolated or set apart by matching single or double quotation marks (' '), for example '1234' or "1234". Quotation marks are not required if the command is on a line by itself.

The valid characters are: 0 - 9, *, and #.

Command	Operation
!N1=	Sets the data directory number
*!N1=	Sets the voice directory number

ISDN CHANNEL PROVISIONING

B-Channel Provisioning

!C4=, !C5=

The B-channels--B1, B2, or both--can be set to either circuit-switched (dial-up) or permanent (nailed) line.

Command	Operation
!C4=0	B1-channel set for circuit-switched line (default)
!C5=0	B2-channel set for circuit-switched line (default)
!C4=9	B1-channel set for permanent line
!C5=9	B2-channel set for permanent line

A permanent line, also referred to as a nailed line, is always connected to the B-channel. The rate adaption protocol selected will constantly try to establish an end-to-end connection on a permanent line. When establishing a permanent line, the protocol, parity, word length, and stop bits should be the same for both units. There is no D-channel signaling associated with the B-channel when a permanent line is established. Once the option has been set and saved, restart the link with the >Z command. This causes the 500 TA to use the newly selected option.

PORT OPTIONS

These options determine how the data and voice ports communicate on the ISDN line used by the 500 TA. The majority of the options apply only to the data port. Unless explicitly designated, you may assume an option applies only to the data port.

Rate Adaption Protocol Selection

%A2

The %A2= commands select the rate adaption protocol.

Command	Operation
%A2=0	Clear channel with no protocol
%A2=2	V.120 rate adaption protocol (default)

NOTE: Both the local 500 TA and remote TA must be set to the same rate adaption protocol. Also, %A2=0 (clear channel) is synchronous mode only. Asynchronous data should be passed using the V.120 rate adaption protocol.

V.120 Configuration

%E

This command customizes the V.120 protocol. Typically, the factory default settings for the V.120 protocol work in almost all applications. The following settings can be modified for special applications.

Command	Operation
%E0=	V.120 Maximum Transmit Frame Size Range: 1-260 <i>default (260)</i>
%E1=	V.120 Maximum Receive Frame Size Range: 1-260 <i>default (260)</i>
%E2=	V.120 Window Size Range: 1-127 <i>default (8)</i>
%E3=	V.120 T200 Transmission Timer Range: 1-255 <i>default (5)</i>

B-Channel Speed

%A4=

This command selects the B-channel speed, which is normally 64 kbps. However, some network B-channels may be limited to a band width of 56 kbps. If so, it should be so stated in the network specifications.

Command	Operation
%A4=0	B-channel speed is 64 kbps (default)
%A4=1	B-channel speed is 56 kbps

Rings To Answer

S0

This command tells the 500 TA on which ring to answer an incoming call. If this value is set too high, the calling unit may "time out" before the call is answered. The 500 TA will *not* automatically answer the call if the value is set to "0".

Command	Operation
S0=	Range: 0-255 default (1)

Ring Count

S1

This command is read only. It returns the current ring count, and is 0 if the phone is not ringing. The count remains for 8 seconds after the last ring.

Command	Operation
S1?	Display the ring count.

Wait for Connection

S7

This command instructs the 500 TA how long it should wait for a connection. If the connection is not complete within this amount of time a NO CARRIER message is returned.

Command	Operation
S7=	Range: 0-255 default (30) Units = seconds

Speech Call Answer Option

%A93

This command instructs the 500 TA as to whether to answer an incoming speech Bearer Capability (BC) call.

Command	Operation
%A93=D	Do not answer (default)
%A93=E	Answer

3.1Khz Audio Call Answer Option

%A94

This command instructs the 500 TA as to whether to answer an incoming 3.1Khz audio Bearer Capability (BC) call.

Command	Operation
%A94=D	Do not answer (default)
%A94=E	Answer

Data Call Answer Option

%A95

This command instructs the 500 TA as to whether to answer an incoming data Bearer Capability (BC) call.

Command	Operation
%A95=D	Do not answer
%A95=E	Answer (default)

NOTE: The 500 TA voice port will answer speech or audio calls only. The voice port answer options are not configurable.

Echo Disable Tone

%A96

This command instructs the 500 TA whether or not to generate an Echo Disable Tone. When selected the 500 TA will send a tone at the beginning of the data call that will disable the echo canceller.

Command	Operation
%A96=0	Off (default)
%A96=1	On

Dialing Method

%A97

This command instructs the 500 TA as to the type of dialing method used when placing a data call. In most cases the default of Enbloc is correct; however, in some instances it may be necessary to change to Overlap dialing for the call to complete properly.

Command	Operation
%A97=O	Overlap
%A97=E	Enbloc (default)

Data Port Originate Mode

%A98

This command alters the bearer capability (BC) sent to the switch in placing outgoing data calls. Placing an outgoing data call with voice BC (3.1 kHz audio) may often facilitate completing a call through the network. The answering unit must be able to receive a voice BC call as if it were a data BC call.

Command	Operation
%A98=D	Originate with data BC (default)
%A98=A	Originate with 3.1 kHz audio BC
%A98=S	Originate with speech BC

Voice Port Originate Mode

***%A98**

This command has the same effect as the %A98 command for the data port except that the voice port cannot be configured to originate with data BC.

Command	Operation
*%A98=A	Originate with 3.1 kHz audio BC
*%A98=S	Originate with speech BC (default)

TERMINAL INTERFACE AND PIN OPTIONS

These options affect the interface between the 500 TA and the PC or terminal. They select the format of the data sent to the PC, and the operation of the pins on the PC interface.

DTE Data Mode

&M

An important consideration in configuring the 500 TA is the type of interface with the PC or terminal. There are two basic types: asynchronous and synchronous. The 500 TA supports an asynchronous mode (default) and two synchronous modes. 500 TA operation in synchronous mode is described on [page 65](#).

Command	Operation
&M	Asynchronous mode (default)
&M1	Synchronous mode 1
&M2	Synchronous mode 2

DTR Detect Time

S25

This command specifies the time (in 0.01 second increments) that DTR must stay low to be recognized. Also, in Sync Mode 1 (&M1) the DTR detect time is the amount of time (in seconds) between when a call connects and when the 500 TA begins to monitor the DTR pin.

Command	Operation
S25=	Range: 0-255 default (5), Units = 1/100 seconds, seconds

DTE Speed

@P2

This command sets the speed at which the PC or terminal operates. The AT command processor is able to detect the DTE speed and parity automatically.

Command	Operation
00	300 bps
200	1200 bps
400	2400 bps

800	4800 bps
600	9600 bps
9200	19200 bps
8400	38.4 kbps
8000	48 kbps
6000	56 kbps
7600	57.6 kbps (default)
4000	64 kbps
12000	112 kbps
15200	115.2 kbps (disables AutoBaud)
28000	128 kbps

DTE Parity

@P3

This command sets the DTE parity. The AT command processor, in most cases, will detect the DTE speed and parity automatically.

Command	Operation
	No Parity (default)
	Odd Parity
	Even Parity
	Mark Parity

DTE Number of Data Bits

@P4

This command sets the number of data bits the PC or terminal uses.

Command	Operation
	7 data bits
	8 data bits (default)

DTE Number of Stop Bits

@P6

This command sets the number of stop bits the PC or terminal uses.

Command	Operation
	One stop bit (default)
	One and one-half stop bits
	Two stop bits

Flow Control Options

\Q

This command controls the flow of data when the 500 TA and the PC or terminal are set to different asynchronous speeds or when using V.120 protocol in asynchronous mode. If the DTE speed is faster than the 500 TA speed, flow control will stop data transmission when the 500 TA buffers are full. When buffer space becomes available, flow control indicates to the PC to resume transmitting data. The opposite will happen if the 500 TA speed is faster than the DTE speed.

The \Q1 command enables bidirectional XON/XOFF flow control. The 500 TA sends an XOFF (DC3) character to the PC to stop data transmission and sends an XON (DC1) character when transmitting can resume. The PC can also send an XOFF character to tell the 500 TA to stop transmitting and an XON character when transmitting can resume.

The \Q2 command enables unilateral CTS flow control. The 500 TA turns CTS off causing the PC to stop transmitting and turns CTS on when the PC can resume transmitting.

The \Q3 command enables bidirectional RTS/CTS flow control. The 500 TA can turn CTS on and off, causing the PC to start and stop transmitting. The PC or terminal can turn RTS on and off causing the 500 TA to start and stop transmitting.

The \Q4 command enables unidirectional XON/OFF flow control. The 500 TA sends an XOFF character to the PC or terminal to stop transmitting and sends an XON character to resume transmitting.

Command	Operation
\Q	Flow control off
\Q1	DTE/DCE XON/XOFF flow control
\Q2	DTE CTS flow control
\Q3	DTE/DCE RTS/CTS flow control (default)
\Q4	DTE XON/XOFF flow control

Data Carrier Detect

&C

This command controls the DCD output (pin 8) in asynchronous mode. There are three choices: *always on*, *normal*, and *always on except during disconnect*.

Always On (default) - Use the &C command to force DCD to always be on.

Normal - Use the &C1 command to specify that DCD remains off until the 500 TA recognizes the remote unit's carrier signal and the rate adaption protocol (if any) is established

Always On except during disconnect - Use the &C2 command to force DCD to always be on except during a disconnect. The S10 command determines how long the DCD signal will remain off after a disconnect.

Command	Operation
&C	DCD always on (default)
&C1	DCD goes on when the 500 TA establishes a connection
&C2	DCD always on except during S10 disconnect

NOTE: *During synchronous data mode operation, the DCD output behaves as if it were in normal mode regardless of the &C option setting.*

DCD Drop Time

S10

This command controls the amount of time which the Data Carrier Detect (DCD) signal is turned off after a disconnect. This command applies only if the &C2 command is in effect.

Command	Operation
S10=	Range: 0-255 default (14) Units = 1/10 seconds

Data Terminal Ready

&D

This command controls interpretation of Data Terminal Ready (DTR) input. &D1, &D2, and &D9 are valid only when the TA is in asynchronous mode.

NOTE: *In synchronous mode, the DTR pin has other functions (page 65).*

Ignore (default) - Use the &D command to allow the 500 TA to ignore the DTR signal. This option is valid for both asynchronous and synchronous modes.

DTR Drop to Command Mode - Use the &D1 command to specify that if the 500 TA is online and detects a high-to-low transition of DTR, the 500 TA will exit the data mode and enter the AT command mode. If the 500 TA is off-line DTR will have no effect; the 500 TA can connect and enter the data mode without DTR on.

DTR Drop Hangs Up - Use the &D2 command to specify that if the 500 TA is off-line, it will not connect (dial or answer) if DTR is low. If the 500 TA is online and a high-to-low transition of DTR is detected, the 500 TA will hang up, return to the command mode, and disable auto answer.

DTR Drop Resets - Use the &D3 command to reinitialize the data port when the 500 TA detects an on-to-off transition of DTR. If it is online it will hang up, reset the active configuration to the stored configuration based on the Powerup Stored Profile (&Y) option. The 500 TA will not automatically answer while

DTR is off. This option is valid for both asynchronous and synchronous modes.

DTR Dial - Use the &D9 command to enable DTR dialing of the stored dial string for the asynchronous mode.

Command	Operation
&D	Ignore DTR (default)
&D1	On-to-off DTR transition recalls the command mode
&D2	On-to-off DTR transition causes the 500 TA data port to disconnect and disables auto answer while DTR is off
&D3	On-to-off DTR transition resets the data port and disables Auto Answer
&D9	Enable DTR dial for asynchronous mode

Persistent DTR Dialing

&L

This command controls the Persistent DTR Dialing (PDD) Feature which provides the capability for a given port to automatically re-dial the configured stored phone number 0 continuously whenever the port does not have an active call, and the DTR pin is on.

Command	Operation
&L0	Disable Persistent DTR Dialing (default)
&L1	Enable Persistent DTR Dialing

Data Set Ready

&S

This command selects the function of the DSR output (pin 6). DSR normal means DSR is off until the 500 TA begins the connect sequence, then remains on as long as the 500 TA is online.

Command	Operation
&S	DSR always on (default)
&S1	DSR on after protocol is connected

Request to Send / Clear to Send

&R

This command controls the CTS output (pin 5) when the 500 TA is in synchronous mode. In asynchronous mode, CTS is always on unless the CTS flow control option is enabled.

Normal (default) - Use the &R command to allow CTS to follow the RTS (pin 4) after a configurable delay. If the 500 TA is online and ready to receive data from the PC, when it detects an off-to-on RTS transition the 500 TA turns CTS on after the delay specified in S26 (default is 0).

Forced High - Use the &R1 command to allow the 500 TA to ignore RTS. CTS is turned on when the 500 TA is online and ready to receive data from the PC.

Command	Operation
&R	CTS follows RTS (default)
&R1	CTS forced on

RTS to CTS Delay

S26

This command sets the amount of time to follow the off-to-on transition of the RTS pin before the CTS pin is turned on.

NOTE: This command is valid only in synchronous mode.

Command	Operation
S26=	Range: 0-255 default (1) Units = 1/100 seconds

COMMAND AND MESSAGE OPTIONS

The AT command interpreter interprets the commands and sends status and connect messages to the PC or terminal. This section describes the options that affect the command interpreter and the messages that it can send.

Choosing to Use Response Messages

Q

This command enables or disables response messages. The unit still responds to commands when the response display is inhibited.

Command	Operation
Q	Response messages (default)
Q1	Response messages off (quiet mode)
Q2	Off during answer mode

Selecting Response Form

V

This command tells the 500 TA which type of response message to display on the monitor. These messages indicate the present state of the 500 TA and can

appear as digits or words. Some software requires digit responses, but word responses are preferred because their meanings are easier to remember.

Command	Operation
V	Enables digit response message
V1	Enables word response message (default)

CARRIER/PROTOCOL/CHANNEL Messages Display **W**

This command instructs the 500 TA whether or not to return the CARRIER, PROTOCOL, and CHANNEL messages (result codes numbered greater than 50) when a call is connected. When this option is disabled only the CONNECT message is returned when a call is connected. **Table 4 on page 63** contains the status and connect messages along with their respective result codes.

Command	Operation
W	Disable (default)
W1	Enable

***NOTE:** If the W option is set to 1 then the CARRIER, PROTOCOL and CHANNEL messages will be displayed regardless of the X option setting.*

Connect Speed and Dial Messages Display **X**

This command selects the connect speed and dial messages display (result codes numbered less than 50). **Table 4 on page 63** contains the status and connect messages along with their respective result codes.

Command	Operation
X	Enable messages OK, CONNECT, RING, NO CARRIER, ERROR (corresponds to result codes 0-4, respectively)
X1	Enable all messages except BUSY (result code 7) (corresponds to result codes 0-5, 10-14, 17-19, 28, 32)
X2	Enable all messages (default) (corresponds to result codes 0-5, 7, 10-14, 17-19, 28, 32)

***NOTE:** If the X option is set to 0 or 1 and a call is placed to a busy line, the 500 TA will return a NO CARRIER message.*

Command Mode **@P1=**

This command determines which set of commands may be used to operate the 500 TA.

Command	Operation
@P1=N	None
@P1=A	AT command mode enabled
@P1=VB	V.25 bis BISYNC
@P1=vH	V.25 HDLC

DTE Character Echo

E

This command instructs the 500 TA whether or not to echo characters received from the PC while in the command mode.

Command	Operation
E0	Disable character echo
E1	Enable character echo (default)

Escape Character

S2

This command configures the character used to escape from the data mode and return to the AT command mode. The default character is '+'.

Command	Operation
S2=	Range: 0-127 default (43) 128-255 is disabled

Carriage Return Character

S3

This command configures the character used by the AT command processor to indicate the end of a command line in both the receive and transmit directions. The standard character used for this is the ASCII carriage return (13).

Command	Operation
S3=	Range: 0-127 default (13)

Line Feed Character

S4

This command configures the character sent by the AT command processor after each status message. The standard character used for this is the ASCII line feed (10).

Command	Operation
S4=	Range: 0-127 default (10)

Back Space Character

S5

This command configures the character sent by the AT command processor to back up one space in the command line. The standard character used for this is the ASCII backspace (8).

Command	Operation
S5=	Range: 0-127 default (8)

Escape Sequence Guard Time

S12

This command sets the escape sequence guard time--the minimum pause before and after the escape characters (pause, +++,pause). The guard time also defines the maximum amount of time between each of the three characters in the escape sequence. This becomes significant only at low data rates and small pauses. The guard time is in 0.02 second increments.

Command	Operation
S12=	Range: 0-255 default (50) Units = 1/50 seconds

DTE Guard

@G

This command prevents any changes to the options via the PC except for the duration of the call. It disables AT commands which write to the stored profile (&W and &Z) and causes the 500 TA to reload all options from stored profile 0 at the end of each call.

Command	Operation
@G=D	Disable DTE Guard
@G=E	Enable DTE Guard

GENERAL

This chapter describes call operation and termination using AT commands. The 500 TA communicates with the PC or terminal asynchronously any time the 500 TA is in the AT command mode.

OPERATION MODES

When the DTE data mode is set to asynchronous, the 500 TA functions in one of three modes:

- Offline Command Mode
- Online Command Mode
- Data Mode

When the DTE data mode is set to synchronous, the 500 TA functions in only the offline mode and the data mode.

***NOTE:** The 500 TA will communicate with the PC asynchronously when in the command mode regardless of the DTE data mode setting (&M).*

Offline Command Mode

In offline command mode (generally referred to as command mode), the 500 TA communicates with the computer or terminal. AT commands can only be issued when the 500 TA is in the command mode. Commands can be entered separately or in strings to change 500 TA options, rebuild profiles, store or change telephone numbers, initiate or receive phone calls, and go to the data mode. There is no data communication link established in this mode.

Online Command Mode (Async Data Mode Only)

This mode is entered from the asynchronous data mode after the escape sequence (+++) has been entered. The data communication link remains established but data transmission is suspended. The 500 TA will now accept commands as it does in the offline command mode.

Data Mode

The 500 TA goes to data mode (online) after it successfully connects with a compatible TA. In data mode, the 500 TA sends and receives data, but will not accept or execute command instructions.

Escape Sequence (Async Data Mode Only)

If the 500 TA is in the asynchronous data mode, the escape sequence can be sent to return the 500 TA to the command mode and remain online. The escape sequence consists of a pause (normally 1 second), three escape characters, and then another pause. The default escape sequence characters are '+ + +'.

The escape sequence character is stored in S-register two (S2) and can be changed if necessary. The escape sequence can also be disabled to prevent any possibility of false escapes into the command mode.

After entering the escape sequence, the 500 TA will return to the AT command mode, but will not hang up or break the connection with the remote unit. AT commands can now be entered to the 500 TA. The ATO command returns the 500 TA to the data mode. The ATH command hangs up the call.

CALL PLACEMENT STRATEGIES

Before a data call is placed, the 500 TA should be configured correctly. Correct configuration depends on the type of data to be sent, PC speed, and ISDN speed. For more information on how to configure the 500 TA, refer to *Application Examples* on [page 23](#), and *Option Configuration* on [page 37](#).

Rate Adaption

When a data call is placed, the 500 TA will try to establish a physical data connection on the ISDN B-channel. The B-channel is a digital channel that can transfer data at either 56 kbps or 64 kbps, depending on the path the network chooses when routing the call.

A rate adaption protocol will be needed if the user's PC is asynchronous or PC rate is at any rate other than 56kbps or 64kbps. A rate adaption protocol adapts the lower speed of the PC to the higher speed of the ISDN B-channel. The AT%A2= command can be used to select a rate adaption protocol.

The 500 TA supports the V.120 rate adaption protocol. V.120 rate adaption protocol is an error-correcting protocol ensuring error free data transfer at speeds up to 115.2 kbps. Note, however, that throughput is limited by the channel speed to about 75 kbps. When using a rate adaption protocol, both the calling and called units must use the same protocol. Also, unless they are using V.120 in asynchronous mode, the PCs on both ends must be set to the same PC speed before data can be transferred.

B-Channel Speed

The B-channel speed of the true end-to-end ISDN connection is 64 kbps. However, if a call is routed outside of the ISDN network, the B-channel speed may be reduced to 56 kbps. The answering TA will automatically adjust to the B-Channel speed of the incoming call.

Data Path Compatibility

In some instances it may not be possible for the 500 TA to make a successful data call from one location to another because a compatible data path does not exist between the calling and called unit networks. In this case, the originate mode command (%A98) can be used to force the network to treat data calls as if they were speech or audio calls. Data calls placed and answered as speech or audio calls have an ISDN B-channel speed of 56 kbps regardless of the unit's link speed setting. This allows the 500 TA to make a data call even if there is no true end-to-end ISDN 64 kbps data path.

Echo Canceling

To eliminate echoes, the network may route calls through an echo canceller. The echo canceller disrupts data calls and can cause the calling TA to fail to connect with the called unit. In these cases, the user should turn the Disable Echo Tone ON using the %A96 command. With this option selected, the 500 TA sends a tone at the beginning of the data call to disable the echo canceller.

DIALING

D

The D command causes the 500 TA to dial a number. For example, to dial the number 555-1212 enter:

```
AT D 555-1212
```

Use spaces, hyphens, parentheses, or other punctuation (except dial modifiers) to make the command line easier to read and enter. For example, the following are all treated as the same command:

```
AT D 1-800-555-1212
AT D 1 (800) 555-1212
ATD1800551212
```

NOTE: Except for the semicolon modifier, standard dial modifiers are ignored by the 500 TA.

Any Key Abort

If you want to abort the dialing sequence at any time before a connection is established, you can do so by pressing any key on the PC. This feature is called any key abort.

Directory Register

The 500 TA stores up to 10 numbers in directory registers 0 - 9. These numbers are maintained in the stored profile to allow the most frequently used numbers to be dialed easily. For each stored number, the 500 TA retains the entire dial command with all its modifiers. The stored numbers remain in the stored profile until they are written over with new numbers. Removing power from the 500 TA does not affect the directory of stored phone numbers.

Store Phone Number

&Zn=x

To store a phone number using AT commands, enter the &Zn=x command, where n is the directory register number (0 - 9), and x is the dial command sequence (digits and modifiers) you wish to store in that register. For example:

```
AT&Z1= 9 1-800-555-1212
```

This stores the dial command above beginning with the 9 into directory register number 1. The total length of the dial command (counting only digits and modifiers, not spaces or punctuation) may not exceed 40 characters.

A slightly shorter form of the &Z command, without the register number and equals sign, can also be used to store a phone number into register zero. For example:

```
AT &Z 1-800-555-1212
```

The &Z commands are disabled if the DTE guard feature is enabled (refer to chapter 3, Option Configuration - DTE Guard Option).

Display Stored Phone Number

&Zn?

To display a number that is stored in the phone number directory, use the &Zn? command. For example:

```
AT &Z1?
```

This command causes the 500 TA to display (send to the PC) the dial command stored in directory register 1.

To display all of the stored phone numbers, enter &V=Z.

Dialing a Stored Phone Number

S=n

Use the S dial modifier to dial a previously stored number. Once stored, a number can be dialed by entering

ATDS=n

where n is 0 to 9. For example ATDS=1 dials the number stored in location 1. Alternatively, the shorthand syntax ATDS may be used to dial the number stored in location 0. This is equivalent to typing ATDS=0.

For maximum flexibility the stored numbers can be linked in series with each other or other digits on the command line. For example, if you were to enter

ATDS=0S=11212

where stored number 0 is and stored number 1 is the 500 TA will dial the number 1-800-555-1212.

ANSWERING CALLS

A

When the 500 TA detects an incoming call, it asserts the RI signal on the PC interface and sends the RING message to the PC after each ring. If the 500 TA is set to auto answer, it will do so. You can also answer the call manually by sending the ATA command to the 500 TA. Each of these answering methods is described below.

Auto Answer

S0=n

The 500 TA can automatically answer incoming calls if the following conditions are met:

- The auto answer option is set. See below.
- The DTR signal is forced on via the DTR option. Refer to chapter 3, <MIC1>Option Configuration - Terminal Interface and Pin Options<DC255>.
- The 500 TA is in the offline mode.

After the specified number of rings, the 500 TA answers and begins the connect sequence.

Auto answer is controlled by command S0. S0 determines which ring the 500 TA answers on. S0 can be set to a value between 1 and 255 for auto answer.

Setting S0 to 0 (factory default) disables auto answer.

Connecting

When the physical link between the 500 TA and the remote TA is established, the 500 TA attempts to establish the rate adaption protocol.

Return Online

O

When the 500 TA has established the link-layer protocol, it enters the online data mode and is ready to send and receive data. Normally, the 500 TA remains in this mode until the PC sends the data mode escape sequence (+++) or until the call is terminated.

If the PC sends the escape sequence to the 500 TA while it is online and in data mode, the 500 TA enters the online command mode. In this mode, the PC can send AT commands to the 500 TA. To return to the data mode, send the O command.

Hang Up Command

H

To disconnect a call, escape to the command mode and enter the command:

ATH

The 500 TA will then disconnect and hang up.

STATUS AND CONNECT MESSAGES

When the PC sends the 500 TA a command, the 500 TA attempts to execute it, and then sends a status message to the PC, when enabled, reporting the results of the command. (For that reason, the status messages returned by the 500 TA are also called result messages.) If the command was a dial command, then the message is called a connect message. Status messages may also be sent as the result of other conditions that are detected by the 500 TA. However, they are sent only when the 500 TA is in the AT command mode (not the data mode).

The messages that are sent depend upon the message configuration options that are in effect: worded messages or number codes (V command), and normal or extended messages (X and W commands). For more information, see *Option Configuration* on [page 37](#).

Table 4 lists the status and connect messages in number codes, in words, and with their corresponding meanings.

Table 4 Normal Status and Connection Messages

Code #	Word Message	Meaning
0	OK	Command received OK.
1	CONNECT	Connection made at 0-300 bps; or at any speed while X command in effect.
2	RING	Incoming ring detected.
3	NO CARRIER	Valid carrier not detected within period specified by register S7, or carrier lost for 300 ms or more.
4	ERROR	Command not recognized or too long.
5	CONNECT 1200	Connection made at 1200 bps.
6	NO DIALTONE	ISDN Link is not synchronized
7	BUSY	Dialed number busy
10	CONNECT 2400	Connection made at 2400 bps.
11	CONNECT 4800	Connection made at 4800 bps.
12	CONNECT 9600	Connection made at 9600 bps.
14	CONNECT 19200	Connection made at 19200 bps.
28	CONNECT 38400	Connection made at 38400 bps.
32	CONNECT 48000	Connection made at 48000 bps
17	CONNECT 56000	Connection made at 56000 bps.
18	CONNECT 57600	Connection made at 57600 bps.
19	CONNECT 64000	Connection made at 64000 bps.
57	CARRIER 56000	ISDN Line Speed is 56000.
59	CARRIER 64000	ISDN Line Speed is 64000.
81	PROTOCOL: ISDN	Clear Channel Protocol.
83	PROTOCOL: V.120	V.120 Rate Adaption Protocol.
96	CHANNEL B1	Using Channel B1.
97	CHANNEL B2	Using Channel B2.

CALL TERMINATION

The 500 TA will terminate the call when any of the configured call termination conditions occur. These conditions are listed in [Table 5](#).

Table 5 Call Termination

Termination Condition	Selective Disable?	Notes
Any Key Abort	No	Only during the connect sequence, before the connection is established.
ATH Command	No	500 TA must be in the command mode.
Loss of DTR	Yes	Depends upon S25.
Call Placement Failure	Partial	Due to no dial tone, busy signal, or no carrier; timeout set in S7.
Rate Adaption Protocol Link Establish Failure	No	Unable to establish the rate adaption protocol.
Protocol Disc. Request Rcvd	No	A disconnect request was received from remote TA.
Protocol Error Detected	No	Fatal protocol error detected.
500 TA Reset or Powered Off	No	500 TA automatically disconnects when reset or powered off.

SYNCHRONOUS MODES

The 500 TA supports two synchronous modes. Operation in each of these modes is described below.

Synchronous Mode 1**Sync Pause Mode**

When a connection is made, the 500 TA delays for 5 seconds (configurable with the S25 command) before monitoring DTR.

This delay serves two purposes. If separate dialing and communication terminals are used, this allows the terminal operator to switch the cable between the two. If separate dialing and communications software is being used on the same terminal, the delay allows time for the dialing software to complete and the communications software to initialize and turn DTR on.

After the 500 TA connects, the DSR, CD, and CTS pins will be high. This can be used by the DTE as an indication to begin sending synchronous data to the 500 TA.

The 500 TA disconnects if it detects an on-to-off transition of the DTR pin when &D0 is not in effect, or it receives a disconnect message from the switch. After a disconnect, the 500 TA returns to the offline state. If the 500 TA is set to auto answer, it will only answer when DTR is on or &D0 is in effect. If you do not want the 500 TA to answer, DTR must remain low for at least 8 seconds after the ringing ends.

Synchronous Mode 2**Dial Stored Number Mode**

The 500 TA will automatically dial the telephone number stored in directory entry number 0 when it detects an off-to-on transition of the DTR pin.

Once the 500 TA connects, the DSR, CD, and CTS pins will be high to indicate to the DTE that it can begin sending synchronous data.

The 500 TA disconnects upon detecting an on-to-off transition of the DTR pin when &D0 is not in effect, or receiving a disconnect message from the switch. After disconnecting, the 500 TA hangs up and returns to the offline state.

If the 500 TA is set to auto answer, it will only answer when DTR is on or &D0 is in effect. If you do not want the 500 TA to answer, DTR must remain off for at least 8 seconds after the ringing ends. After that time, if DTR turns on, the 500 TA will originate a call. If DTR turns on during the ringing process, but before the required ring count is reached, the 500 TA will not originate a call.

GENERAL

The 500 TA supports voice communications over the ISDN B-channels. This chapter describes the operation of the features and services supported by the 500 TA.

PLACING A CALL

To place a voice call, first verify that the VS indicator is on, but not blinking. This indicates that the 500 TA is synchronized with the ISDN network on the voice channel. To dial, lift the handset and dial a telephone number. The telephone operates the same as a telephone connected to a standard phone line.

ANSWERING A CALL

To answer an incoming voice call, lift the handset to complete the connection as you would with a standard phone line.

TERMINATING A CALL

To terminate the voice call replace the handset on the telephone. The call will also be terminated if the other end disconnects.

SIMULTANEOUS VOICE AND DATA CALLS

The 500 TA supports simultaneous voice and data calls provided you subscribe to two B-channel services. All three switch types supported by the 500 TA support simultaneous voice and data.

A voice call can be placed or received while a data call is already in progress. Likewise, a data call can be placed or received while a voice call is in progress. However, the 500 TA does not support two simultaneous data calls or voice calls. (The 500 TA has only one PC (DTE) port for data and one telephone jack for voice).

VOICE SERVICES

The 500 TA Voice services are designed to emulate existing voice services in use on most systems. The 500 TA can internally generate call progress tones (such as dial or busy) for the voice interface.

GENERAL

V.25 bis is an autodialer option used by synchronous DTE to perform dialing and terminal adapter control functions. The 500 TA supports a subset of the CCITT V.25 bis recommendation, primarily intended for the dialing and answering commands for HDLC or BISYNC modes of V.25 bis operation.

SELECTING V.25 bis

The V.25 bis option is selected using the AT@P1 command. To select V.25 bis, type one of the following AT commands:

AT@P1 = VB for V.25 bis BISYNC mode *or*

AT@P1 = VH for V.25 bis HDLC mode.

The DTR pin is used to activate the V.25 bis dialer. When the DTR pin is turned on, the dialer command setting is used to start the appropriate V.25 bis mode. When you select V.25 bis dialer operation, the DTE SPEED is used to configure the dialer port speed.

***NOTE:** The V.25 bis dialer option is not activated until the DTR signal has been turned off and then back on. This will most likely occur when the asynchronous DTE used to enter AT commands is disconnected from the DTE port and the device which uses the V.25 bis dialing feature is connected. Once the V.25 bis dialer is activated AT commands can no longer be entered.*

OPERATION IN V.25 bis MODE

When the V.25 bis option is enabled, most 500 TA options still apply. Selecting V.25 bis forces the 500 TA into the synchronous communications mode (regardless of the synchronous mode option). Only the DCD pin option setting applies when V.25 bis is enabled and the 500 TA is offline.

REACTIVATING THE AT COMMAND PROCESSOR

The V.25 bis dialer option and the AT command processor cannot be active at the same time. Subsequently, once the V.25 bis dialer has been activated the 500 TA will have to be forced back to its factory default configuration in order to reactivate the AT command processor. This is accomplished by placing the switch labeled 1 on the 8-position switch located on the rear of the 500 TA into the ON position and removing and reapplying power to the unit. AT commands can now be entered and the V.25 bis dialer will no longer be active.

DTE INTERFACE PINS

The function of some pins on the DTE port is different than in other synchronous modes.

DTR Pin Operation

For the 500 TA to accept V.25 bis commands, the DTE must hold the DTR signal high. When configured for V.25 bis dialing, the DTR pin option setting does not apply because the V.25 bis specification explicitly defines how the dialer will respond to changes in DTR.

DCD Pin Operation

The default operation of the V.25 bis dialer asserts the DCD pin when DTR is high (DCD follows DTR). Some devices may require DCD to be low until the connection is established. For those devices, the 500 TA can be configured to only raise DCD upon connection by setting the DCD pin option to NORMAL. The DCD pin option setting of ON is the default for CCITT V.25 bis operation. Refer to the Terminal Interface and Pin Options ([page 48](#)).

CTS Pin Operation

The 500 TA asserts the CTS pin when DTR is high (CTS follows DTR), except that CTS goes low during the connect sequence.

DSR Pin Operation

The 500 TA holds the DSR pin low until a connection is established.

Command Messages

The following V.25 bis commands are supported by the 500 TA:

Command	Description
CRN	Dial Command
CIC	Connect Incoming Calls
DIC	Disregard Incoming Calls

Indication Messages

The following V.25 bis indications are supported by the 500 TA:

Command	Description
CNX	Call Connect Indication
INC	Incoming Call Indication

GENERAL

BONDING is a protocol standard from the Bandwidth ON Demand Interoperability Group for combining the bandwidth of several 56 kbps or 64 kbps channels. BONDING can `bond' from 2 to 31 channels at once. The high speed data, which must be a multiple of 56 kbps or 64 kbps, is split after arrival at the DTE interface into the various channels. On the opposite end the data is recombined into the original data stream and sent to the DTE interface. Due to delays between different calls, the channels are delay-equalized to permit correct positioning of data for the interleaving.

NOTE: Although the BONDING specification defines four modes, Mode 1 is the common mode of operation for all BONDING-compatible implementations, and is the only mode supported by the 500 TA.

BONDING ON THE 500 TA

Because the 500 TA supports one ISDN basic rate interface (2B+D), two simultaneous calls can be made for an effective bandwidth of 112 kbps (2 x 56 kbps) or 128 kbps (2 x 64 kbps).

BONDING SETUP

The following table lists the AT command options required to place a BONDING call.

%A2=n	Protocol	n=3 BONDING
	BONDING RATE MULTIPLIER	n=1: 56 or 64 kbps (1 B-Channel) n=2: 112 or 128 kbps (2 B-Channels)

PLACING A BONDING CALL

You can place a BONDING call using the 'ATD' AT command. The answering party must be set to run BONDING or the call will disconnect shortly after connection. If you have specified a rate multiplier of 2 and the answering party indicates it will support 2 or more channels for BONDING, the answering side will pass the directory number for the second call in the negotiation. The second call is made automatically, and is indicated by the flashing CS (call status) LED. If delay equalization between the channels is obtained, data mode is entered. The terminal screen will indicate the BONDING connection and the

DTE speed (56 kbps, 64 kbps, 112 kbps, or 128 kbps), and the CS LED will be on.

***NOTE:** When a rate multiple of 2 is negotiated, both B-Channels are used and therefore a voice call is prevented from being made for the duration of the BONDING call. Likewise, a BONDING call with a rate multiplier of 2 is not possible when a voice call is established.*

If the rate multiple is set to 1 on either the originator or answerer, the second call will not be made and data mode will be entered immediately after negotiation. The terminal screen will indicate the speed the call connected at on units so equipped.

If the 500 TA is answering a multi-channel call, the Voice directory number will be used for the second call. If you are using a point-to-point line with only one Directory Number, then upon answering a BONDING call requesting two channels this directory number will be sent to the origination side (the same number as the first one dialed). This is because a point-to-point line can receive two calls using the same Directory Number. AT&T 5E5/5E6 can also be configured to receive two calls using the same Directory Number.

DISCONNECTING A BONDING CALL

Disconnecting by any normal means disconnects all BONDING channels. If either channel is disconnected by the switch, the entire call is disconnected by the 500 TA. The disconnection can be validated by the CS LED being off.

GENERAL

The point-to-point protocol (PPP) provides a standard method of transporting multi-protocol datagrams (a unit of transmission in the network layer such as IP) over point-to-point links. PPP is a popular protocol standard used in the equipment employed by many Internet access providers. The PPP feature allows the 500 TA (in asynchronous mode) to connect with a remote synchronous PPP device via the ISDN.

The Point-to-Point Protocol is designed for simple links which transport packets between two peers. These links provide full-duplex simultaneous bidirectional operation, and are assumed to deliver packets in order. It is intended that PPP provide a common solution for easy connection of a wide variety of hosts, bridges and routers. PPP was implemented using RFC documents 1661 and 1662 from the Internet Engineering Task Force.

PPP can be enabled using the AT%A2 command using the following syntax:

```
AT%A2=95.
```

There are no other user selectable parameters directly associated with PPP. Point-to-point protocol can be selected within the *LocalMenu* (AT@MENU) menu structure in units so equipped.

NOTE: *Bidirectional RTS/CTS flow control (\Q3) is the only flow control supported by the PPP protocol.*

COMMUNICATION DIAGNOSTICS

Communication diagnostic tests verify that the 500 TA, the PC, the central office switch, and the remote unit are operating correctly. These tests can help determine the source of a fault down to a particular element responsible for it. Communications tests are initiated and terminated via the AT command set.

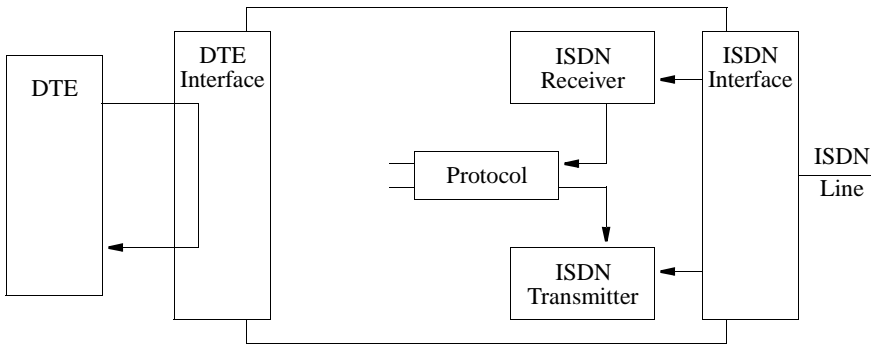
NOTE: If the S18 Test Timer is enabled (not set to 0) then any test currently executing will end when this timer expires.

Local Terminal Loopback

&T9 S18

A local terminal (DTE) loopback loops data back to the PC by connecting the TD and RD pins so that whatever the PC sends is echoed back (Figure 6).

Figure 6 Local Terminal Loopback



To initiate the test, enter AT&T9 from the PC. The 500 TA may be online or offline when the test is initiated. Any protocol, mode, and DTE rate can be used. The test is successful if the data is successfully echoed back to the PC. A BERT device can be helpful in checking for data errors. This test verifies the operation of the PC, the PC cable, and the PC interface of the 500 TA.

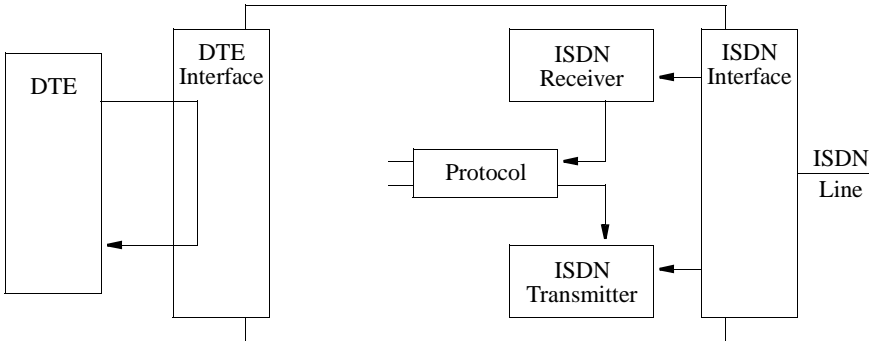
This test terminates when the S18 timer expires.

Local Loopback Test

&T1

Local loopback loops data from the local PC back to the PC so that whatever the PC sends is echoed back (Figure 7). Also the RTS pin is echoed on the CTS pin and the DTR pin is echoed on the DSR, DCD, and RI pins. Run this test if you are encountering data errors before and after data calls are placed. This test is useful in diagnosing the PC and the 500 TA. The DTR Reset (&D3) option will not affect this test mode.

Figure 7 Local Loopback



To initiate the test, enter AT&T1 from the PC or terminal. The 500 TA may be online or offline when the test is initiated. Any protocol, mode, and DTE rate may be used. Data from the local PC will be echoed back to the sender and the CTS pin follows the RTS pin and the DSR, DCD and RI pins follow the DTR pin. The PC portion of the test verifies the operation of the PC, the PC cable the PC interface in the 500 TA and of the data buffers in the 500 TA. The test is successful if the data is successfully echoed back to the sender. A BERT device can be helpful in checking for data errors.

The test is terminated by using the AT '+++' escape sequence.

Digital Loopback Test

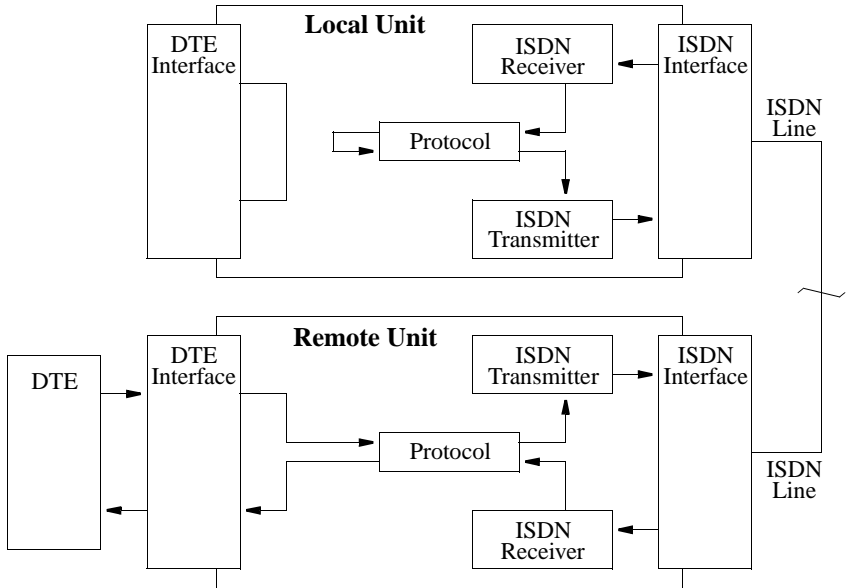
&T3

Digital loopback loops the ISDN B-Channel data normally sent to the local PC (Figure 8). Any B-Channel data received by the 500 TA is processed by the rate-adaptation protocol, and then echoed back out the B-channel to the sending unit. This test is useful in diagnosing the PC, 500 TA, switch ISDN line, and remote unit. Run this test if you are encountering data errors after a call is placed successfully.

To initiate the test, enter '+++' to escape to command mode and AT&T3 from the PC. The 500 TA must be online when the test is initiated (a call must be placed) before the unit can loop B-channel data. Any protocol, mode, and DTE

rate may be used although the protocol on the two units must be compatible. The remote unit should be set to the same rate adaptation protocol as the local 500 TA, and left in normal data mode. Data sent by the remote TA will be received by the local 500 TA, then echoed back to the remote TA. The test is successful if the data is correctly echoed back to the sender. A BERT device can be helpful in checking for data errors.

Figure 8 Digital Loopback



The test should be run in both directions if possible (i.e. use the local 500 TA as both the sending unit and as the loopback unit). If the B-channel data test is successful, it indicates that the local and remote units and network are functioning. If there are errors, the problem could be in any of those elements.

The test is terminated by entering AT&T0.

Bilateral Loopback Test

&T8

Bilateral loopback combines the functions of local loopback and digital loopback. Its loops data from the local PC back to the PC, so that whatever the PC sends is echoed back (Figure 9). Also, it loops the ISDN B-Channel data normally sent to the local PC. Any B-Channel data received by the 500 TA is processed by the rate-adaptation protocol, and then echoed back out the B-channel to the sending unit. This test is useful in diagnosing the PC, 500 TA, switch, ISDN line, and remote unit. Run this test if you are encountering data errors

GENERAL

This chapter is designed to help you if you have trouble installing, configuring, or operating the 500 TA.

Caution: *Do not attempt to repair the 500 TA yourself. Both FCC and IC regulations prohibit user servicing.*

Because a data communications system typically involves a number of components (the PC, the 500 TA, the cables, the telephone line, the remote TA, and the remote PC), there are many factors that can contribute to a communications problem. The first step is to identify where the problem lies within the system.

Before you begin troubleshooting, consider the following:

- Has the problem always been there, or did it start recently?
- If the problem started recently, what has changed since the 500 TA last worked? Was the unit's configuration changed? Was the PC's configuration or software changed? Are you trying to communicate with a different remote device, or has the remote device's configuration changed?
- Is the problem intermittent, or can you duplicate it at will?
- Does the 500 TA work with other remote devices, or with other PCs?
- Check the unit's configuration. Do the switch options match those provided by your service provider?
- Does the problem occur when placing data calls, and does it affect voice operation as well?

The answers to these questions may help you identify the source of the problem. If you don't know where the problem lies, or if the problem seems to be in the 500 TA, the following section may help you pinpoint and correct the problem. Each describes a problem symptom, and explains the possible causes and solutions. If the problem persists even after following the troubleshooting procedures, contact TxPORT for assistance. If you do find it necessary to contact TxPORT for assistance, please have the following information available:

- Name of the product you are using
- How you have configured your 500 TA and what you are using it for (Internet access, LAN connection, etc.)
- What software you are using (MS-DOS, Windows 3.x, Windows 95, comm package, etc.)
- Type of PC, terminal, or other DTE you are using and its characteristics (processor speed, RAM, etc.)

- What tests (if any) you have run and what the results were (loopback test for example)
- LED status indications (if your unit has LED indicators)

If you are using a communications software package on your PC, see if it has a terminal emulation mode so that you can communicate directly with the 500 TA. This will allow you to enter AT commands directly to the 500 TA, and see the responses on the screen.

When power is turned on, nothing happens.

The 500 TA may not be getting power.

- Check to be sure the power adapter is plugged in to a live outlet.

The 500 TA will not communicate or establish a link to the network switch.

- Ensure the ISDN cable is connected.
- Try performing a network restart.
- Verify that the VS and DS LEDs are on but not blinking. If the VS LED is red or blinking, voice operation may not be properly configured. Likewise, if the DS LED is off, data operation may not be properly configured.
- Verify that the switch type and version settings are for the correct switch.
- Verify that the Directory Numbers (DNs), SPIDs, and TEI values match those agreed to at subscription time with the network provider. Also check that the switch options have been saved into the stored profile and the network link has been restarted.
- Verify that the network switch supports Northern Telecom ISDN Basic Rate Access on the user-network interface and functional mode operation in the layer 3 user network signaling, or AT&T ISDN Basic Rate Access 5ESS generic program 5E4.2 or above for a TYPE A terminal, or National ISDN-1 Basic Rate Access for a basic (non-EKTS) terminal.
- @BULLET DOUBLE = Verify that for Northern Telecom and National ISDN-1, EKTS and CACH are turned off at the switch and there are no supplementary data services turned on.

The 500 TA appears to power up correctly, but does not respond to AT commands sent from the PC.

The TD LED indicates if the 500 TA is receiving any data from the PC. If the TD LED does not blink when the PC sends an AT command, the problem may be in the PC or the cable:

- Check your PC. Make sure that the PC is configured properly and is set up to communicate using the correct port.
- Check the PC cable. Is it connected properly?

- You may need a different type of PC cable. If your PC port is set up as a DCE, then you may need a crossover (null modem) cable, which reverses the receive and transmit lines. Try to find out the function of the pins on PC's serial interface port, and compare them with the unit's pin functions listed in [Appendix E](#). For example, the PC's receive pin should be connected to the unit's transmit pin, and vice versa.
- Some PCs expect a CD and CTS signal from the 500 TA in order to transmit. In the default configuration, both CD and CTS are forced (always on).

If the TD LED blinks when the unit receives an AT command, but the RD LED does not blink (indicating the 500 TA does not respond to the command), then the problem may be in either the PC's configuration or the unit configuration.

- Make sure the 500 TA is set to the proper communications mode. The 500 TA will only respond to AT commands if it is in the command mode.
- Make sure the unit's AT command interpreter is enabled. Try unplugging and plugging the power supply to cause the 500 TA to reset. The Installation chapter describes how to force the 500 TA into AT command mode.
- Be sure that the PC either provides a DTR signal, or that the 500 TA is set to force DTR On (DTR Option 0, AT&D).

AT commands echoed from the 500 TA are not displayed correctly at the PC (but response messages are).

- Check the PC echo option. If the PC displays duplicate characters (i.e. AATT), PC echo should be disabled. If the PC does not display AT at all, be sure PC echo is enabled.

AT response messages are not being displayed properly at the PC (but AT commands are).

- First, be sure that the unit's AT command interpreter is enabled and that AT messages are enabled. Both these settings are the default. The Installation chapter describes how to force the 500 TA into AT command mode.
- If numbers are being returned from the 500 TA when you enter commands, the 500 TA is probably set to return message codes instead of messages. Change to the message code option.
- Some terminals automatically display what is typed, rather than waiting for the 500 TA to echo the characters (half-duplex mode). It is possible that the AT commands aren't really getting to the 500 TA at all, but are being displayed on the terminal anyway. If the AT commands are getting to the 500 TA, it's TD LED will blink.

Data calls do not automatically answer.

- Check that the rings to answer command S0 is set to a nonzero value. Also, if the ring count is set too high, the calling device may time out and terminate the call.

Data calls connect but automatically terminate within about 5 seconds.

- Check that the remote device is running the same rate adaptation protocol.
- Make sure you are calling the correct device.

Calls to the unit are rejected by the unit or calls from the unit are not accepted by the switch.

- Verify that the switch type and version settings are for the correct switch.
- Verify that the SPID and DN match the number agreed to at subscription time with the local telephone company. Also check that the switch options have been saved in the stored profile and that the network link has been restarted.
- Verify that the line is configured at the switch to accept the type of call desired. Data calls need circuit-switched data capability, and voice calls need circuit-switched voice capability.

When the 500 TA tries to dial or answer data calls, it aborts for no apparent reason.

This can occur if the PC sends any characters to the 500 TA while it is dialing, answering, or connecting. The 500 TA has a feature called 'any key abort' that aborts if any characters are received from the PC during the connect sequence.

- If this problem occurs in the answer mode on the first ring, the problem may be that the PC is echoing the RING message back to the 500 TA, causing it to abort. In this case, you can disable response messages using the ATQ command.

After a data call connects, the local PC receives bad or garbled data.

This usually indicates a rate adaptation problem.

- Verify that both the 500 TA and the remote device are set for the same rate adaptation protocol (e.g. V.120).
- The remote device may be trying to establish a synchronous protocol, unaware that the 500 TA is set for asynchronous mode. Suspect this problem if the garbled data consists of long streams of one or two characters. To correct the problem find out which mode and protocol the remote device is attempting, and set your 500 TA and PC accordingly.

After a data call connects, the 500 TA seems to intermittently lose data, especially when transferring large amounts of data.

This usually indicates a flow control problem.

- Be sure that the 500 TA and PC flow control methods match. Flow control must be configured in both. Refer to Chapter 7, Option Configuration - Terminal Interface and Pin Options, Flow Control.
- Remember that if you are using the clear channel protocol, there is normally no flow control between the two devices. You may want to use V.120, if possible, since it supports this feature.

The 500 TA hangs up in the middle of a data call.

- If your 500 TA appears to be initiating the disconnect, refer to Chapter 8 (Call Placement). Table 5 on page 64 lists the possible reasons for call termination.

After a data call is made, the 500 TA intermittently stops sending or receiving data.

- Check to see if software flow control (such as XON/XOFF) is enabled in the 500 TA or in the PC. If so, you can only transfer ASCII data (text). Binary files may contain embedded XON or XOFF characters, which can be misinterpreted as flow control signals. If you need to send binary data, use hardware flow control methods. Refer to Chapter 7, Option Configuration (Flow Control Options on [page 50](#)).

Appendix A

Specifications

ISDN Line Type

ISDN Basic Rate Interface, ANSI T1.601 compliant, "U" reference point

Connection Types

Circuit-switched (dial-up), Permanent (nailed up)

DTE Data Rates

300, 1200, 2400, 4800, 9600, 19.2k, 38.4k, 48k, 56k, 57.6k, 64k, 115.2k

DCE Data Rates

B-channel: 56 kbps or 64 kbps

D-channel: 16 kbps

Data Rate Adaption Protocols

Clear Channel

V.120

DTE Available Interfaces

EIA-232E (V.24)

Switch Compatibility

Northern Telecom DMS100 - Central office switch running software version BCS-29 or above

Layer 1 (physical): Conforms to ANSI T1.601

Layer 2 (Link): Conforms to Northern Telecom specification NIS 208-4, Issue 1.1 section C, based on CCITT Recommendation Q.921

Layer 3 (Signaling): For BCS-29 and BCS-30, conforms to NIS 208-4, Issue 1.1, sections D-H. For BCS-31, -32, and -33 conforms to NIS 208-5, Issue 1.1 Section D-H. These are based on CCITT Recommendation Q.931. For BCS-34, conforms to National ISDN-1.

AT&T 5ESS - Central office switch running generic program 5E4.2, or above for type A terminal

Layer 1 (physical): Conforms to ANSI T1.601

Layer 2 (Link): Conforms to AT&T specification 5D5-900-311, December 1987, Part III, based on CCITT Recommendation Q.921

Layer 3 (Signaling): For 5E4.2, conforms to 5D5-900-301, Issue 1.04, September 1987, Parts IV - VI. For 5E5, conforms to 5D5-900-311, Issue 1.00, December 1987, Parts IV - VII. For 5E6 and 5E7, conforms to 5D5-900-321, Issue 1.02, September 1990, Parts IV - VII. These are based on CCITT Recommendation Q.931. For 5E8, conforms to National ISDN-1.

US National ISDN-1 - Central office switches, as described in Bellcore Special Report SR-NWT-001953, Issue 1, June 1991, and Revision 1, December 1991

Supplementary Services

The 500 TA does not support any supplementary data services, nor does it support Electronic Key Telephone Service (EKTS).

Dimensions

Width: 6.25 inches

Height: 1.25 inches

Depth: 5.25 inches

Environmental

0 to +40° Celsius

95% relative humidity, non-condensing

Power Requirements

115 Vac, 60 Hz

Power Consumption

3 watts nominal

Appendix B

Ordering ISDN

GENERAL

There are two ways to specify your ISDN line configuration to your service provider. The first way is to use an ISDN ordering code, if your service provider supports that method. If your service provider does not recognize the ISDN ordering codes then you will be required to specify the ISDN line configuration. To simplify the ordering of your ISDN line, TxPORT has provided forms for both methods.

The following sections describe the ways you can order your ISDN line. TxPORT suggests that you use the ordering codes if your service provider recognizes them.

Ordering Using ISDN Ordering Codes

The ISDN industry has recognized the difficulty for the user in ordering ISDN lines. Hence, an organization called *ISDN Solutions* was formed which is made up of service providers and ISDN equipment vendors such as TxPORT. A method of ordering ISDN lines has been approved utilizing *ISDN ordering codes*. These ordering codes define the configuration of the ISDN line. ISDN products have been tested with the service providers to ensure that they will operate with the appropriate ordering codes.

The 500 TA has been tested to operate with the following ordering codes. Choose an ordering code which is available from your ISDN service provider and best suits your needs. Using an ordering code that provides capabilities you will not use may cost you more.

- **Capability B:** This ordering code supports data operation only. This is the most economical ISDN line configuration if you will be using only the data feature. *Voice calls cannot be placed or received with this configuration.*
- **Capability C:** This ordering code supports both voice and data operation, but not simultaneously. This is the most economical configuration if you require both voice and data operation, *but not at the same time.*
- **Motorola Access 2:** This ordering code supports simultaneous voice and data operation.

When ordering with the ISDN ordering codes, use the ISDN Line Configuration **REQUEST FORM #1**. If it is not convenient to deliver the form to your service provider, you can call your provider with the information using the form as a guide. Indicate the ordering code you wish to have configured and the ISDN service provider will return the information necessary to configure your 500 TA.

***NOTE:** When using the ISDN ordering codes method you will need to configure your 500 TA switch type to National ISDN-1. Refer to the Network Setup section (Chapter 3).*

Ordering ISDN Using Alternate Method

If your service provider does not support the ISDN ordering codes method of ordering then you must specify the configuration of your line. To help you, TxPORT has provided a form specifying the required options for the service provider. This information is found in the ISDN Line Configuration **REQUEST FORM #2**. Follow the instructions below to order your service.

- Fill out the **Consumer Information** on pages one and two.
- Fax, or in some other way deliver, all four pages of the request form to your ISDN service provider.
- Use the information returned to you by your service provider to configure your 500 TA.
- After the 500 TA is configured, you must save the configuration and re-start the 500 TA before the setup will take effect. See the Installation section (Chapter 2) for details.
- You are now ready to use your ISDN service.

FAXBACK REQUEST FORM #1

CONSUMER: Please fill out the section below, then fax or otherwise deliver this page to your ISDN service provider. Configure your 500 TA with the information returned to you.

Name: _____ Title: _____

Company Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone Number: _____ Fax Number: _____

Please check the ISDN Ordering Code desired:

Capability B Capability C Motorola Access 2

Please check the preferred long distance carrier*:

AT&T MCI Sprint Other

* Some long distance carriers do not provide ISDN data service. If you choose a long distance carrier that supports ISDN data service, you must contact that carrier and request ISDN data service. You should also provide the directory number(s) you will be using.

ISDN SERVICE PROVIDER: Please fax, or otherwise return, this sheet with the requested configuration to the person listed above.

National ISDN-1:

Data SPID _____ Voice SPID _____

Data DN _____ Voice DN _____

FAXBACK REQUEST FORM #2

CONSUMER: Please fill out the section below and the top of page 2, then fax, or otherwise deliver, all four pages to your ISDN service provider. Configure your 500 TA with the information returned to you.

Name: _____ Title: _____

Company Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone Number: _____ Fax Number: _____

ISDN SERVICE PROVIDER: Listed on the following pages are the line configuration requirements for the TxPORT 500 TA ISDN Terminal Adapter. Please fax, or otherwise return, this sheet with the requested configuration to the person listed above.

Please check one answer for each of the following questions:

1. Is the line set for custom (e.g. switch specific) or NI-1 (e.g. AT&T standard, NT1 PVCIC-2, or Siemens EWSD NI-1)? Custom NI-1

2. Switch Type? AT&T 5ESS NT1 DMS 100

3. Switch Version? DMS100 only PVC IC-0 PVC IC-1
AT&T 5ESS Point-to-Point Multi-point

4. Carrier: AT&T MCI Sprint Other _____

Please list the applicable ISDN line information in lines 5 or 6:

AT&T Specific:

5a. SPID _____ 5b. Voice and Data DN _____

Northern Telecom DMS100 or National ISDN-1 Specific:

6a. Data SPID _____ 6b. Voice SPID _____

6c. Data DN _____ 6d. Voice DN _____

CONSUMER: Please select the following optional services desired for this particular line.

Feature Requirements:

Please check the preferred long distance carrier*:

AT&T MCI Sprint Other

NI-1 Signalling (recommended) Yes No

* Some long distance carriers do not provide ISDN data service. If you choose a long distance carrier that supports ISDN data service, you must contact the carrier and

request ISDN data service. You should also provide the long distance carrier with the directory number(s) you will be using.

ISDN SERVICE PROVIDER: The following is a list of ISDN line configuration requirements for the 500 TA. In addition to the basic requirements, the optional features listed above should also be incorporated into the line setup.

ISDN Physical Line Requirements:

- 2B+D Basic Rate Interface (BRI), 2B1Q U interface (ANSI T1.601)
- NIUF Standard Line Configuration Line Set (NIIG) 11.

ISDN Line Configuration Requirements:

The 500 TA supports the following switch types and versions:

- AT&T 5ESS 5E4.2 and later, Custom or Standard (NI-1)
- Northern Telecom DMS100 BCS-29 and later, PVC0 - PVC-1 or PVC2 (NI-1)
- Siemens EWSD 10.0 and later NI-1
- Other NI-1 Compliant NI-1

The following bearer capabilities are required:

- Circuit mode voice (circuit switched voice, CSV) service for speech and 3.1 kHz audio.
- Circuit mode data (circuit switched data, CSV) for 56 kbps and 64 kbps unrestricted data.
- Simultaneous circuit switched voice (CSV) and circuit switched data (CSD) calls.

AT&T

General:

Line Set (NIIG)	11
B1 Service	On Demand (DMD)
B1 Long Distance Access Rate	64 kbps (desired)
B2 Service	On Demand (DMD)
B2 Long Distance Access Rate	64 kbps (desired)
Data Line Class	Point-to-Point (PP) or Multi-Point (MP)
desired	
Maximum B Channels	2
Circuit Switched Voice (CSV) Bearer Channels - Any	
Number of CSV Calls	1
Circuit Switched Voice (CSD) Bearer Channels - Any	
Number of CSD Calls	1
Terminal	Type A
Hold, Conference, Drop	No
Caller ID	No

Electronic Key Telephone Sets (EKTS)	No
Intercom Groups	No
Hunting / Multi-line Hunt	No
Message Waiting	No
Shared Directory Numbers	No
D Channel Packet	No

NI-1 Specific:

Line Type	Standard
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Northern Telecom DMS100

General:

Line Type	ISDN Basic Rate, Functional
Line Set (NIIG)	11
B1 Long Distance Access Rate	64 kbps (desired)
B2 Long Distance Access Rate	64 kbps (desired)
Bearer Service	Circuit Switched Voice and Data on any B channel

	<u>CSV</u>	<u>CSD</u>
Circuit Switched Service	Yes	Yes
TEI	Dynamic	Dynamic
Non Initializing Terminal	No	No
Electronic Key Telephone Sets (EKTS)	No	No
Call Appearance Handling (CACH)	No	No
Hold, Conference, Drop	No	No
Caller ID	No	No
Intercom Groups	No	No
Hunting / Multi-line Hunt	No	No
Message Waiting	No	No
Shared Directory Numbers	No	No
D Channel Packet	No	No

NI-1 Specific:

Version	PVC IC-2
---------	----------

TxPORT welcomes any suggestions on how to improve this document to help make ordering ISDN lines easier. If you have any suggestions or comments, please let us know. You may fax all comments to Technical Publications using the 'Sales / Administration' fax number on the rear of this manual.

Appendix C

AT Command Set

CMD	DESCRIPTION	POSSIBLE VALUES
Global Commands: Action		
>V=	View Switch & Global Parameters	G - View Global Parameters C - SPIDs, Directory Numbers, and TEIs
>F	Load Switch Options from Quick Setup factory profile	
>W	Save ISDN Switch & Global Options to Stored Profile	
>Z	Restore Switch Options from stored profile and restart network	
Global Commands: Switch Configuration		
!C0=	Switch Type	0 - AT&T 5ESS 1 - Northern Telecom DMS-100 2 - National ISDN <default>
!C1=	Switch Software Version	!C0=0: 0 - AT&T Point-to-Point 1 - AT&T Multi-Point !C0=1: 2 - DMS100 PVC IC-0 3 - DMS100 PVC IC-1 !C0=2: 4 - National ISDN 1 <default>
!C6=	Data SPID	Range: 0-20 characters <i>default (null string)</i>
*!C6=	Voice SPID	Range: 0-20 characters <i>default (null string)</i>
NOTE: Voice Port parameters are preceded by '*'.		
!C4=	B1-Channel Provisioning	0 - Dial-up <default> 9 - Nailed Up Line
!C5=	B2-Channel Provisioning	0 - Dial-up <default> 9 - Nailed Up Line
!D3=	SAPI-0 data TEI	Range: 0-63, 255 (auto), 127 (disable) <i>default (255)</i>
*!D3=	SAPI-0 voice TEI	Range: 0-63, 255 (auto), 127 (disable) <i>default (255)</i>

CMD	DESCRIPTION	POSSIBLE VALUES
!N1=	Data Directory Number	Range: 0-20 characters (0-9,#,*) <i>default (null string)</i>
!N1=	Voice Directory Number	Range: 0-20 characters (0-9,#,) <i>default (null string)</i>
Port Commands: Configuration		
En	Local Echo Off	n = 0 Echo Off n = 1 Echo On <i><default></i>
Qn	Status displays	n = 0 Status On <i><default></i> n = 1 Status Off n = 2 Status off during answer mode
Vn	Verbose	n = 0 Numeric n = 1 Verbose <i><default></i>
Wn	Carrier / Protocol result codes	n = 0 Disables <i><default></i> n = 1 Enables
Xn	Connect Messages	n = 0 Enable result codes 0-4 n = 1 Enable 0-5, 10-15, 17-19, 28, 32 n = 2 Enable 0-5, 7, 10-15, 17-19, 28, 32 <i><default></i>
S0=	Rings until answer	Range: 0-255 <i>default (1)</i>
S1?	Ring Count (Read Only)	Range: 0-255 <i>default (0)</i>
S2=	Escape Character	Range: 0-127 <i>default (43)</i> Range: 128-255 Disabled
S3=	Carriage Return Character	Range: 0-127 <i>default (13)</i>
S4=	Line Feed Character	Range: 0-127 <i>default (10)</i>
S5=	Back Space Character	Range: 0-127 <i>default (8)</i>
S7=	Wait for connection	Range: 1-255 <i>default (30)</i> Units = seconds
S10=	DCD Drop Time	Range: 1-255 <i>default (14)</i> Units = 1/10 seconds
S12=	Guard Time	Range: 0-255 <i>default (50)</i> Units = 1/50 seconds
S18=	Test Timer	Range: 0-255 <i>default (0)</i> Units = seconds
S25=	DTR Detect Time	Range: 0-255 <i>default (5)</i> Units = 1/100 seconds

CMD	DESCRIPTION	POSSIBLE VALUES
S26=	RTS to CTS time	Range: 0-255 <i>default</i> (1) Units = 1/100 seconds
&Cn	Data Carrier Detect	n = 0 Always On <i><default></i> n = 1 Tracks Connection (async only) n = 2 always except during S10 disconnect (async only)
&Dn	Data Terminal Ready (DTR)	n = 0 Ignore DTR (async / sync) <i><default></i> n = 1 Recall ACU (async only) n = 2 Hangup - auto answer disabled while DTR down (async only) n = 3 Hangup - reset port n = 9 DTR Dial
&Ln	Persistent DTR Dialing	n = 0 Disable n = 1 Enable
&Mn	Sync mode	n = 0 Async <i><default></i> n = 1 Sync - DTR disc delay (S25) n = 2 Sync - DTR dialing (auto answer disabled while DTR down)
&Rn	Clear to Send (CTS)	n = 0 CTS follows RTS n = 1 CTS always on when on-line <i><default></i>
&Sn	Data Set Ready (DSR)	n = 0 DSR always on <i><default></i> n = 1 DSR on after protocol installed except test modes
&Yn	Select Powerup Stored Profile	n = 0 Select stored Profile 0 upon powerup or DTR reset <i><default></i> n = 1 Select Stored Profile 1 upon powerup or DTR reset
&Zn=	Store Telephone Number	n = 0-9 n = 0-40 characters (0-9,#,*)
\Qn	Flow Control	n = 0 Disable flow control n = 1 Enable bidirectional XON/XOFF flow control n = 2 Enable unidirectional CTS flow control n = 3 Enable bidirectional RTS/CTS flow control <i><default></i> n = 4 Enable unidirectional XON/XOFF flow control

CMD	DESCRIPTION	POSSIBLE VALUES
%A2=	Rate Adaption Protocol	0 None - Clear Channel 2 V.120 <default> 3 BONDING 95 PPP
%A4=	Line Channel Speed	0 64kbps <default> 1 56kbps
%A93=	Speech BC Call Answer Option	D Do Not Answer <default> E Answer
%A94=	3.1Khz Audio Call Answer Option	D Do Not Answer <default> E Answer
%A95=	Data BC Call Answer Option	D Do Not Answer E Answer <default>
%A96=	Echo Disable Tone	0 Off <default> 1 On
%A97=	Dialing Method	O Overlap E Enbloc <default>
%A98=	Originate Mode Data	D Data <default> A 3.1Khz audio S Speech
.*A98	Originate Mode Voice	A 3.1 kHz Audio S Speech <default>
BOND- ING Rate Multiplier	1 56 or 64 kbps (1 B-Channel) 2 112 or 128 kbps (2 B-Channels) <default>	DTE Guard Mode
D disabled <default> E enabled	Command Interpreter	N None A AT <default> VB V.25 bis BISYNC VH V.25 bis HDLC
DTE Speed	300, 1200, 2400, 4800, 9600, 19200, 38400, 48000, 56000, 57600, 64000*, 112000,115200 <default>, 128000* * disables Autobaud	Parity

CMD	DESCRIPTION	POSSIBLE VALUES
N None <default> O Odd E Even M Mark	Number of Data Bits	Range: 7-8 <i>default (8)</i>
	Number of Stop Bits	0 One <i><default></i> 1 One and One-Half 2 Two
Port Commands: Action		
A	Answer	
D	Dial	S = n Dial Stored Number n 0-9,#,* Digits ; Stay in command mode P,T,W, and comma are ignored
H	Hangup	
In	Information	n = 0 Product ID ("960") n = 1 ROM Checksum n = 2 Checksum Verification n = 3 Revision ("4574166-1E C34A PASS") <board #>-<software> <checksum> <PASS FAIL> n = 4 Capability String
O	Return On-line	
0, 1	Load Port from Quick Setup factory profile n	n = 0-3
&Tn	Test Modes	n = 0 End Test n = 1 Local Loopback n = 3 Digital Loopback n = 8 Bilateral Loopback n = 9 Local Terminal Loopback
&H	Help Command	
&H=	Help for Individual Command	Enter individual commands for which help is desired. AT&H=cmd[,cmd...]
&V	View Port Parameters	
&V=	View Parameters	E V.120 Parameters Z Stored Telephone Numbers

CMD	DESCRIPTION	POSSIBLE VALUES
&Wn	Save active to stored profile n	n = 0, 1
	Port Commands: V.120 (B-channel only)	
%E0=	V.120 Maximum Transmit Frame Size	Range: 1-260 <i>default (260)</i>
%E1=	V.120 Maximum Receive Frame Size	Range: 1-260 <i>default (260)</i>
%E2=	V.120 Window Size	Range: 1-127 <i>default (8)</i>
%E3=	V.120 T200 Transmission timer	Range: 1-255 <i>default (5)</i>

Appendix D

Quick Setup Profiles

The following profiles can be loaded using the AT&Fn command where n is the profile to be loaded.

Factory Profile #0 (Asynchronous V.120 Operation)(AT&F0)

AT COM	OPTION SETTING	AT COM	OPTION SETTING
E1	Local Echo Enabled	&S0	DSR Forced On
Q0	Status Message Enabled	&D0	DTR Ignored
V1	Verbose Messages	\Q3	RTS/CTS Flow Control
W0	Disable Protocol Messages	&M0	Asynchronous Mode
X2	All Connect Messages	&R1	CTS Forced (Synchronous)
S0=1	Autoanswer Enabled	%A2=2	V.120 Protocol
S2=43	'+' Escape Character	%A4=0	Line Channel Speed 64K
S3=13	Carriage Return Character	%A93=D	Do Not Answer Speech Call
S4=10	Line Feed Character	%A94=D	Do Not Answer Audio Call
S5=8	Backspace Character	%A95=E	Answer Data Call
S7=30	Wait For Connect 30 Seconds	%A98=D	Originate Call As Data
S10=14	Carrier Fail Detect Time 1.4 Seconds	%D0	Disconnect Buffer Delay 0 Seconds
S12=50	+++ Escape Guard Time 1 Second	@P1=A	AT Commands
S18=0	Test Exit Timer (Disabled)	@P2= 115200	DTE Speed = 115.2 Kbps
S25=5	DTR Drop Response Time 0.5 Seconds	@P3=N	DTE Parity None
S26=1	RTS To CTS Delay Time (Sync) 0.1 Second	@P4=8	DTE Data Bits 8
&C0	DCD Forced On	@P6=0	DTE Stop Bit 1

Factory Profile #1 (Synchronous V.120 Operation) (AT&F1)

AT COM	OPTION SETTING	AT COM	OPTION SETTING
E1	Local Echo Enabled	&S1	DSR Normal
Q0	Status Messages Enabled	&D2	DTR Disconnect
V1	Verbose Messages	Q3	RTS/CTS Flow Control
W0	Disable Protocol Messages	&M1	Synchronous Mode
X2	All Connect Messages	&R0	CTS Follows RTS
S0=1	Autoanswer Enabled	%A2=2	V.120 Protocol
S2=43	'+' Escape Character	%A4=0	Line Channel Speed 64K
S3=13	Carriage Return Character	%A93=D	Do Not Answer Speech Call
S4=10	Line Feed Character	%A94=D	Do Not Answer Audio Call
S5=8	Backspace Character	%A95=E	Answer Data Call
S7=30	Wait For Connect 30 Seconds	%A98=D	Originate Call As Data
S10=14	Carrier Fail Detect Time 1.4 Seconds	%D0	Disconnect Buffer Delay 0 Seconds
S12=50	+++ Escape Guard Time 1 Second	@P1=A	AT Commands
S18=0	Test Exit Timer (Disabled)	@P2= 9600	DTE Speed = 9600 bps
S25=5	DTR Drop Response Time 0.5 Seconds	@P3=N	DTE Parity None
S26=1	RTS to CTS Delay Time (Sync) 0.1 Second	@P4=8	DTE Data Bits 8
&C1	DCD Normal	@P6=0	DTE Stop Bit 1

NOTE: Shading indicates variation from profile #0.

Factory Profile #2 (Synchronous Clear Channel 64k) (AT&F2)

AT COM	OPTION SETTING	AT COM	OPTION SETTING
E1	Local Echo Enabled	&S1	DSR Normal
Q0	Status Messages Enabled	&D2	DTR Disconnect
V1	Verbose Messages	Q3	RTS/CTS Flow Control
W0	Disable Protocol Messages	&M1	Synchronous Mode
X2	All Connect Messages	&R0	CTS Follows RTS
S0=1	Autoanswer Enabled	%A2=0	Clear Channel Protocol
S2=43	'+' Escape Character	%A4=0	Line Channel Speed 64K
S3=13	Carriage Return Character	%A93=D	Do Not Answer Speech Call
S4=10	Line Feed Character	%A94=D	Do Not Answer Audio Call
S5=8	Backspace Character	%A95=E	Answer Data Call
S7=30	Wait For Connect 30 Seconds	%A98=D	Originate Call As Data
S10=14	Carrier Fail Detect Time 1.4 Seconds	%D0	Disconnect Buffer Delay 0 Seconds
S12=50	+++ Escape Guard Time 1 Second	@P1=A	AT Commands
S18=0	Test Exit Timer (Disabled)	@p2= 115.2	DTE Speed =115.2 Kbps
S25=5	DTR Drop Response Time 0.5 Seconds	@P3=N	DTE Parity None
S26=1	RTS to CTS Delay Time (Sync) 0.1 Second	@P4=8	DTE Data Bits 8
&C1	DCD Normal	@P6=0	DTE Stop Bit 1

NOTE: Shading indicates variation from profile #0.

Factory Profile #3 (Synchronous Clear Channel 56k) (AT&F3)

AT COM	OPTION SETTING	AT COM	OPTION SETTING
E1	Local Echo Enabled	&S1	DSR Normal
Q0	Status Messages Enabled	&D2	DTR Disconnect
V1	Verbose Messages	Q3	RTS/CTS Flow Control
W0	Disable Protocol Messages	&M1	Synchronous Mode
X2	All Connect Messages	&R0	CTS Follows RTS
S0=1	Autoanswer Enabled	%A2=0	Clear Channel Protocol
S2=43	'+' Escape Character	%A4=0	Line Channel Speed 64K
S3=13	Carriage Return Character	%A93=D	Do Not Answer Speech Call
S4=10	Line Feed Character	%A94=D	Do Not Answer Audio Call
S5=8	Backspace Character	%A95=E	Answer Data Call
S7=30	Wait For Connect 30 Seconds	%A98=D	Originate Call As Data
S10=14	Carrier Fail Detect Time 1.4 Seconds	%D0	Disconnect Buffer Delay 0 Seconds
S12=50	+++ Escape Guard Time 1 Second	@P1=A	AT Commands
S18=0	Test Exit Timer (Disabled)	@p2= 115.2	DTE Speed =115.2 Kbps
S25=5	DTR Drop Response Time 0.5 Seconds	@P3=N	DTE Parity None
S26=1	RTS to CTS Delay Time (Sync) 0.1 Second	@P4=8	DTE Data Bits 8
&C1	DCD Normal	@P6=0	DTE Stop Bit 1

NOTE: Shading indicates variation from profile #0.

ISDN Interface

Figure E-1 and Table E-1 illustrate and describe the 500 TA ISDN interfaces.

Figure A-10 U Interface RJ45 Female Connector

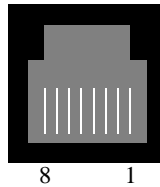


Table A-6 U Interface RJ45 Pin Functions

Pin	Name	Function
1	Battery Status	No Connection
2	Battery Status	No Connection
3	---	No Connection
4	Signal	U interface tip or ring
5	Signal	U interface tip or ring
6	---	No Connection
7	Powering	No Connection
8	Powering	No Connection

DTE Interface

Table A-7 describes the pin functions of the PC (DTE) interface on the 500 TA.

NOTE: In the following table, unused pins have no electrical connection.

Table A-7 EIA232E / V.24 Pin Functions

DB-25 Pin	EIA-232E Pin	V.24 Pin	Function
1	AA	101	Protective Ground (FG)
2	BA	103	Transmitted Data to TA (TC)
3	BB	104	Received Data from TA (RD)
4	CA	105	Request to Send (RTS)
5	CB	106	Clear to Send (CTS)
6	CC	107	Data Set Ready (DSR)
7	AB	102	Signal Ground (SG or GND)
8	CF	109	Data Carrier Detect (CD or DCD)
15	DB	114	Transmit Clock (TC)
17	DD	115	Receive Clock (RC)
20	CD	108	Data Terminal Ready (DTR)
21	RL	---	Remote Loopback
22	CE	125	Ring Indicator (RI)
24	DA	113	External Transmit Clock
25	TM	142	Test Mode