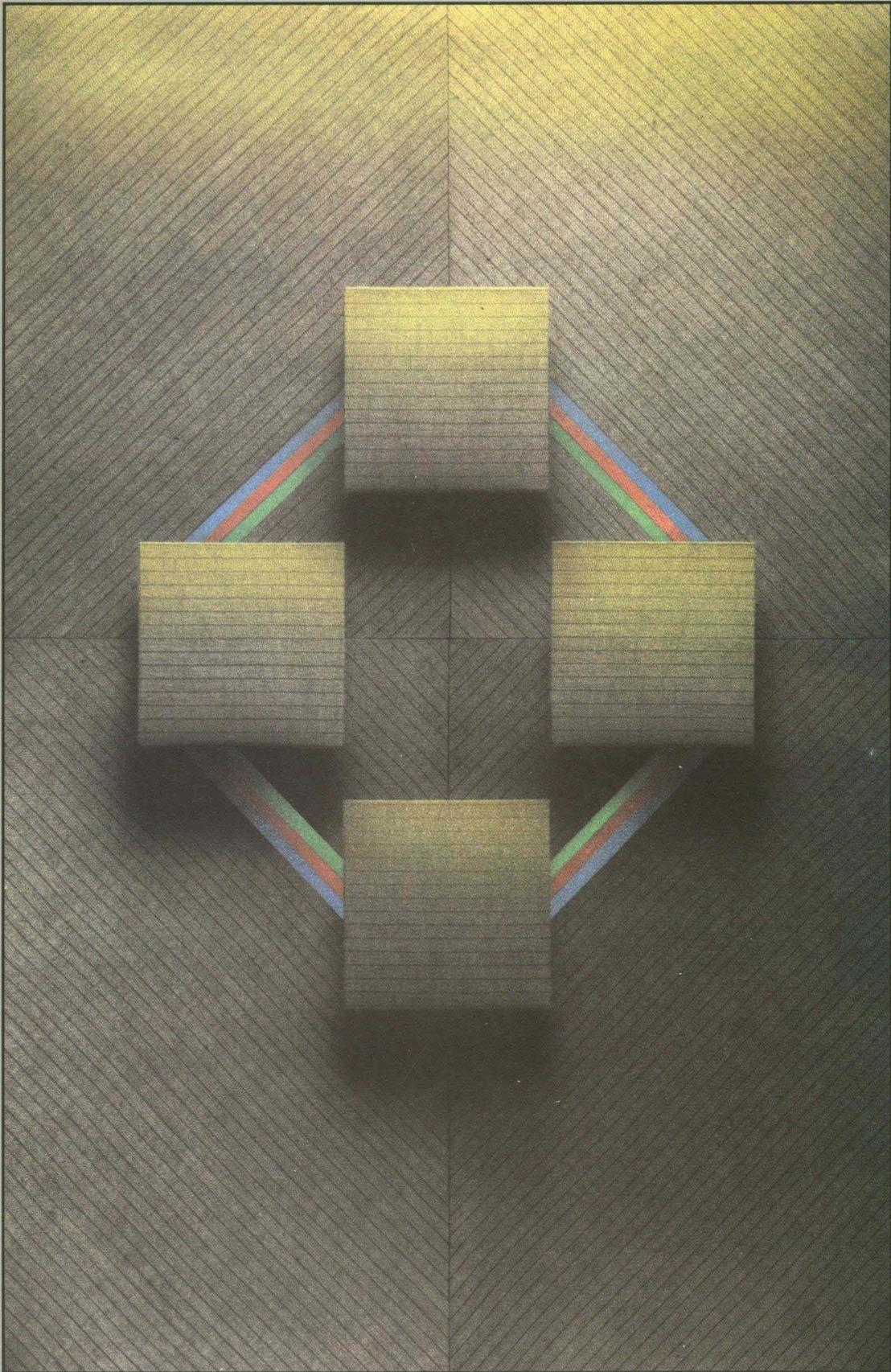
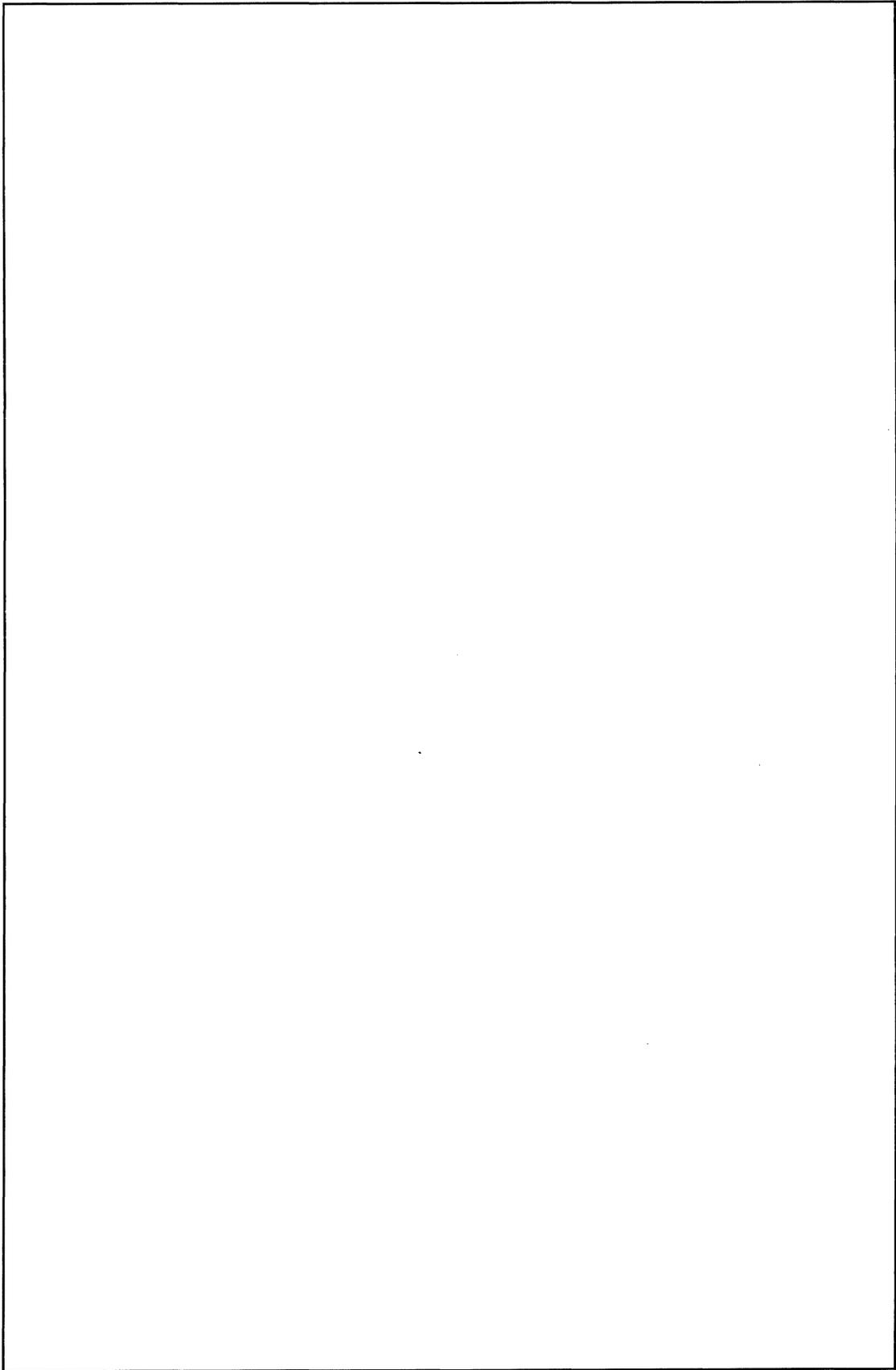


CODEX



6502 X.25 Asynchronous PAD
User's Manual

CODEX



**6502 X.25 Asynchronous PAD
User's Manual**

Notice

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WARNING

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

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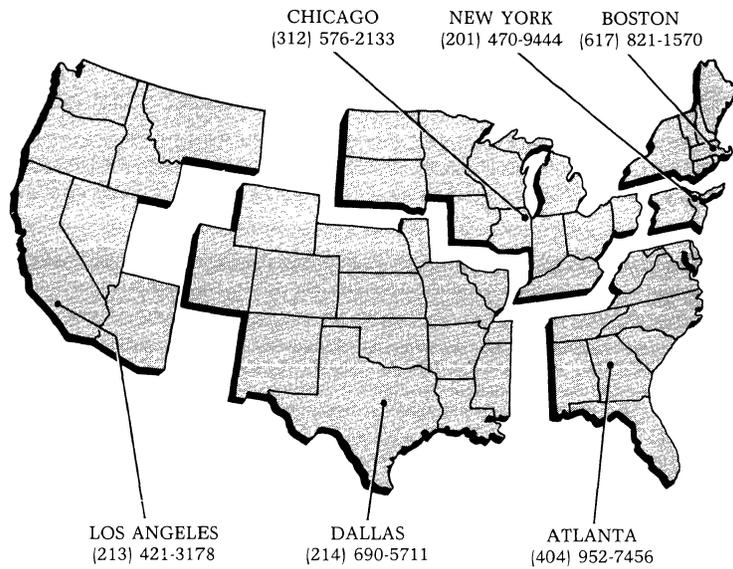
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codex
 **MOTOROLA**

Codex Customer Service

This User's Manual has been written to help you understand, install, and use your Codex product. For further technical assistance, please contact the Codex

Customer Service Management System office in your area during normal business hours. Use the map below to determine the telephone number to call.





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Preface

This User's Manual explains the features and capabilities of the Codex 6502 X.25 Asynchronous PAD (Packet Assembler Disassembler). The manual is intended for the Network Administrator, the Designer, the Technician, and the user who wishes to access a Packet Data Network (PDN) using a PAD.

The following paragraphs describe the general content of each of the remaining sections and appendixes in the manual.

- Chapter 1, Product and Document Overview, presents an overview of the Codex 6502 X.25 Asynchronous PAD (Packet Assembler Disassembler) and describes the various features and uses of the PAD.
- Chapter 2, Installation and Configuration, provides information on installation of a standalone or a rack-mount unit and explains how to setup the PAD. It also contains information on setting software (soft) switch selections to meet your operating requirements.
- Read Chapter 3, Theory of Operation, before you plan the initial installation of the PAD. This chapter presents an overview of the operational techniques implemented in the PAD. It also provides information on the PAD's support of Recommendations X.25, X.3, X28, and X.29, and its support of the X.121 numbering plan.
- Chapter 4, User Interface, explains how to establish a connection to the PAD, place a call over the PDS, and check and modify configuration parameters for a call. This section also gives information on invoking test procedures and performing a local copy or call transfer on the PAD.
- Chapter 5, Using the Command Facility, gives the administrator information on accessing and using the Command Facility. The Command Facility is a user-friendly, menu-driven software module that you can use to examine and modify configuration parameters, execute diagnostics, monitor PAD performance, and gather statistics.
- Chapter 6, Diagnostics and Troubleshooting, provides both the operator and the experienced technician with information on the Self Test, indicators, Terminal-Activated Channel Tests (TACT), and operator troubleshooting.
- Chapter 7, Configuration Sheets, contains the Configure Menu and selection sheets for summarizing all the configuration parameters used with the the Command Facility.
- Chapter 8, Equipment Return Procedures, describes equipment return guidelines.
- Chapter 9, Specifications and Ordering, outlines the specifications you need to know and provides you with ordering information.
- Appendix A, Factory Parameter Settings, describes all of the PAD's configuration parameters as they are set at the factory. As described in Chapter 5, you may use the Command Facility to change these default settings to meet the needs of your specific operating environment. However, you may be able to operate the PAD without changing these defaults. If you want to make only a few changes, the information in this appendix may help you get "up and running."
- Appendix B, ASCII Chart, contains an ASCII chart that is an essential reference to determine the various control characters used to define the PAD device profiles and other configuration parameters.

Conventions Used in this Manual

Throughout this manual, certain keys are represented as shown below:

<i>Symbol</i>	<i>Explanation</i>
CR	The Carriage Return key on your keyboard

Also throughout this manual, the Codex 6502 X.25 Asynchronous Packet Assembler Disassembler is referred to as the PAD.



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INTRODUCTION

This chapter presents an overview of the Codex 6502 X.25 Asynchronous PAD (Packet Assembler Disassembler) shown in Figure 1-1. Throughout this manual the unit is referred to as the PAD. The information in this chapter includes a description of:

- The modules and other major hardware components of the PAD
- General, terminal, and X.25 trunk characteristics of the PAD
- Applications for the PAD
- An optional Codex product that allows for centralized management of multiple PADS

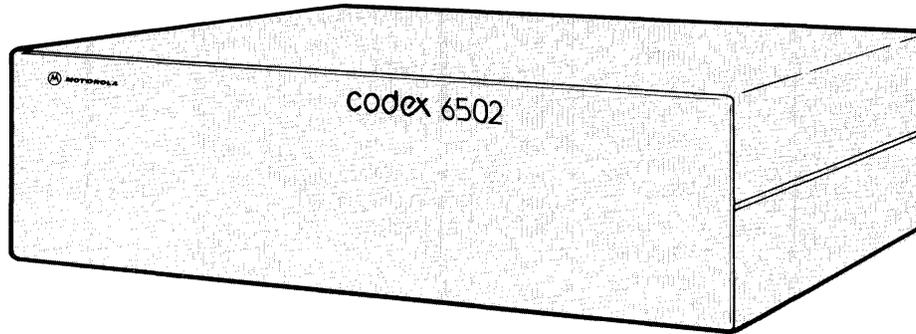


Figure 1-1. Product Appearance

FEATURES

Asynchronous devices connected to the PAD can access CCITT X.25-compatible Packet Data Networks (PDNs) or equipment. A PDN is a data communications network containing services available to the public on a subscription basis. The PAD concentrates the asynchronous data from 4, 10, or 16 terminals to computer ports onto a single X.25 access line.

The PAD is fully configurable on-site to meet the operating requirements of CCITT-compatible PDNs and most existing terminals and computer systems. It meets all of the requirements of CCITT Recommendations X.3, X.25, X.28, X.29, and X.121 (for information on these standards, see Chapter 3 in this manual). The PAD also includes additional special capabilities that result in extra user convenience and flexibility.

You can use the PAD to adapt to different types of devices by using a set of parameter values for each channel interface. To improve communications efficiency, you can use other parameters to control the format of data transferred between a terminal and a computer. These parameters reduce the number of packets generated over the PDN. Additionally, you can also configure a number of trunk-related parameters, for optimal PAD operation when it is connected to different kinds of networks.

The modular design of the PAD makes it easy to install and adapt to your needs. You can add modules as your needs expand. Table 1-1 relates the number of PAD modules to the number of channels.

Table 1-1.
Modules Related to Number of Channels

<i>Number of Channels</i>	<i>Base Module</i>	<i>Expansion Modules</i>
4	1	0
10	1	1
16	1	2

An easy-to-install FEATUREPAK cartridge contains the PAD's operating software. The FEATUREPAK cartridge is described later in this manual.

PAD MODELS

The PAD is available in 4-, 10-, and 16-channel models. Table 1-2 lists the various PAD models numbers and describes each model.

A FEATUREPAK cartridge, containing the PAD software, is part of each model. All PAD models use the same enclosure.

PAD MODULES

The PAD modules are circuit boards that contain the logic and support circuitry required for operation. The modules are illustrated in Figure 1-2.

■ **Note:** A Hex-Channel Expansion Board is included in the 10-channel model. Two of these are included in the 16-channel model. The model number for the Hex-Channel Expansion Board is 65552.

MAJOR COMPONENTS OF THE PAD

In addition to the modules previously described, the PAD's major components include the following (see Figure 1-2)

- Enclosure (base, cover, front panel, and back)
- Touch Panel
- Indicators
- FEATUREPAK cartridge
- Power supply

An optional Rack-Mount Upgrade Kit (65553) is available for installing the PAD in a 19-inch (48.26 cm) wide rack (see the section, "Installing the PAD", in Chapter 2).

Enclosure

The enclosure consists of a base, a cover, a front panel, and the back. The base, which interlocks with the cover, contains the major components. The movable and translucent front panel swings open for access to the inside of the unit. The back consists of interlocking panels that are attached to the modules. A blank panel is installed when an expansion module is not in place. The one enclosure allows 4- and 10-channel models to be field-upgraded to 10 or 16 channels, respectively.

Touch Panel

The touch panel, located behind the front panel, is sectioned into 24 keys. You can use the Touch Panel to configure some of the PAD's operating parameters and to reset the PAD. For more information on the Touch Panel see section, "Using the Touch Panel to Set Operating Parameters", in Chapter 2.

Indicators

The indicators, also located behind the front panel on the right side, are labeled with their abbreviated names. They display the operating status of the unit and are used with the Touch Panel keys. When you plug the PAD into a power outlet, some indicators light and are visible through the front panel.

FEATUREPAK Cartridge

■ **CAUTION:** To avoid possible damage to an expansion module from static discharge, be sure to touch the PAD's metal enclosure before reaching for the FEATUREPAK cartridge.

A FEATUREPAK cartridge, containing the system software, is inserted into an opening behind the front panel (see Figure 1-2). The software includes, but is not limited to, the following standard features:

- Block mode device support (see the section, "Flow Control", in Chapter 3)
- Configuration of operating parameters using the Command Facility (see section, "Soft Switches", in Chapter 5)
- Extended packet sequencing (see Figure 2-11)
- Fast Select (refer to the section, "Using X.28 Connect Command", in Chapter 3)
- KDD Network support (see Figure 2-10)
- Local Copy and Call Transfer (refer to the sections, "Local Copy and Call Transfer" in Chapter 4)

6502 X.25 Asynchronous PAD

Product Overview

Table 1-2.
PAD Model Descriptions

Model Number	Description
65540	4-channel unit with 115 VAC primary power. Includes base module with one EIA 232 composite interface, firmware cartridge and user manual.
65541	4-channel unit with 220 VAC primary power. Includes base module with one EIA 232 composite interface, firmware cartridge and user manual.
65542	4-channel unit with 115 VAC primary power. Includes base module with one X.21 composite interface, firmware cartridge and user manual.
65543	4-channel unit with 220 VAC primary power. Includes base module with one X.21 composite interface, firmware cartridge and user manual.
65544	10-channel unit with 115 VAC primary power. Includes base module with one EIA 232 composite interface, one hex channel expander module, firmware cartridge and user manual.
65545	10-channel unit with 220 VAC primary power. Includes base module with one EIA 232 composite interface, one hex channel expander module, firmware cartridge and user manual.
65546	10-channel unit with 115 VAC primary power. Includes base module with one X.21 composite interface, one hex channel expander module, firmware cartridge and user manual.
65547	10-channel unit with 220 VAC primary power. Includes base module with one X.21 composite interface, one hex channel expander module, firmware cartridge and user manual.
65548	16-channel unit with 115 VAC primary power. Includes base module with one EIA 232 composite interface, two hex channel expander modules, firmware cartridge and user manual.
65549	16-channel unit with 220 VAC primary power. Includes base module with one EIA 232 composite interface, two hex channel expander modules, firmware cartridge and user manual.
65550	16-channel unit with 115 VAC primary power. Includes base module with one X.21 composite interface, two hex channel expander modules, firmware cartridge and user manual.
65551	16-channel unit with 220 VAC primary power. Includes base module with one X.21 composite interface, two hex channel expander modules, firmware cartridge and user manual.

Power Supply

A multi-output AC power supply is installed in the unit (see Figure 1-2) prior to shipment. The input voltage is 115/230 VAC. Output voltages are +5, +12, and -12 VDC.

Prior to shipment, the power supply is set for the appropriate voltage used within your area.

6502 X.25 Asynchronous PAD

Product Overview

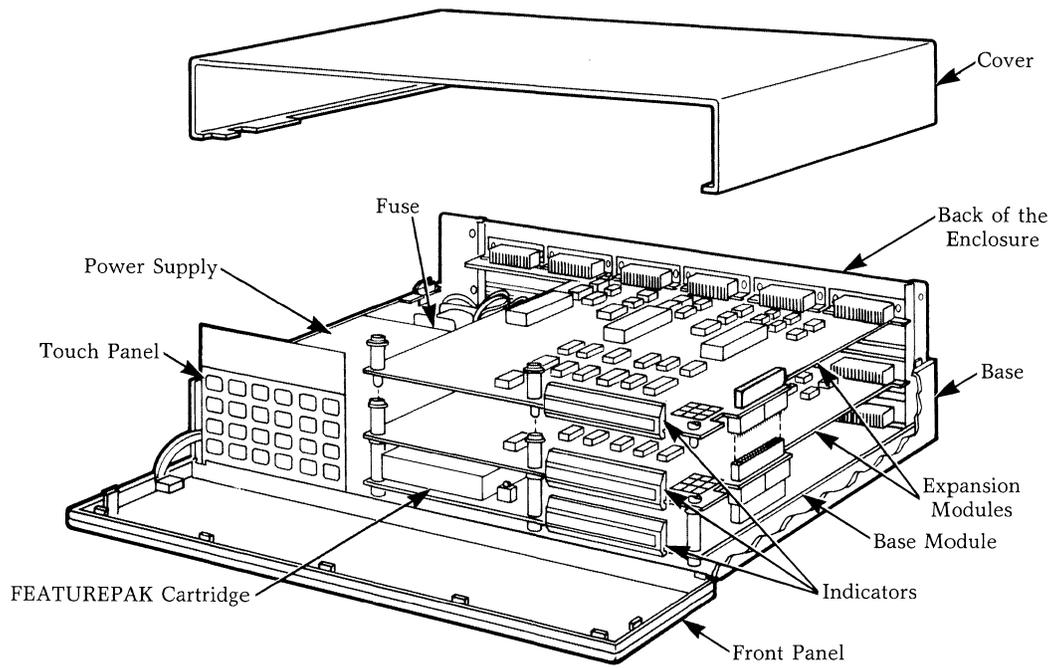


Figure 1-2. Locations of the Modules and Major Components

SUMMARY OF PAD CHARACTERISTICS

The following paragraphs summarize the general, terminal support, and X.25 trunk characteristics of the PAD.

General Characteristics

The PAD includes the following general characteristics:

- Functionally compatible with the Codex 6510 IXP.
- Fully compatible with CCITT Recommendations X.3, X.25, X.28, X.29 and X.121.
- From 4 to 16 asynchronous channels and a single X.25 composite channel.
- Dedicated Command Port and a user-friendly Command Facility.
- Configuration parameters stored in separate memory and protected by a backup battery in case there is a power failure.
- X.25 facilities supported:
 - Closed user group
 - Fast select
 - Priority (DATAPAC)
 - Reverse charging
 - Throughput class negotiation
 - Window and packet size negotiation
- Extensive call control capabilities:
 - Full X.121 addressing
 - Abbreviated addressing
 - Autocall feature
 - Subaddressing by using X.121
 - Subaddressing by using call user data
- Local copy and call transfer features
- Class selection with port contention
- TACT diagnostic tests
- Default configurations upon power-up
- Compact tabletop enclosure and rack-mount versions

Terminal Support Characteristics

The PAD includes the following characteristics to provide support for almost all asynchronous terminals:

- All channels independently configurable through the Command Facility
- Speed range from 50 to 9600 bps
- Autobaud and auto parity detection to 9600 bps
- Call accounting statistics upon call completion
- Dedicated, dial-in, or dial-out channel connections
- Extended flow control capabilities:
 - XON/XOFF, CTS/RTS
- Support of block mode devices
- Extended packet forwarding conditions
- User-definable Welcome Message at channel logon
- User-definable Bulletin Message at channel logon
- Extended X.28 command mode
- Extended X.29 command mode
- Enhanced asynchronous terminal handling beyond the requirements of X.3:
 - Special terminal echo sequences
 - Formatted screen support
 - Automatic forms handling
 - Escape sequence forwarding
 - Printer/CRT editing
 - Echo masking

Product Overview

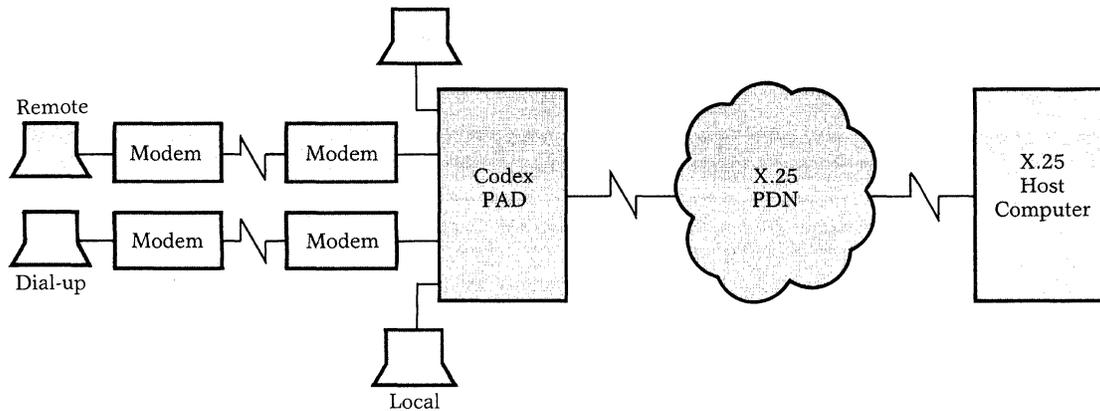


Figure 1-3. Terminal Concentrator

X.25 Trunk Characteristics

The PAD includes the following characteristics on the X.25 trunk line to the PDN:

- Compatible with 1980 version of *Recommendation X.25 LAPB/HDLC Operation*
- Speeds up to 9600 bps with external or internal clock
- Configurable X.25 trunk parameters:
 - k = Frame level window
 - W = Packet level window
 - T1 = Acknowledgment timer
 - N2 = Number of retransmissions
 - AT = Assurance timer
- Standard (modulo 8) or extended (modulo 128) packet sequence numbering
- Any combination of Permanent Virtual Circuits (PVCs) or Switched Virtual Circuits (SVCs)
- Configurable logical group and logical channel numbers
- Incoming call validation based on:
 - Password
 - Facilities
 - Requested channels
- Full support of Q-bit, M-bit, and D-bit as defined by CCITT Recommendations.

APPLICATIONS

You can use the PAD in any of the applications described below:

Terminal Concentrator

The PAD can support direct, dedicated, and dial-in connections. This makes it adaptable to many types of terminal applications (see Figure 1-3). It can support terminals at speeds up to 9600 bps that are connected directly to individual channels or connected using point-to-point modems. In addition, the PAD's dial-in capabilities allow a population of more than 16 terminals to contend for its channels.

Port Concentrator for X.25 Hosts

An increasing number of computer manufacturers provide X.25 protocol support for packet network access. The PAD can appear as a DTE or a DCE as defined by Recommendation X.25; it can operate as a DCE (looking like a PDN to a computer providing X.25 support) instead of operating in its more usual DTE role, as a concentrator PAD attached to a PDN. In the DCE configuration, the PAD serves as a port concentrator, connecting a cluster of terminals to a single computer port (see Figure 1-4).

With the dial-in channel capability of the PAD, you can use the port concentration capability to provide contention for a large population of dial-in terminals. You need only one X.25 port at the host computer for all these terminals.

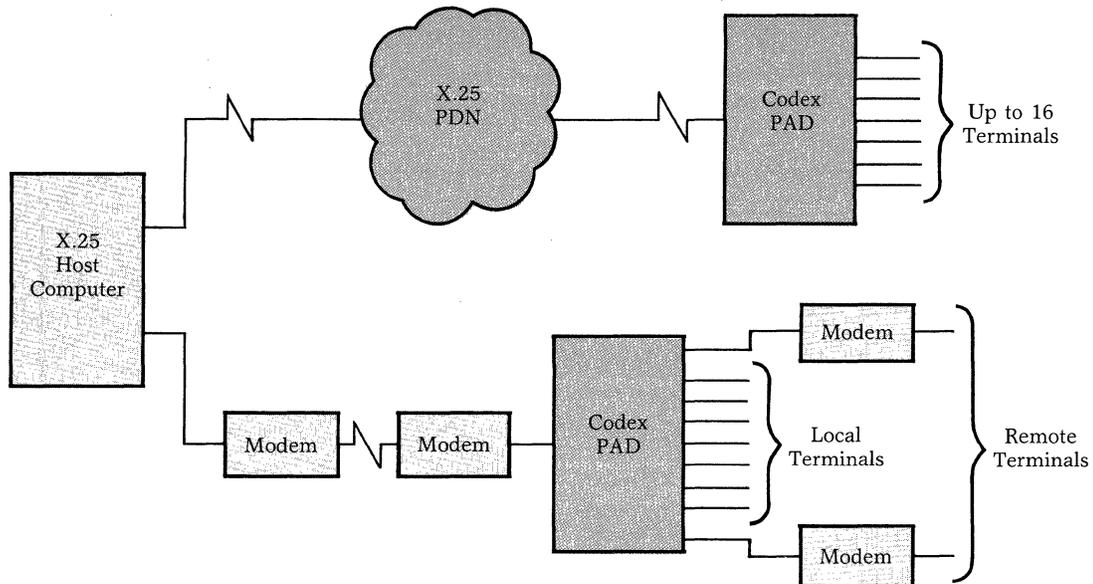


Figure 1-4. Port Concentrator for X.25 Hosts

USING NON-X.25 COMPUTERS

Many minicomputers do not provide X.25 protocol support for packet network access. Even for those that do, you may find it more convenient and cost-effective to use standard asynchronous computer ports and an external X.25 PAD to connect to the PDN. You can use the PAD for either a host computer connection or a terminal connection—without making any changes to existing computer and terminal systems (see Figure 1-5).

Special features of the PAD which make it unusually powerful as a minicomputer "front-end" include: automatic setup of the calling terminal PAD parameters; emulation of Bell 212 modem signaling at call setup time; and the optional ability to switch local terminals through the host computer without placing a call through the PDN.

COMPUTER PORT SELECTION

The PAD provides a port selection function allowing you to select between different computers connected to a remote 6502 PAD (see Figure 1-6). This powerful feature represents another major functional enhancement over the basic requirements of X.3 and X.28. You can group ports at a computer site that are connected to a PAD into classes, and remote PAD users can select classes. Port selection also automatically provides contention, allowing a large population of terminals to compete equally for a smaller number of ports. The port selection feature permits access to:

- A specific port
- Any port of the desired speed
- Any port on the selected computer
- Any available port

Port selection by remote PAD users is easy. To select a port, enter a 2-character class identifier when placing a call. The PAD ensures that a connection is made to the desired type of computer port.

Product Overview

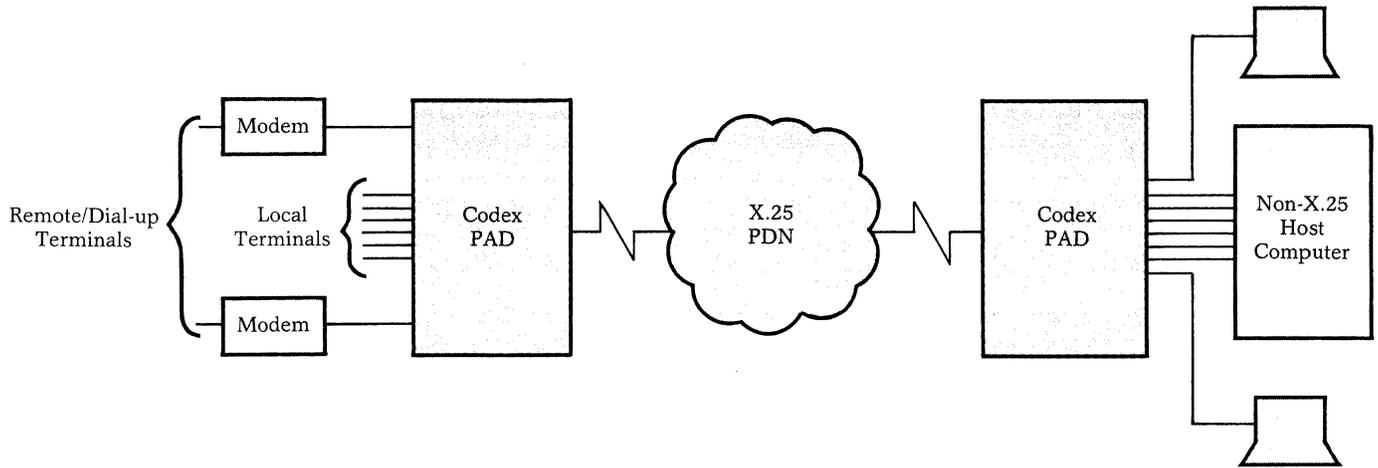


Figure 1-5. Interfacing Non-X.25 Computers

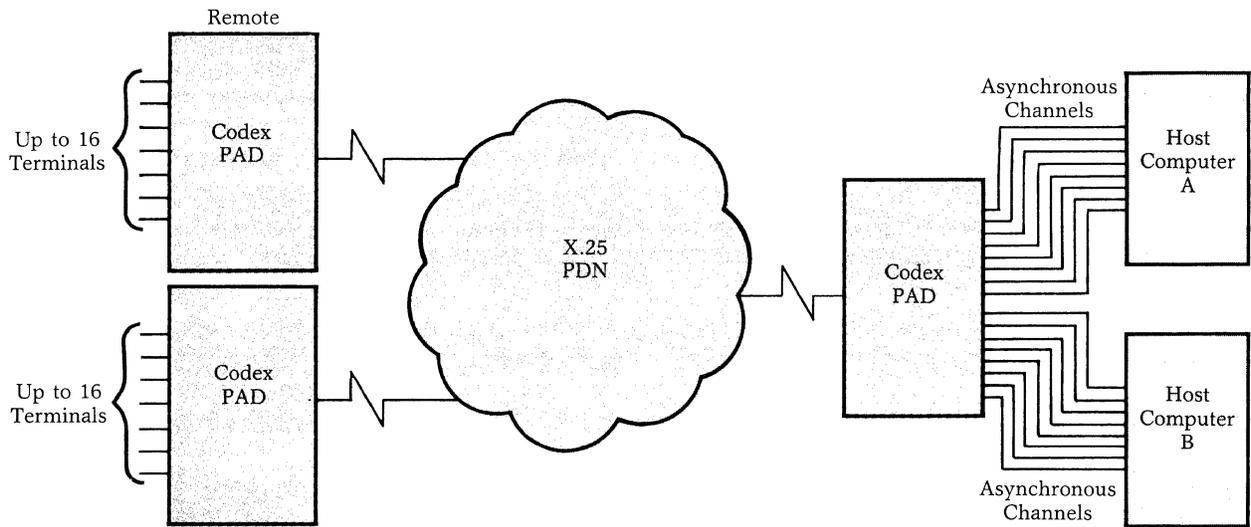


Figure 1-6. Computer Port Selection



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INTRODUCTION

This section explains how to unpack, select a site, and install the PAD. The information in this chapter is for the experienced telecommunications technician.

UNPACKING

Customer audits by Codex indicate that rough handling by the shipper causes most early failures. After you unpack a 6502 component, check it carefully for damage that may have occurred during shipment. Because circuit boards may have been jarred or shaken loose, check them carefully before you power up the system.

After unpacking, check the material you received against the packing invoice. The PAD is shipped in one carton containing the following items:

- PAD Unit
- FEATUREPAK Cartridge
- 7.5-ft (2.3m) AC power cord
- 10-ft (3.04m) Male-Female cable
- User Key
- 6502 X.25 Asynchronous PAD User's Manual

After unpacking, check the PAD for possible shipping damage. If you see any damage, contact the shipper. Direct any other questions about damage or missing parts to your local Codex representative, or contact:

Codex Corporation
Sales Operations
Maresfield Farm
7 Blue Hill River Road
Canton, Massachusetts 02021-1097
U.S.A.

SELECTING AND PREPARING THE SITE

The PAD has specific size, ventilation, and cabling requirements. The following information will help you in your selection of a location. Select a site for your PAD that is within 6 feet (1.8m) of a grounded AC outlet furnishing the required power. The power requirements for the PAD are listed in Chapter 9, Specifications and Ordering.

Allow at least 36 inches (91.5cm) in front of the PAD for easy access to the Touch Panel on the front of the unit. Allow at least 5 inches (12.7cm) in back for cable clearance. Position the PAD so that you can easily use the front Touch Panel.

■ **CAUTION:** *To avoid overheating, never place anything on top of the 6502 or within 1 inch of either side. The air vents on the bottom of the enclosure must always be kept clear of obstructions.*

All cables used to connect terminals and external modems to the PAD must be shielded and cannot be longer than 50 feet (15.2m).

INSTALLATION PROCEDURES

Instructions for installation include:

- Expansion modules
- FEATUREPAK cartridge
- The PAD

Removing the Cover of the PAD

To install or to remove an expansion module you must remove the cover of the PAD. The instructions below explain how to open the PAD.

■ **CAUTION:** *To avoid possible damage to an expansion module from static discharge, be sure to touch the PAD's metal enclosure before installing or removing a module.*

- 1) Make sure that the AC power cord is not connected to an AC outlet.
- 2) Open the cover of the PAD.

First, use a Phillips-type screwdriver to remove the two screws on each side of the enclosure as shown in Figure 2-1.

Next, use the Codex User Key provided with the equipment to release the four locking clips. Insert the User Key blade not more than halfway, in the four slots on both sides of the base (see Figure 2-1). Pry the cover up with the key in each of four slots to release the clips. Lift the cover off when all four clips are released.

To close the PAD, identify the front of the cover (see the stamp on the underside of the cover). Align the front of the cover with the front of the base and place the cover over the base. Align the slots in the cover edges on both sides with the tabs on the base edges (see Figure 2-1). Push in the edge of the cover over the alignment tabs as you press the cover down. The locking clips will lock the cover in place. Then replace the four screws that you removed to open the PAD.

6502 X.25 Asynchronous PAD
Installation and Configuration

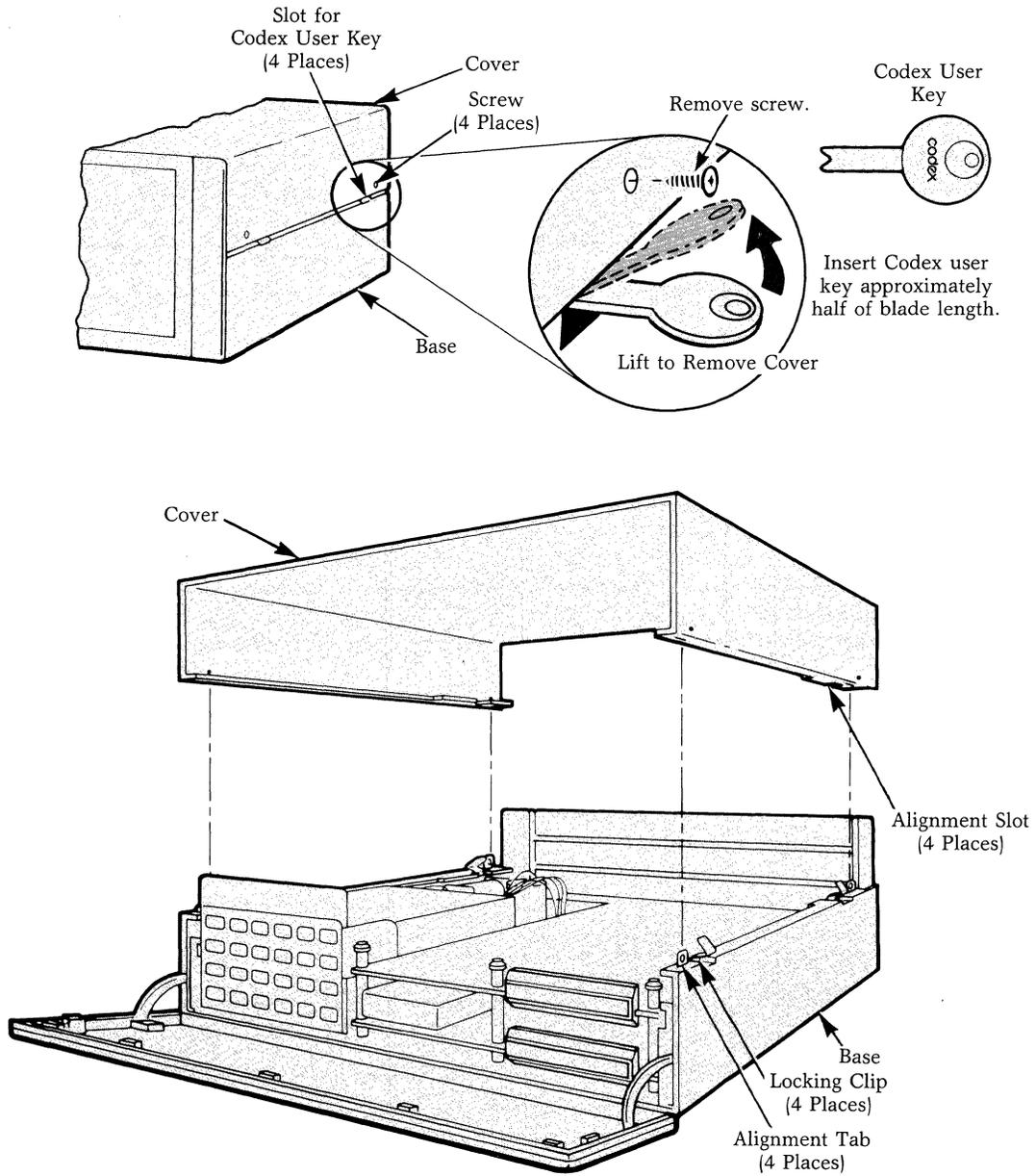


Figure 2-1. Opening and Closing the PAD

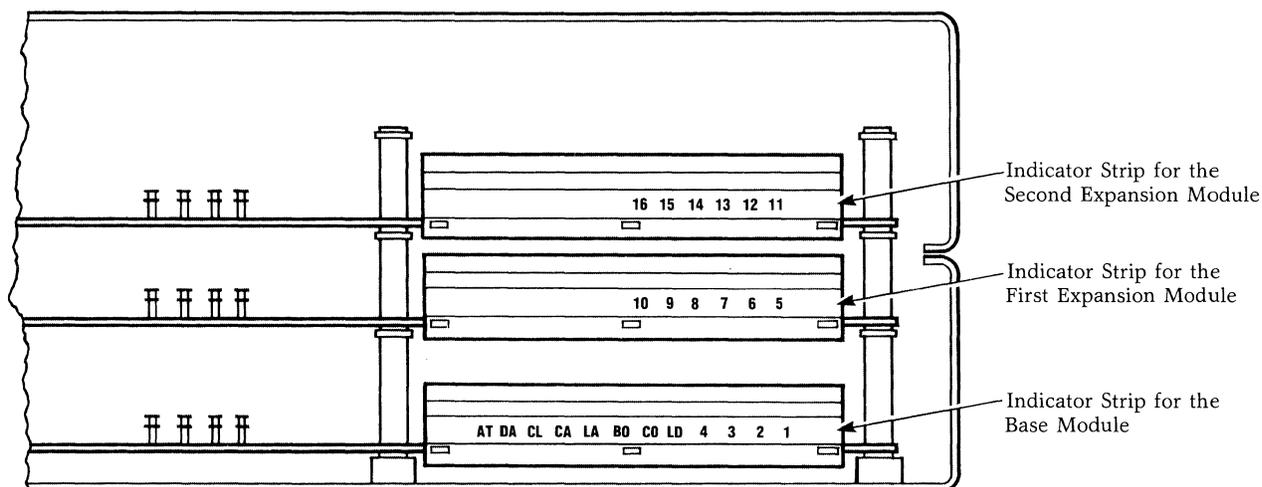


Figure 2-2. Applying Indicator Strips to the Modules

Installing and Removing Expansion Modules

The instructions below explain how to apply the indicator strips and install an expansion module.

- 1) Apply the indicator strips.

One indicator strip accompanies each expansion module. The indicator strip shows the channel numbers for the module (see Figure 2-2) and has an adhesive backing.

For the first expansion module, apply the indicator strip labeled 5 through 10 in the location shown in Figure 2-2.

If you have a second expansion module to install, apply the strip labeled 11 through 16 in the location shown in Figure 2-2. ■ **Note:** If necessary, also apply the base module indicator strip shown in Figure 2-2.

- 2) Secure the back of the module (see Figure 2-3).

A panel is attached to the back of each expansion module. Slide the panel into the side guides until it couples with the panel below. Where a module is not installed, you must slide in a panel without an attached module to form a solid back for the PAD's enclosure.

Installing an expansion module requires the use of stacking connectors and jumpers for channel selection as explained in Step 3.

- 3) Connect the stacking connectors and use jumpers for selection of the channels.

A stacking connector has two parts: a shroud and a block. The shroud is on the bottom of the module being installed and fits over the block on the module below. As you slide in the back panel, align the shroud and the block. Then press the two together until the connector is completely coupled.

In the 10-channel unit, ensure that the jumpers on the expansion module are in E4, E5, and E6 positions, for proper channel connections (see Figure 2-3 for locations of the headers).

In the 16-channel unit, ensure that the jumpers are placed to allow the use of all 16 channels, as follows: on the bottom expansion module—in positions E4, E5, and E6, and on the top expansion module—in positions E7, E8 and E9 (see Figure 2-3 for locations of the headers).

- 4) Secure the front of the module.

In the front, the modules snap together using three standoffs. Place the standoffs (on the bottom of the module being installed) over the standoffs that are on the module below. Place the user key over the standoff so that the top of the standoff fits into the depression in the handle of the key. Press down until the standoffs snap together (see Figure 2-1).

Connecting the External Cables

Connect the external cables to the connectors on the back of the enclosure. For information on connecting cables, refer to the section on System Cabling later in this chapter.

The instructions below explain how to remove an expansion module. Refer to Figure 2-3.

- 1) Disconnect the external cables from the back connectors.
- 2) Separate the three standoffs from the module using the Codex user key or a screwdriver with a 1/4-inch blade (refer to the caution that follows). Firmly insert the user key between the module edge and the standoff below. A fully inserted key will cause the module to unsnap (see Figure 2-3). When the key is properly inserted, twist the key to one side to separate the module from the standoff. Repeat this operation for each standoff.
■ CAUTION: *If you use a screwdriver instead of the Codex user key, be careful to avoid scratching or gouging the underside of the module.*
- 3) Pull apart the stacking connector between the two modules.
- 4) Slide the back panel out of the side guides.

6502 X.25 Asynchronous PAD
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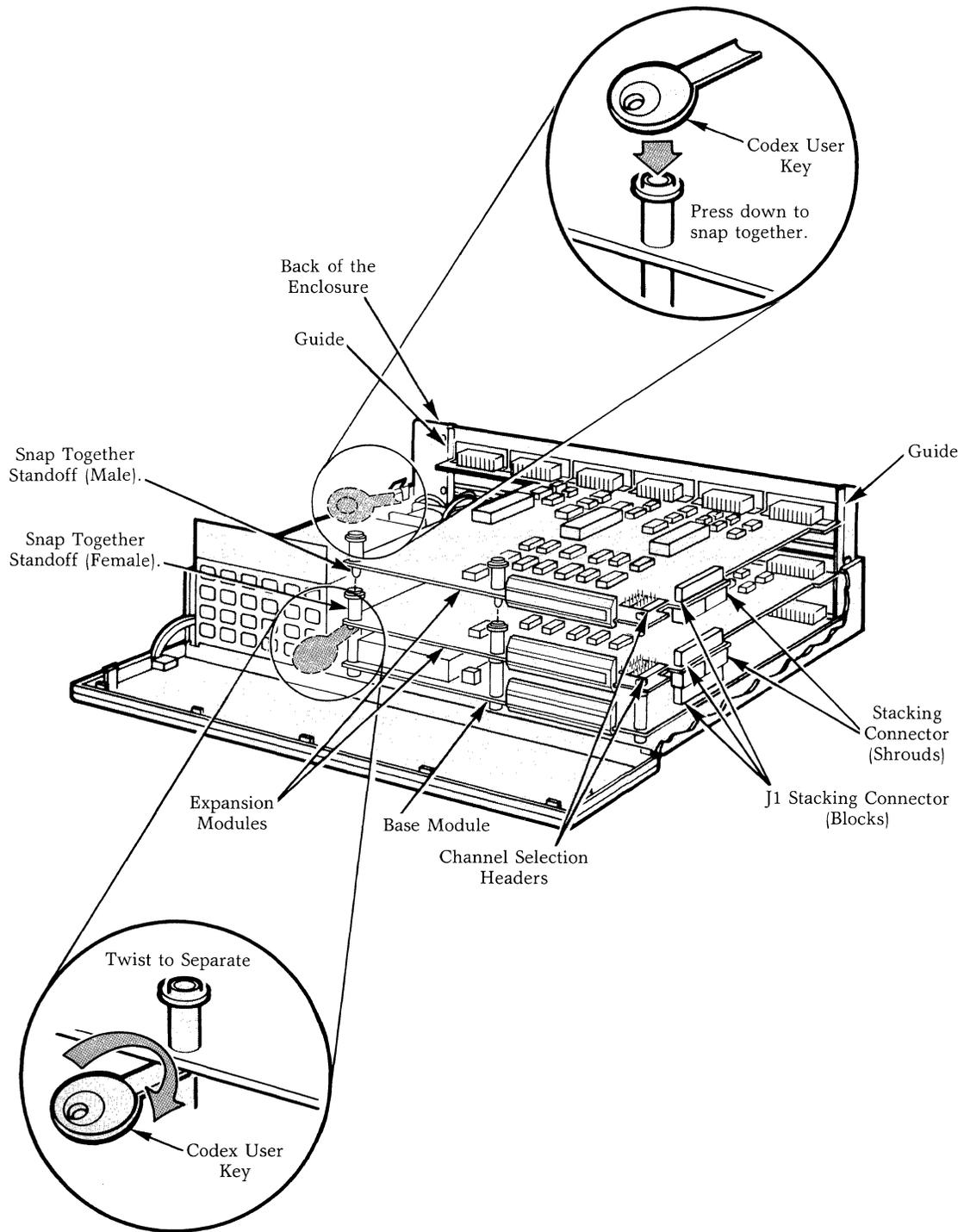


Figure 2-3. Module Installation and Removal

6502 X.25 Asynchronous PAD
Installation and Configuration

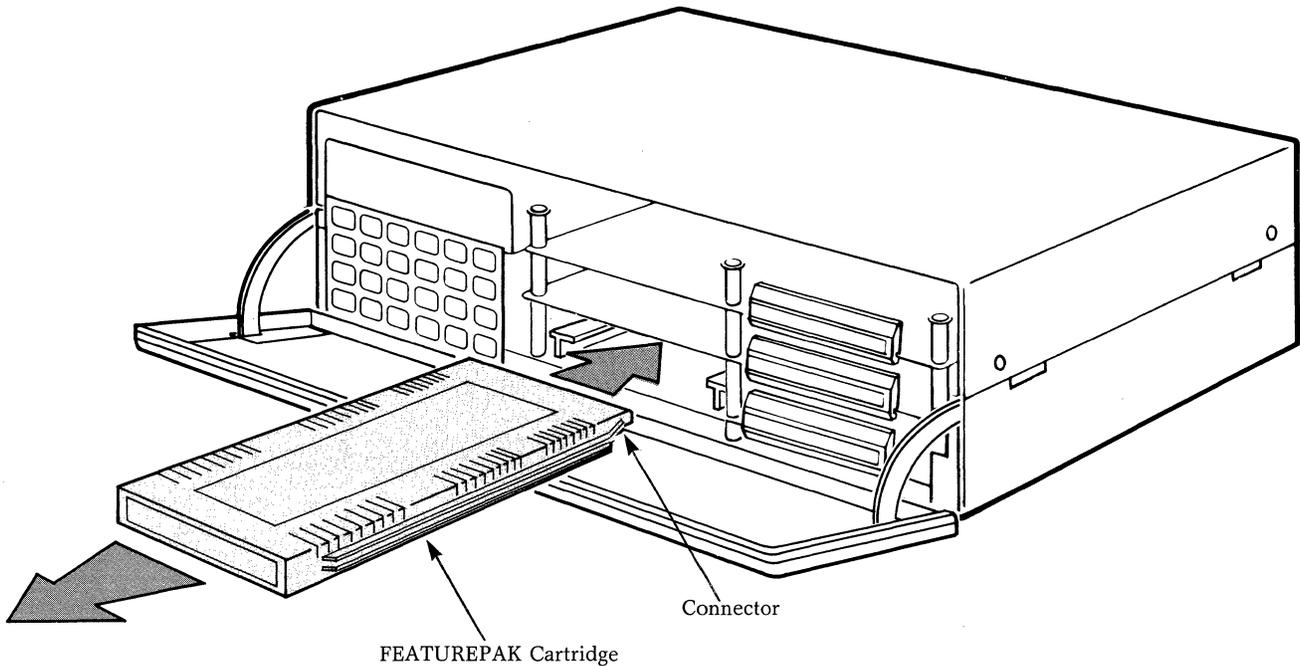


Figure 2-4. FEATUREPAK Cartridge Installation

Installing and Removing a FEATUREPAK Cartridge

The receptacle for the FEATUREPAK cartridge is located behind the front panel as shown in Figure 2-4. To open the front panel, pull the panel top out and down.

■ **CAUTION:** To avoid possible damage to an expansion module from static discharge, be sure to touch the PAD's metal enclosure before reaching for the FEATUREPAK cartridge.

To install, insert the FEATUREPAK cartridge into the receptacle, with the connector pins going in first. Tracks on the cartridge will mate with the slides inside the unit. With a fair amount of pressure, push the cartridge so that the pins of the connector are firmly seated. This will ensure the proper connection of the cartridge.

To remove, grip the cartridge firmly on the sides and pull with a fair amount of force to dislodge the connector. Then lift the front of the cartridge over the edge of the front panel.

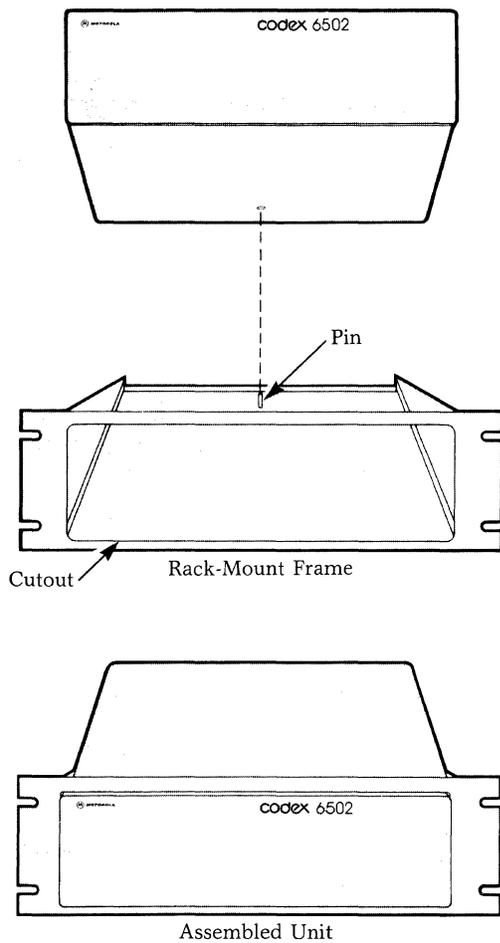


Figure 2-5. Rack-Mount Installation

INSTALLING THE PAD

You can install the unit either as a standalone or as a rack-mount. The information below provides instructions for installing both types of units.

Standalone Unit

Place the standalone unit on a tabletop or shelf. Allow enough space for cover removal, handling of the back panel connectors, opening the front panel, and unobstructed air flow.

Rack-Mount Installation

Use a standalone unit with an optional Rack-Mount Upgrade Kit (see Figure 2-5). Mount the standalone unit in a standard 19-inch (48.3cm) wide rack, using the kit. Installation instructions are included with the kit.

Connecting the System

To connect the system you can use either Codex cables or your own cables. Connect these cables to the connectors located on the back of the enclosure as shown in Figure 2-6. **Note:** Some equipment connected to the PAD does not require a shielded enclosure and shielded cables for the PAD in compliance with the FCC Rules and Regulations, Part 15/J. In this case, it may be necessary to use a filtered connector between the PAD and such equipment. This will provide the safeguards as required by FCC. Contact your local Codex representative for correct filter application.

Each connector on the back panel of the enclosure contains two channel numbers, as shown in Figure 2-6. The first number in the pair applies to the first expansion module while the second number applies to the second expansion module. For example, the label CHANNEL 5/11 refers to channel 5 on the first expansion module, or to channel 11 on the second expansion module.

When you are installing the unit, you must make the following system connections (see Figure 2-6):

- Channel Interface
- Composite Interface
- Command Port
- Power (AC)

**6502 X.25 Asynchronous PAD
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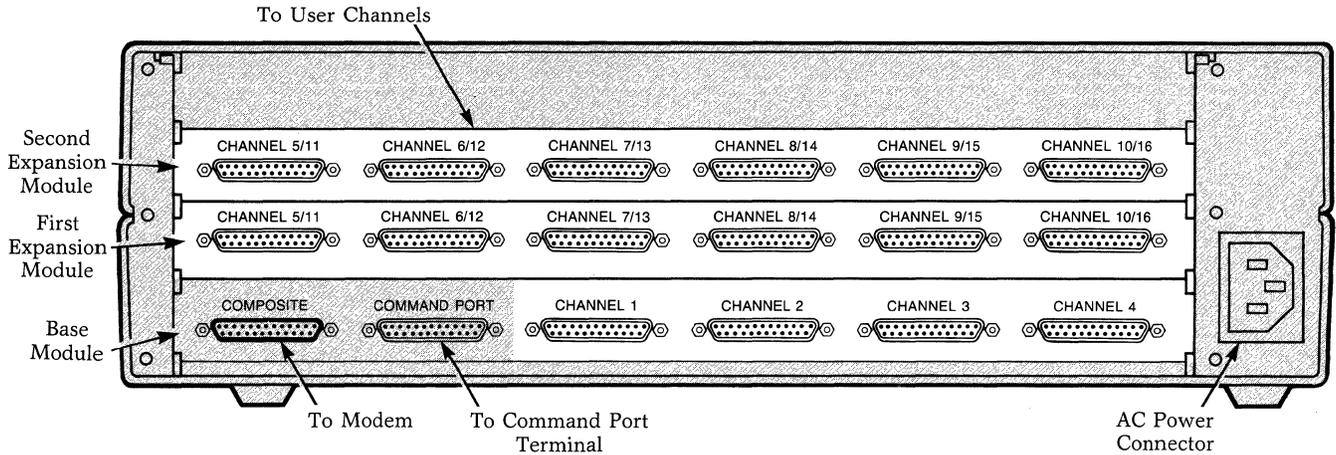


Figure 2-6. Connectors on the Back Panel of the Enclosure

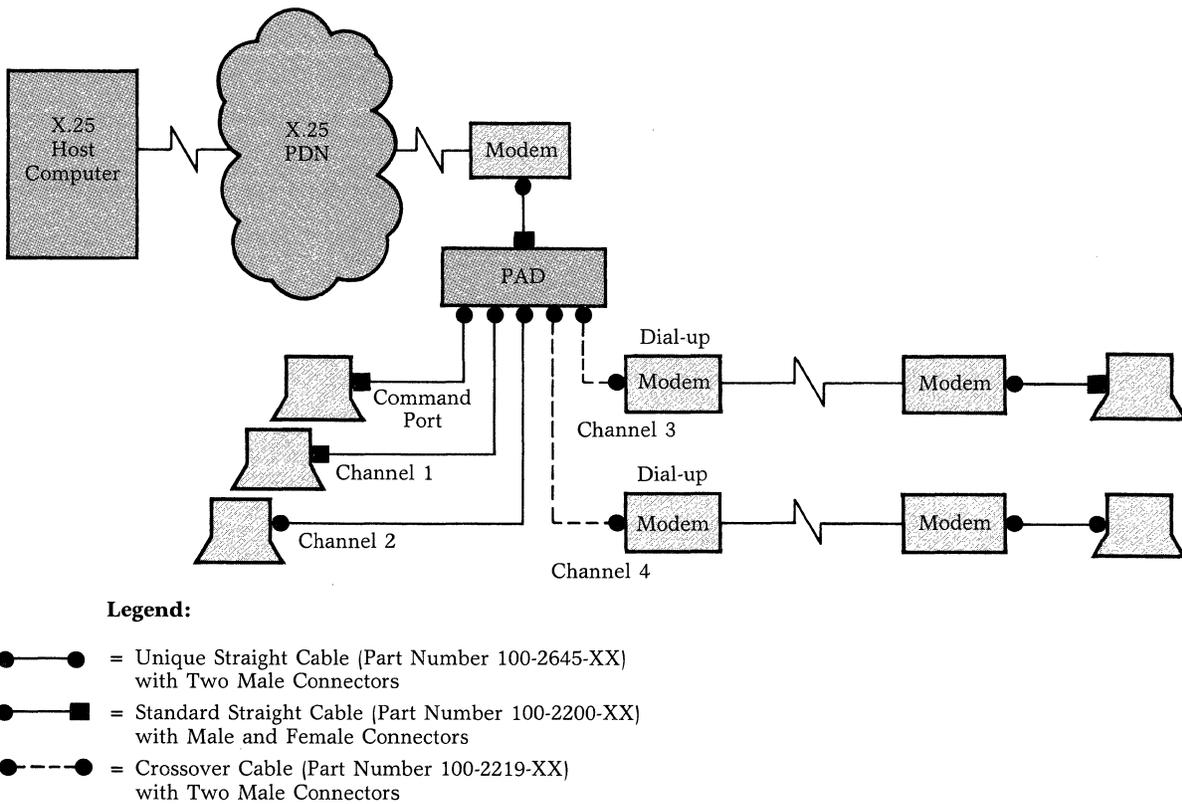


Figure 2-7. Example of System Cabling

SYSTEM CABLING

To connect the system, you can use either Codex cables or your own cables. If you are using your own cables, ensure that they are shielded and are not longer than 50 feet (15.2m). (If you are using a filtered connector, refer to the note on Page 2-10.)

The Codex cables are identified by their part numbers:

<i>Part Number</i>	<i>Cable Description</i>
65555	EIA 232 Male to Male crossover cable for connecting a modem to a channel connector.
65556	EIA 232 Male to Female cable for connecting a modem to the composite link connector.

Figure 2-7 shows cabling in a typical system arrangement. For cable pin assignments, see Figure 2-8. The following information describes the system connections.

■ **CAUTION:** *To prevent errors caused by induced noise, do not operate the PAD with open-ended cables connected to the channel interface connectors. The other ends of the cables must be connected to devices.*

Cable Pin Connectors

Each pin in the cable connector transmits a specific electrical signal that provides a unique function. EIA 232-C/D determines which signals pass through which pins on the connectors. The cable diagrams in Figure 2-8 show the number and function associated with each pin in the standard straight cable and the crossover cable:

- Straight Cables
 - PAD Composite to Modem cable
 - Terminal to Pad Command Port or Channel cable
- Crossover Cable
 - Port or Channel to Modem cable

Channel Interface Connections

You can use either a user cable or the Codex cable to connect your terminal or computer port (DTE) to a channel connector on the back panel. Panel labels identify the connectors—CHANNEL 1 through CHANNEL 16, as shown in Figure 2-6. For an explanation of the labels for channel pairs on expansion modules, refer to the section, Installing the PAD, in Chapter 2. Depending on the channel capacity of your unit, you can use the connectors for 4, 10, or all 16 channels.

Use either a shielded cable not longer than 50 feet (15.2m) or one of the Codex shielded cables listed below (refer to Figure 2-8 for pin assignments for these cables):

- Standard straight cable
- Unique straight cable
- Crossover cable

The standard straight cable and the unique straight cable have identical circuit pin assignments. The only difference between the two cables is that the standard straight has one male and one female connector, while the unique straight has two male connectors. Because their pin assignments are identical, Figure 2-8 shows only the standard straight cable. The two examples are used to show the standard straight cable connected to different equipment.

The crossover cable connects to an external modem. Unlike a straight cable (where conductors are directly connected pin-for-pin), a crossover cable switches (crosses over) the pins so that a DCE can communicate with a DCE.

Composite Interface Connection

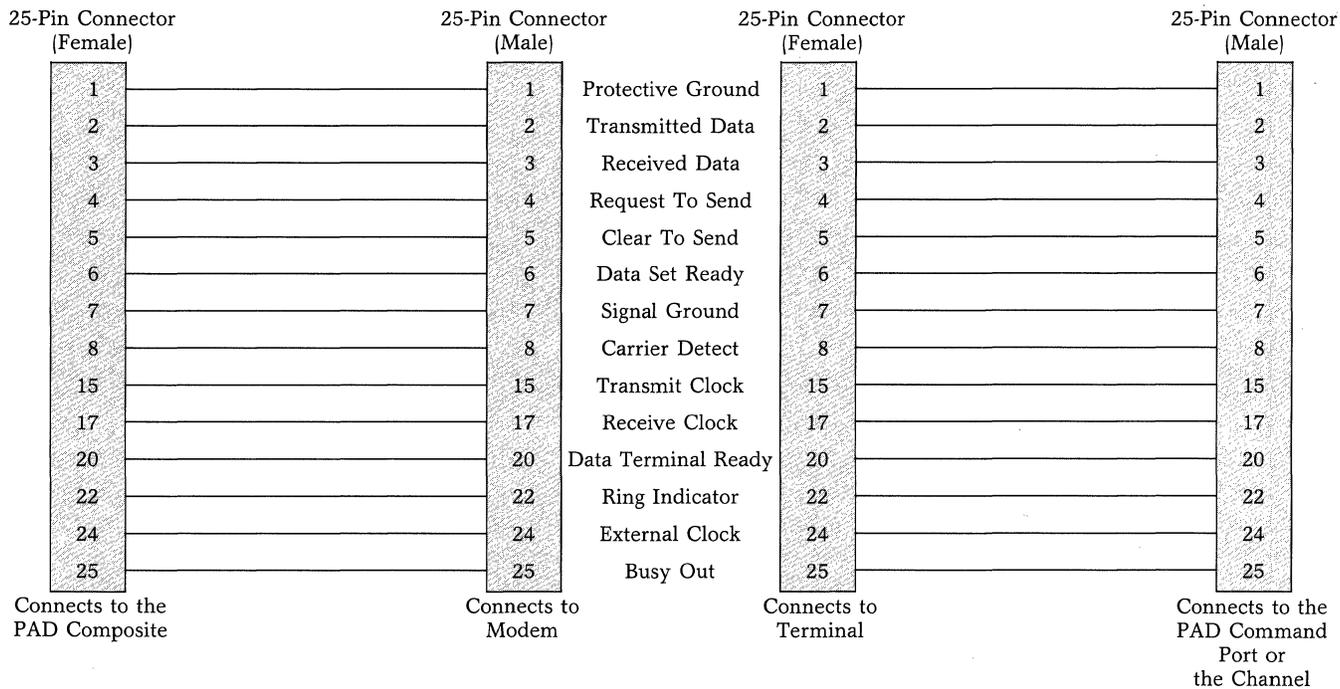
Connect an external modem to the connector on the back panel marked COMPOSITE (see Figure 2-8). Use either a shielded cable not longer than 50 feet (15.2m) or a Codex shielded standard straight cable, Codex Product Code 65556 (see Figure 2-8).

Command Port Connection

Connect a terminal to the connector on the back panel marked COMMAND PORT. Once the connection is made, this terminal is dedicated for use with the PAD command port facility. Use either a shielded cable not longer than 50 feet (15.2 meters), a Codex shielded standard straight cable or a shielded unique straight cable. For a remote access, connect a dial-in modem to the connector labeled COMMAND PORT, using a Codex shielded crossover cable. See Figures 2-7 and 2-8.

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Standard Straight Cable
Part Number 65556



Crossover Cable
Part Number 65555

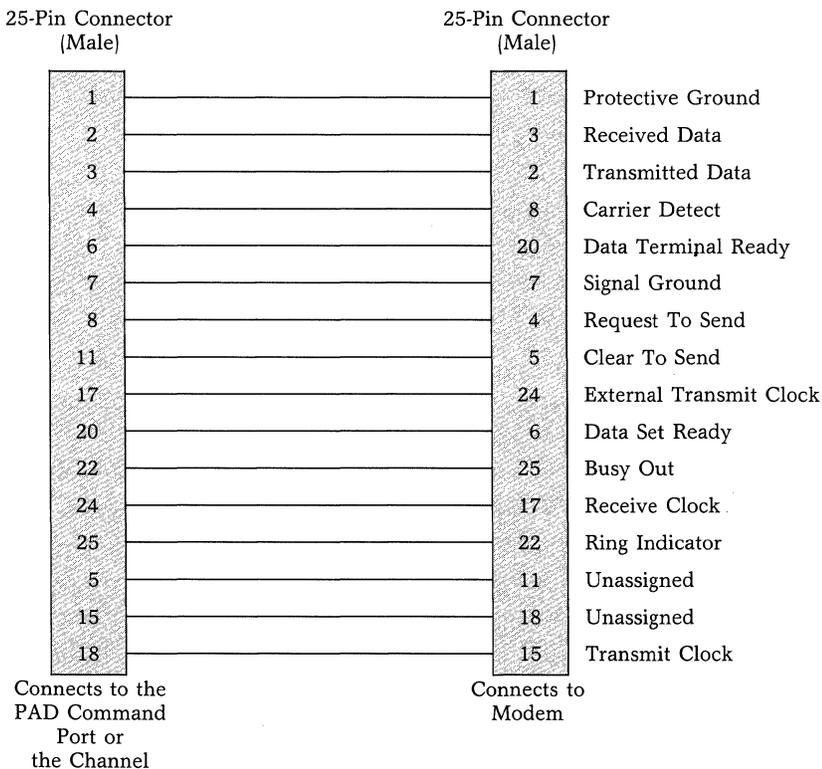


Figure 2-8. Pin Assignments

Power Supply Connection

Connect the AC power cord to a grounded AC outlet as shown in Figure 2-6. Some indicators on the front panel of the PAD will go on (refer to Chapter 6 for a description of the indicators).

CHANGING EIA CONTROL SIGNAL BIAS FOR USER CHANNELS

A bias is set on the input EIA control signals (RTS, DTR, and Unassigned). If the device attached to the user channel does not terminate the input EIA control signals, the bias ensures that the PAD will recognize these signals as being in a specific state. This prevents the signals from floating and picking up noise.

The default EIA bias control setting for PAD user channels is off. This is the required setting for normal PAD operations. When bias control is set to off, the PAD will recognize an inactive EIA signal when:

- there is no connection to the signal,
- The attached device asserts the signal inactive.

In some cases you may have to change the bias control setting to on. For example, if your terminal to PAD cables have only the Signal Ground, Received Data, and Transmitted Data signals, set the bias control on to enable the terminals to place or receive calls.

When bias control is set to on, the PAD will recognize an active EIA signal when:

- there is no connection to the signal,
- the attached device asserts the signal active.

Whether bias control is set to on or to off, the PAD will always recognize the state asserted by the attached device when there is a connection to the signal.

The default EIA bias control setting (off) is correct for most PAD applications. However, if you need to change the bias control setting, you have a choice of two methods. You can use either the Touch Panel method as explained in the next section or the Command Facility method as explained in Chapter 5.

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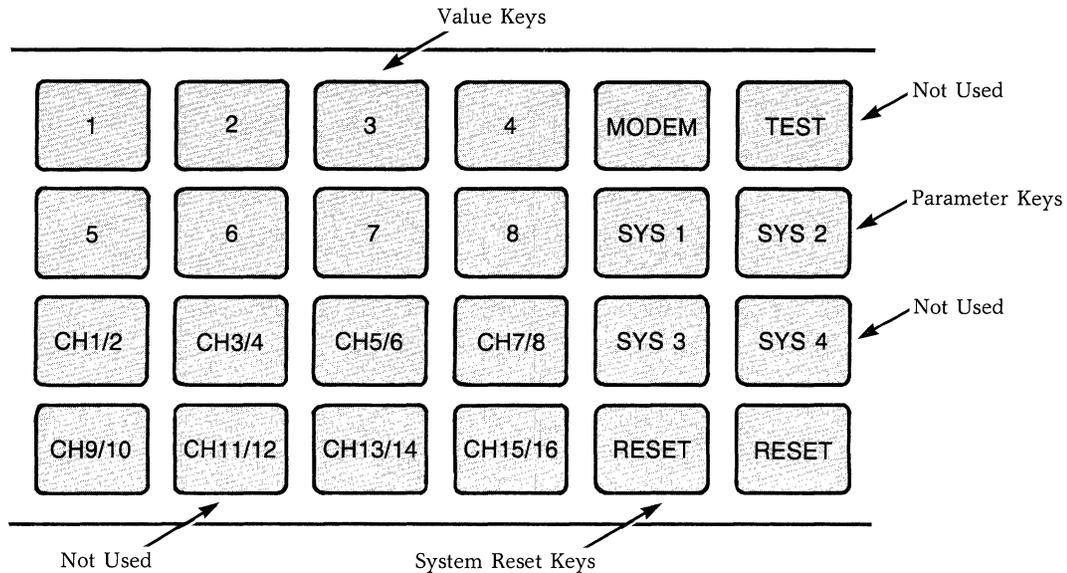


Figure 2-9. Touch Panel

USING THE TOUCH PANEL TO SET OPERATING PARAMETERS

You can use either the Command Facility or the Touch Panel to set the PAD's operating parameters. The information in this section explains how the PAD stores operating parameters and how to use the Touch Panel to set these parameters. For information on the Commands Facility, refer to Chapter 5.

The operating parameters that you set relate to the PAD's soft (software) switch groups. The on or off settings of selections within those groups determine how the PAD will operate. For example, one selection determines whether the PAD will be cold or warm started upon reset.

The Parameter and Value keys on the Touch Panel allow you to set the PAD's operating parameters. The Reset Keys on the touch Panel allow you to reset the PAD. Figure 2-9 shows the location of the Touch Panel keys.

How the PAD Stores Operating Parameters

A battery-backed, nonvolatile CMOS stores all of the operating parameters that you need to operate the PAD. The battery is not rechargeable and the software can detect a CMOS failure or battery low state. Either of these conditions will cause some indicators on the front of the PAD to go on or start flashing. See Table 6-1 for information on these indicators. If the PAD detects a CMOS error, it displays the message:

CMOS ERROR/BATTERY LOW

How to Operate the Touch Panel

The Touch Panel is located behind a swing-down door on the front of the PAD. Pull lightly on the top of the door to open it.

The PAD's Touch Panel, in conjunction with the base module indicators, allows you to easily set the PAD operating parameters. Each Parameter key corresponds to a different soft switch group. For example, if you press SYS 1 key, the PAD will access the software associated with group 1. After you press a Parameter (SYS) key, the PAD's base module indicators show whether selections within that soft switch group are currently set to on or off.

- 1) Touch either the SYS 1 or SYS 2 key to select a group of operating parameters (see Figure 2-10 for the SYS 1 group or Figure 2-11 for the SYS 2 group). Touch the SYS 3 key to change the EIA control signal bias for user channels (see Figure 2-12). After you touch one of these keys, the indicators will show the current settings of the selections.

After you press a SYS key, a 25-second timer starts. If you press another SYS key or a numeric key, the timer restarts. If the timer expires, the indicators revert to their normal state; they reflect system status and channel data activity rather than the current status of operating parameters. Also, after the 25-second timer expires, the current on or off settings are stored in CMOS.

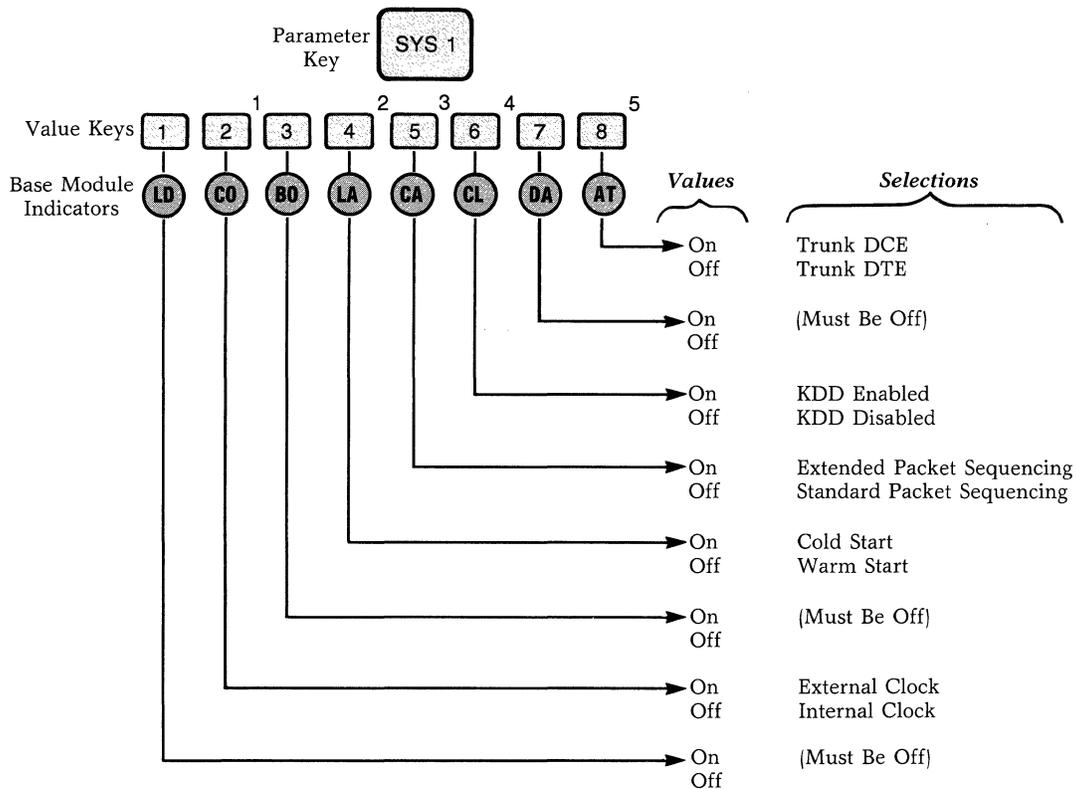
- 2) The Value keys, labeled 1–8, allow you to make specific selections from the group of parameters (SYS 1, SYS 2, or SYS 3) you have just selected. Repeated touching of one of these keys toggles the corresponding value between off and on. The indicators (1-8) will show the new status (on or off). The correlation of selections-to-indicators is shown in Table 2-1.

Table 2-1.
Correlation of Soft Switch Selections to Indicators

<i>Indicator</i>	<i>Selection</i>
LD	1
CO	2
BO	3
LA	4
CA	5
CL	6
DA	7
AT	8

- 3) Touch both Reset keys to reset the PAD and store the current selection values. During the reset, the PAD's base module indicators should be on.

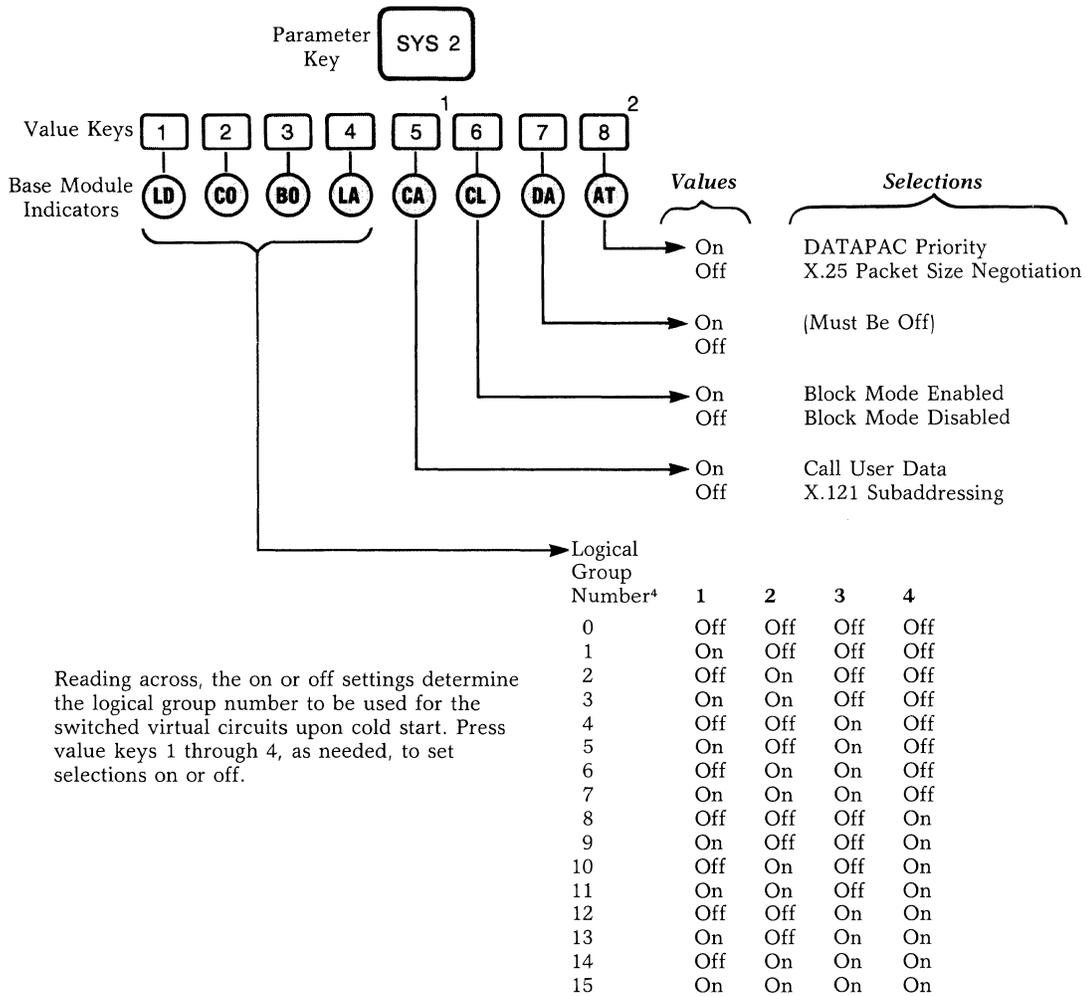
**6502 X.25 Asynchronous PAD
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- 1) The clocking speed is fixed at 9600 bps.
- 2) Once you have reconfigured your PAD to meet your operating requirements, Selection 4 should be off (warm start). Otherwise, a PAD reset or a power failure will cause the factory-set operating parameters to be restored.
- 3) When Selection 5 is on, the PAD conforms to the CCITT recommendation for Extended (Modulo 128) Packet Sequencing. When this selection is off, the PAD conforms to the CCITT recommendation for Standard (Modulo 8) Packet Sequencing.
- 4) If Selection 6 is on, Selection 5 must also be on. When KDD and Extended (Modulo 128) Packet Sequencing are enabled, the PAD is compatible with the Japanese KDD network.
- 5) Normally, the PAD would be set to have a DTE appearance, thus making the PAD suitable for connection to packet data networks. Selection 8 must be on (DCE appearance) for connection to other X.25 equipment (front-end processors or host computers), which are configured for DTE appearance.

Figure 2-10. Using the SYS 1 Key to Set Operating Parameters

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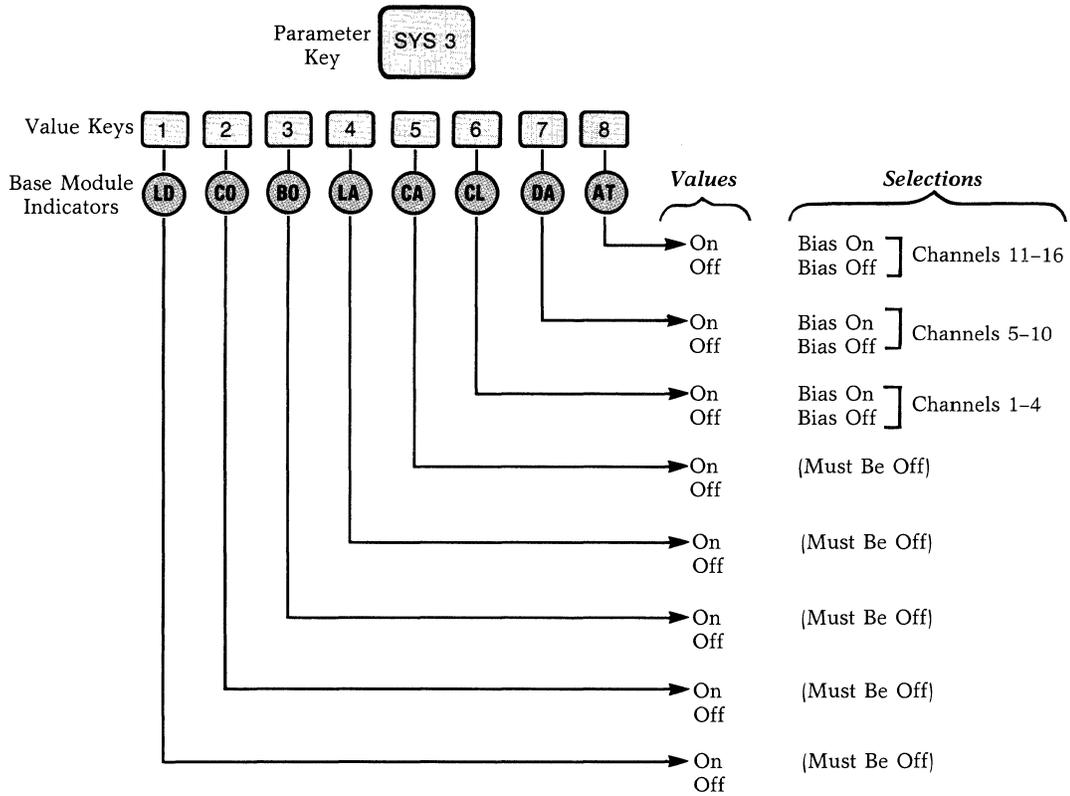
- 1) Normally, you would set the PAD to support subaddressing, using the X.121 method. You must set Selection 5 on (call user data field method). If your network (for example, DATAPAC) does not support X.121 subaddressing.
- 2) Normally, you would set the PAD to support the X.25 packet-size negotiation facility coding, as per CCITT 1980. Selection 8 must be on to accommodate the 128-byte priority operation over the Canadian DATAPAC network.
- 3) Selection 1 through 5 take effect upon cold start.
- 4) Normally, you would set the PAD to support $n + 2$ virtual circuits, where n is equal to the number of physical channels. For numbering, the PAD assumes an LGN = 0 and an LCN = 1 through $n + 2$. This allows, for example, 18 virtual calls for 16 channels.

While an LGN = 0 is suitable for most countries, the United Kingdom's PSS network for one, requires an LGN = 4 for SVC operation. You can reset selections 1 through 4 so that the LGN will be set to a value between 1 and 15 (instead of 0), on cold start.

When the LGN is set to a value other than 0, the LCN range will be 0 through $n + 1$, where n equals the number of physical channels installed.

Figure 2-11. Using the SYS 2 Key to Set Operating Parameters

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■ **Note:** For normal PAD operation, the EIA control signal bias is Off (inactive). Therefore, Off is the default value for Selections 6, 7, and 8.

Figure 2-12. Using the SYS 3 Key to Select EIA Control Signal Bias

Chapter 3

Theory of Operation

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INTRODUCTION

This section presents an overview of the characteristics and operational features of the PAD. A detailed description of the PAD's support of Recommendations X.25, X.3, X.28, and X.29 is included. Information about the X.121 numbering plan is also included.

You will find the information in this section useful when:

- You plan the initial installation of the PAD
- You examine what happens when you change applications
- You change devices that use the PAD to access the Network

This section also illustrates the relationships that exist in the following operational areas:

- X.25 trunk handling
- Asynchronous device support; X.3 and PAD extensions to CCITT Recommendation
- Physical channel connection/EIA handling
- X.25 addressing schemes
- What is involved in placing a call
- What occurs when an incoming call is received
- X.28 support with additional Codex characteristics
- X.29 support with additional Codex characteristics
- Permanent virtual circuits

Because of the strong relationships that exist in these operational areas, the text in this section includes extensive cross-referencing notes. We have also cross-referenced each subject or characteristic with its related configurable parameters in Chapter 5.

THE X.25 TRUNK

Packet switching networks provide two methods of connection for the asynchronous equipment user:

- A dedicated X.25 access line
- Dial-in or dedicated asynchronous lines

In order to use the X.25 access line, asynchronous equipment users must connect by using equipment

(i.e., host computer, front ends, and communications processors) which complies with Recommendation X.25 as adopted by CCITT in 1980. This is a well known and widely used protocol standard and the Codex PAD fully supports these requirements.

Normally, you would use the Codex PAD as an in-house PAD when you have a cluster of asynchronous terminals or a non-X.25 computer system that you must connect to the X.25 packet data network. You can also use the PAD for an extension to the backbone PDN to offer both dial-in and dedicated asynchronous device access.

Because the network's asynchronous access facilities are typically limited to 1200 bps, you can also use a PAD when you require a higher data rate.

In summary, the Codex PAD is a very cost-effective system when you need to interface a number of asynchronous terminals at high data rates.

The X.25 Connection

The PAD uses a full-duplex, point-to-point circuit as a physical transmission path to the PDN or to other equipment that adheres to the X.25 procedures defined by CCITT in 1980.

While some networks and equipment still support older link access procedures, the Codex PAD supports only the most current LAPB procedures with the more efficient HDLC format. Therefore, you must ensure that you connect the PAD only to an X.25 access link defined for LAPB-HDLC operation.

The PAD can connect to public or private data networks or directly to an X.25-based host computer or front-end processor.

Usually, you would set a PAD to exhibit an X.25 DTE logical appearance on the trunk. If you interconnect the PAD to other X.25 equipment, you may have to set up the PAD to operate as an X.25 DCE. You can change the set up of the PAD by using a single soft switch selection.

In addition to the DTE or DCE logical appearance setting, the PAD allows you to tune the trunk parameters to meet the characteristics of the X.25 facilities that you are using (i.e., line speed and quality). This allows you to achieve a better match with different networks and/or X.25-based equipment.

Trunk Parameters

The following trunk parameters are set at the factory:

K	Known also as the frame or HDLC window, this parameter indicates the maximum number of information frames that can be unacknowledged at any given time on the X.25 trunk between the PAD and the Network. The factory setting is 7.
T1	The T1 timer protects against loss of frames between the PAD and the Network. Both sides of the circuit must have the same timer value. The factory setting is 5.
N2	This parameter specifies the allowable number of times an unacknowledged frame can be retransmitted before the link is reset. The factory setting is 10.
Link Assurance Timer	To ensure that the X.25 trunk is operational, you can configure the PAD to use the X.25 link-assurance procedure when it detects no activity on the trunk for the duration of the timer. The factory setting is 15 seconds.
w	This parameter indicates the maximum number of packets which can be unacknowledged at any given time for each of the PAD's established X.25 calls. The factory setting is 2.
Packet Size	The packet size defines the maximum number of characters that the PAD will insert into a Network-bound packet. It also defines the maximum number of characters the PAD can expect in an in-bound packet. The factory setting is 128 bytes.
Segment Size	The PAD maintains a segment counter for networks that use the segment as the chargeable unit instead of the packet or character. The factory setting is 64 bytes.

If you need to change any of the factory settings listed above, refer to the section entitled "Trunk" in Chapter 5.

Virtual Circuits

The most striking feature of packet switching is the ability to have virtual circuits (also referred to as logical channels). In a virtual circuit approach, a route between stations is established prior to data transfer. Virtual circuits allow you to support multiple simultaneous communications sessions with only one physical connection—the X.25 trunk.

It is important to select the number and type of virtual circuits (switched or permanent) to achieve optimum use of the PDN and the X.25 trunk. The number of virtual circuits dictates the number of simultaneous sessions that you can support over the X.25 trunk. This number can be less than, equal to, or greater than the number of physical channels. It is fully dependent on your operational requirements.

The PAD supports concurrent PVC and SVC operation over the X.25 trunk.

The factory setting for virtual circuits is as follows: the number of PVCs is set to zero, and the number of SVCs is set to the number of physical channels, plus two.

Theory of Operation

Permanent Virtual Circuit (PVC). A PVC is a subscription option that is specified when you order an X.25 Access line to a PDN. From a user viewpoint, a PVC is a permanent logical connection between two end-points over the network. It is comparable to a point-to-point leased line. You select a PVC when you require that a device connected to the PAD only communicates with a predefined destination.

The use of the PVC eliminates the need for the user to initiate any connect or disconnect procedures.

- For each PVC that you subscribed to, you must associate one of the PAD's channels (1 through 16).
- The Network identifies each PVC with a unique logical group number (LGN) and logical channel number (LCN). Permissible values are: 0 through 15 for the LGN and 0 through 255 for the LCN. You cannot define a PVC with both the LGN and LCN set to 0.
- An asynchronous channel defined for PVC operation cannot be used to call different destinations. This service is basically a "logical" point-to-point dedicated connection.
- Refer to Chapter 3 for further details.

Switched Virtual Circuit. A switched virtual circuit (SVC) is required for each virtual call. A virtual call is set up dynamically when one device attached to the PAD needs to communicate with another device connected to the PDN.

The Network identifies each SVC with a unique logical group number (LGN) and logical channel number (LCN). The permissible values are: 0 through 15 for the LGN and 0 through 255 for the LCN. You cannot define SVCs to use any LGN/LCN number defined for PVC use. The total number of SVC's plus PVC's cannot exceed 18.

Typically, the PDNs differentiate between the various types of virtual circuits by the appropriate allocation of the LGN.

- You must configure all logical group numbers and logical channel numbers assigned to you for operating switched virtual circuits.
- You should subscribe to SVCs which have both incoming and outgoing call capabilities.
- To restrict the number of calls in each direction, restrict some of the PAD channels to either or to both calling directions rather than subscribing to one-way SVCs. Once a call is established, data transfer always occurs in both directions.
- If your PAD is connected to the TRANSPAC/France Network or to equipment that functions like TRANSPAC, configure the LGN and the LCN of one of the SVCs to 0.
- Do not configure unassigned numbers or more circuits than you have subscribed to. You can set the PAD to ignore calls or to restart the trunk when it detects an incoming call over an undefined circuit. This condition results in performance degradation.
- If you place a call and the Pad is configured as a DTE, the PAD will use the highest numbered, free logical channel defined for SVC operation. If the PAD is configured at a DCE, it will use the lowest numbered, free logical channel. The Network's incoming call uses the lowest numbered, free logical channel. If you configure more logical channels than you have subscribed to, the Network will clear the PAD's call requests and indicate a local procedure error.

X.25 and National Facilities in Network-Bound Calls

The PAD supports a number of X.25 facilities that you can request on a per-call basis. Consult your Network to determine which facilities are available. You may also need to subscribe to one or all of the facilities you expect to use. Networks vary in the number of X.25 facilities that they support. Some networks do not support all of the facilities and other networks support non-X.25 facilities, referred to as National facilities.

Using X.28 Connect Command. When you initiate a call you can use a Facility Request Indication Code to specify the requested facility. When the PAD detects one or more of these indication codes in the X.28 Call Connect Request Command, it performs the necessary encoding of the Call Request Packet. For information on the complete format of an X.28 Call Connect Request Command, refer to the section titled "Placing A Call," later in this chapter.

Supported Facilities. The following Information describes the indication code and facility request:

<i>Indication Code</i>	<i>Facility Request</i>
G + ID	Closed user groups and associated two-digit ID assigned to the closed user group by your network
R	Reverse charging
F	Fast select
P	Packet size negotiation or DATAPAK priority code
D	Throughput class negotiation

Other Facilities. To incorporate other facilities in the Call Request Packet, you can use a free format syntax in the X.28 Call Connect Request Command.

■ **Note:** Separate individual facility codes with commas. Terminate the Facility field with a `-`. Use the following format:

```
$Xcc=pp:pp:....pp
```

Where:

cc=facility code in hexadecimal

pp=facility parameter field in hexadecimal

For example: To request RPOA 1234, enter:

```
$X44=12:34
```

You can also specify a non-X.25 (National) facility by using the free format syntax:

```
$Ncc=pp:pp:....pp
```

Where:

cc=facility code in hexadecimal

pp=facility parameter field in hexadecimal

Please consult CCITT proceedings and/or your Network guide for the coding of different facilities.

■ **Note:** When National facilities are specified, they must follow the X.25 facilities. The PAD will separate the X.25 facilities from the National facilities, using the CCITT National marker when the Call Request Packet is encoded.

Theory of Operation

Using Abbreviated Connect Command. You can also predefine the X.25 facilities using mnemonic addressing. In this case, you can preconfigure the facility indication code associated with each mnemonic. For security purposes, the user cannot override the predefined facilities when mnemonic addressing is used. For information on mnemonic definition, refer to, Address ID, in Chapter 5.

Using Automatic Facility Requests. In addition to facility request codes on a per-call basis, the PAD can be configured to automatically encode all Call Request Packets with one or more X.25 facilities. For example, you can configure the PAD to issue all calls with reverse charging. In addition to reverse charging, you can also configure the PAD to encode all calls with packet size and window size negotiation facilities (see the section titled "Trunk" in Chapter 5).

PAD processing of Facility Requests. In addition to encoding the facility field of the Call Request Packet, the PAD processes facilities request codes as follows:

<i>Facility</i>	<i>PAD Action</i>
Throughput Class	When the PAD detects a throughput class facility request, it will encode the facility parameter field with the throughput class code equivalent to the speed of the calling device. If the remote PAD is another Codex PAD, it will attempt to use this code to match the calling device with a channel of the same speed.
Fast Select	When the PAD detects a Fast Select request, it will prompt you for an entry of up to 124 bytes (you can enter up to 256, but only 124 will be transmitted, and the rest discarded). The entry will be inserted in the call user data field of the Call Request Packet. The PAD supports "Restricted Fast Select," which means that the destination device cannot convert the call into a normal call. For Restricted Fast Select, the response is a clear indication packet with up to 128 bytes in the call user data field.
Free Format Facilities	Not validated by the PAD.

Theory of Operation

X.25 AND National Facilities In Inbound Calls

You can configure the PAD to restrict incoming calls on the basis of the requested facilities. However, you must enable reverse charge calls if you expect users to access the PAD through the dial-in access ports of the public packet data network. You may also want to enable reverse charging if you want to receive billing at a single location or if the network tariff

structure offers a volume discount based on the volume of data transmitted and received at a single location.

If you want to accept Fast Select calls, enable the Fast Select facility.

PAD Processing of Incoming Facilities. When incoming call packets specify X.25 facilities, the PAD performs the following functions:

<i>Facility</i>	<i>PAD Action</i>
Closed User Group	No action.
Packet Size Negotiation	If the trunk packet size is configured for 256 bytes and the requested packet size is 128 or 256 bytes, the call is accepted. A Call Accept Packet is transmitted with a confirmation of 128- or 256-byte packet operation for both transmit and receive directions. Asymmetric packet-size requests will not be accepted.
Window Negotiation	The call is accepted if the window size is larger than 2 but less than 7. A Call Accept Packet is transmitted with a confirmation of 2 and 3 through 7 for both transmit and receive directions. Asymmetric window-size requests will not be accepted.
Reverse Charge	If you enable Reverse Charge acceptance, the call is accepted. You may also have to subscribe to this facility with your Network in order for the call to be routed to the PAD.
Fast Select	If you enable Fast Select acceptance, the user at the receiving channel is prompted for a response of up to 128 bytes (the user can enter up to 256 bytes, but only 128 will be transmitted, and the rest discarded). The user or device has approximately two minutes to enter this data. The PAD will forward the response in the clear request packet.
Throughput Class	When the PAD detects a throughput class facility in an incoming call, it will decode the throughput class code to determine the speed of the calling device (75, 150, 300, 600, 1200, 2400, 4800, or 9600 bps). It will then attempt to perform speed-matching with one of its channels, as described in Speed Matching, later in this chapter. When the call is accepted by the receiving device, the PAD will transmit a call accept packet indicating the speed of the assigned channel.
Non-X.25 Facilities	The call is accepted.
Other X.25 Facilities	The call is accepted.

Trunk-Out-Of-Order

The following paragraphs describe the PAD's response to a physical or a logical trunk disconnection. The information also describes the effect of a trunk disconnection on the PAD's dial-in channels.

Physical Disconnection

- Temporary Failure

The PAD will sustain a loss of DCD or DSR signals for up to a length of time specified by the following formula:

$$2 \pm N2 \pm T1 + \text{link Assurance Timer value}$$

Based on the default parameters settings, this value is equivalent to 115 seconds.

- Permanent Failure

If the link assurance procedure fails, the PAD will clear all switched virtual calls in progress and reset all permanent virtual circuits. The clear/reset service signal will contain the appropriate diagnostic code, indicating a trunk failure.

The PAD's LD indicator will go on and all dial-in and dial-out devices will be physically disconnected.

Logical Disconnection

- Temporary Failure

When the PAD enters the disconnected phase because of protocol errors or internal malfunctions, it automatically tries to reestablish operation by continually transmitting a DISC Command; it then waits for a UA response to resume frame and packet level reestablishment procedures.

- Using a Command

If the trunk is logically disconnected by the Trunk Down Command, the PAD will be in a disconnected phase. It will continue to transmit a DM response to any received command until a Trunk Up Command is issued using the Command Facility.

Effect of Trunk Failure on Channels. If the trunk is disconnected either logically or physically, the PAD will raise the Busy Out (BO) signal on pin 22 of all channels configured for dial-in operation. This causes the attached dial-in modem to take the phone line off-hook. Where two or more PADs are collocated and the phone lines are configured as rotary, the incoming telephone call will be routed to the PAD that has its X.25 trunk up. You must strap the modem to honor this busy signal otherwise, the PAD will answer the call when an incoming ring occurs.

Trunk In-Service

The PAD will reinitialize the trunk when one of the following conditions occurs:

- You initiate a Trunk Up Command using the Command Facility
- You initiate a PAD Reset Command
- You physically reset the PAD

When any one of these conditions exists, the PAD reinitializes the trunk by transmitting a DISC Command and waiting for a UA response. When it receives the UA response, the PAD resumes frame and packet level reestablishment procedures.

When the restart procedure reestablishes operation at the packet level, the PAD considers the trunk status to be up and turns the LD indicator off.

Effect of Reestablishing Trunk Operation. After reestablishing trunk operation, the PAD will automatically try to reconnect all channels configured for "fixed speed and parity" and "dedicated" and "Autocall on Device Ready." However, this will only occur if the device is still connected and powered-on.

Packet Description

All data transmitted over the X.25 trunk is in packet form. The PAD does not change or rearrange data received from a device. It simply assembles received characters into packets and received packets into characters.

Networks normally support information in packets containing up to 128 bytes of user data. However, some networks can handle a larger packet size. For example, the normal arrangement for DATAPAC is 256-byte packets. The PAD can support 128- or 256-byte packets for both incoming and outgoing packets.

To permanently operate a particular packet size, you must negotiate with your Network administration. With this kind of permanent arrangement, you can configure the PAD's trunk to support 128- or 256-byte packets.

In addition, some networks support a negotiation facility at call set-up time to determine the packet size. Others demand a Packet Size Negotiation Facility Request at each call setup. To support the mandatory packet size negotiation, you can configure the PAD to automatically issue a Packet Size Negotiation Request for every outgoing call. The value of the packet size used for this negotiation is as configured for the trunk.

If your normal operational mode is based on 256-byte packets and you wish to selectively issue a 128-byte packet size negotiation facility on a call basis, use the P Facility Indication Code in the X.28 Connect Command. ■ **Note:** If your PAD is connected to DATAPAC/CANADA, you must use this procedure to issue a Priority call. However, first you may have to change the On/Off setting of one soft switch selection until DATAPAC completes their implementation of the X.25 packet size negotiation. This will cause the PAD to encode the Call Request Packet to be compatible with DATAPAC.

Number of Characters in a Packet. The actual number of characters in a packet can vary. As soon as the PAD detects a forwarding condition, it forms a packet and forwards it to the Network. For example, the PAD may send a packet to the Network every time it receives a "carriage return" character or after an "idle period" has elapsed following receipt of the last character. The packet utilization is controlled by two major factors:

- The amount of data activity as dictated by the user application
- The configuration of the packet-forwarding parameters to offer a balance between packet character density and optimum response time.

The amount of data in a packet has a serious effect on the response time and charges incurred over the Network. While transmitting full packets is the most cost effective, it may not be the ideal answer to your application. On the other hand, you should limit the occurrence of single character packets. This condition represents a serious degradation of the trunks' useful bandwidth. To help you strike an optimum balance between response time and cost, the PAD supports a comprehensive array of functions and forwarding conditions that you can select on a channel basis. You are given full control over these parameters. However, you must apply careful judgement when you specify these values.

Packet Window. The Packet Window is a mechanism used to restrict the number of packets that the Network or the PAD can accept on any logical channel at any given time. The size of the window refers to the maximum number of transmitted packets that have not been acknowledged at any given time. Allowable packet window values are 2 through 7. To enable extended packet sequencing for networks such as Japan's KDD, selection 5 of soft switch group SYS 1 must be on.

A window size of 2 is the PAD default value and is satisfactory for most users. In certain circumstances, you may desire a different size. Some networks offer a permanent arrangement to support a window size of 2 through 7. Other networks that support an extended Call Request format require that each call be coded with the Window Size Negotiation facility. You can configure the PAD to automatically code each call request with a Window Size Negotiation facility. The value of the window size will be the same as configured for the trunk window parameter.

M-Bit Support. The Codex PAD sets the M-bit in full packets under the following conditions:

- When the edit mode is enabled the PAD will wait for the 129th character. If it is received before a data forwarding character and the packet size is configured for 128 bytes, the first packet of the two 128-byte editing buffers will have its M-bit set. The second packet, formed by the 129th to 256th bytes of the editing buffer, will not have its M-bit set, even if it is full.
- When the packet size is configured for 128 or 256 bytes and idle timer forwarding (Parameter 4) is enabled, the PAD will wait for the 129th or 257th character. If the PAD receives it before a data forwarding character (if defined using Parameter 3) or before the idle timer expires, each full packet, except the last packet, will be transmitted with the M-bit set.
- When Parameter 106 (Character-Count forwarding) is enabled and the count is greater than 128 bytes, the PAD will wait for the count to be reached. If no data forwarding conditions occur prior to receiving the 129th character, the PAD will set the M-bit in the first 128-byte packet. The character count has a maximum value of 255. Hence, this condition cannot affect the M-bit setting of 256-byte packets. ■ **Note:** Incoming packets are forwarded to the attached device as they arrive with no special M-bit treatment.

Trunk Password

You can protect your PAD against unauthorized access by defining a trunk password. Specifically, this means that call requests for your PAD must have the proper password in octets 5 through 8 of their 16-octet call use data field. If you enable the call user data method of subaddressing, the trunk password must be in octets 7 through 10. Typically, the caller has no control over octets 1 through 4. A caller's failure to include the proper password will result in the PAD rejecting the call with a diagnostic code equal to 133.

ASYNCHRONOUS DEVICE SUPPORT

In a typical minicomputer/terminal system (see Figure 3-1) using point-to-point leased lines, the minicomputer directly controls such functions as:

- Character echo
- Control character sequence
- Editing
- XON/XOFF
- BREAK handling

Application programs use this control ability to perform cursor positioning, selective echo, echo suppression, and other functions for CRT and printer devices. When this type of system is connected over an X.25 PDN, the operation changes from character-oriented operation to block-oriented or packet-mode operation. See Figure 3-2. This results in the computer losing synchronization with the terminal and subsequent loss of control.

To keep the application programs unchanged and most of the computer and terminal operational procedures in place, the PAD must take over the asynchronous terminal handling that the host computer previously handled. To satisfy this requirement, Codex PADs fully support all 20 CCITT X.3 parameters (see Table 3-1) and an additional set of 18 parameters. You can use these parameters to support a wide variety of asynchronous equipment. You can also use them to reestablish control over the terminals in the remote sites and to reduce overhead on the X.25 trunk. The parameters accomplish this by performing many functions that the host computer would otherwise have to perform (host computer handling always involves greater transmission of data).

Collectively, the 38 parameters are grouped in a "device profile." The PAD supports up to eight user-defined profiles that you can assign to the PAD's individual asynchronous channels.

By configuring each of the device profile parameters, you can adapt the resources of the PAD, on a per-channel basis, to the characteristics of the attached start/stop device and/or the application program to which the device is logically attached.

Theory of Operation

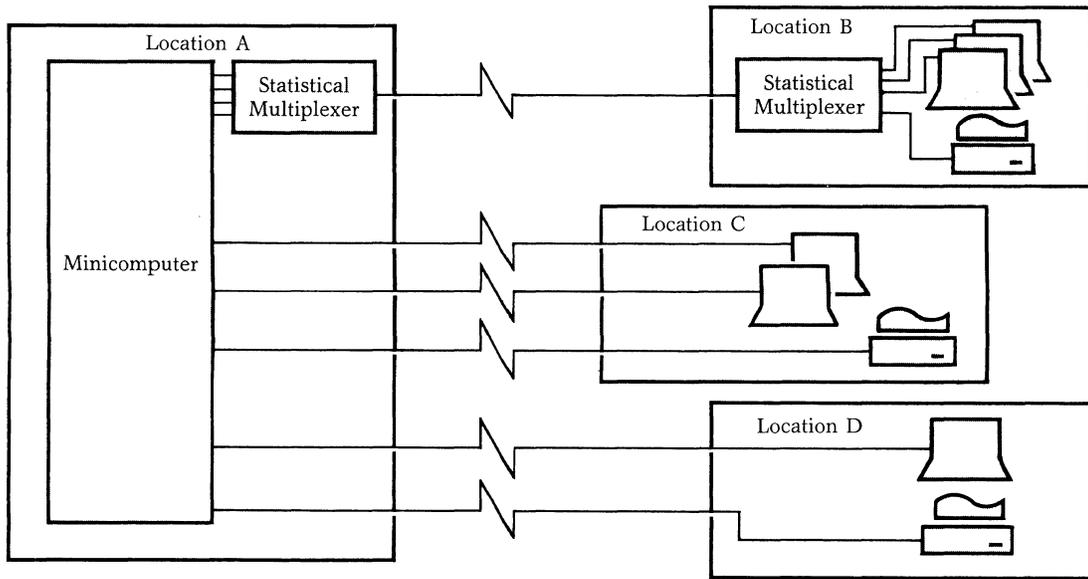


Figure 3-1. Typical Minicomputer/Terminal System

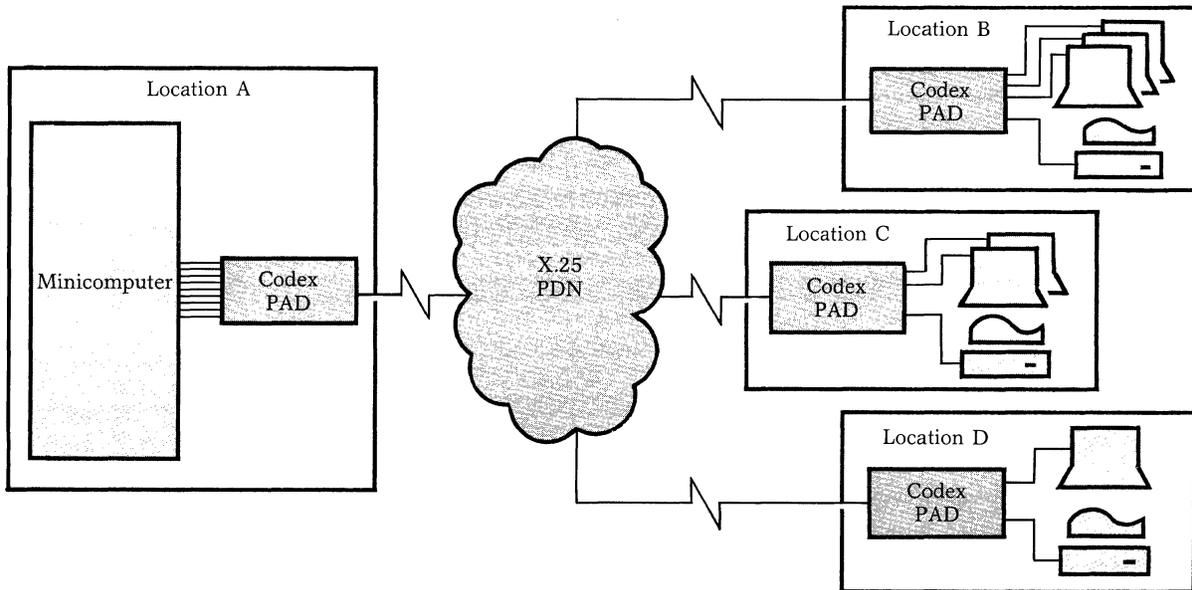


Figure 3-2. Minicomputer/Terminal System Using PDN Facilities

Theory of Operation

Table 3-1.
Device Profile Parameters

<i>Parameter</i>	<i>Reference Number</i>
PAD Recall	1
Echo	2
Data Forward	3
Idle Timer	4
Device XON/XOFF	5
Service Signal	6
Break Handling	7
Discard Output	8
CR Padding	9
Line Folding	10
Speed	11
PAD XON/XOFF	12
Auto LF Insertion	13
LF Padding	14
Edit	15
Char. Delete	16
Line Delete	17
Line Display	18
Device Type	19
Echo Mask	20
Bits per character	100
Device Parity	101
Network Parity	102
XON Char.	103
XOFF Char.	104
Enhanced Flow Control	105
Data Fwd Count	106
ESC Timer	107
Sp Break Char.	108
Temp Echo Supp Char.	109
Echo Subst Char.	110
Echo Control	111
Special Echo Seq. ID	112
Page Length	113
Form Feed Character	114
Form Feed Padding	115
Inactivity Timer	116
X.29 Access Char.	

■ **Note:** The Codex-enhanced parameters are numbered 100 through 117. The CCITT parameters are numbered 1 through 20.

When a device profile is assigned to a channel (using the Command Facility) the behavior of the channel is basically controlled by the values of the parameters in the profile. However, the X.28 commands can modify these parameters when a device is physically connected to a channel. In fact, you can assign an alternate profile to the channel in order to satisfy the requirements of a single calling session. When a call is in progress, the destination device can use X.29 messages to alter the parameters.

Any alteration of this type is only valid for the duration of the call. As soon as the call is cleared, the initial device profile parameters are reinstated to that channel.

In the following paragraphs, the parameters that are included in a device profile are grouped by major function. This format shows the relationships between different parameters and how they can affect your operation. This information should help you determine how you can effectively use device profiles in your application.

Data Character Definition

The Codex PAD allows you to define the format of data characters to be received or transmitted. Character definition parameters include: the number of data bits, the parity type, and the number of stop bits.

Data Bits Per Character. The PAD supports characters which consist of 5, 6, 7, or 8 data bits plus a parity bit. For terminal applications, Parameter 100 is normally set to 7-bit characters. Eight-bit support should be configured for host computer channels and graphic terminals.

Fixed Parity. The PAD supports Even, Odd, Mark, Space, and Transparent parity. To configure 5 or 6 bit characters with Transparent parity, use Parameter 101. For 8-bit characters, Transparent parity means no parity. If you require 9-bit character support, configure the character for 8 bits and set the parity to either Odd or Even.

Autoparity Recognition. For 7-bit character operation, you can also use parameter 101 to configure the PAD for fixed parity or for autoparity recognition. If you select autoparity, the PAD will determine the parity dynamically when a channel logon sequence is received. The channel logon sequence <CR> . <CR> (<CR> means user-entered; CR means transmitted without user entry). The selection of autoparity automatically selects autobaud recognition.

Theory of Operation

Parity Checking. For 7-bit characters, the PAD will check the parity of device-generated characters. A parity check will cause the PAD to generate a "?" to the attached device. If the bad character is not corrected using the editing functions, the data forwarded to the host will include a "?" in lieu of the character.

Network Parity. You can configure the PAD to pass data transparently or to perform parity conversion to the Network. When you enable Parameter 102, the PAD will replace the parity bit of the character received from the device with the bit that corresponds to the type of parity specified as Odd, Even, Mark (1), or Space (0) before forwarding the character over the X.25 trunk.

Each virtual call can support a different network parity to accommodate different remote devices. This is particularly useful when the host computer cannot support the full combination of parity options.

Stop Bits. The number of stop bits is a function of the data rate. At 110 bps, the number of stop bits is set to 2. At 50, 75, and 134.5 bps, the stop-bits setting is 1.5. At 300 bps and higher speeds, the number of stop bits is set to 1.

Data Rate

The PAD lets you select a channel's data rate or lets you define the channel as an autobaud channel. Use Parameter 11 to perform either function.

Asynchronous Speed. The PAD supports the following asynchronous data rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, and 9600 bps.

Autobaud Recognition. For a channel that supports a dedicated physical connection, the channel would typically be defined to operate at one of the fixed speeds using Parameter 11 of the profile assigned to the channel.

For a dial-in channel or in applications where the PAD is front-ended with a Data PABX, you can configure the channel for autobaud recognition. The PAD will then determine the speed dynamically when it receives a channel logon sequence (<CR> character). In this mode, the PAD can detect all speeds in the 110-9600 bps range except 134.5 bps. There is no requirement for a Low or High speed signal from a dial-in modem. ■ **Note:** You can only perform the autobaud recognition when the channel is configured for 7- or 8-bit characters.

For a dial-out channel configured for autobaud, the PAD will generate an outbound sequence of characters to autobaud the attached device when an incoming call is received.

Echo Control

The PAD allows character echoing to be enabled or disabled. It also allows selective echoing.

Echoing User Input. In a typical leased line or dial-in minicomputer/terminal system, configure the computer ports and terminals for full-duplex operation. They rely on the computer to perform the echoplex function. The echo function confirms receipt of the keyed character retains control of where the echoed character is displayed on the terminal.

In a packet-switched environment, the PAD (not the host computer) is normally configured to perform this echo function in the remote terminal sites. Local echo by the PAD results in faster response, better utilization of the X.25 trunk, and enables the application program to preserve data integrity.

At the host computer site, configure the PAD and the computer to which it is connected for no echo.

Parameter 2 controls the character echo function of the PAD.

Selective Echoing. The PAD allows you to select which character to echo and which to pass without echo for host computer action. Typically, you would specify echo of all displayable characters and some control characters. The decision as to which control characters the PAD should handle locally depends entirely on the application terminal and computer capabilities.

Parameter 20 (Echomask) instructs the PAD to echo selected groups of characters.

Handling Escape Sequences. The use of Escape Sequences (ESC) in computer systems is quite common. The ESC character is normally followed by qualifying characters specifying the type of ESC sequence requested by the terminal user. In a leased-line system each character is transmitted directly to the host computer and processed accordingly. In order to simulate this environment, the PAD ensures that all characters following the ESC are not echoed to the generating device. Parameter 107 defines this special ESC sequence. The echo of the ESC character itself is controlled by Parameter 20 (Echomask).

Theory of Operation

Selective Echo Control. When the computer handles echo, user passwords are not normally displayed at the device. Using packet data networks with echo disabled at the host computer can create a security problem. The remote PAD cannot distinguish a password from normal data entry. The selective echo control capability allows the Codex PAD to suppress echo on receipt of a user-defined character from the user's terminal. Refer to Parameter 109 for the definition of this character. Echo is then reenabled when a forwarding condition or subsequent input of the echo suppression character is detected.

When echo is temporarily suppressed, an echo substitution character, defined by Parameter 110, will be echoed instead. However, it is only echoed if it is part of the characters to be echoed as specified by Parameter 20 (Echomask).

Special Echo Sequence. The Special Echo Sequence enables the Codex PAD to emulate a host computer system where a sequence of characters is echoed in response to receipt of a single ASCII character from the attached terminal. For example, you can use this to erase the CRT terminal and position the cursor at the home position when a particular key is pressed. Special Echo is enabled only if Echo, Parameter 2, is set to 1.

Each device profile can be associated with any one of three sets of echo sequences specified by Parameter 112. Each set contains up to eight different echo sequences and associated input trigger characters.

The input trigger character will cause previously accumulated data to be forwarded. The trigger character itself is not forwarded.

Input/Output Data Priority

Use Parameter 111 to configure the PAD to emulate host computer handling for both character input and character output.

Output Priority. In a full-duplex CRT environment, the computer can reposition the cursor, output data, and then return the cursor to a previously known position. In this fashion, the host computer preserves screen integrity. Likewise, for a printer, the host can be programmed to reecho the users' input on the next line.

To emulate host computer character handling, the Codex PAD offers a similar capability by setting Parameter 111, Enhanced Echo Control, to 2. Using this parameter, the character-handling operations of the host computer are not changed. Once the computer output is forwarded to the attached device, the PAD will reecho any data that may have been previously accumulated to the device.

Input Priority. In a conventional host echo-plex environment, you can configure the host to suspend output to the terminal when the user is keying in data.

In a packet-switching environment, the PAD performs the echo. In this environment, the host computer has no way of knowing when the user is actively keying in data. The host will write to the device when it is ready. This can result in corruption of the user input from being displayed or printed.

When Enhanced Echo Control (Parameter 111) is set to 0, the PAD will hold the output that is destined to the device, until it detects one of the following conditions:

- A forwarding condition
- No keying activity for a certain period of time. The inactivity period is equal to the value of Parameter 4, Forwarding Idle Timer. This is true whether or not Edit (Parameter 15) is enabled.

No Priority. Parameter 111 (Enhanced Echo Control) enables you to define input; output priority, or no priority handling. When no priority (Parameter 111 = 1) is specified, the PAD will not hold the computer's output.

Formatted Screen Support

Formatted data-entry screens are normally supported over packet-switched networks by performing echo from the host computer. While this guarantees the integrity of the display format, it results in high overhead over the X.25 trunk. It also causes response time delays and higher packet charges.

This allows the host computer to indirectly control when input data is echoed by the PAD. Typically, the application that needs this will require that each input field be appropriately echoed against each prompt sent from the host computer. This is enabled by setting Parameter 111 to 4.

Theory of Operation

The PAD achieves this by echoing the user's input until a forwarding condition occurs. Additional characters from the terminal are accumulated during data entry. But, the PAD will not echo characters to the terminal or forward them to the host until a data packet is received for output to the terminal (typically cursor repositioning or field prompt) and the output operation has been completed. The characters accumulated for the second packet or field will then be echoed to the terminal and forwarded to the host. The Codex PAD will accumulate up to five fields, terminated with a packet forwarding condition, without echoing them to the attached terminal. At the end of the data entry function, the data displayed on the screen will reflect the input source document.

Editing

The PAD's editing capabilities enable any data that is input at an attached device to be edited prior to forwarding the accumulated data to its destination. In support of this, the PAD has a full editing package which you can invoke on a per-channel basis, under the following conditions:

- When the user is in X.28 mode
- During data transfer mode if Parameter 15 of the device profile associated with that channel is enabled

Editing Functions. When editing is on, Parameters 16, 17, and 18 define which input characters will cause the PAD to delete a character, delete the contents of the editing buffer, and/or re-display the contents of the editing buffer.

- Forwarding conditions are also affected when editing is on:

The PAD will not forward data when the packet is full, but will when the edit buffer is full.

The PAD will not forward data on character count (Parameter 106).

The PAD will not forward data on idle timer (Parameter 4).

Editing Buffer. To process editing functions, the PAD provides temporary storage for the user's input in a 256-byte editing buffer.

The PAD stops accepting characters into the editing buffer when it detects a forwarding condition (Parameter 3). The idle timer is not taken into consideration when editing is enabled.

When the PAD accumulates 256 bytes in the editing buffer, the buffer is full and the PAD will act as follows:

- If the next character is an editing character, the PAD performs the required editing function.
- If the next character is not an editing character, the PAD discards the character and all subsequent characters until a <CR> is entered. All data currently stored in the buffer is forwarded. The PAD also displays the message "edit line too long," unless Parameter 6 is set to 0.

Editing Signals. When the PAD detects Parameter 16, 17, or 18, it acknowledges the user's request by generating the appropriate service signals. Because CRTs and printer devices have inherently different capabilities (that is, the printer cannot erase a character once it has been printed), you can tailor the editing service signals to suit your device type using Parameter 19 (dv.type).

For a character delete function, the PAD transmits the character sequence BS SP BS to a display-type device. This sequence erases the last keyed data character and repositions the cursor for the replacement character. The PAD will not generate service signals for a printer.

For a line delete function, the PAD transmits the same sequence to a display. The sequence is repeated as many times as the number of characters being deleted from the edit buffer. For a printer device, the character sequence X X X CR LF is transmitted.

■ **Note:** Neither of these editing service signals will be transmitted if you:

- disable the PAD service signals by setting Parameter 6 to 0, and
- specify a hard copy device by setting Parameter 19 to 1.

For a line display function, the PAD transmits the character sequence CR LF (accumulated data) CR LF to either device type (CRT or printer).

Output Formatting

Several of the profile parameters let you specify the format of output. For example, with Parameter 10 you can define the number of characters to be output before the PAD automatically inserts a CR. This and related parameters are described in the following paragraphs.

Padding LF, CR, and FF Characters. The PAD can accommodate many different types of printing terminals by making allowances for mechanical delays associated with the movement of the print mechanism. It does this by inserting null (padding) characters after the LF, CR, or FF characters that are received from the host or are originated locally.

You can define up to 127 padding characters using Parameter 9 for CR, Parameter 14 for LF, and Parameter 115 for FF.

Line Folding. The PAD can accommodate many types of terminal devices by controlling the width of the output lines. For example, this allows the attachment of devices which support 40 to 132 characters a line. When the output reaches the count defined by Parameter 10 (line folding), the PAD will automatically insert a CR and an LF character. You may also disable this capability by setting the parameter to zero.

Line Feed Character Insertion. The PAD can insert an LF character in data transmitted to the device when it detects a CR character in incoming, outgoing, echoed data, or any combination thereof. You can control this behavior using Parameter 13.

Automatic Pagination. The PAD's pagination allows you to use forms of any length with many different types of hard-copy devices without any changes to your current applications programs. To enable automatic pagination, you need only specify the number of lines per page in Parameter 113. The PAD will automatically insert the required number of line feed characters when the end-of-page character defined by Parameter 114 is detected from the host computer.

Flow Control

To avoid data loss, the PAD may need to stop input on one or more of its channels. It can do this in one of two ways:

- CTS/RTS EIA (out-of-band) method
- XON/XFF Character (In-band) method

The PAD can also accommodate block mode terminals.

EIA Method. For devices that support EIA flow control (typically host computers), the PAD can be configured using Parameter 105 to lower its CTS lead to halt reception. When it is able to accept more data, it raises it. The device may also need to control data transmission from the PAD. If so, you will want to enable flow control in both directions.

When EIA flow control is enabled for both directions, the PAD will monitor lead 4 (RTS) to see if the attached device wants to exercise flow control.

Character Method. For devices that support XON/XOFF flow control, the PAD can be configured using Parameter 5 to issue XOFF to halt transmission, and XON to signal the device to resume transmission. Also, if the device can initiate flow control, the PAD can be configured using Parameter 12 to support flow control for both directions.

In order to accommodate different devices, you can define the XON/XOFF characters to be used for flow control. ■ **Note:** XON/XOFF characters are not forwarded or echoed if flow control is enabled. Refer to Parameters 103 and 104.

User Signaling. You may instruct the PAD to prompt a terminal user to stop entering data by issuing a BEL character when it invokes CTS flow control. This is enabled by setting Parameter 105 appropriately.

How the PAD Handles Block Mode Terminals. For non-block mode terminals, the PAD buffers are allocated dynamically to channels as required. The number of buffers allocated to a channel before the channel is flow-controlled is calculated dynamically, and is based on the systems' total buffer utilization. After the PAD attempts to flow-control an attached device, a maximum of 63 additional characters are accepted before the PAD begins to discard characters.

This method of buffer allocation and flow control presents problems for the following types of devices:

- Block mode terminals which do not respond to flow control and which may transmit up to 2K bytes of continuous data. Devices which respond to flow control, but may transmit a maximum of 512 bytes after flow control is initiated (for example, some minicomputers)
- The solution for both types of devices is the same. The change necessary for block mode support is the removal of the check (after flow control) that allows receipt of only 63 characters before data is discarded.

■ **CAUTION:** *This solution works only in half-duplex applications. Problems may arise if you attempt to use block mode in a full-duplex environment.*

After exercising flow control, a PAD set up for block mode will accept a minimum of 512 characters before it begins discarding data (it may actually accept more characters, depending on the activity of the other devices attached to it at that time).

To enable the PAD for block mode, selection 6 in soft switch group SYS 2 must be on.

Break Signal Support

The following paragraphs describe how you define the BREAK key, what action the PAD takes upon detecting a BREAK signal, and when the PAD generates a BREAK signal.

Break Key. In addition to the normal BREAK key, you can define an additional character that the PAD should interpret as a BREAK key. This is most useful for terminals and personal computers not equipped with a BREAK key. Refer to parameter 108.

Action on Break Detection. When BREAK is detected from the device in the data transfer mode, the PAD may:

- Take no action.
- Send a reset package.
- Allow the user to escape to the X.28 mode. This is the only available method to escape to the X.28 mode when transmitting transparent data.
- Send an Interrupt packet. If the destination device is another PAD unit but not a 6502 PAD, the Interrupt packet may be required to generate a physical BREAK signal to the remote start/stop device.
- Discard the output. This will cause the PAD to stop output to the device and discard all incoming packets until a Resume Output packet (an X.29 set message) is received.
- Send a BREAK Indication packet. When it is received by another 6502 PAD, this will result in a physical BREAK signal being generated to the remote attached device. An X.29 packet is also sent back by the receiving 6502 PAD to resume output.

You can specify any combination of these actions to meet your operational requirements by setting Parameter 7.

Generation of a Break Signal. The PAD will generate a BREAK signal when it receives an X.29 BREAK Indication packet from the Network. In addition to generating a BREAK signal, the PAD will issue an X.29 message to set X.3 Parameter 8 of the calling party to 0. This will enable the remote PAD to resume output.

Data Forwarding

Data collected from a channel is assembled into a packet until any one of the following conditions causes it to be transmitted.

Forwarding Conditions. The following information describes the different types of forwarding conditions:

- The PAD receives a termination character (also called a data forwarding character) as defined by Parameter 3.
- The PAD detects a BREAK key unless Parameter 7, action on BREAK, is set to 0.
- The PAD detects an X.28 mode recall character as specified by Parameter 1.
- The PAD detects an X.29 mode recall character as specified by Parameter 117.
- The PAD receives no characters during a period of time specified by Parameter 4 (Idle Timer), unless Editing is enabled using Parameter 15.
- The Packet (128 or 256 bytes) is full, unless Editing or Parameter 106 (Character Count Forwarding) is enabled.
- The PAD receives a number of characters that is equal to the character count specified by Parameter 106, unless Editing is enabled.
- The PAD detects a special echo sequence trigger character. This can also be used to cause the PAD to forward on data forwarding characters not covered by Parameter 3.
- The PAD detects an edit buffer full condition.
- The PAD will also forward accumulated data on expiration of the inactivity timer, specified by Parameter 116, before clearing the call.

Forwarding ESC Sequences. In some computer-terminal systems, it is necessary to forward a complete ESC sequence to the host in the same data packet.

This allows the user to instruct the PAD to override Parameter 3 by delaying data forwarding when an ESC character is detected. The ESC character, and all characters subsequently received during the delay time specified by Parameter 107, are transmitted over the Network in the same packet.

X.28 Mode

By setting Parameter 1, you can control whether the device connected to a channel should be allowed to issue any X.28 commands after establishing a virtual call.

X.29 Mode

You may control whether the device connected to a channel should be allowed to issue X.29 messages, by setting Parameter 117.

Inactivity Timer

You can configure the PAD to clear a call if it detects no data activity in either direction for a certain period of time. This period is defined by Parameter 116 (Device Profile Inactivity Timer). Because the resolution of this timer is one minute, you should configure this timer equal to the desired value, plus one.

CHANNEL CONNECTIONS

The PAD provides access to a wide variety of asynchronous devices, that is, visual displays, send and receive printers, RO terminals, data collection devices, and various computer systems.

You can connect terminals to the PAD with dial-in, leased line, or with local EIA 232-C cables. You can share the PAD between dial-in terminals or use it in a dedicated mode for several devices at a single location. In addition to supporting terminal devices, the PAD channels offer a very flexible interface for almost any asynchronous host computer. The ability to connect host asynchronous ports to the PAD allows any computer with dial-in or dedicated terminal support to use the packet data networks without changing the host software or hardware.

Support of these different device types is made possible by individually assigning appropriately configured device profiles to each channel. Also, each channel can be configured to support one of several EIA signaling methods to accommodate the requirements of the different attachments. The following paragraphs describe the EIA methods and how they affect the device connect and disconnect procedures. Table 3-2 describes the different types of channel connections.

Cabling

Because channels have an EIA-DCE, that is, modem appearance, you would normally use a standard EIA 232-C cable between terminal equipment and the channel.

The PAD channels also support the attachment of private wire modems or auto-answer modems, 212 and 103. In this case, you need to use a crossover cable between the modem and the channel.

For detailed information on these cables and cable numbers refer to the section "System Cabling" in Chapter 2.

Physical Connection Versus Physical Path

Throughout this document, a physical connection refers to successful completion of the EIA handshake procedures between a PAD channel and a device.

However, a call cannot be completed, and inbound data cannot be forwarded before this physical path is established.

For autobaud or autoparity channels, a connection is only established on successful completion of the speed and/or parity detection of the attached device. For fixed speed and parity channels, both physical connection and physical paths have the same meaning.

6502 X.25 Asynchronous PAD

Theory of Operation

Table 3-2.
Types of Channel Connections

Channel Option Number	Connection Type	Impact on the Channel's Operation
0	Dedicated	EIA Signals will remain High following a call clear.
	Dedicated with extended EIA Controls Enabled*	EIA signals will be dropped for 500 ms following a call clear.
1	Auto Answer	EIA signals will remain High for two minutes following a call clear.
2	Ring-Out	EIA signals will be dropped, following a call clear.
	Ring-Out with extended EIA controls enabled*	Following a call clear, EIA signals will be dropped for 500 ms. If DTR remains High, the EIA signals will be raised again.
3	Auto Answer	EIA signals will be dropped immediately following a call clear.
4	Ring-Out (with security)	Following a call clear, the channel will become available only upon DTR toggle.
	Raise DCD (with security)*	Following a call clear, the channel will become available only upon DTR toggle.
6	Raise DCD	EIA signals will be dropped following a call clear.
8	Host Port	The PAD will send an invitation to Clear message when a physical disconnect or clear service signal is detected. There will be a delay before data is output to the host port. This delay will be equal to the idle timer value (if that value is an even number), or equal to the idle timer value plus 128 (unless that value is already greater than 128).
16	Priority Channel	The channel will have a higher priority than other channels on the PAD.
32	Enable Call Accounting	Upon conclusion of a call, call accounting information will be obtained from the channel.
64	Disable X.28 Extended Mode	X.28 access will be restricted to the standard X.28 commands.
128	Micro 600 Line Interface Option	The channel will be able to interface with Codex's Micro 600 Data PABX.
xxx	Combination of Options	Options 0 through 6 cannot be combined with each other. Options 8 through 128 can be combined with each other, or with one of the 0 through 6 options.

* Call Option 64, Extended EIA Controls, must be used in combination with this channel connection type (refer to the section titled "Channel" in Chapter 5).

Channel Physical Interface

The channel interfaces are DCE EIA 232-C type, that is, each channel interface connector is wired to look like a modem. In accordance with EIA 232-C signal protocol, control of eight simultaneous signals is provided for each channel.

The control signals generated by the channel are:

Carrier Detect	lead 8
Data Set Ready	lead 6
Clear-To-Send	lead 5
Ring-Out (Pulsing)	lead 22
Busy-Out (Constant)	lead 22

The control signals monitored by the channel are:

Data Terminal Ready	lead 20
Request To Send	lead 4
Ring-In	lead 25

The data signals supported are:

Received Data	lead 3
Transmitted Data	lead 2

The type of connection configured for a channel determines the status of these leads in both idle and operational modes. In addition, you can suspend the operation on any given channel by invoking either the Busy-out or Disconnect Command from the Command Facility. Either one will cause a dial-in channel to raise BO on lead 22 (the Busy-out Command will take effect only upon termination of any call in progress). Also, the PAD will not monitor any input control signals on channels that are in the "busy-out" or "disconnect" state. Refer to the "Channel Control" section in Chapter 5 for details about these commands.

Dedicated Connection

All PADs are shipped with factory configurations to support dedicated connections on each of the channels. You would normally implement dedicated connections for devices that are colocated with the PAD by using an EIA 232-C cable that supports the leads previously outlined.

You can also attach devices with private wire modems when it is not possible to use a cable, or when a dial-in modem is not an acceptable alternative.

EIA Leads in Idle State. In idle state, a channel configured for dedicated support will maintain the output control signals DCD, DSR, and CTS High, for leads 8, 6, and 5, respectively. See Table 3-2 for the status of the EIA signals following a call-clear condition.

Physical Connection. Physical connection is considered complete when either one of the input controls signals (lead 20 or 4) is High. However, if EIA flow control is enabled for that channel (that is, Parameters 5 and 12 are set to 0, and Parameter 105 is set to 3), only lead 20 will be considered a valid input to establish the connection.

An incoming call, routed to a dedicated channel, will only be accepted if the physical path is established. If you expect to receive calls on a channel, you should configure it for fixed speed and parity support.

Physical Disconnection. The PAD will clear a call in progress on a channel when the incoming signals on leads 20 and 4 are dropped for more than 500 milliseconds. However, if EIA flow control is enabled for that channel (that is, Parameters 5 and 12 are set to 0, and Parameter 105 is set to 3), only lead 20 is considered a valid incoming signal for disconnection.

If the call is cleared by the Network or by the PAD, the channel will generate the appropriate X.28 service signals. The EIA status will be as outlined in Table 3-2.

Theory of Operation

Auto Answer (Ring-In) Connection

Auto answer support allows the channel to support Bell 212 or compatible modems. You normally use the auto answer support when you want to access the PAD over the telephone network.

EIA Leads In Idle State. In idle state, a channel configured for dial-in support will maintain all EIA leads Low. The exception is when it is in the Busy-Out state. Then, it will maintain its BO (lead 22) permanently High.

The status of the X.25 trunk can also affect the EIA status of the dial-in channel.

Physical Connection. When a channel is enabled (not busied-out), the PAD will search for a ring-in indication on input lead 25. When RI is received from the attached modem, the PAD will raise EIA leads 6 and 8 (viewed by the modem as DTR and RTS) and wait up to one minute for input leads 4 and 20 to be raised. These are the modem DCD and DSR leads. If input leads are not raised within the one-minute time period, the PAD will drop the DTR and RTS leads.

A physical connection is considered successful at the conclusion of this handshake procedure.

Physical Disconnection. The PAD will clear a call in progress on a channel when the incoming signal on lead 20 or 4 (the modem DCD and DSR leads) is dropped. However, if EIA flow control is enabled for that channel, a loss of signal on lead 20 (DSR) will cause the call to be cleared (the DCD lead will have no effect).

The PAD will also drop the EIA leads if the user fails to establish a call within two minutes or makes four unsuccessful call attempts.

If the call is cleared by the Network or the PAD, the channel will either drop the EIA leads immediately, or it will wait for two minutes or four retries for the user to initiate another call. EIA signals will remain High for two minutes when channel option number 1 is selected. EIA signals will be dropped immediately when channel option number 3 is selected.

Ring-Out Connection

The ring-out capability allows a computer with dial-in or dedicated terminal support to use the Packet Data Network with no changes to cabling, computer hardware, or software.

Two EIA signaling methods are provided to indicate an incoming call to the host: pulsed ringing and constant ringing (raise DCD).

EIA Leads In Idle State. In idle state, a channel configured for ring-out support will maintain all EIA leads Low.

Pulsed Ringing. This method allows a channel to emulate a Bell 212 or compatible modem.

- *Physical Connection*

When an incoming call is routed to a ring-out pulsed ring channel, the channel will pulse EIA lead 22 (BO) up to five times in a cycle of 2 seconds on/4 seconds off.

During this period it will wait for lead 20 (DTR of the attached port) to become High before it raises leads 6 and 8 (DSR and DCD). Subsequently, it will wait for lead 4 (RTS) to become High before it raises lead 5 (CTS).

The PAD will only accept the incoming call if DTR and RTS are detected during the allowable ring time of 30 seconds.

- *Physical Disconnection*

The channel will drop the EIA leads and clear the call in progress if the signal on lead 20 (DTR) disappears for more than 500 milliseconds. It will also drop the EIA leads when the call is cleared from the network or by the PAD. See Table 3-2 for EIA leads status following a call-clear condition.

Additional security is provided when channel option 4 is selected. Following a call clear, a channel configured with channel option number 4 will not be available for incoming calls, until DTR is toggled. Following DTR toggle, the channel will again be available to accept calls.

 Theory of Operation

Constant Ringing (Raise DCD). This method allows a channel to emulate a dedicated line, that is, a nonswitched modem.

- *Physical Connection*

When an incoming call is routed to a ring-out constant ring channel, the channel will raise lead 8 (DCD) and wait for lead 20 to become High before it raises lead 6 (DSR) and lead 5 (CTS).

- *Physical Disconnection*

The channel will drop the EIA leads and clear the call in progress if the signal on lead 20 (DTR) disappears for more than 500 milliseconds. It will also drop EIA leads when the call is cleared from the Network or by the PAD. See Table 3-2 for the status of the EIA signals following a call-clear condition.

Additional security is provided when channel option 4 is selected. Following a call clear, a channel configured with channel option number 4 will not be available for incoming calls until DTR is toggled. Following DTR toggle, the channel will again be available to accept calls.

Host Port

When channel option 8 is selected, the channel behaves differently following a physical disconnect or during data output.

Priority Channel

Data coming through each channel is grouped in a first-in/first-out queue for forwarding to the Network. When the PAD is used as a host front end, you can reduce the impact of batch type transmissions (printer-bound) over interactive data (terminal-bound) by assigning the terminal-bound data a high priority. This capability can be configured on a per-channel basis.

Enable Call Accounting

A channel is configured for call accounting, when channel option number 32 is selected. Upon conclusion of a call, call accounting information will be obtained from this channel.

Disable X.28 Extended Mode

When channel option 64 is selected, the channel user will be restricted to the standard X.28 commands.

PAD Action On Data Loss

A possible network data-loss condition, on a given virtual circuit, is signaled to the user with a reset service message. Data loss can also occur when the device attached to a channel does not obey flow control when invoked by the PAD.

If it is necessary, you can configure that PAD on a per-channel basis to clear an SVC instead of resetting the SVC when a data loss condition occurs. A PVC can only be reset.

User Connection Messages

When a connection is established, the PAD service signals are not inhibited using X.3 Parameter 6. The 6502 PAD issues the messages described in the following paragraphs.

Herald Message XX. The Herald Message is configurable, and XX indicates the PAD channel to which the user is connected. The channel number provides useful information for such functions as problem reporting. The Herald Message can be up to 32 ASCII characters.

The factory setting for the Herald Message is:

Codex 6502 ASYNCH PAD CHANNEL XX

Bulletin Message. This message follows the Herald Message and is also configurable. It is typically used for Network notices (that is, to advise users of events such as a planned system shut down). the Bulletin Message can be up to 120 ASCII characters.

X.28 Service Prompt. This configurable prompt follows the Bulletin Message. It will also be displayed when the PAD channel is ready to accept an X.28 command. The X.28 Prompt Message can be up to 16 ASCII characters.

The factory setting for the X.28 Service prompt is *.

ADDRESSING

The following paragraphs define the Network address (including a subaddress), and describe how the PAD handles address fields in both incoming and outgoing call packets.

Introducing X.121

CCITT Recommendation X.121 defines a universal numbering scheme for addressing devices. This numbering scheme ensures that a device on a public packet data network can be accessed using the same address from anywhere in the world.

A device is defined as any addressable entity connected to the Network via an X.25 access line.

X.121 Numbering Structure

Each device connected to the Network via an X.25 access line, such as a 6502 PAD and other X.25 equipment, is assigned a Network address. The X.121 numbering plan specifies an address of up to 15 digits with the following structure:

International prefix	This is a 1-digit prefix which is required by some networks to determine that the call address belongs to another Network.
DNIC	This is a 4-digit data network identification code which uniquely identifies the public packet data network to which the called device is connected. The following are sample network DNICs: TELENET = 3110 TYMNET = 3106
NTN	This is up to a 10-digit terminal network number. The NTN portion of the address is not restricted, and the definition of its format is dictated by the different network administrations.

Subaddressing. The NTN is typically divided into two parts. The first part is used to route the call to an X.25 device connected to the Network. The second part is referred to as the subaddress. It is passed transparently (that is, not verified by the Network) for the device's own use. For example, a subaddress can be used by an X.25 host computer to determine which application is selected by the incoming call. The Codex PAD uses it to determine the channel where it should route the incoming call. The length of the two parts differ from one network to another. Typically a 2-digit subaddress is used, but some networks can assign up to four digits.

X.121 Support

The PAD fully supports encoding of the X.121 address structure for both outgoing and incoming calls. The following paragraphs describe PAD handling of the address fields, including the subaddress, in both incoming and outgoing call packets.

Incoming Calls

The following paragraphs describe ways in which incoming calls can be routed to the PAD.

Call Routing. The PAD supports a "class," also known as a "rotary mechanism," where an incoming call can request (that is, computer port, a particular device, and so on), by specifying the channel or the group of channels where the resource is attached. This is most useful when the PAD is acting as a front end to one or more host computers, or when PAD channels are connected to computer ports that support different applications programs. Using this method, a caller can address a particular computer or applications program by specifying the associated PAD channel in the call request.

When the PAD determines the rotary to which it should route the call, it will attempt to find a free channel in that rotary. If none is found, the call is cleared. If there is a free channel the PAD will initiate the EIA handshake procedures as outlined in the section titled Channel Connections earlier in this chapter.

Subaddressing Using the X.121 Method. If your Network supports X.121, you will normally configure the PAD for X.121 subaddressing. However, some networks offer 2-, 3-, or 4-digit subaddressing. The PAD may then have to communicate with devices that have subscribed to any of these subaddressing lengths. In order to accommodate this requirement, the PAD implements the following algorithm for determining the subaddress in an incoming call.

If the length of the called address is greater than the length of its own address by 1 or more digits, the least significant 1 or 2 digits of the called address will be considered as the "class rotary" requested. If the length is the same, the PAD will assume a class/rotary equal to 00.

 Theory of Operation

If your network only propagates the subaddress field (that is, AUSTPAC/AUSTRALIA and other compatible implementations), the length of the called address will be less than the length of the PAD's own address. In this case, the PAD will retain the least two significant digits (or one if there is only one) of the called address field for class/rotary selection.

Subaddressing Using the Call User Data Method. The call user data method can be used instead of the X.121 scheme when X.121 is not supported by your network. In this case, the PAD interprets octets 5 and 6 of the incoming packet's call user data field as being the requested class/rotary.

The channel selection mechanism (X.121 or call user data) can be combined with the trunk password to minimize the chances of routing an unauthorized call to one of the PAD channels.

Channel Addressing Rotaries. The PAD class selection allows remote callers to specify a class/rotary of channels where they want to be connected.

You can define one or more classes which consist of one or more channels. Each of the PAD channels can be assigned a class ID. You can define a rotary of channels by assigning the same class ID to more than one channel. Definitions of rotaries are normally based on operational criteria such as host type, application, speed, and so on.

Explicit Channel Selection. In addition to rotaries, the PAD allows you to route the incoming calls to specific channels. In fact, the PAD allows you to simultaneously support rotaries and explicit channel selection. This is achieved by assigning each channel two different class IDs. One class ID can identify the rotary to which the channel belongs. The second class ID can be used to uniquely identify the channel. If your application requires that a channel belong to two different rotaries, the second class ID can also be used to identify a second rotary.

Disabling Class Selection. The first class ID of the PAD channels are set to 0 at the factory. The second class ID is set to a value equal to the physical channel number (that is, class ID 2 of channel 1 is set to 1, class ID 2 of channel 2 is set to 2, and so on). If your operational requirements can be satisfied with a single rotary and you do not require the added security of subaddressing, you can subaddress field set to 00. In this case, it is not necessary to reconfigure the class IDs for each channel.

Accessing the Command Facility. The PAD also uses the class selection mechanism to route an incoming call to the Command Facility. Such a call will only be accepted if its subaddress is equal to the Command Facility's class ID. This ID is set to 99 at the factory. Refer to the section titled "Command Port" in Chapter 5 for instructions on changing the class ID. If you need to disable remote access to the command facility, you must set its class ID to 00.

Outgoing Calls

The following paragraphs describe addressing related to outgoing calls.

PAD Network Address. You should configure the PAD with the address assigned to you by your Network administration (the DNIC and the NTN, excluding the subaddress field). Refer to the section titled "Trunk" in Chapter 5 for configuration. The PAD will typically insert this address in the calling address field of all Call Request packets forwarded over the Network. Some networks check the validity of this number for each outgoing call. Other networks will the call if this address is present. To accommodate these networks, you may restrict the PAD from inserting its address in outgoing Call Request packets. You do this by using the out call parameter of the trunk.

You must, however, configure the PAD's address to:

- Execute Terminal-Activated Channel Test (TACTS or TACTR).
- Receive local calls.
- Allow channel selection by incoming calls.

Refer to Chapter 6 for a description of TACTS and TACTR. Refer to the section titled "Addressing" earlier in this chapter for routing of incoming calls.

PAD Channels Address. The PAD can also append the originating channel number (1 through 16) to the PAD address. This can be used by your destination to identify the calling party on your PAD.

Remote Destination Subaddress. Like the remote user who can use subaddressing to call the PAD, a local user can also use subaddressing when placing an outgoing call to another PAD (or to other equipment attached to the Network).

While the PAD uses the subaddress of an incoming call for channel routing purposes, you should investigate the interpretation of that field by other equipment. It can vary.

- Using an X.28 Long Form Connect Command

When a terminal user enters an X.28 Connect Command, he can indicate the subaddress digits by separating them from the main address field with a /. For example, the calling destination 12345 and a subaddress 22 can be specified as follows:

```
5C 12345/22*Calluserdata
```

- Using an X.28 Abbreviated Connect Method where AB=12345:

```
C .AB/22*Calluserdata
```

In the case of an abbreviated command, the 22 will override the subaddress field configured for mnemonic .AB. In both cases, the treatment of the 22 will be based on the method of subaddressing specified in the PAD's configuration (that is, X.121 or call user data method).

- The X.121 Subaddressing Method

If the X.121 subaddressing method is enabled, the subaddress digits 22 are appended to the main address 12345 and will appear as 1234522 in the called address field of the Call Request packet.

- The Call User Data Subaddressing Method

If the call user data (CUD) method is enabled, the subaddress digits 22 are automatically relocated to octets 5 and 6 of the call user data field. This causes any data present in that field to be shifted right by two positions. If you are using CUD subaddressing and your network supports X.121 subaddressing, you can still call a destination that uses X.121 subaddressing. You can achieve this by defining the subaddress as part of your main address field.

If you need to specify a subaddress greater than two digits, you must use the X.121 method and enter the subaddress digits as part of the main address. Do Not Use the / between the main address and the subaddress.

Theory of Operation

PLACING A CALL

The following paragraphs describe the calling capabilities of the PAD, and the types of Call Connect Request Commands.

Channel Calling Capabilities

A channel may be restricted to either receive or initiate calls, or it can be allowed to receive and initiate calls. When a user successfully connects to a channel, he can place a call if the channels "call option" allows outgoing calls. ■ **Note:** A PVC channel has no calling capabilities.

Command Port Calling Capabilities

You can also use the Command Port to place an outgoing call. This function allows you to manage (that is, configure, control, etc.) remote PADs without using one of your user channels. It will also allow you to initiate diagnostic tests for the X.25 trunk. However, you may not receive calls on a device connected to the Command Port.

■ **Note:** The input to the Command Port will be disabled if the PAD's Command Facility is engaged in a session with a remote caller. On the other hand, a remote caller attempting to connect to the PAD's Command Facility will be cleared with diagnostic code 133—if you initiated a call from the Command Port.

Calling Methods

Each channel can be configured to support one or any combination of the following calling methods for a call connect request command:

- Long form
- Abbreviated
- Autocall

The Command Port supports both long form and abbreviated calling methods.

Long Form. This method requires the user to enter a standard X.28 Call Connect Request Command to establish a virtual call.

[C] (facility codes-) [network address] (/subaddress) (*call user data)

or

[con] (facility codes-) [network address] (/subaddress) (*call user data)

In the preceding formats, square brackets [] indicate required entries and parentheses () indicate optional entries.

The following paragraphs define valid entries in each field of the Call Connect Request Command:

- [C] or [con] — C followed by a space, or con, is the X.28 Call Connect Request Command.
- (facility codes-) — Facility codes are optional entries in the Call Connect Request Command. If included, they may consist of one or more of the following facility indication codes:

R = Reverse Charge

P = 128 bytes, packet size negotiation/DATAPAC Priority Call

D = Throughput Class Negotiation

F = Fast Select

Gxx = Closed User Group xx

The format of facility codes and associated parameter fields for X.25 and other national facilities is as follows:

\$Xcc=pp:pp:...pp=other X.25 facilities

cc = facility code in hex

pp = facility parameter field in hex

\$Ncc=pp:pp:...pp=other national facilities

cc = facility code in hex

pp = facility parameter field in hex

When present, National facilities must follow the X.25 facilities.

Individual facility codes must be separated by commas. The facility field must be terminated with a hyphen.

- [network address] — The address field is a required entry in the Call Connect Request Command and specifies the network address of the destination device. It can be up to 15 digits.
- (/subaddress) — The subaddress can be included if the address field is 13 digits or less. If it is included, it can be two digits to specify additional routing associated with the destination address.
- (*call user data) — The call user data field is available as an option. If it is included, it must be preceded by an *. Call user data can be up to 12 characters and can have any value.

Theory of Operation

■ **Note:** If you do not want PAD to echo the call user data field, follow the * with the echo suppression character defined by Parameter 109.

The following examples further describe the format of a Long Form Call Connect Request Command.

Example 1:

Call Connect Request Command with only the destination network address field:

```
C 12345678
```

Example 2:

Call Connect Request Command with the optional subaddress field:

```
C 12345678/01
```

Example 3:

Call Connect Request Command with a closed user group facility code, a subaddress field, and call user data:

```
C G12-12345678/01* HELLO
```

The 12 ASCII characters are inserted in octet 5 through 16 of the Call Request packet's call user data field.

If your PAD is configured for the call user data subaddressing method, the subaddress digits which are preceded by / will be inserted in octets 5 and 6. This shifts your input by two positions. In this case, your input is limited to 10 characters instead of 12.

Abbreviated. The Abbreviated Call Connect Request Command method simplifies the calling procedures by using a mnemonic in lieu of the fields described in the long form method. This method saves time and reduces the chances of calling a wrong number. It may also be used to restrict the calls from a given channel to a single or limited number of destinations.

The format of the Abbreviated Call Connect Request Command is as follows:

```
[C .][AA] (/Subaddress) (*Call User Data)
```

or

```
[con.][AA] (/Subaddress) (*Call User Data)
```

In support of the abbreviated calling method, the PAD allows you to preconfigure up to twelve 2-alphanumeric characters mnemonics.

Each mnemonic will act as an index key to an internal configuration table in the PAD. The fields of the table are:

- The X.25 facilities (to incorporate in the Call Request packet).
- The remote DTE address.
- The remote subaddress.
- The Call Request protocol ID (using octets 1 through 4 of the call user data field). It is typically set to 01000000 to indicate X.29 support. However, you may modify it to accommodate certain equipment or networks. In the latter case you must enable the Protocol ID option in the facility field.
- The call user data (using octets 5 through 16 of the call user data field).

A Call Connect Request Command, using AB as a mnemonic, can be reduced to the simple format:

```
C .AB
```

When an abbreviated call is initiated, the user can override the predefined subaddress and/or the call user data fields.

Example:

```
C .AB/16 *UPT0120CTETS
```

This override capability dramatically increases the number of destinations which can be reached via the 12 mnemonics. For security reasons, the user cannot override the facilities or protocol ID associated with each mnemonic.

Autocall. A channel can automatically initiate a call to a predefined destination when a physical connection is established with the attached device. This is referred to as AUTOCALL ON DEVICE READY.

A channel can also initiate a call on detection of a <CR> from the device when the channel connection is established or after a call is cleared. This is referred to as AUTOCALL ON <CR>.

As with calls using the abbreviated calling method, autocall can be used to restrict access of certain channels to a given destination or to remove the burden of placing a call from the user. This method is also recommended for teleprinters not equipped with a keyboard and devices which cannot generate an X.28 call Connect Request Command.

For each channel configured for autocal support, you must associate a mnemonic defined in the Abbreviated Autocall table. When the connection is established, the PAD will construct the call using the definition of that mnemonic. If the call attempt fails, the PAD will automatically retry the call. You may associate the same mnemonic to more than one Autocall channel.

■ **Note:** Following a link restart or PAD power-on, the PAD will automatically place a call on behalf of each channel configured for AUTOCALL ON DEVICE READY if the type of connection is "dedicated," and the physical path to the device is established.

Types of Calls

There are different types of calls which you can initiate using a PAD channel:

- Local Call
- Remote Call
- Fast Select Call
- Diagnostic Call

Local Call (Local Switching). The PAD allows a terminal user to connect locally to another device connected to the same PAD without accessing the X.25 Network. To do this, the Call Connect Request Command must specify the PAD address in the called address field of the X.28 Call Connect Request Command. The user may also specify the class ID of the called channel in the subaddress field of the Call Connect Request Command, that is, after the separator character /.

You can also initiate a local call using the abbreviated or the autocal method. This is achieved by appropriately configuring one of the address mnemonics.

A local call does not use any X.25 virtual circuits and does not generate call accounting information (refer to Chapter 5 for a discussion of call accounting).

Remote Call. The PAD will initiate a call request over its X.25 trunk when the called address in the X.28 Call Connect Request Command does not match the PAD address and there is a free logical channel. Remote calls can be placed to destinations on the same network to which the PAD is connected or to destinations connected to other networks, providing that your network has a gateway to these networks. The PAD is totally transparent to the called address, which can be up to 15 digits long. This satisfies the needs of networks that require 15 digits to place internetworks calls.

Refer to the section titled "Service Signals" in Chapter 4 for a description of the service signals used to acknowledge call completion or call clearing.

Fast Select Call. The Fast Select call is essentially a call where the user has specified a Fast Select Facility Indication code in the X.28 Call Connect Request Command.

In this case, the PAD will prompt the user using an X.28 service prompt for up to 124 bytes of data (the user can enter 256, but only 124 will be transmitted, and the rest discarded). This data is placed in the call user data field of the outgoing Call Request packet.

The response to the Call Request packet must be a clear indication packet. The clear indication can contain up to 128 bytes of data in the call user data field.

This type of call would typically be used for applications requiring only one data packet transmission in each direction. A credit card transaction is an example of this type of call.

Diagnostic Call. Channels configured for X.28 extended mode may initiate diagnostic calls. These calls are essentially loopback calls to the channels where the PAD places a call to itself over the Network. A diagnostic call is automatically initiated by the PAD when it detects either one of the following Terminal-Activated Channel Test Commands: TACTR and TACTS. The call is subsequently cleared when the PAD detects a BREAK key.

To place the call to itself, the PAD makes use of the configured PAD network address. Each call requires two switched virtual circuits.

Refer to Chapter 6 for a detailed explanation of the diagnostic calls.

RECEIVING A CALL

In addition to placing a call, the PAD allows you to receive calls from the X.25 Network. In fact, it can screen incoming calls and reject unauthorized access with no involvement of the attached device. You can configure the PAD to accept or reject incoming calls, based on:

- Security access code (a trunk password)
- Requested facilities
- Channel availability
- Device authorization to accept the incoming call

On accepting an incoming call, the PAD can also adjust the parameters of the calling party to make the call compatible with the attached resource (that is, host port, applications, and so on).

Password Protection

As previously stated, there are several ways the PAD can protect your equipment against unauthorized callers. One of these is to restrict callers to only those who have a valid password. This password must be present in octets 5 through 8 (four ASCII characters) of the incoming calls' call user data field (if the PAD is configured to support subaddressing using the call user data field, the trunk password must be present in octets 7 through 10). The caller's failure to do this causes the PAD to respond by rejecting the call with diagnostic code 133.

Facilities Requested

The PAD can be configured to reject incoming calls on the basis of the requested facilities. You can specifically reject calls that request any one of the following:

- Reverse charging (collect calls)
- Fast Select

Refer to the section titled "X.25 and National Facilities" in "Inbound Calls" in Chapter 3.

If the call is rejected because of the requested facilities, the diagnostic code in the clear packet will be set to 133.

Channel Availability

When the PAD determines the subaddress value of the incoming call, using the X.121 or call user data field method, it will determine which channels have been assigned a class ID equal to the subaddress. The channels must have incoming or incoming and outgoing call capability.

If no available channel is found, the call is cleared with diagnostic code 134.

If one or more channels meet the above criteria, the PAD will allocate the call to the first free channel in that group. If no free channel is found, the call is cleared with diagnostic code 134. If the call is routed to a channel configured for a dedicated connection, the call will be accepted only if the following conditions exist:

- The device connected to that channel has its DTR/DSR signal High.
- The device profile assigned to that channel specifies fixed speed and parity support. If the channel is defined for auto speed and/or autoparity support, the channel must be autobauded by the attached device.
- The channel has both incoming and outgoing call capability, and it has not received any input from the attached device in the last four minutes (the edit buffer is purged of data after four minutes of inactivity).

If the call is routed to a channel configured for dial-out connection, the call will be accepted when the device responds to ringing. Otherwise, the call is cleared with diagnostic code 133.

Speed Matching

When the PAD detects a throughput class facility in an incoming call, it will decode the throughput class code to determine the speed of the calling device at 75, 150, 300, 600, 1200, 2400, 4800, or 9600 bps.

When the PAD determines the correct speed, it will attempt to find a channel (within the rotary requested) that is configured with a matching speed.

Theory of Operation

If there are no free channels (a free channel is a channel which is not engaged in a virtual call or EIA handshaking) in the rotary that support the same speed, the PAD will attempt to find a dial-out channel that is configured for autobaud support. If a channel is found, the PAD will establish a physical connection and then transmit the outbound autobaud sequence at the required speed. This action is taken to autobaud the attached device, typically a host computer, with the right speed.

If no dial-out, autobaud channel is available or free, the PAD assigns the call to the first free channel in that rotary regardless of its speed.

Outbound Autobaud and Data Forwarding Delay

- Outbound Autobaud

In installations where the PAD is used as a front end to a data PABX, the channels typically contend with other devices for the host computer ports. In this environment, the host computer ports normally expect an autobaud character sequence when the call is accepted.

In this case, PAD channels cannot be set for fixed speed. With channels set at fixed speed, the first data character would be passed on to the host where it would be interpreted as the autobaud character. This would result in mismatched speed and call failure.

The Outbound Autobaud characteristic allows the PAD to autobaud the host computer before it passes any incoming data from the Network. In this environment, installation of the PAD is transparent to your setup. This is also useful when you need to match the speed of the host port with the speed of the calling terminal.

- Data Forwarding Delay

The PAD will also support host computers that require delay after the EIA connection is established and before any incoming data can be accepted. This delay will be equal to the idle timer value in the device profile if that value is an even number. Otherwise, the delay will be equal to the idle timer value plus 128 (unless that value is already greater than 128).

For Fixed Speed Channel. When an incoming call is routed to a channel configured for dial-out, the channel will establish the physical connection as described in the section titled "Ring Out Connection." Following a successful connection, a delay timer equal to the forwarding idle timer (Parameter 4) is triggered on that channel.

When the timer expires, the channel will start forwarding incoming data.

This will meet the requirements of many computer systems that require a delay after EIA handshaking is completed and before accepting incoming data.

For Autobaud Channel. Both outbound autobaud and data forwarding delay for an autobaud channel is processed as previously described. The channel will transmit the autobaud character sequence when the timer expires. The timer is then triggered a second time. When the second timer expires, the channel will start forwarding incoming data.

The speed of the autobaud character sequence is determined by the incoming call's Throughput Facility. If the speed is not included in the incoming call, the default value is 9600 bps.

Refer to Chapter 5 for the definition of the autobaud character sequence.

Service Signal

When an incoming call is accepted and service signals (Parameter 6 of the device profile) are enabled, the channel will transmit the following signal to the attached device:

```
(Calling dte address):(facilities code):com[cr,lf] (Call user data)[cr,lf]
```

Fields in parentheses are transmitted if they are present in the incoming call packet. If the PAD is configured for trunk password and/or subaddressing in the call user data field, the forwarded call user data will not contain the trunk password or the two subaddress bytes.

If service signals are disabled for the channel, none of the above fields will be transmitted. Refer to Chapter 3 for information on forwarding of the call user data field when service signals are disabled.

X.28 COMMANDS AND SERVICE SIGNALS

This section describes the purpose of the X.28 mode and how the PAD uses service signals to acknowledge X.28 commands.

Purpose of X.28 Mode

X.28 specifies the dialogue between a user and the PAD. This dialogue has two components. The first component relates to commands that the attached device can input, while the second component refers to a set of responses called "service signals." The dialogue is made possible by a service prompt and a predefined command repertoire. During this dialogue, the user can do the following:

- Alter X.3 parameters
- Initiate a virtual call
- Clear or reset a call in progress
- Inquire about channel status
- Initiate channel connection, terminal, or X.25 trunk tests

Escape TO X.28 Mode

Once a connection is established between the user's device and any of the PAD's channels, the user is in X.28 mode. In this mode, the user may enter any X.28 command, including a call, unless the channel is a PVC or is configured for incoming calls only.

When a call is successfully established, the user is in data transfer mode. In this mode, the user may need to escape to X.28 mode to modify the parameters in the Device Profile assigned to the channel or to clear the call.

If you want to be able to modify parameters or to clear a call, set Parameter 1 of the Device Profile to indicate which character should be interpreted by the PAD as an X.28 recall character; or, set Parameter 7 to allow the BREAK key to be used. The BREAK key selection is recommended if the channel supports transparent data (8-bit character) transmission.

When you escape to X.28 mode, you are notified with an X.28 Service prompt signal. Typically, an * is output to the device. If service signals (Parameter 6) are disabled, the prompt is not generated by the PAD.

X.28 Commands

The Codex PAD supports all commands defined by the X.28 recommendation. In addition to the standard X.28 commands, the PAD supports a set of commands referred to as X.28 extended commands. These commands enable the user to initiate some special PAD functions and to control the Codex-enhanced device profile parameters.

Access can be restricted to the standard X.28 commands on a per-channel basis.

■ **Note:** Refer to Chapter 4 for the format and function of both the standard and the extended X.28 command that are supported by the PAD. Commands can be entered in upper or lower case.

X.28 Service Signals and X.28 Service Prompt

The PAD uses service signals to acknowledge X.28 commands. It also uses the service signals to inform the user of Network events and/or PAD actions. The X.28 service prompt is generated to confirm to the user that the channel is in X.28 mode following the detection of an X.28 recall character.

In order to accommodate APL terminals, all service signals are generated in lower case.

Clear and Reset Service Signals. The service signals are generated by the PAD to indicate to the device that the virtual call has either been cleared or reset.

The clear or reset service signal is generated when a Clear or Reset Indication packet is received from the Network. They can also be generated by the PAD or the destination device. These service signals include a cause field and, optionally, a 3-digit diagnostic code field. The diagnostic code is only included if the Network supports diagnostic codes.

A DTE cause field in a clear service signal indicates that the clear or the reset was caused by the local PAD or the destination device. If the destination device is another Codex PAD, diagnostic codes indicate the reason the clear or reset occurred.

Control of Service Signals. When the PAD is acting as a front-end for a non-X.25 host computer, all service signals and the X.28 prompt should be suppressed by setting Parameter 6 to a value of 0. With this parameter set to suppress service signals, the PAD will also suppress the Herald and the Bulletin Messages. The editing signals and responses to X.28 commands are also suppressed.

Call User Data. When you suppress service signals, the incoming call indication message is suppressed. Consequently, the call user data is not passed through. There are conditions where you may want to pass call user data when service signals are suppressed. If your call user data contains a host computer password or an application program selection, it is obviously desirable to have this information forwarded. To support this requirement, the PAD provides an override mechanism on a per-channel basis.

Editing Service Signals. By setting Parameter 19, you can instruct the PAD to issue the appropriate editing service signals according to the device type, either a visual display or a printer.

X.29 SUPPORT

This section describes the purpose of the X.29 mode and how the PAD processes incoming and outgoing X.29 messages. It also describes the extended X.29 support and the ASCII to X.29 Conversion.

Purpose of the X.29 MODE

The Codex PAD fully supports CCITT recommendation X.29. X.29 support provides a mechanism for exchanging control information between the PAD and the destination device. The exchange of these control messages can be transmitted in both directions over the virtual circuit anytime after the virtual circuit is established.

Incoming X.29 Messages

The processing of incoming X.29 messages may include:

- Change (SET) and/or examine (READ) device profile parameters assigned to the physical channel engaged in the current calling session
- Indication of BREAK from the destination device. In an environment where the PAD is used as an X.25 front-end, terminals that are connected to remote PADs will typically generate a BREAK to halt host computer transmission. A remote PAD translates this BREAK Indication packet. When the BREAK Indication packet is received by a Codex PAD, it will cause a physical BREAK to be generated to halt host computer transmission.
- An invitation to clear the call. Upon receipt of this message, the Codex PAD will issue the appropriate service signal (if enabled) to the attached device and clear the call.
- Parameter indication. The PAD will receive this message when the device connected to the active channel issues an X.29 Read Message. On receipt of a Parameter Indication Message, the PAD translates it into the equivalent X.28 service signal and forwards the PAR list of parameter references, with their current values, to the attached devices.

Outgoing X.29 Messages

- On receipt of a Read, or Set and Read Message, the 6502 PAD will indicate the value of the parameters assigned to the active channel in an X.29 Parameter Indication Message. Any changes that are made to these parameters with a Set and Read, or Set Command are only valid for the duration of the session. Preconfigured values are reinstated at the conclusion of the call.
- BREAK Indication Message. When a physical BREAK or equivalent BREAK character (specified in Parameter 108 of the Device Profile) is detected, and if the value 4 is specified (in Parameter 7 of the Device Profile), the PAD will transmit an X.29 BREAK Indication Message.
- An Invitation to Clear. The 6502 PAD will generate an X.29 Invitation To Clear Message when a physical disconnect or clear service signal on a host-type channel is detected.
- Error Message. The 6502 PAD will generate an error message when there is an error that prevents decoding of the incoming X.29 message.
- A SET Parameter Message. In addition to generating a BREAK signal on receipt of a BREAK indication packet, the 6502 PAD will issue an X.29 message to set X.3 Parameter 8 of the calling party to 0. This enables the remote PAD to resume output.

Initiation of X.29 Message

In addition to the outgoing X.29 message previously discussed, the Codex PAD offers extended X.29 support. This support allows you to implement the following:

- Automatic remote parameters setup
- ASCII to X.29 conversion for start-stop host computers
- Remote Parameters Setup. The PAD allows you to set up the parameters of the calling device when an incoming call is accepted. This is handled by using an X.29 Set Message.

Remote Parameter setup sequences are used to alter the parameters of a calling device when an incoming call is accepted. The PAD allows you to define up to five different remote parameter setup sequences. Each sequence can have up to 20 parameter entries and associated values. When you configure an asynchronous channel, the PAD automatically transmits the sequence assigned to the channel in the form of X.29 Set Messages.

This is particularly useful when you expect to receive calls from devices connected using the public asynchronous access ports of your Packet Data Network. The device profiles are typically too general to be used as is. Using the remote parameters setup, you can adjust them without involving the caller.

As previously described, you can define up to five different remote configuration setup sequences. Each one can reference up to 20 parameters. To allow you to control non-X.3 remote parameters, the PAD allows you to define parameters with reference numbers from 1 to 255. These parameters can also be assigned any value from 0 to 255. For example, this value range should give you control of the so called "national parameters" of some networks' public access ports. Channels with the same class ID (that is, belong to the same rotary), should typically be assigned the same "remote configuration parameters sequence."

ASCII to X.29 Conversion. The 6502 PAD supports a powerful characteristic to enable asynchronous host computers to alter the value of remote PAD parameters dynamically. This complements the "Remote Parameter Set-up" capability previously described. In essence, it allows a non-X.25 host to transmit X.29 messages (Read, Set, Set and Read, and Invitation to Clear) over the Network by issuing the equivalent X.28 ASCII command strings (PAR?, SET, SET?, and CLR).

When these command strings are received, the PAD will translate them into equivalent X.29 messages and transmit them over the Network. This allows applications programs that use an attached PAD to alter the caller's PAD parameters to be compatible with the application requirements (such as, "turn echo off" for a password entry).

This conversion capability can be enabled or disabled by setting device profile Parameter 117. This parameter defines which parameter should be interpreted by the PAD as an X.29 access request (that is, escape character). The device can escape to X.29 mode from data transfer mode only, not from X.28 mode.

■ **Note:** Also, to forward the access character over the Network requires that the device generates that character twice, that is, the same mechanism required for forwarding the X.28 escape character.

X.29 Service Signals

- **X.29 Service Prompt.** On detection of an X.29 escape character, the PAD will generate a # service prompt.
- **X.29 Command Delimiter.** The <CR> character must be used as a command delimiter.
- **X.29 Exit Command.** To return to data transfer mode from X.29 mode, the user must enter an X.29 escape character, or a <CR> as a command.
- **X.29 Command Acknowledgment.** The LF character will be used by the PAD as an acknowledgment service signal.

PERMANENT VIRTUAL CIRCUIT OPERATION

The PAD supports concurrent operations of Permanent and Switched Virtual Circuits (PVCs and SVCs).

An SVC is set up dynamically when a device connected to a channel places a call to a remote destination. The PVC is a predefined connection between one of the PVC channels and a destination device over the Network. For that reason, you are required to assign one of the PAD channels for each defined PVC channel.

Establishment of a PVC

The user can transfer data over a PVC only when there is an operational logical connection between the destination and the PAD channel. Since there is a permanent logical connection, there is no need to place a call and/or place the circuit.

PVC Operational Indication

The PAD will use the com service signal to indicate that a PVC is operational. The PAD assumes the PVC is operational after a link restart. Following a link restart, and when the PAD detects a "device not ready" condition on a channel configured for PVC operation, the PAD will notify the remote destination device by a Reset DTE 01 (see Table 4-6 for Reset Service Signals).

Command Facility Requirements

You may dedicate all the PAD channels to a PVC mode of operation. However, you need to subscribe to and define a single SVC if you want to enable remote access to the PAD's Command Facility. Also, a minimum of two SVCs are necessary to invoke the full TACT diagnostics. For the Command Facility and diagnostic capabilities, two SVCs are required.



Chapter 4

User Interface

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INTRODUCTION

As a user, you may be most interested in how you can use the PAD to initiate and complete calls over the Network. However, you may occasionally find it necessary to modify or examine operating parameters for a particular call, or to execute channels tests when some unusual calling condition occurs. In addition, you may want to use the PAD's local copy or call transfer capabilities. The information in this section describes the procedures that allow you to:

- Establish a connection between your terminal and the PAD.
- Initiate and terminate a call.
- Examine or modify device parameters associated with you channel.
- Invoke test procedures.
- Perform a local copy or call transfer.

In addition, this section describes the PAD service signals. These are messages that the PAD generates in response to user's commands or as a consequence of certain Network events.

TERMINAL TO PAD CONNECTION

To gain access to the PAD, you must first establish a physical connection to one of its channels, followed by a logon sequence (if your channel is configured for autobaud or autoparity).

After you have successfully established a connection between your terminal and the PAD, you may:

- Initiate calls over the Network.
- Initiate calls to other devices connected to the same PAD.
- Initiate local copies.
- Examine or modify device parameters assigned to the channel to which you are connected.
- Initiate diagnostic-type calls.
- Initiate Fast Select calls.
- Receive calls from the Network.
- Receive calls from a device connected to the same PAD.

Your terminal can be connected to the PAD using a dial modem, or be permanently connected using a dedicated arrangement of cables and/or private wire modems.

Dial-In Access Procedures

The connect sequence for dial-in access is as follows:

- 1) Turn on the terminal and modem.
- 2) Dial the PAD access number and wait for a high pitched tone.
 - If you do not hear a tone, hang up and try again.
 - If you hear a busy signal, try again when the line is free.
- 3) When you hear the tone, place the receiver in the coupler or press the appropriate pushbutton on the data set.
- 4) For an autobaud-autoparity access channel, enter the ABR sequence <CR>.<CR>. For an autobaud-only access channel, enter <CR>. For a fixed-speed access channel, do not enter any characters.
- 5) The PAD will acknowledge a successful connection and prompt you for a command.
- 6) Following the prompt, you can examine the parameters assigned to your channel or place a call.

■ **Note:** You must establish a call within two minutes, or the PAD will drop your terminal connection. The PAD will also drop your connection after four unsuccessful call attempts.

If you keep getting a busy signal when you dial the PAD access number, consult your Network administrator. A trunk-down condition will cause the PAD's dial-in channels to appear busy.

Dedicated Access Procedures

The connect sequence for dedicated access is as follows:

- 1) Turn on the terminal: If you are using a private wire modem, turn on the modem.
- 2) Enter the logon sequence if necessary.
- 3) The PAD will acknowledge a successful connection and prompt you for a command.
- 4) Following the prompt, you can examine the parameters assigned to your channel or place a call.

Once you have completed this procedure, you may receive an incoming call if you are not typing a command or have not established a call to another destination. ■ **Note:** If the PAD does not respond with a User Connect message following the connect sequence for either dial-in or dedicated access arrangements, one of the following conditions may exist:

- Your terminal or your access equipment and/or cables require service.
- The PAD requires service, or the service signals are disabled.
- The PAD is configured for autobaud/autoparity, and it has not been synchronized by the ABR sequence. If this condition is true, press the BREAK key and repeat the ABR sequence.

USER CONNECT MESSAGES

When you have successfully established a connection between your terminal and the PAD, the PAD will transmit the following messages or prompts:

- **Herald Message** — The PAD Herald Message is the equivalent of a greeting or welcome message. The factory setting is: "mb2-x.25 asynch pad channel nn" (nn is the channel number your terminal is physically connected to).
- **Bulletin Message** — The Bulletin Message is transmitted immediately following the Herald Message. There is no factory default setting for this message. A Bulletin Message is normally used to send Network notices, such as advance notice of system maintenance shut-down.
- **X.28 Service Prompt** — The X.28 Service Prompt is transmitted immediately following the Bulletin Message. The factory setting is an *. The X.28 Service prompt indicates that the PAD is ready to accept X.28 commands.

As an example of this sequence (when factory default settings have not been changed), the following message indicates that you have completed a successful connection between your terminal and the PAD's Channel 12.

```
mb2-x.25 asynch pad channel 12
```

*

You may enter X.28 commands to examine or modify device parameters assigned to your channel for the current calling session, or just proceed to place a call.

INITIATING A CALL

Depending on the configuration of a particular channel, you may use one of the following calling methods:

- Long Form
- Abbreviated
- Autocall

Consult your network administrator to determine the calling method(s) that are enabled on your channel.

Long Form Calling Method

Using the Long Form Calling Method, you are required to enter the standard X.28 Call Connect Request Command (a "c" followed by a space; or con) and the destination address to establish a virtual call. The format of the command is as follows:

```
[C] (facility codes-) [network address] (/subad-
dress) (*call user data)
```

or

```
[con] (facility codes-) [network address] (/subad-
dress) (*call user data)
```

■ **Note:** In the above format, square brackets [] indicate required entries, and parentheses () indicate optional entries.

The following paragraphs define valid entries in each field of the Call Connect Request Command:

- [C] or [con] - C followed by a space, or con, is the X.28 Call Connect Request Command
- (facility codes-) - Facility codes are optional entries in the Call Connect Request Command. If included, they may consist of one or more of the following Facility Indication codes:

R = Reverse Charge

P = 128 bytes, packet size
negotiation/DATAPAC Priority Call

D =Throughput Class Negotiation

F = Fast Select

Gxx =Closed User Group xx

User Interface

The format of facility codes and associated parameter fields for X.25 and other National facilities is as follows:

\$Xcc=pp:pp:....pp=other X.25 facilities
 cc = facility code in hex
 pp = facility parameter field in hex

\$Ncc=pp:pp:....pp=other national facilities
 cc = facility code in hex
 pp = facility parameter field in hex

When present, National facilities must follow the X.25 facilities.

Individual facility codes must be separated by commas. The facility field must be terminated with a -.

- [network address] - The address field is a required entry in the Call Connect Request Command and specifies the network address of the destination device. It can be up to 15 digits.
- (/subaddress) - The subaddress is not required. It can be included if the address field is 13 digits or less. If it is included, it can be two digits specifying additional routing associated with the destination address.
- (*call user data) - The Call User Data field is optional. If it is included, it must be preceded by an *. Call user data can be up to 12 characters and can have any value. ■ **Note:** If you do not want the PAD to echo the call user data field, follow the * with the echo suppression character defined in Parameter 109.

The following examples further describe the format of the Long Form Call Connect Request Command.

Example 1:

Long Form Call Connect Request Command
 with only the destination network address field:

C 12345678

Example 2:

Long Form Call Connect Request Command
 with the optional subaddress field:

C 12345678/01

Example 3:

Long Form Call Connect Request Command
 with closed user group facility code, a subaddress field, and call user data:

C G12-12345678/01*HELLO

Abbreviated Calling Method

The abbreviated calling method simplifies the call connect procedure by allowing you to initiate a call with the X.28 Call Connect Request Command (a C followed by a space; or con) and a 2-character mnemonic. For both formats of the X.28 Call Connect Request Command (c followed by a space, or con), a decimal must immediately precede the 2-character mnemonic. The general format of the Abbreviated Call Connect Request Command is as follows:

```
C .aa
    or
con.aa
```

where aa is a 2-character abbreviated call mnemonic that has previously been defined by your network administrator.

Example:

```
C .aa
```

If you need to change the subaddress and/or the call user data fields for the current session, you may also enter the Abbreviated Call Connect Request Command in the format:

```
C .aa (/subaddress)(*call user data)
```

Valid entries in the subaddress and call user data fields are described in the section titled "Placing a Call" in Chapter 3.

Autocall Calling Method

If you are using a channel that is configured for autocall on device ready, the PAD will automatically initiate a call to a predefined destination. A device is "ready" when a physical connection is complete and, if applicable, following entry of a logon sequence.

The PAD can also be configured to initiate the call when it receives a carriage return character <CR> from your terminal. As in autocall on device ready, you must have previously established a connection between your terminal and the PAD.

When the automatic call is accepted by the remote destination device, the PAD will notify you with the message: com.

■ **Note:** If the destination address is equivalent to the PAD's own configured address, the call will be routed locally to another channel. The subaddress field is used to determine the identity of that channel.

Table 4-1.
Device Parameter Commands

<i>Purpose</i>	<i>Command Format</i>	<i>PAD Response</i>
To examine the current value of specified parameters	PAR?nnn.....nnn nnn = 1 thru 127	Parnnn:yy,.....nnn:yyy nnn = :parameter reference number yyy = :associated value
To examine the current value of all parameters associated with that channel	PAR?	Parnn:yyy,....nnn:yyy. nnn = :Parameter reference number yyy = :associated value of a parameter
To modify existing parameters values and read new values	SET?nnn:yyy,....nnn:	parnn yyy,....nnn:yyy
To modify parameter values	SETnnn:yyy,....nnn:yyy	CR and LF Characters
To assign a device profile to your channel	PROF n (n=1-8)	CR and LF Characters

- **Notes:**
- 1) All commands must be terminated with the <CR> or a + character.
 - 2) When X.28 extended mode is enabled, these commands also apply to Codex enhanced parameters 100 through 117.
 - 3) The values of the following parameters cannot be modified:
 - Parameter 11 — data rate
 - Parameter 100 — bits per character
 - Parameter 101 — parity (can be modified; but not set to auto-parity)
 - Parameter 117 — X.29 access character

X.28 COMMANDS

When you establish a connection between your terminal and the PAD, the PAD transmits a Herald Message, possibly a Bulletin Message, and an X.28 service prompt to indicate that a successful connection has been established. At this point you may proceed to place a call as described previously in the Section titled "Initiating a Call" or you may examine and/or modify parameter values for the duration of the current calling session. You may also enter commands to execute channel tests. The following paragraphs describe valid X.28 command entries that can be used to examine or modify PAD parameter values for the current connect sequence and to execute Terminal-Activated Channel Tests (TACT).

X.28 Parameter Commands

The commands in this group are used to set and read PAD parameter values. Parameters that are modified using the Set Command will retain their new values for the duration of the calling session only. When you clear the current call, the original values assigned to your channel parameters will be restored. Table 4-1 defines the purpose, format, and PAD response for each of the X.28 Set and Read Commands.

Miscellaneous Commands

You may issue certain instructions to the Network and/or your PAD (see Table 4-2). However, you should fully understand how these commands can affect the applications and equipment to which you are connected.

X.28 Test Commands

The commands described in Table 4-3 can be used to execute Terminal-Activated Channel Tests (TACT) from your terminal. When you enter a TACT Command, you exit X.28 mode and enter the PAD's test mode.

User Interface

Table 4-2.
Miscellaneous Commands

<i>Purpose</i>	<i>Command Format</i>	<i>PAD Response</i>
To request communications status	STAT	(Herald message) (Channel #) 1 (bulletin) (CR, LF) (free/engaged) CR, LF (X.28 prompt) or (free/engaged) (CR, LF) (X.28 prompt)
To clear a virtual call	CLR	clr conf or clr err (in the case of local procedure error)
To reset the virtual call or permanent virtual circuit	RESET	CR, LF (X.28 prompt)
To transmit an interrupt packet to the remote device	INT	CR, LF (X.28 prompt)
To exit X.28 command mode	<CR> or PAD recall character	...

■ **Note:** If X.28 extended mode is enabled on that channel.

Table 4-3.
Terminal Activated Channel Test Commands

<i>Purpose</i>	<i>Command Format</i>	<i>PAD Response</i>
To initiate a TERMINAL test	TACTT	in tact mode (refer to the section titled "TACTT" in Chapter 6)
To initiate a LOCAL channel test	TACTL	in tact mode (refer to the section titled "TACTL" in Chapter 6)
To initiate a SYSTEM test	TACTS	tact call placed or clr xxx yyy (refer to the section titled "TACTS" in Chapter 6)
To initiate a REMOTE trunk test	TACTR	tact call placed or clr xxx yyy (refer to the section titled "TACTR" in Chapter 6)
To terminate any above test and return to X.28 mode	(BREAK)	tact mode completed

- **Notes:**
- 1) All TACT commands are enabled in X.28 extended mode only. In addition, these commands cannot be initiated if a virtual call is already in progress on that channel.
 - 2) X.28 commands must be terminated with <CR> or a ° character.
 - 3) Refer to Chapter 6 for more detailed information on the Terminal-Activated Channel Tests.

SERVICE SIGNALS

The PAD may transmit certain messages, called service signals, to your device:

- In response to one of your commands
- On its own initiative
- As a result of a Network action
- As a result of your destination action

The information in this paragraph describes the normal service signals that you may encounter in the call connect sequence, and the clear and reset messages that may be transmitted when a call is prematurely disconnected. All clear and reset messages include a cause code mnemonic indicating the reason the clear or reset condition occurred. In some cases a diagnostic code will also be included. The diagnostic code provides additional information relative to the clear or reset condition. Table 4-4 describes the content and format of each of the PAD service signals.

Table 4-5 lists all cause mnemonic and diagnostic codes associated with clear service signals. These are always used in reference to virtual circuits.

Table 4-6 lists all cause mnemonic and diagnostic codes associated with reset service signals. Reset signals are most often used in conjunction with permanent virtual circuits.

Table 4-4.
X.28 PAD Commands and Service Signals

PAD Service Signals	Explanation
clr (cause mnemonic) ¹ (diagnostic code) ²	See Table 4-5.
reset (cause mnemonic) ¹ (diagnostic code) ²	See Table 4-6.
err	An illegal X.28 command.
com	The call is established.
(calling dte address): (facilities code) ³ ; com cr, 1f (call user data) cr, 1f	Incoming call indication.
enter fs dat	The X.28 Fast Select Facility is detected. The user at the initiating device may enter up to 124 characters (for the Call Request packet); the user at the responding device may enter up to 128 characters (for the Clear Request packet). ⁴
* or a user-defined 16-character service prompt	An X.28 recall character (typically control P) is detected.
data lost	PAD discarded data because of buffer overflow.
not found	The mnemonic specified in Abbreviated Call Connect Request Command is not defined or device profile requested by Prof Command is unavailable.
edit line too long	Edit buffer overflow. Enter <CR> twice to recover from this error condition.
inactivity time out	Call has been cleared because of the inactivity timer.

¹ The cause mnemonic consists of three alphabetic characters.

² The diagnostic code consists of three numeric characters.

³ Hexadecimal value.

⁴ Actually, either user may enter up to 256 characters, but only 124 are transmitted in the Call Request packet, and only 128 are transmitted in the Clear Request packet. Other characters entered are discarded.

Table 4-5.
Clear Service Signals Cause Mnemonics and Diagnostic Codes

<i>Cause Mnemonic</i>	<i>Diagnostic Code</i>	<i>Explanation</i>
dte	00 ¹	Remote Codex PAD cleared the call
	133 ¹	Facilities requested are not allowed, or trunk password is invalid at the remote Codex PAD
	134 ¹	Device connected to requested channel is not ready at the remote Codex PAD
	135	Call is cleared by local PAD as a result of a trunk restart
	136	Trunk is down
	137	Undefined mnemonic in Abbreviated Call Connect Request Command or for an autocal channel
	138	There is no free logical channel on your PAD
	142	TACT call is not allowed from your channel
	146	XCC call is already in progress
	nnn	Generated by other X.25 equipment
occ	xxx	Number is busy
inv	xxx	Invalid facility request
nc	xxx	Network congestion
der	xxx	Out-of-order
na	xxx	Access barred
np	xxx	Not obtainable
rpe	xxx	Remote procedure error
err	xxx	Local procedure error
nrc	xxx	Reverse changing not subscribed
inc	xxx	Incompatible destination
nfs	xxx	Fast select not subscribed
pad	xxx	The PAD has cleared the call following the receipt of an invitation to clear from the remote X.25 equipment

¹ The values may have different significance when generated by non-Codex remote equipment.

Legend:

xxx = Network-Dependent Diagnostic codes. Consult your network directory for their significance.

nnn = Destination DTE Diagnostic code.

Table 4-6.
Reset Service Signals Cause Mnemonics and Diagnostic Codes

<i>Cause Mnemonic</i>	<i>Diagnostic Code</i>	<i>Explanation</i>
dte	1	PVC was reset
	01 ¹	Remote device is not ready (PVC)
	128	Received a restart (PVC)
	130	Trunk is down (PVC)
	131	Remote PVC is out-of-order
	nnn	Generated by other X.25 equipment
der	xxx	PVX is out of order
rpe	xxx	Remote procedure error
err	xxx	Local procedure error
nc	xxx	Network congestion
rop	xxx	Remote DTE is operational (PVC)
nop	xxx	Network is operational (PVC)
inc	xxx	Incompatible destination

¹ The values may have different significance when generated by non-Codex remote equipment.

Legend:

xxx = Network-Dependent Diagnostic codes. Consult your network directory for their significance.

nnn = Destination DTE Diagnostic code.

LOCAL COPY

The PAD's Local Copy capability lets a terminal operator (connected to a PAD) define another device connected to the same PAD as a copy device. Typically, that operator would use Local Copy to obtain a hard (printed) copy of screen input or output. However, the copy device does not have to be a printer (for example, it could be another terminal). Throughout this document, the I/O device will be called the master device, and the destination device will be called the copy device.

■ **Note:** The copy device does not have to be physically connected to the master device. The only requirement is that both the master device and the copy device be connected to the same PAD.

No special configuration is necessary to use Local Copy. However, prior to entering a copy command, make sure the following conditions exist:

- The master device is in the X.28 mode (refer to the section titled "X.28 commands").
- The copy device is in a ready and free state.

■ **Note:** If you are connected to a PAD's Command Facility while you are engaged in a local copy relationship, you typically would have configured Parameter 13 (Autolf) on the master device to 6 (for additional information refer to the section titled "Profile" in Chapter 5). This configuration would provide for proper formatting on the copy device.

Both the data that is sent from the master device to the network, and the data that is sent from the network to the master device, can be copied to the copy device. Four distinct commands (described below) allow the master device operator to specify which data paths are to be followed.

After one of these copy commands is entered, it stays in effect until one of the following events takes place (causing the Local Copy to be terminated):

- The call is cleared.
- The Kill Copy (KCOPY) Command is entered at the master device.
- Either the master or copy device physically disconnects.

In the case of a physical disconnect, there are differing results, depending on whether the master or the copy device is physically disconnected:

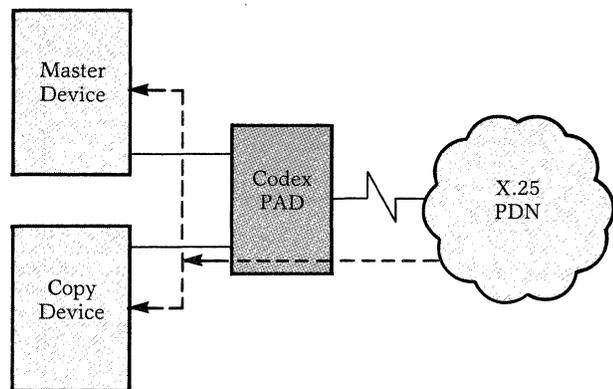
- If the master device is physically disconnected in the midst of a call, the call is automatically transferred to the copy device (see the section titled "Call Transfer" later in this Chapter). Input from the copy device is then allowed (of course, this applies only if the copy device has a keyboard).

Also following a master device disconnect, the inactivity timer of the copy device is activated, to make sure that the copy device will be returned to a ready and free state, after it receives all the output. If the value of Parameter 116 (Inactivity) is equal to 0, the value is automatically changed to a value of 3 (for the duration of the call).

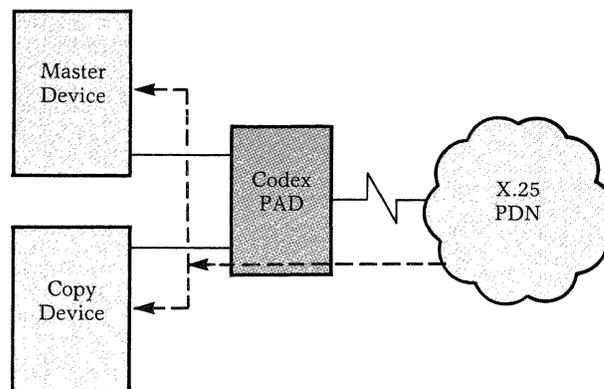
- If the copy device is physically disconnected in the midst of a call, the master device receives a notification message that the copy device is down, and the local copy relationship is terminated.

■ **Note:** You should not enable Local Copy prior to entering any confidential information (such as a password). If you do enter confidential information while Local Copy is enabled, that information will be copied (echoed) to the copy device.

User Interface



■Note: Arrows Indicate Direction of Data Flow



■Note: Arrows Indicate Direction of Data Flow

Figure 4-1. Data Flow Related to COPYA Command

Figure 4-2. Data Flow Related to COPYH Command

COPYA (Local Copy All Input/Output) Command

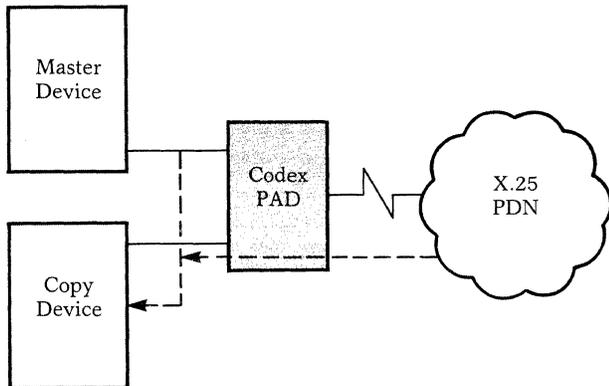
When the master device operator enters the COPYAnn Command (nn = the 2-digit port number of the copy device), it causes data from the network to be sent to both the master and copy devices (see Figure 4-1).

In addition, any data from the master device is sent to the network and is copied to the copy device. Data from the copy device is always ignored.

COPYH (Local Copy Host Output) Command

When the master device operator enters the COPYHnn Command (nn = the 2-digit port number of the copy device), it causes data from the network to be sent to both the master and copy devices (see Figure 4-2). Data from the master device is sent to the network only (it is not copied to the copy device). Data from the copy device is always ignored.

User Interface

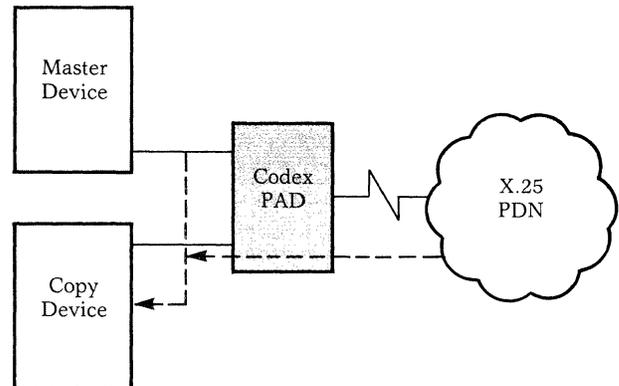


■ **Note:** Arrows Indicate Direction of Data Flow

Figure 4-3. Data Flow Related to COPYC Command

COPYC (Redirect Output to Copy Device) Command

When the master device operator enters the COPYCnn Command (nn = the 2-digit port number of the copy device), it causes data from the network to be sent to the copy device, but not to the master device (see Figure 4-3). Data from the master device is sent to the network only (it is not copied to the copy device). Data from the copy device is always ignored.



■ **Note:** Arrows Indicate Direction of Data Flow

Figure 4-4. Data Flow Related to COPYI Command

COPYI (Redirect Output and Copy Input) Command

When the master device operator enters the COPYI-nn Command (nn = the 2-digit port number of the copy device), it causes data from the network to be sent to the copy device, but not to the master device (see Figure 4-4). Data from the master device is sent to the network and is copied to the copy device. Data from the copy device is always ignored.

KCOPY (Terminate Local Copy) Command

The master device must be in the X.28 mode (refer to the section titled "X.28 Commands" in Chapter 4) to allow the entry of the KCOPY command. When the master device operator enters the KCOPY command, it causes the local copy relationship to be terminated. Following entry of the KCOPY command, a message is sent to the copy device, signaling termination.

General Information and Guidelines

The following list summarizes special conditions that you should be aware of when using the PAD's local copy capability.

- Any data entered at the copy device is lost following the initiation of a Local Copy Command.
- Data from the copy device is always ignored (that is, echo is suppressed, and data is not forwarded). The exception is XON/XOFF characters which are recognized from the copy device, causing output to the copy device to be resumed or suspended (of course, this exception applies only to channels that are configured for XON/XOFF flow control, see the section titled "Flow Control" in Chapter 3).
- A call cannot be transferred to a device that is already engaged in a local copy function. The KCOPY Command must be entered at the master device, before the target device can receive a transferred call. For information on the call transfer capability, refer to the next section, titled Call Transfer.
- In most cases, the relationship of the master device to the copy device is independent of the master device's logical connect status. However, if the master device may be reinitiated (depending on how the master device's channel is configured as described in the section titled "Channel Connections" in Chapter 3. If controls are dropped and the master device is reinitiated, the Local Copy relationship is terminated.
- X.29 commands and responses are not copied (see the section titled "X.29 Support" in Chapter 3). If an X.29 command is issued while the COPYC Command is active, responses to the X.29 commands are only output to the master device (not to the copy device).

CALL TRANSFER

The call transfer capability allows a call to be transferred from one device (source) to another device (target) that is connected to the same PAD. As shown in Figure 4-5, a typical call transfer application includes the following steps:

- 1) The source device user places a call to a host computer.
- 2) After receiving a com signal, the source device user enters the X.28 recall character (refer to the section titled "Profile" in Chapter 5).
- 3) From the X.28 mode, the source device user enters a call transfer command in the format:
`XFERnn`

Where nn represents the two-digit port number of the target device.

- 4) The PAD transfers the call to the user-specified target device, leaving the source device free to place another call.

As shown in Figure 4-5, the call transfer capability offers two major advantages:

- After a source device transfers a call, it is free to perform other applications.
- A target device that cannot place a call on its own (for example, a printer), can receive information. That is, a source device connected to the PAD can transfer information to a receive-only target device.

The following requirements must be met prior to entering the XFERnn Command:

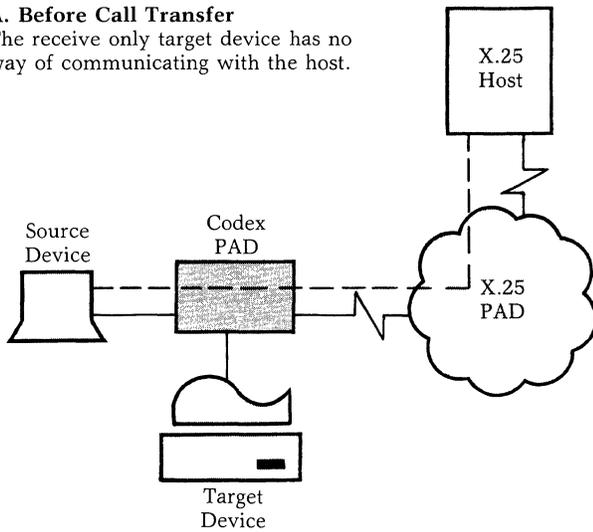
- The source device must be engaged in a call, and must be in the X.28 mode as described in the section titled "X.28 Modes" earlier in this Chapter. (These requirements were met in the above steps 1 and 2.)
- The target device must be in a ready and free state.

After the XFERnn Command is entered, some of the profile parameters set for the source device are copied to the target device. The profile parameters that do *not* get copied are: 5, 6, 11, 12, 13, 19, 100, 101, and 105 (see Table 3-1 for descriptions of these parameters).

User Interface

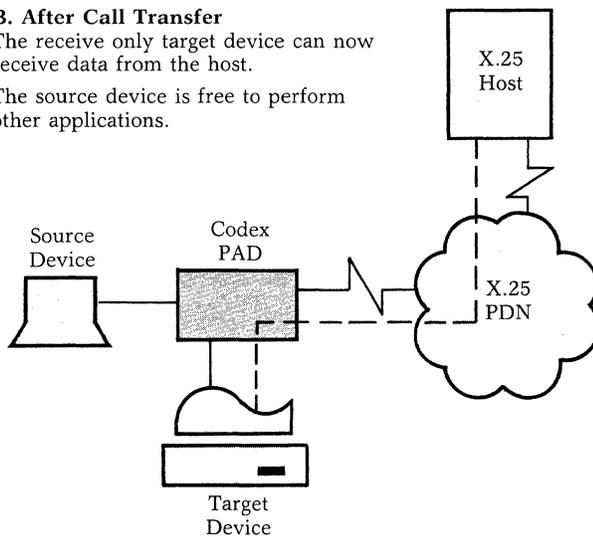
A. Before Call Transfer

The receive only target device has no way of communicating with the host.

**B. After Call Transfer**

The receive only target device can now receive data from the host.

The source device is free to perform other applications.



■ **Note:** Connections to the X.25 Host are Represented by Broken Lines.

After the profile parameters are copied, the source device is reinitialized, and its profile parameters are restored. The call at the source device is transferred to device nn. Then the source device is logically disconnected and is free to place another call, or to perform another application.

General Information and Guidelines

The following list summarizes special conditions that you should be aware of when using the XFERnn Command:

- Any data entered at the target device is discarded following initiation of a Call Transfer Command.
- Any data output to the source device (as it initiates a Call Transfer Command) is discarded.
- A call cannot be transferred to any device that is engaged in a local copy function. The KCOPY Command (described earlier in this chapter) must be entered at the master device before the target device can receive a transferred call.

Figure 4-5. Typical Call Transfer Application

ERROR AND STATUS MESSAGES RELATED TO LOCAL COPY OR CALL TRANSFER

The messages listed in Table 4-7 may be sent to the master or source device. Table 4-8 lists messages that may be sent to the copy or target device.

Table 4-7.
Master or Source Device Messages

<i>Message</i>	<i>Description</i>
not ready	The copy device specified is not ready.
target busy	The copy device specified is already involved in a call.
copy active - must kill	The master device is already engaged in a local copy function.
done	A Local Copy or Call Transfer request has been initiated.
copy device down	The copy device is physically disconnected.
err - not connected	The source device that is requesting a call transfer is not logically connected.

Table 4-8.
Copy or Target Device Messages

<i>Message</i>	<i>Description</i>
local copy active	The master device has been reinitialized.
Local copy terminated	The master device has terminated the local copy function.
xfer:com	A call has been transferred to the target device.

Chapter 5

Using the Command Facility

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INTRODUCTION

The Command Facility, a powerful, yet user friendly, software tool, allows you to perform the following PAD administrative and management functions:

- Configuration

Selecting the right parameter values is essential to smooth and efficient operation of the PAD. In an effort to anticipate your requirements, Codex ships a preconfigured PAD (for example, all channels will support dedicated connection and automatic speed and parity detection). If you need to "customize" your PAD in terms of its channel configurations, trunk parameters, or other preconfigured items, you use the Command Facility.

- Channel control and activity monitoring

You can monitor and control access to the PAD's channels.

- Trunk status monitoring and control

You can monitor and control access to the X.25 trunk.

- PAD performance statistics monitoring

You can monitor the PAD, its channel activity, and its utilization.

- System initialization and CMOS diagnostics

You can monitor the quality of the X.25 trunk, reset the PAD, and perform configuration memory diagnostics.

- Statistics collection

You can initiate periodic reporting and can collect events and call accounting information.

This section explains the PAD set-up procedures and how to access and logon to the Command Facility. This section also includes detailed step-by-step descriptions of each Command Facility function.

SETTING UP THE PAD

Before you try to establish any kind of communications with the PAD, review the following checklist to set up your PAD:

- 1) The power is *on*.
- 2) PAD indicators show normal status, as described in Tables 6-1 and 6-2. The CA indicator may be *blinking*, indicating that the configuration memory contains factory settings. If you have not connected your PAD to the PDN, the LD indicator will also be *on*, indicating a trunk-down condition.
- 3) The soft switch selection values reflect your requirements (see Figures 2-10, 2-11, and 2-12).
- 4) Selection 4 of soft switch group SYS 1 is *off*, for warm start (see Figure 2-10).
- 5) If you have reviewed the factory settings and found them acceptable, you may want to update the time and date using the Command Facility logon procedures described in the section titled "Logging On to the Command Facility" later in this chapter. You may also have to configure the PAD's Network address as described in the section titled "Trunk" in Chapter 5.

ACCESSING THE COMMAND FACILITY

You may access the Command Facility locally at the PAD, or from anywhere in the Network. You use one of the following methods:

- Use a dedicated or dial-in connection to the PAD's dedicated Command Port.
- Place a local call from any of the PAD's channels
- Place a virtual call to the PAD using the X.25 PDN.

Using the Dedicated Command Port

To access the PAD's Command Facility using the dedicated Command Port, you can use direct EIA 232-C connections, private wire modems, or dial-in modems configured for auto-answer support. Perform the following procedures:

- Set your terminal to full-duplex, use a data transmission rate not greater than 9600 bps, 7 ASCII-coded bits per character, and any parity type.
- The factory-configured device profile assigned to the Command Port supports autobaud and auto-parity recognition. Therefore, you must log on using the character sequence <CR>.<CR> (unless you have changed the profile).
- You will be greeted with the Herald Message "mb2-x.25 asynch pad channel 0" (unless it has been changed). This message tells you that the unit is a Codex Type 2, that the unit is being used as an X.25 asynchronous PAD, and that you are connected to channel 0. An X.28 Service prompt will also be displayed. If this does not occur, enter BREAK, and retry. You may now place a call (see the section titled "Command Port Calling Capabilities" in Chapter 3) or access the Command Facility by entering <CR> twice.
- The PAD will prompt you for your password (mx25, unless you have changed it). Refer to the section titled "Logging On to the Command Facility" later in this chapter.
- To disconnect, power off your device or select "logout" from the Command Menu.

■ **Note:** You will not receive the Herald Message or be able to establish dialogue with the Command Port if the Command Facility is being accessed by a remote caller. You will also be disconnected from the Command Port if a remote caller establishes a connection with the Command Facility.

Using One of the PAD's Channels

You can access the PAD's Command Facility by placing a local call from any of the PAD's channels, as follows:

- Make sure Parameter 13 of your device profile is set to 4 (see the section titled "Profile" later in this Chapter).
- If the PAD configuration memory contains the factory settings, your Call Connect Request Command will be C 00/99. Otherwise, you have to use the PAD address and the Command Port subaddresses that have been configured.
- Your connection will be confirmed with a com service signal. Enter <CR>.
- The PAD will prompt for your password (mx25, unless you have changed it). Refer to the section titled "Logging On to the Command Facility" later in this chapter.
- After successful connection to the Command Facility, you disconnect by clearing the call (enter clr).

Using the Network

You can place a call to the Command Facility from anywhere in the Network in the same way you place a call to any one of the PAD's channels. Access the Command Facility using the Network as follows:

- An important aspect to watch for is subaddressing. If the PAD contains factory settings, the subaddress will be 99.
- Make sure Parameter 13 of your device profile is set to 4 (see the section titled "Profile" later in this chapter).
- Once your connection to the command Facility is confirmed with a com or equivalent service signal, enter <CR>.
- The PAD will prompt you for your password (mx25, unless you have changed it). Refer to the section titled "Logging On to the Command Facility" later in this chapter.
- After successful connection to the Command Facility, you disconnect by clearing the call (enter clr).

Using the Command Facility

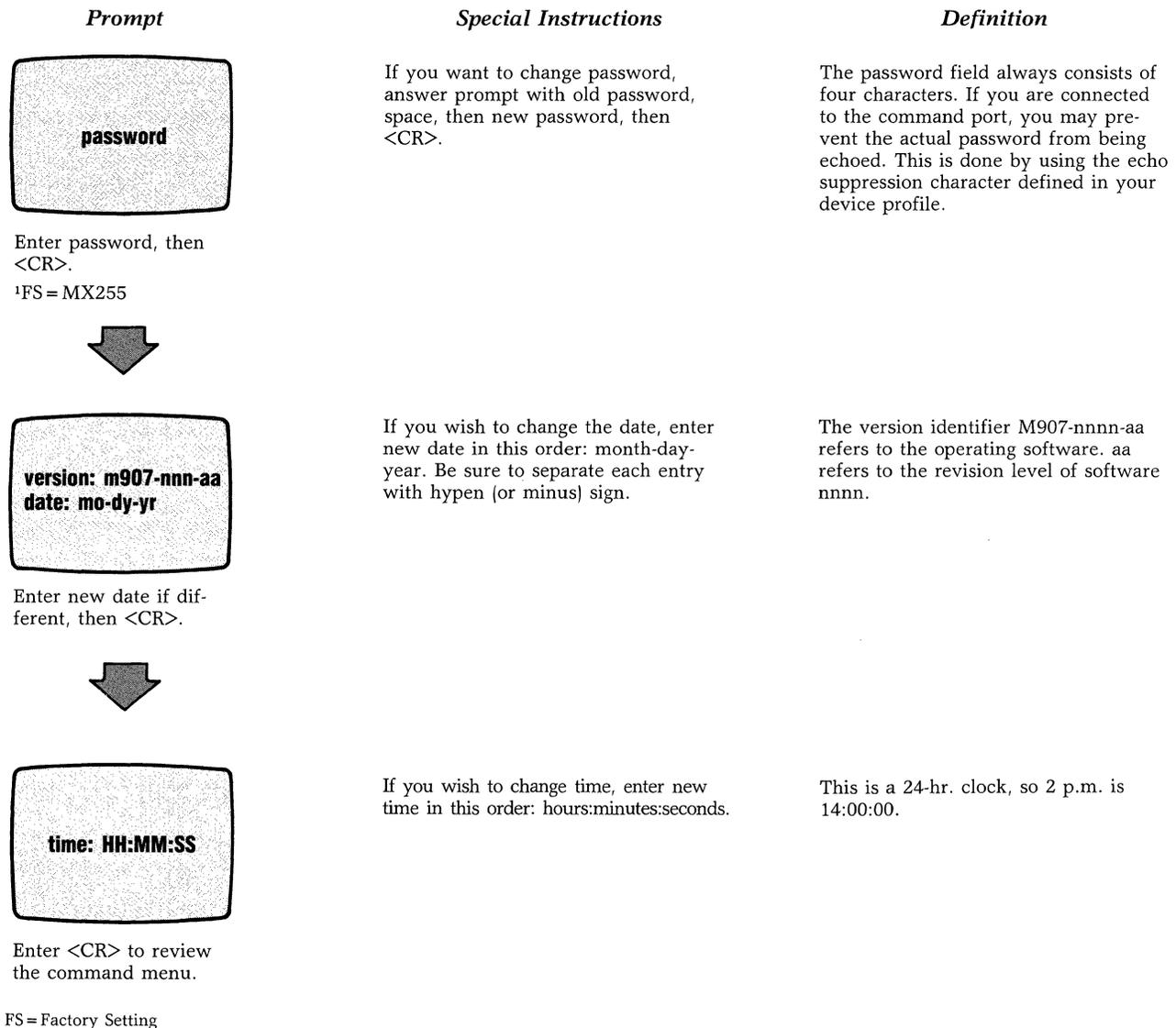


Figure 5-1. Logging on to Command Facility

LOGGING ON TO THE COMMAND FACILITY

To log on to the Command Facility, you must have the key to the Command Facility—the password. You may also use this procedure to change the factory-set password. Following the password, the Command Facility will display the software version, the time, and the date, as shown in Figure 5-1.

■ **Note:** An additional security capability is provided when you make a plus sign (+) part of the password. To do this, you must place a remote call to the Command Facility. You cannot perform this function from the local Command Port.

Once a part of the password, the + disables local access to the Command Facility (that is, access through the local Command Port). Then, the Command Facility can only be accessed remotely.

```
command menu
1. configure
2. busyout
3. disconnect
4. reenable
5. trunk status
6. trunk down
7. trunk up
8. list stats
9. reset stats
10. reset pad
11. load cmos
12. logout

select:
```

Figure 5-2. Command Menu

Command Menu

Once you have logged on to the Command Facility (refer to the section titled "Logging On to the Command Facility" later in this chapter) you will be presented with a Command Menu. The menu consists of clear descriptions of each of the available administrative functions (see Figure 5-2). You can invoke any of the Command Facility management functions by making a selection.

Subsequent menus and data entry prompts guide you through the various PAD administrative functions. This approach greatly simplifies PAD configuration and management tasks, because you do not have to memorize special commands or complex syntax.

Selecting a Command Menu Command

To select a command from the Command Menu, key in the associated number and <CR>. If you should make an error in your selection before keying <CR>, simply backspace and reenter the correct number. You can exit the Command Menu via selection 12. The next time you try to access the Command Facility, you will again be prompted for your password.

Figure 5-3 relates each command to different management functions. Paragraphs that follow Figure 5-3 are organized in terms of these management functions, and are referenced in the figure.

6502 X.25 Asynchronous PAD

Using the Command Facility

		Configuration	Channel Control	Trunk Monitoring and Control	Performance Statistics	Monitoring Channel Activity	System Initialization and Diagnostics	Call Accounting and Event Reporting	Exit
Selection	Commands	5.5	5.6	5.7	5.8	5.9	5.10	5.11	
1	configure	•							
2	busyout		•						
3	disconnect		•						
4	reenable		•						
5	trunk status			•					
6	trunk down			•					
7	trunk up			•					
8	list stats				•	•			
9	reset stats				•				
10	reset pad	• ²					• ³	•	
11	load cmos						• ³		
12	logout ¹				•			•	

¹ You must logout in order to initiate the periodic output of the statistics report. Refer to page 5-47.
² Resetting the PAD is required following any reconfiguration of the trunk parameters (except trunk passwork).
³ Refer to Chapter 6 for other types of diagnostic tools available.

Figure 5-3. Commands and Functions

CONFIGURATION

As mentioned at the beginning of this section, you may have to change Codex's preconfigured (default) values to meet your operating requirements. Parameters that you enter are stored in the PAD's nonvolatile configuration memory (CMOS) and then override the PAD's default operating parameters which are stored in the FEATUREPAK cartridge. However, be aware that the default parameters are copied from the FEATUREPAK cartridge back into CMOS:

- If you reset or power-on the PAD with the cold/warm start selection on (selection 4 of soft switch group SYS 1).
- If the PAD resets itself upon detection of a checksum error or a battery-low condition.

Also be aware that the selections in the soft switch groups SYS 1 and SYS 2 are not preconfigured (that is, they have no defaults). This is because user requirements related to these selections are so diverse. Before you attempt to use your PAD, be sure that these selections are configured to meet your requirements.

Unlike the SYS 1 and SYS 2 soft switch groups, the SYS 3 soft switch group comes preconfigured. All of its selections are preconfigured to off, to accommodate EIA control signal biasing requirements for most PADs.

■ **Note:** To configure selections in the soft switch groups, you can use the Touch Panel as described in Chapter 2 or the Command Facility (see the section titled "Soft Switches" later in this chapter). The format of the Configure Menu is shown in Figure 5-4.

From the Configure Menu, you can perform the following PAD configuration functions:

- Configure asynchronous channels
- Define:
 - Device profiles
 - Special echo sequences
 - X.25 trunk parameters
 - Switched and Permanent Virtual Circuits (SVCs and PVCs)
 - Remote DTE IDs for auto and abbreviated calling
 - Command Port profile and Command Facility subaddress
 - Remote Parameter set up sequences

- Compose messages for:
 - Herald Message
 - Bulletin Message
 - X.28 Prompt
- Set frequency of statistical reports
- Configure host autobaud sequence
- Enable or disable local channel-to-channel calls
- Disable remote terminal-activated channel tests (TACT)
- Set soft switch selections

Also from the Configure Menu, you can configure a remote PAD to initiate a call to the XCC (X.25 Control Center).

Guidelines and Notation Conventions

Format of Configuration Procedure Descriptions

The configuration procedures are formatted as follows:

- 1) At the left of every page is a screen showing each successive prompt. Immediately below the screen is an instruction. It tells you what the appropriate response is for each prompt. At the right side of the screen is added information, such as a range of possible entries or the number of a parameter in a given sequence.
- 2) In the center of each page, one of the following items is presented:
 - A graphic illustration of what the battery-backed CMOS memory contains relative to a given prompt.
 - A special set of instructions
 - A table of options or standard selections that must be keyed into a table in memory
- 3) Finally, at the right of every page is a section labeled "Definition." It contains a brief explanation of the purpose or function of each prompt, and, where applicable, a cross-reference to paragraphs.

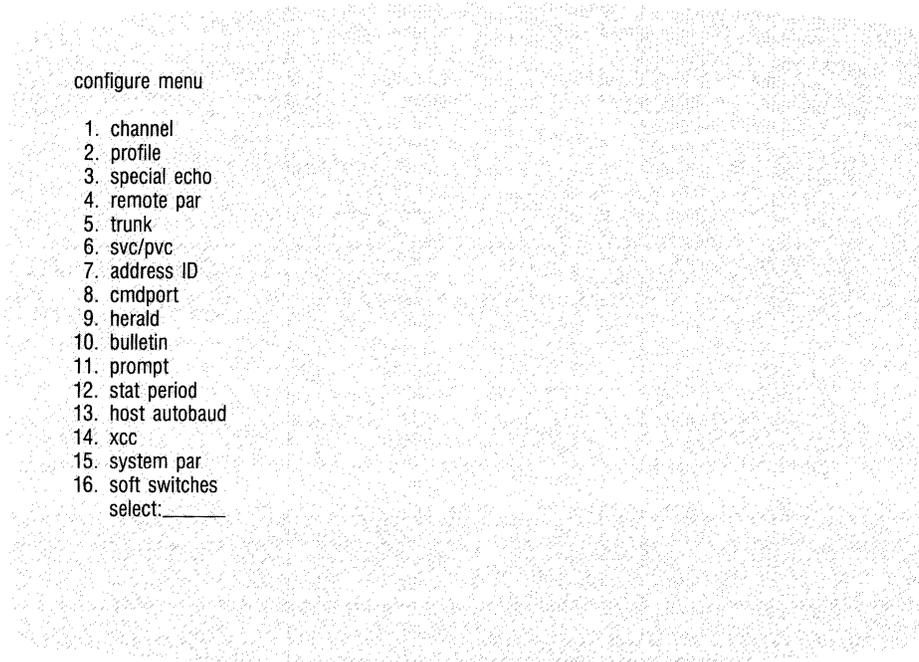


Figure 5-4. Configure Menu

Advancing Through the Prompts

You advance through a prompt sequence by keying <CR> after each response to a prompt. For any parameter that has a default value, you do not have to respond to the prompt, just press <CR>. This causes the next prompt to appear. When you have reached the final prompt of a completed sequence, you will see the following completion prompt:

Done...the configuration menu will be displayed.

Once you enter a prompt sequence, you must complete it; otherwise, the values you have entered will not be retained. For example, if you change a speed value in a device profile and then enter Ctrl-C, the configuration menu returns and change is cancelled. You must enter the new value and respond to each prompt that follows in a given sequence until the "done" message is displayed.

Input Errors

There are two types of errors that will cause the "error" message to appear:

- Out-of-Range Error — You have entered a character outside the range of possible values.
- Consistency Check Error — You have entered a character that is logically inconsistent with some other character already entered. For example, you cannot select the same logical channel number for both an SVC and a PVC.

Notation Conventions

There are several time-saving notation conventions that are used in this section. If you make a note of these conventions, we will not have to repeat procedural steps that are used in each procedural description. They are as follows:

- The symbol for a user-entered carriage return is <CR> (for a carriage return that is transmitted without user entry, the symbol is a CR).
- Press <CR> after every entry or response to a prompt.
- Enter Ctrl-B and <CR> if you want to go back to the previous data entry field.
- Press the backspace key or enter Ctrl-H to move the cursor left one position and delete the character at that position (Ctrl-H may be used if your keyboard has no backspace key).
- Press <CR> if you accept the value currently displayed and simply want to continue to the next item.
- Enter Ctrl-Y in any of the following ASCII-character fields to clear the fields: Userdata (Selection 7), Herald (Selection 9), Bulleting (Selection 10), Prompt (Selection 11), or Autobaud Seq (Selection 13).
- Press <CR> if you want to exit from the Configure Menu.
- Enter CTRL-C and <CR> when you want to exit a procedure and return to the menu from which you are working.
- Prompts that require alphanumeric entries are enclosed in brackets: [XX]. They indicate parameters values now in effect.
- A prompt may include one or more asterisks (*). This means that there is no value currently stored for a given parameter. The number of asterisks indicates the length of the field.

Example: Channel #: **

This prompt asks you to enter the number of the asynchronous channel to be defined. The two asterisks indicate the number has not been entered. When it is entered, it can be up to two digits.

- Control characters are entered using the ^X format, where ^ is a caret character and X is the character required (e.g., control G. BEL, is entered as ^G).
- Enter ^M for CR (see the section titled "Host Autobaud" later in this chapter).

Channel

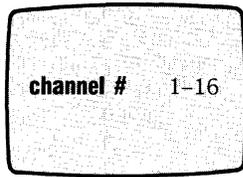
With this selection you can do several important things, one of which is to associate one of the eight possible device profiles with each channel. The relationship, however, is not one-to-one; you can assign any number of channels to the same device profile. In a later step of channel definition, you can associate a set of device parameters that the PAD will automatically send to a calling device. This is typically done to make a terminal compatible with the host computer that it is calling. In addition, you pick from among the various call and channel choices; these will define important characteristics about how your PAD handles inbound and outbound calls. Finally, you can set up a simple hierarchical scheme for addressing your channels by associating each channel with two class IDs. Each of these functions is shown in Figure 5-5.

Profile

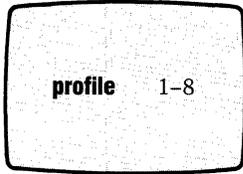
With this procedure, you can define eight unique device profiles. Each profile contains all the 20 parameters defined in the CCITT X.3 specification and an additional 18 Codex-enhanced parameters. By assigning a device profile to a channel, you adapt the channel to the different equipment you may want to connect. Figure 5-6 shows the selections associated with each device profile.

Using the Command Facility

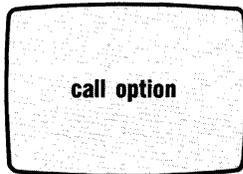
Prompt



Enter the desired channel number ID (1-16).

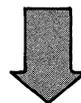


Enter the profile associated with the channel.

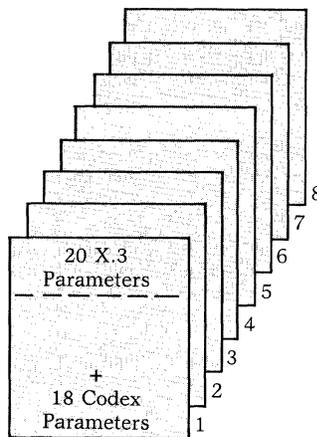
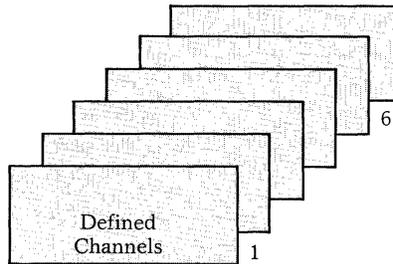


Select desired option(s), add values, then enter.

Example: If you desire to enable both long form and abbreviated calls, add 1 + 2 = 3. Enter 3.



CMOS



Definition

This entry designates the channel that you are now going to configure. The possible values are 1 through 16.

Each of these eight possible device profiles includes 20 X.3 parameters, plus 18 Codex-enhanced parameters. They are assigned to the asynchronous channels to control the operation of the attached equipment. Only one profile can be in use for one asynchronous channel at a time. However, one profile could be used by many channels without restriction.

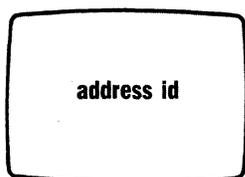
Call No.	Option	
0	Enable incoming calls	Enables incoming calls. (See page 3-27).
1	Long form calls	Restricts this channel to long form calls. (See page 4-3.)
2	Abbreviated calls	Permits outgoing calls using abbreviated addressing. (See page 4-5.)
4	Autocall On device ready	Initiates call automatically when EIA and autobaud completed. See next prompt. (See page 4-5.)
8	Autocall On <CR>	Initiates a call upon data activity signalled by a <CR>. (See page 4-5.)
16	Always pass call user data	Used when service signals are disallowed. (See page 3-33.)
32	Incoming calls barred	Allows outgoing calls only. (See page 3-27.)
64	Extended EIA controls	Controls EIA signals after a call clear, in conjunction with the channel option prompt. (See page 3-29.)
128	Clear on data loss	Clears SVC upon data loss. (See page 3-23.)
XXX	Any combination	

Figure 5-5. Selection 1: Channel

(continued on next page)

Using the Command Facility

Prompt



Enter associated mnemonic for autocal. Use any 2 alphanumerics.

Example: Enter address ID AA. The address associated with this mnemonic will be defined in selection 7.

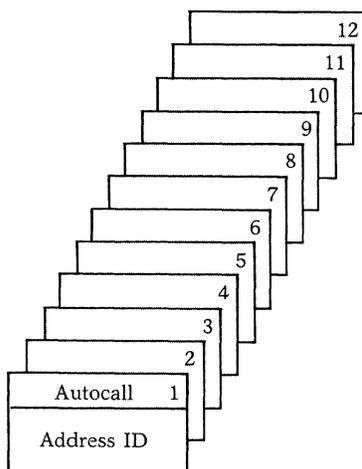


Select desired option(s), add value(s), then enter.

Example: If you want both options 1 and 32, then add 1 + 32 = 33. Enter 33.



CMOS



Skip entry if channel is not an autocal.

Definition

The mnemonic entered here is used to retrieve the information needed to make an automatic call on behalf of the device. (See page 3-28.)

Option No.	Connection Type	
0	Dedicated or dedicated with extended EIA controls enabled ¹	(See page 3-21.)
1	Auto answer	(See page 3-22.)
2	Ring-out or ring-out with extended EIA controls enabled ¹	(See page 3-22.)
3	Auto answer	(See page 3-22.)
4	Ring-out (with security) or raise DCD (with security) ¹	(See page 3-22.)
6	Raise DCD	(See page 3-23.)
8	Host port	(See page 3-31.)
16	Priority channel	(See page 3-23.)
32	Enable call accounting	(See Chapter 5 — Call Acct. and Event Rep.)
64	Disable X.28 extended mode	(See page 3-32.)
128	Micro600 line interface option	Applicable when attached to a Codex Micro600 port selector
XXX	Combination ²	

¹Call option value 64, extended EIA controls, must be used with this connection type.

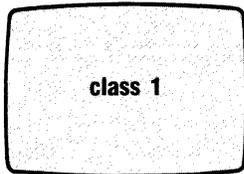
²Option numbers 0 through 6 cannot be combined with each other. Options 8 through 128 can be combined with each other, or with one of the 0 through 6 options.

Figure 5-5 (continued). Selection 1: Channel

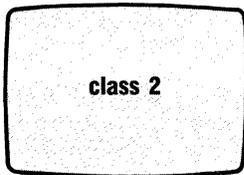
(continued on next page)

6502 X.25 Asynchronous PAD
Using the Command Facility

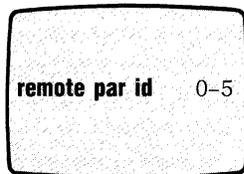
Prompt



Enter desired class/rotary ID for subaddress selections.



Enter second desired class/rotary ID for subaddress selection.



Enter which setup sequence is associated with this channel.

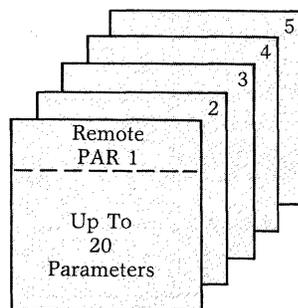
Enter 0 if none is required.

Done . . . The configuration menu will be displayed.

CMOS

00-99 possible assignments

00-99 possible assignments



Definition

While network addresses specify a given PAD, the class number allows you to specify one or more of the PAD's channels. (See page 3-24.)

The addition of class 2 gives you a secondary mechanism to address the channel. (See page 3-24.)

You can associate 1 of 5 remote parameter setup sequences with the channel you are now defining. (See page 3-34.)

Figure 5-5 (continued). Selection 1: Channel

6502 X.25 Asynchronous PAD
Using the Command Facility

Prompt

profile 1-8

Enter a device profile number.



x28acc* P1

Enter one decimal 0-126.



echo P2

Enter 0 or 1.

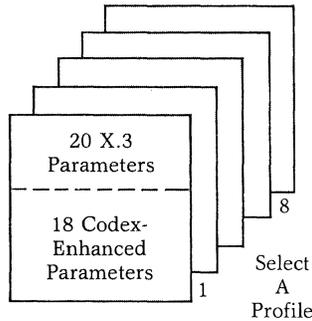


data fwd P3

Enter value of selection(s).



CMOS



- 0 = Not possible
- 1 = Possible by character DLE (Control P) or ...
- 2-127 = Decimal value of ASCII character used to access the X.28 mode

- 0 = Disable Echo
- 1 = Enable echo

- 0 = No data forwarding¹
- 1 = Alphanumeric characters
- 2 = <CR>
- 4 = ESC, BEL, ENQ, or ACK
- 8 = DEL, CAN, or DC2
- 16 = EOT or ETX
- 32 = HT, LF, VT, or FF
- 64 = Other characters in columns 0 and 1 of the ASCII chart not included above
- XXX = Any combination of above values

Definition

Your profile selection here tells the system which of eight profiles you are now about to configure. To help you define the different parameters, we have provided you with an ASCII Table in Appendix B.

PAD Recall Character.

Using parameter 1, you can either allow or deny X.28 mode access via an ASCII character. (See page 3-32.)

Echo Enable.

Parameter 2 controls whether or not the PAD should echo the received characters. (See page 3-13.)

Data Forwarding Characters.

Parameter 3 defines the character(s) that will cause a packet to be sent. (See page 3-18.)

■ **Note:** The * is used throughout this selection to indicate the parameters which must not be assigned the same value. The asterisk does not, however, appear on the screen.

¹Data will still be forwarded upon detection of a <CR> unless you also set parameter 15 equal to 0 (editing disabled).

Figure 5-6. Selection 2: Profile

(continued on next page)

Using the Command Facility

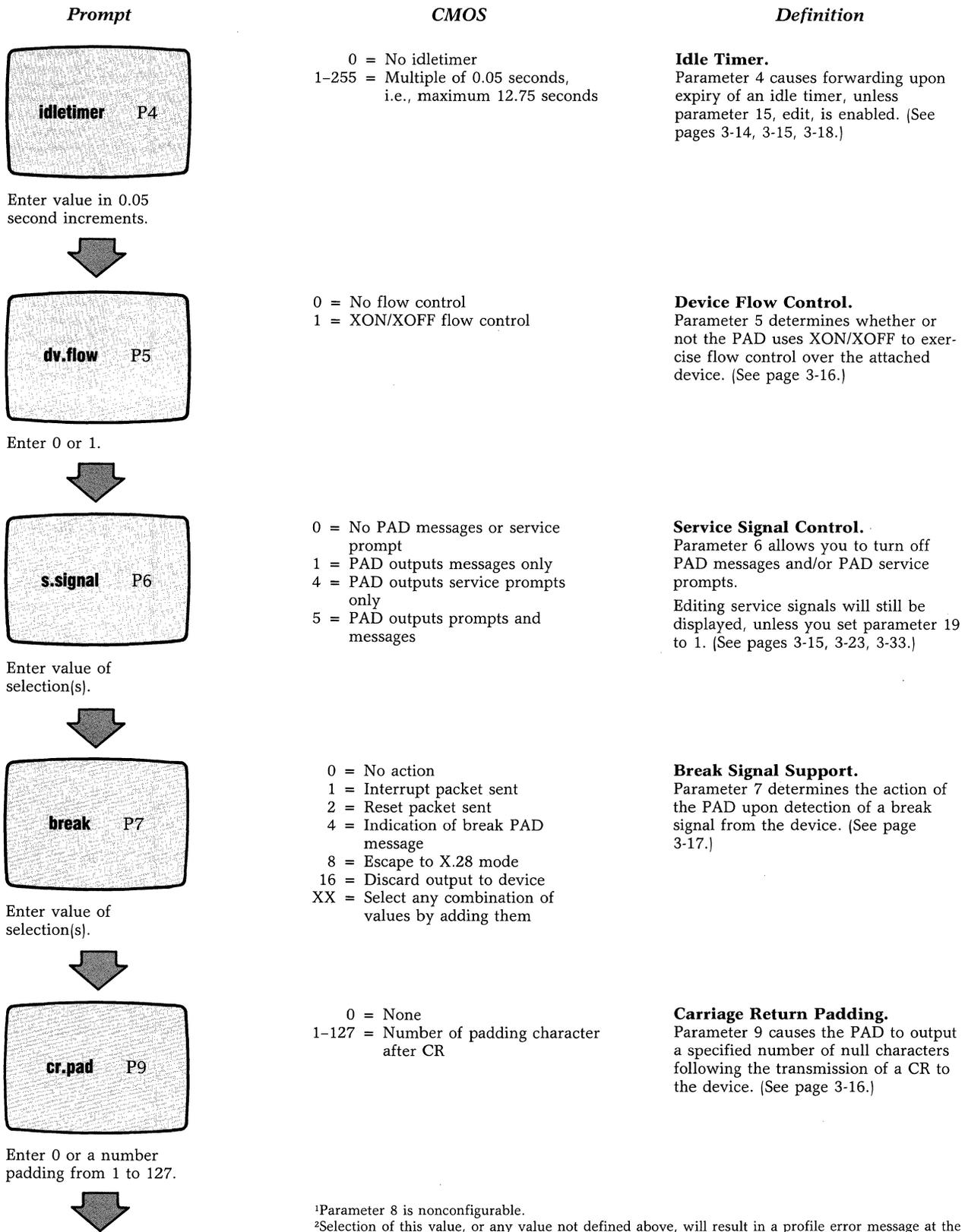


Figure 5-6 (continued). Selection 2: Profile

(continued on next page)

6502 X.25 Asynchronous PAD

Using the Command Facility

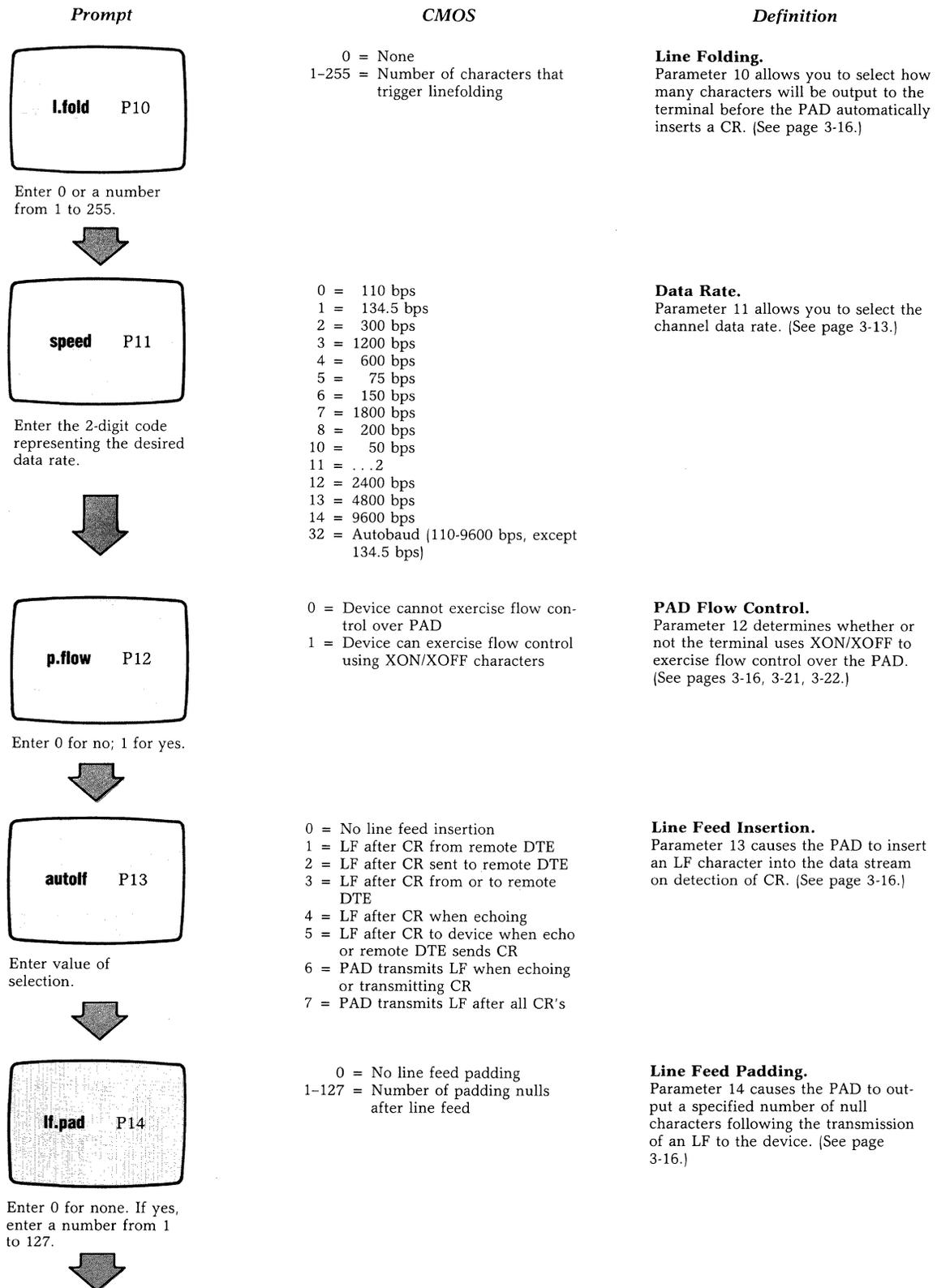


Figure 5-6 (continued). Selection 2: Profile

(continued on next page)

6502 X.25 Asynchronous PAD

Using the Command Facility

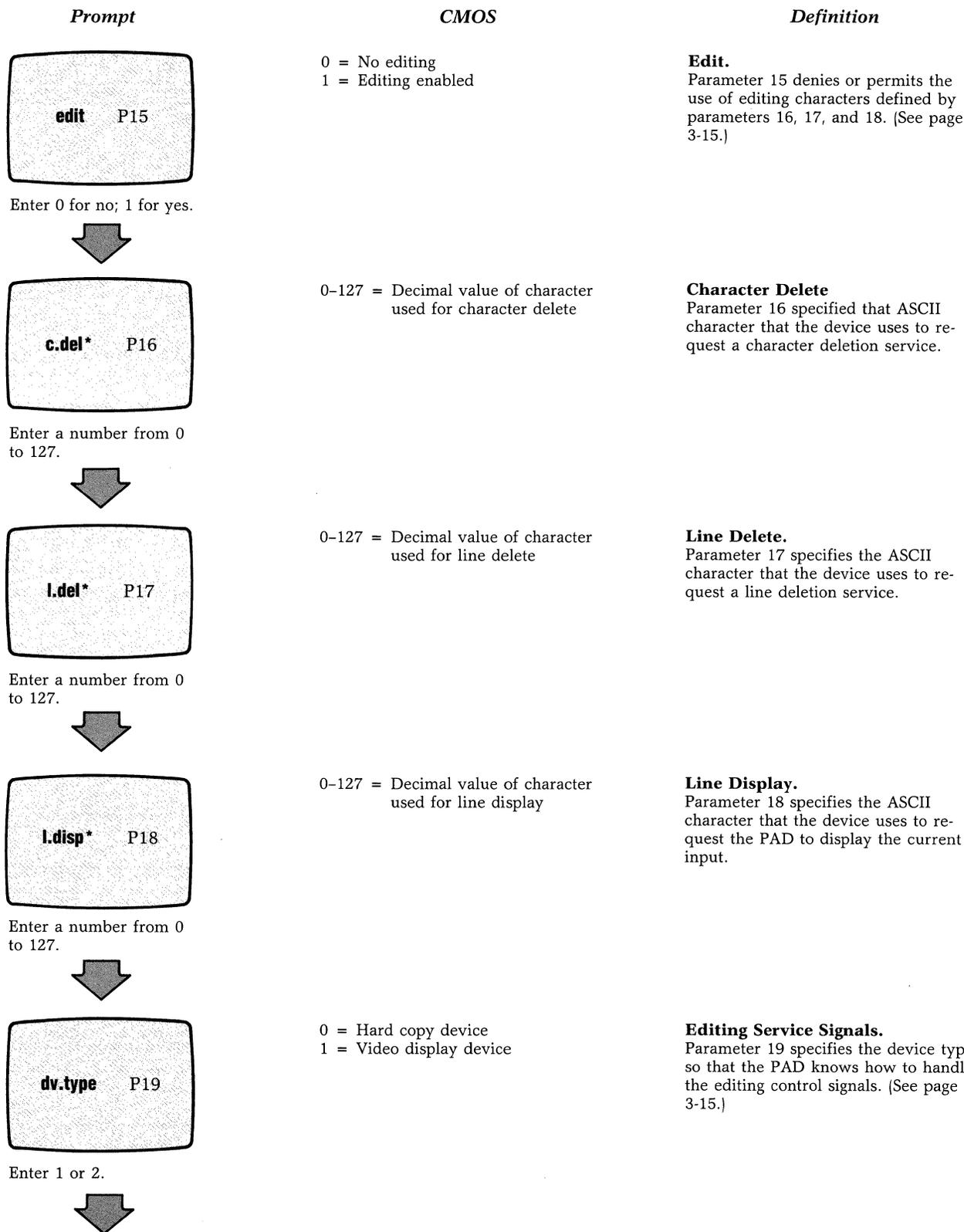


Figure 5-6 (continued). Selection 2: Profile

(continued on next page)

6502 X.25 Asynchronous PAD

Using the Command Facility

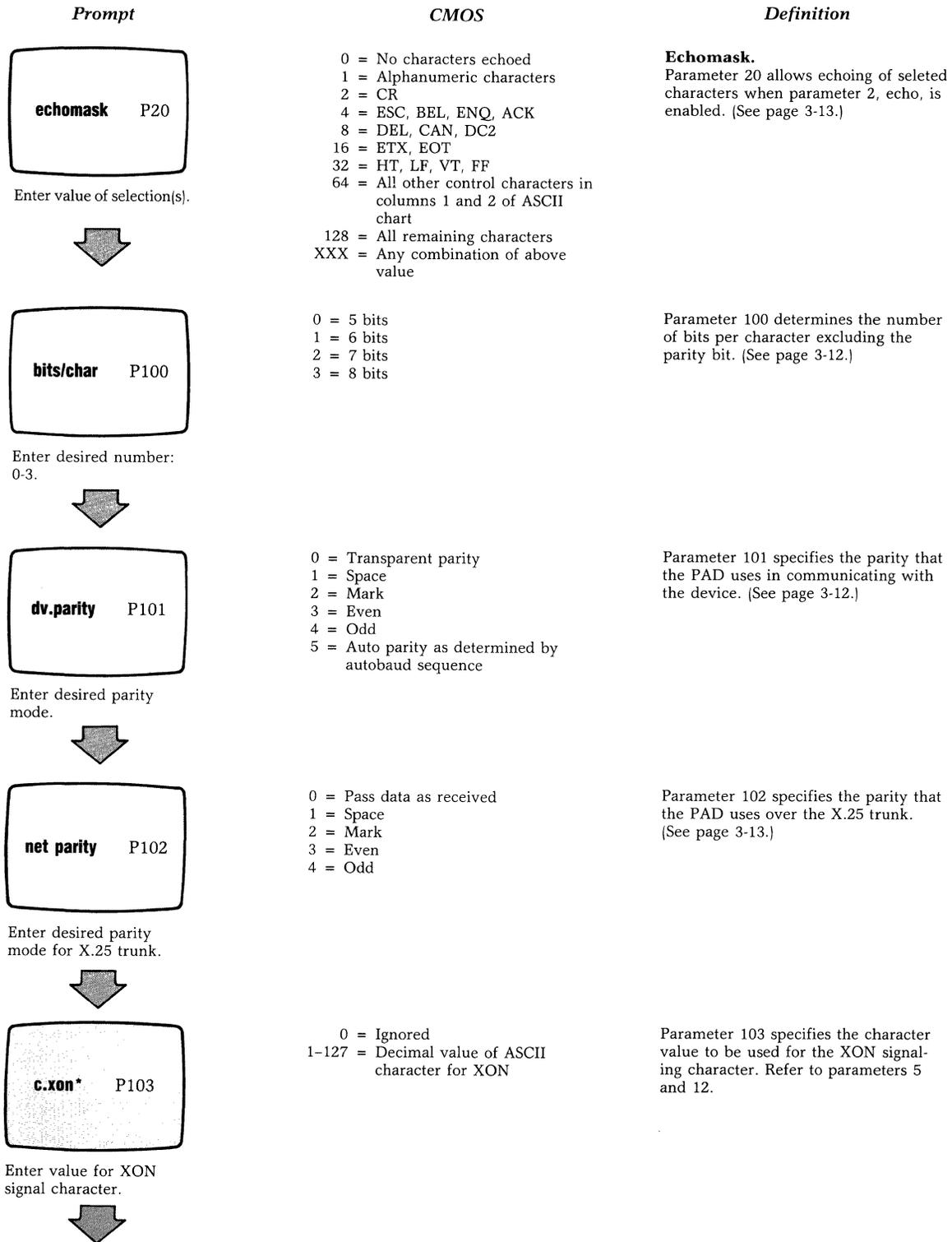


Figure 5-6 (continued). Selection 2: Profile

(continued on next page)

6502 X.25 Asynchronous PAD

Using the Command Facility

<i>Prompt</i>	<i>CMOS</i>	<i>Definition</i>
<div style="border: 1px solid black; padding: 5px; text-align: center; background-color: #e0e0e0;"> c.xoff* P104 </div> <p>Enter value for XOFF signal character.</p>	<p>0 = Ignored 1-127 = Decimal value of ASCII character for XOFF</p>	<p>Parameter 104 specifies the character value used for the XOFF signaling character. Refer to parameters 5 and 12.</p>
		
<div style="border: 1px solid black; padding: 5px; text-align: center; background-color: #e0e0e0;"> special flow P105 </div> <p>Enter value of selection(s).</p>	<p>0 = None 1 = Device can flow control PAD with RTS 2 = PAD can flow control device with CTS 4 = PAD issues BEL character to device in CTS flow control X = Any combination</p>	<p>Parameter 105 specifies whether or not the attached terminal can exercise flow control using request to send or whether the PAD can exercise flow control over terminal using clear to send. (See page 3-16.)</p>
		
<div style="border: 1px solid black; padding: 5px; text-align: center; background-color: #e0e0e0;"> count fwd P106 </div> <p>Enter 0 or a character count value.</p>	<p>0 = No forwarding on character count¹ 8-255 = Number of characters that will trigger data forwarding</p>	<p>Parameter 106 specifies forwarding on a character count rather than on a packet. It is ignored if parameter 15, edit, is enabled. Refer to selection 5, PKTSIZE prompt. (See page 3-10.)</p>
		
<div style="border: 1px solid black; padding: 5px; text-align: center; background-color: #e0e0e0;"> escdelay P107 </div> <p>Enter 0 for no delay; 4-255 for desired delay timer.</p>	<p>0 = No special handling² 4-255 = The forwarding delay time after ESC input, selected in 0.05 second increments</p>	<p>Parameter 107 enables forwarding an ESC sequence in a single packet by delaying the forwarding of an ESC character. (See pages 3-13, 3-18.)</p>
		
<div style="border: 1px solid black; padding: 5px; text-align: center; background-color: #e0e0e0;"> c.break* P108 </div> <p>Enter 0 for normal break; 1-127 for specified break.</p>	<p>0 = Normal break signal 1-127 = Decimal value of an ASCII character to be interpreted by the PAD as a break key</p>	<p>Parameter 108 allows you to simulate a break signal using a regular character key. (See page 3-17.)</p>

¹Entering character count values 1 through 7 is not recommended.

²Entering character count values 1 through 3 is not recommended.

Figure 5-6 (continued). Selection 2: Profile

(continued on next page)

Using the Command Facility

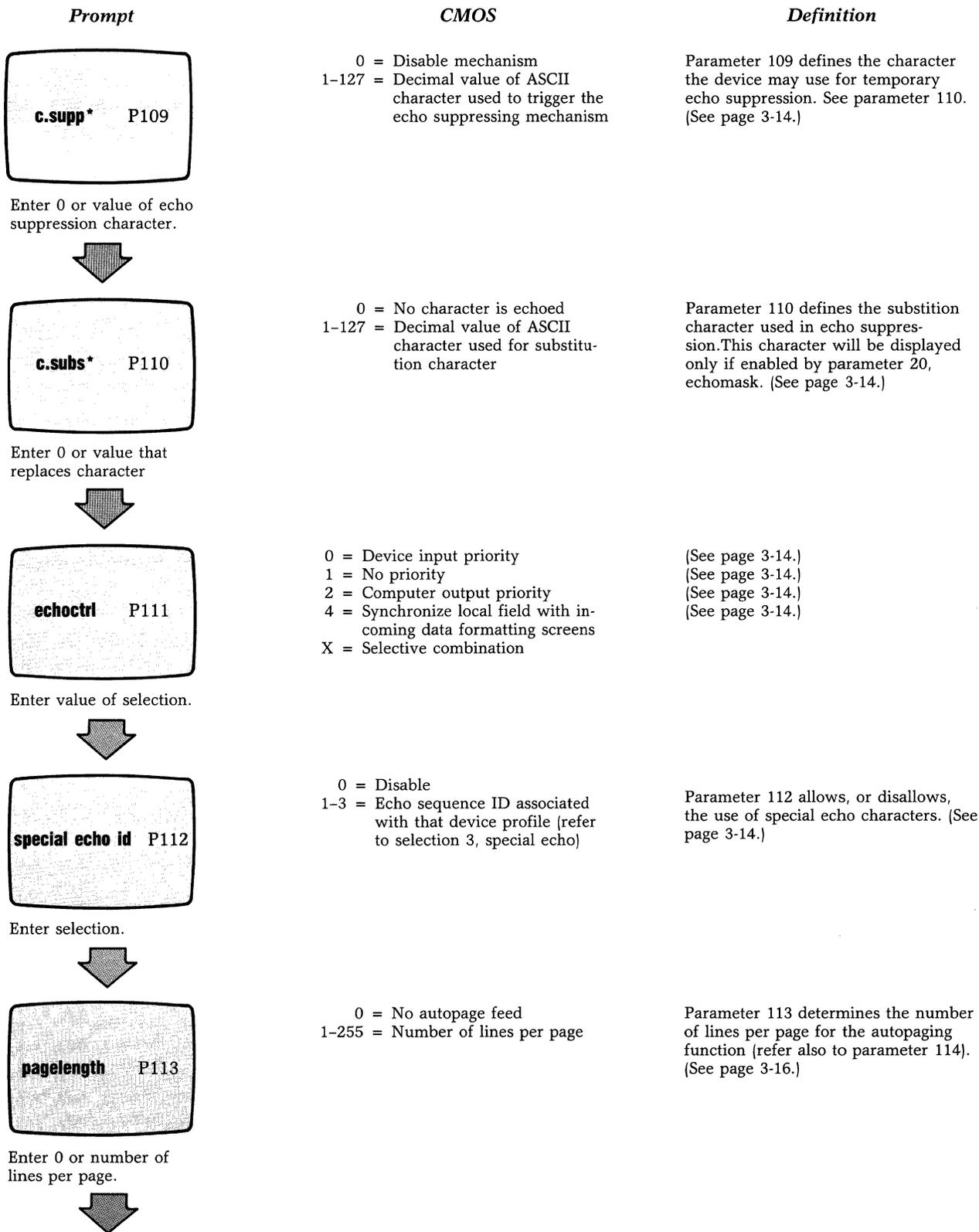


Figure 5-6 (continued). Selection 2: Profile

(continued on next page)

6502 X.25 Asynchronous PAD

Using the Command Facility

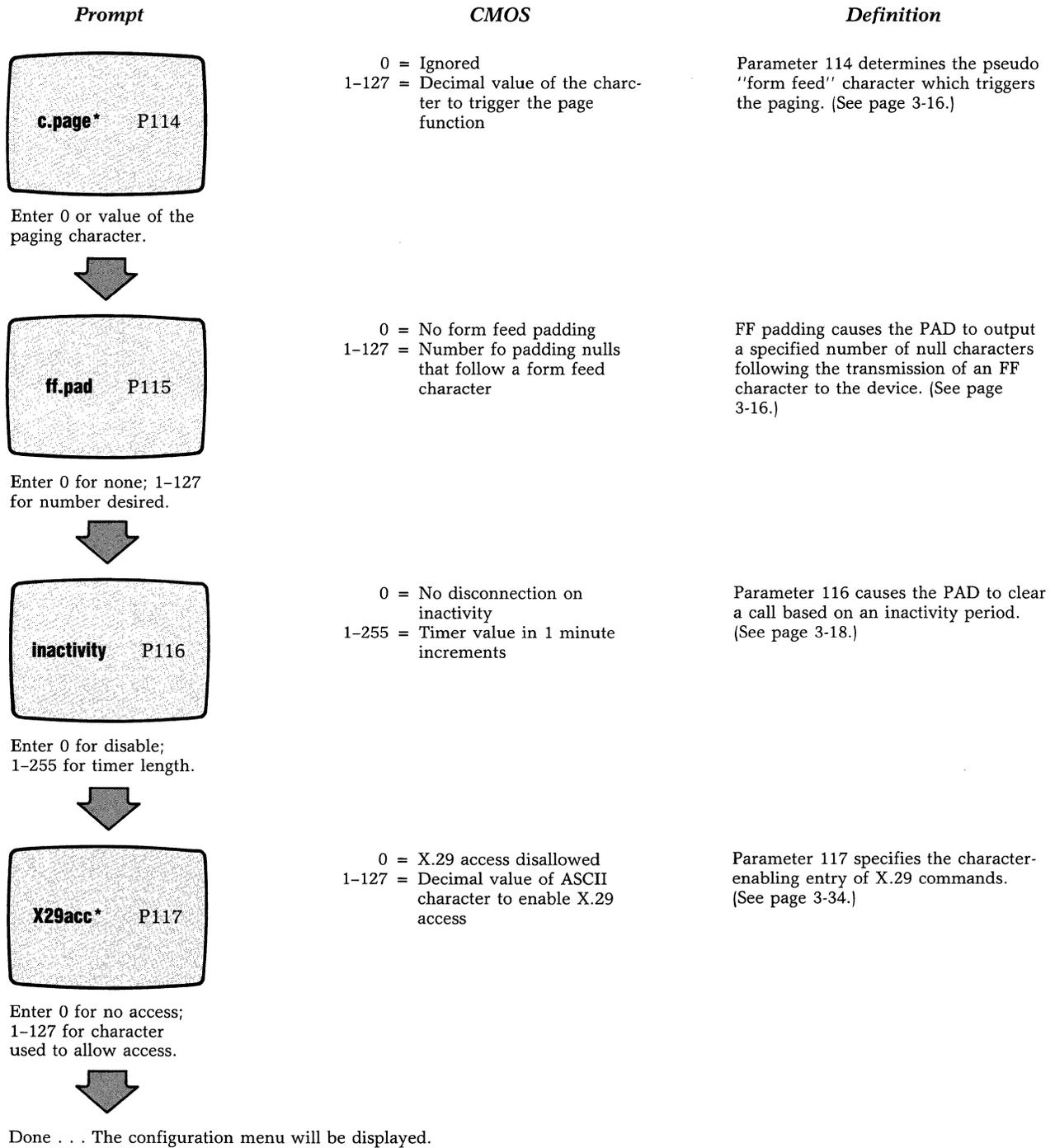


Figure 5-6 (continued). Selection 2: Profile

Special Echo Sequences

With this procedure, you can define up to three sets of special echo sequences, as shown in Figure 5-7. Each set can contain eight sequences of one-to-four special echo characters. One associates these multi-echo sets with one or more device profiles (refer to the section titled "Echo Control" in Chapter 3).

To enable Special Echo, set Parameter 2 (Echo) in the device profile to 1.

Remote Parameters

With this selection, you can define up to five remote parameter setup sequences, as shown in Figure 5-8. Each can have up to 20 parameters. The PAD, upon call connection, will send these parameters to the caller using an X.29 message. The PAD therefore, gives you the ability to adjust the parameters of any calling device (refer to the section titled "Initiation of X.29 Messages" in Chapter 3).

Each of these setup sequences may be associated with a PAD channel—a channel configuration, "remote par ID" (refer to the section titled "Channel" in Chapter 5).

Entering a National Parameter Separator

If you want to enter Codex-enhanced parameters as well as standard CCITT parameters, you must enter a National Parameter Separator between the two types of parameters (see Table 3-1). When you use a National Parameter Separator, it affects the Count, Parref, and Parval Prompts of Selection 4.

In certain cases, the Count Prompt must be incremented by one to accommodate the National Parameter Separator. For example, to enter two CCITT parameters and two Codex-enhanced parameters, you enter a Count value of five, not four. The third Parreff-Parval pair is for the National Parameter Separator. This case is illustrated in the Parval section of Figure 5-8.

The total number of combined CCITT and Codex-enhanced parameters cannot exceed 19. With a Count value equal to 20, this leaves one Parreff-Parval pair for the National Parameter Separator.

6502 X.25 Asynchronous PAD
Using the Command Facility

Prompt

seq id	1-3
---------------	-----

Enter the ID of the sequence to be defined.



count	1-8
--------------	-----

Enter the number of sequences to be defined for that set.



inchar

Enter ASCII character to trigger output of echo sequence.



echout

Enter up to four characters that you want echoed for this sequence.

CMOS

Example: 2

Sequence	3
1	
2	
3	
4	
5	
6	
7	
8	

Example: Select five sequences for set 2.

	2			
	In		Out	
1				
2				
3				
4				
5				

Prompt 4

Inchar	^A

Example: SOH¹ Character

Example: To echo "A A CR LF" in response to an SOH character

Inchar	^A
Echout	A A ^M ^J

Definition

The identification number that you select is the one used in parameter 112 of the device profile.

The count number you select tells the PAD how many sequences will be in this set. The PAD will continue to ask for inchar and echout sequence until count is reached.

Inchar is used to trigger the output of the echo sequence.

With this selection, you define the characters that will be triggered by inchar.

Repeat entering characters for all sequences.

Done . . . The configuration menu will be displayed.

¹See Chapter 5 — Guidelines and Notation Conventions.

Figure 5-7. Selection 3: Special Echo

6502 X.25 Asynchronous PAD

Using the Command Facility

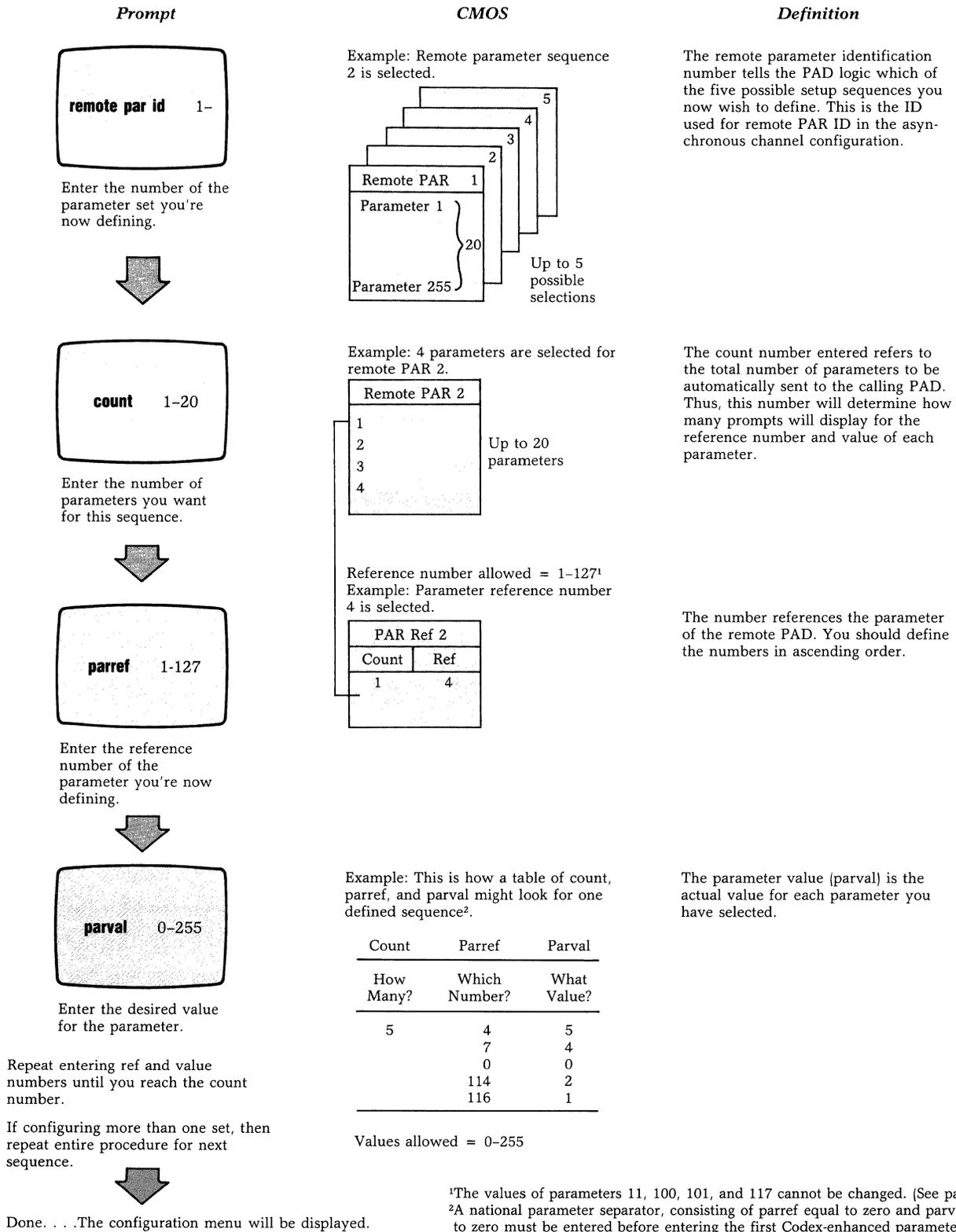


Figure 5-8. Selection 4: Remote Parameter

Trunk

With this procedure you can define the trunk parameters. This includes parameters at the link, frame, and packet levels. Besides these, you will select among various options affecting call establishment. Figure 5-9 displays all of the trunk parameters.

Switched Virtual Circuit/Permanent Virtual Circuit

With this procedure, you can define the settings for the Logical Group Numbers (LGNs) and the Logical Channel Numbers (LCNs) (refer to the section titled "How to Operate the Touch Panel"). You can do this for each Switched Virtual Circuit (SVC) and each Permanent Virtual Circuit (PVC) selected. You may choose any mix of assignments so long as the sum

does not exceed the number of asynchronous channels plus two, that is, a possibility of 18 for a 16-channel PAD. Figure 5-10 displays the settings associated with the LGNs and LCNs.

■ **Note:** If the combined total number of SVCs and PVCs is greater than 18, then the PAD automatically assigns a value of 2 to the number of SVCs (see the `svccnt` and `pvcnt` prompts in the figure that follows).

You may want to define more SVCs than channels:

- If you want to guarantee access to the Command Facility from the network, while all channels are active.
- If your PAD is managed by the XCC (X.25 Control Center).

6502 X.25 Asynchronous PAD
Using the Command Facility

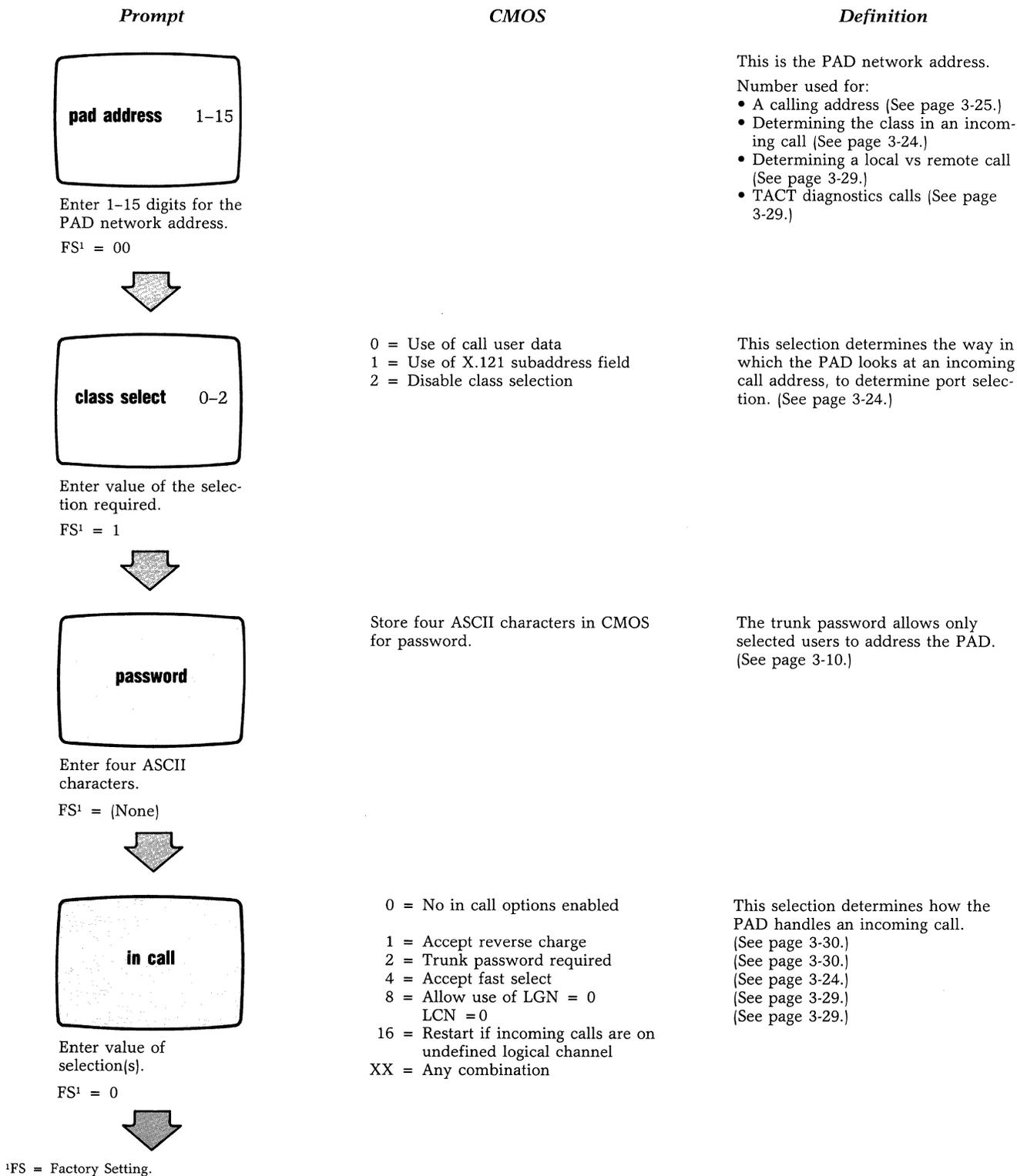


Figure 5-9. Selection 5: Trunk

(continued on next page)

Using the Command Facility

Prompt

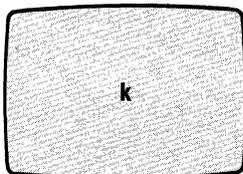
CMOS

Definition



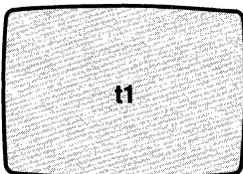
Enter value of selection(s).

FS¹ = 0



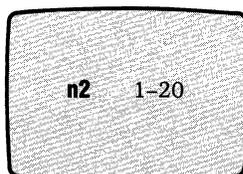
Enter HDLC window size.

FS¹ = 7



Enter time-out value.

FS¹ = 5



Enter number of retransmissions allowed.

FS¹ = 10



- 0 = Call packet with calling address field
- 1 = No calling address
- 2 = Append channel number to calling address
- 4 = 1980 call accept packet with option fields
- 8 = All calls reverse charge
- 16 = Use packet negotiation
- 32 = Use window negotiation
- XX = Any combination

This selection determines the characteristics of the call request and call accept packet.
(See page 3-25.)
(See page 3-26.)

Used for networks which require the extended call accept packet.
(See page 3-6.)
(See page 3-8.)
(See page 3-9.)

K = 1 to 7

(See page 3-3.)

T1 = 1 to 15 seconds

(See page 3-3.)

N2 = 1 to 20 retries

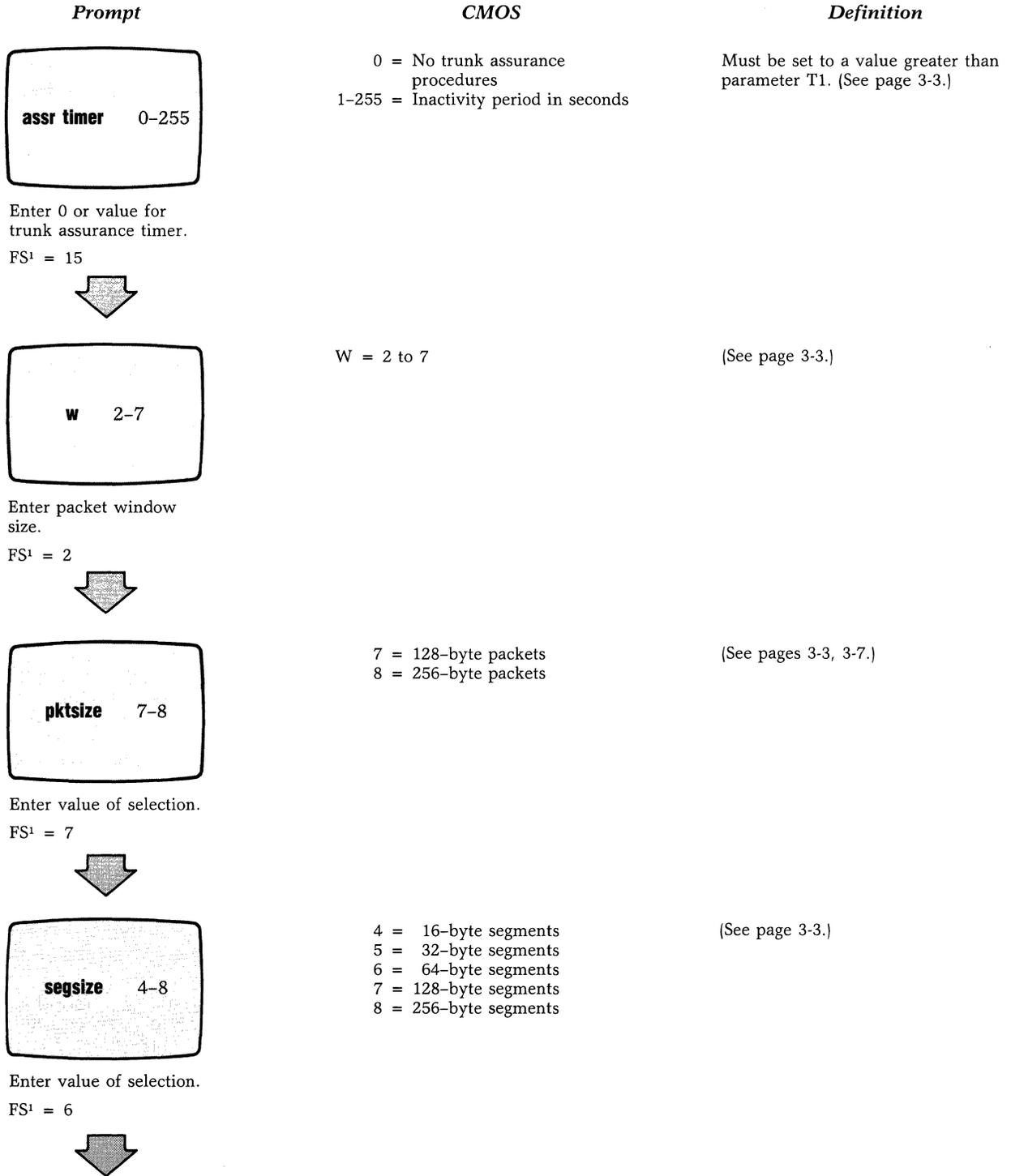
(See page 3-3.)

¹FS = Factory Setting.

Figure 5-9 (continued). Selection 5: Trunk

(continued on next page)

6502 X.25 Asynchronous PAD
Using the Command Facility

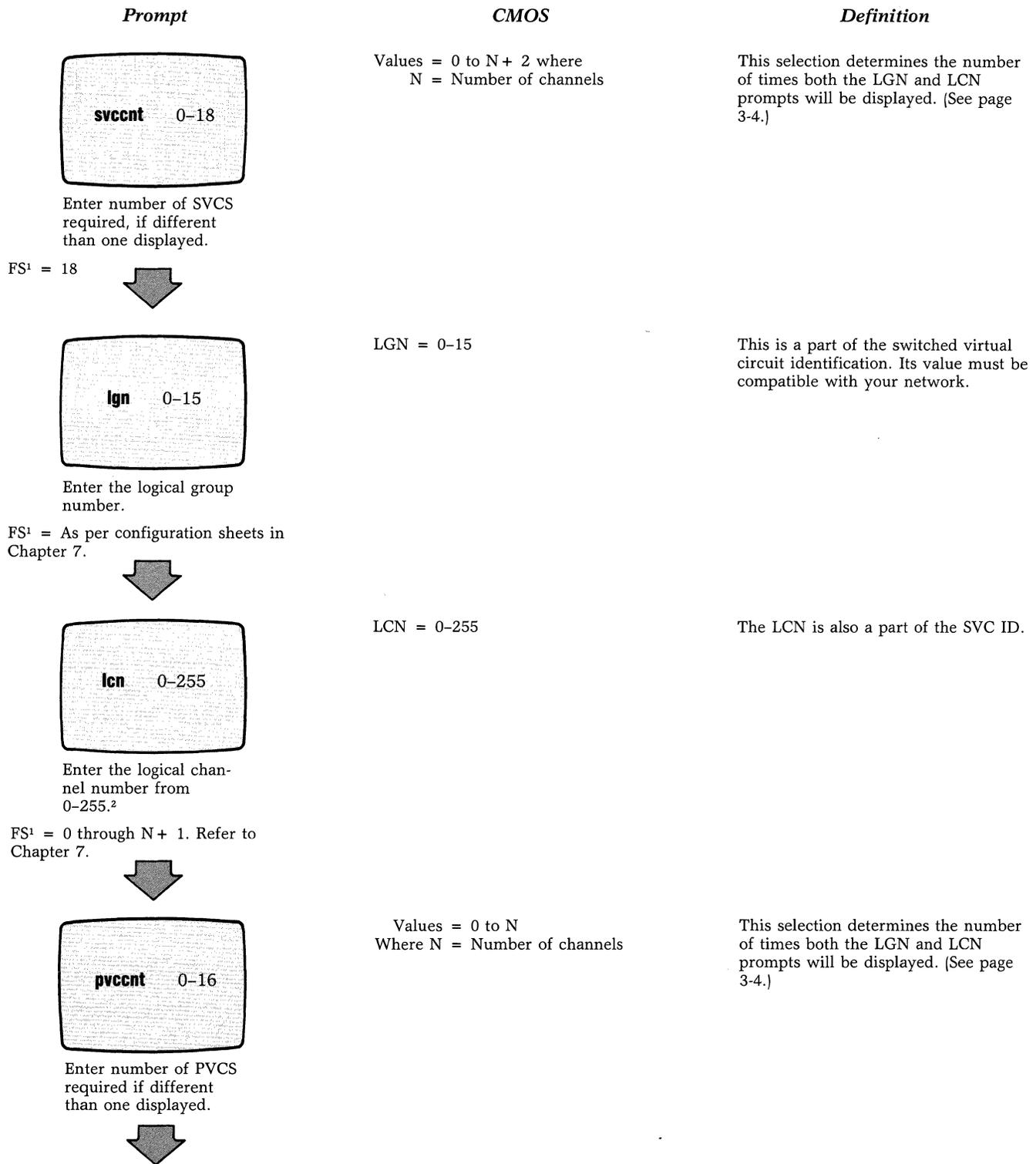


Done. . . The configuration menu will be displayed.

¹FS = Factory Setting.

Figure 5-9 (continued). Selection 5: Trunk

6502 X.25 Asynchronous PAD
Using the Command Facility



¹FS = Factory Setting.
²Always enter LCNs in ascending numerical order.

Figure 5-10. Selection 6: SVC/PVC

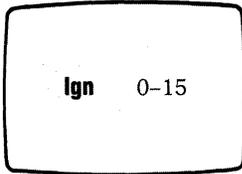
(continued on next page)

Using the Command Facility

Prompt

CMOS

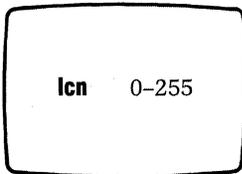
Definition



Value = 0-15

This is a part of the permanent virtual circuit identification. Its value must be compatible with your network.

Enter the logical group number.

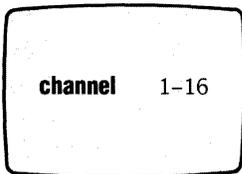


Value = 0-255

The LCN is also a part of the PVC ID.

Note: The LGN and LCN of a PVC must be different from those of an SVC.

Enter a logical channel number from 0-255¹.



Value = 1 to N
Where N = Number of PAD channels

This is the channel to be associated with the selected PVC.

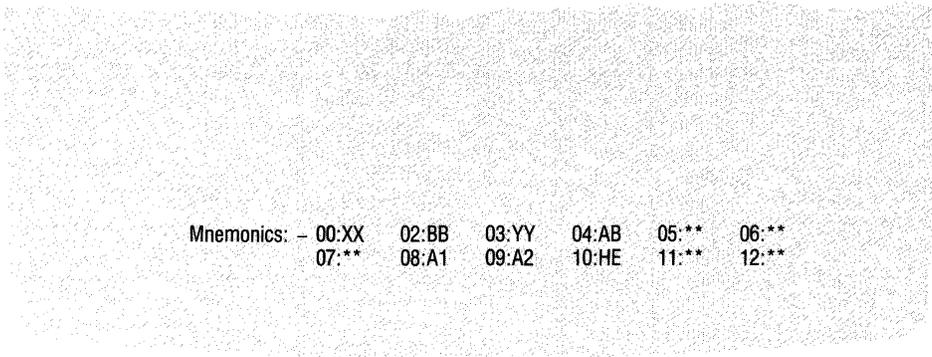
Enter a physical channel number from 1-16.



Done. . . The configuration menu will be displayed.

¹Always enter LCNs in ascending numerical order.

Figure 5-10 (continued). Selection 6: SVC/PVC



```
Mnemonics: - 00:XX 02:BB 03:YY 04:AB 05:** 06:**
              07:** 08:A1 09:A2 10:HE 11:** 12:**
```

** = Not Defined

Figure 5-11. Mnemonic Display

Address ID

With this procedure you can define up to 12 mnemonics associated with autocalling channels and/or for use by those using abbreviated addressing, as shown in Figure 5-12. One uses auto-calling/abbreviated addressing to routinely make calls to the same DTE, or to restrict a user to calling one or more of a selected number of destinations.

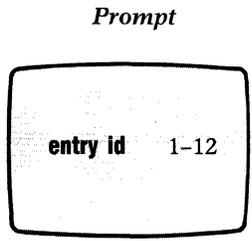
This procedure allows you to define the X.25 facilities, the address, the subaddress, the call user data field and also, if required, the protocol ID of the Call Request packet (refer to the section titled "Calling Methods" in Chapter 3).

Before prompting you for entries, and to inform you of mnemonics already defined, the Command Facility will display all 12 mnemonics each time you make this selection (see Figure 5-11).

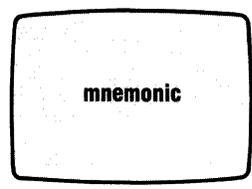
Command Port

This procedure associates a device profile with the Command Port and associates a subaddress (class) with the Command Facility, as shown in Figure 5-13. The profile is needed to adapt the Command Port to the characteristics of the attached device. The class definition (Class 1 and Class 2) is needed to allow access to the Command Facility from the Network or from the XCC (X.25 Control Center). You may also want to define whether the Command Port and/or the XCC will be used for logging Events and Per-Call Accounting information.

6502 X.25 Asynchronous PAD
Using the Command Facility



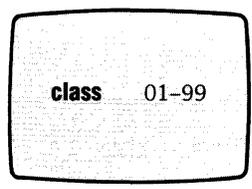
Enter mnemonic ID 1-12. See above.



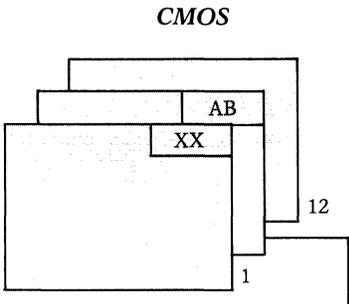
Enter two characters for a mnemonic or <CR>.



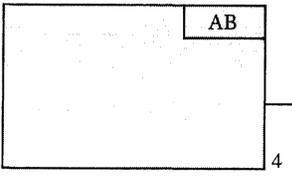
Enter from 1 to 15 digits for remote destination address.



Enter 2 digits for class ID/subaddress.



Mnemonic = any 2 alphanumeric characters.



Remote DTE address = 1 to 15 digits.

Remote Address	AB

Class = 2 digits.

Remote Address	AB
Remote Subaddress	//
	//
	//
	//
	//

Definition

A mnemonic associated with an autocalled channel can also be used for abbreviated calling. You can delete a mnemonic by entering ctrl-y.

Up to 15 digits.

If X.121 Method.
The 2 digits will be appended to above address. Note that if the address contains 15 or 14 digits these 2 digits will be ignored.

If Call User Data Method.
The 2 digits will be relocated to octets 5 and 6 of the cud field.

Figure 5-12. Selection 7: Address ID

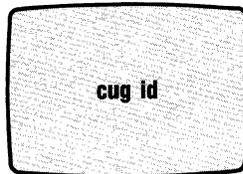
(continued on next page)

Using the Command Facility

Prompt



Enter value of selection(s).



Enter 2 digits for closed user group ID if allowed by previous prompt.



Enter 8 hexadecimal values.



Enter up to 12 ASCII characters.



Done. . . The configuration menu will be displayed.

CMOS

- 0 = No facility
- 1 = Reverse charging
- 4 = Closed user group
- 8 = 128 byte packet negotiation
- 16 = Throughput class
- 32 = Nonstandard protocol ID
- XX = Any combination

Cug ID = 2 digits.

Remote Address	AB
Remote Subaddress	//
Facilities	//
Cug ID	//
	//
	//

8 Hexadecimal Values

Remote Address	AB
Remote Subaddress	//
Facilities	//
Cug ID	//
Cud Field 1-4	//
	//

"^x" notation to enter control characters.

Remote Address	AB
Remote Subaddress	//
Facilities	//
Cug ID	//
Cud Field 1-4	//
Cud Field 5-16	//

Definition

The cug ID is a 2-digit number used to identify a closed user group on your network.

This is a non-standard protocol ID. The eight values are inserted in octets 1, 2, 3, and 4 of the call user data field overriding the standard value 01000000 which is typically used by the PAD when placing a call.

If you are using call user method for subaddressing, your entry will be inserted in octets 7 through 16, i.e., allowing you a maximum of 10 characters instead of 12.

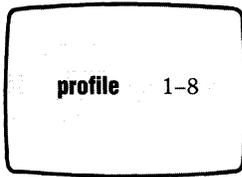
Figure 5-12 (continued). Selection 7: Address ID

6502 X.25 Asynchronous PAD
Using the Command Facility

Prompt

CMOS

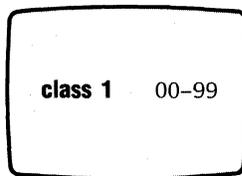
Definition



Select 1 of 8 device profiles.

This step is to associate one of eight possible device profiles with the command port.

Enter device profile ID.

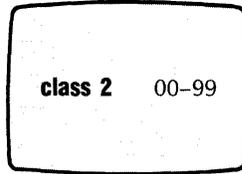


00 = Access from network not allowed
 NN = Any 2 digits (must be different from channels class IDs)

This step is to assign the command facility a class ID so it can be accessed by an X.25 call. (See page 3-25.)

Enter 2 digits.

FS¹ = 99

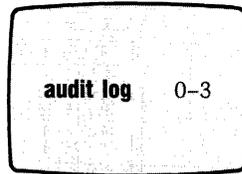


00 = Access from X.25 control center not allowed
 NN = Any 2 digits (must be different from channels class IDs and from value of previous prompt)

This step is to assign the command facility a class ID so it can be accessed by Codex's X.25 control center.

Enter 2 digits.

FS¹ = 98



0 = Disable to both X.25 control center and the command port
 1 = Enable to command port
 2 = Enable to X.25 control center
 3 = Both 1 and 2

This selection enables or disables logging call accounting and events information to the command port and/or the X.25 control center. (See Chapter 5 — Call Accounting Event Reporting.)

Enter a value from 0 to 3.

FS¹ = 0



Done. . . The configuration menu will be displayed.

¹FS = Factory Setting.

Figure 5-13. Selection 8: Command Port

6502 X.25 Asynchronous PAD
Using the Command Facility

Prompt



Enter characters for
herald message.¹

CMOS

0-32 ASCII characters.

Definition

The herald message is the PAD's way of saying "here is" when a device connects to any one of the PAD's channels. You may turn it off on certain channels via parameter 6 of the device profile.

FS² = mb2-X.25 async PAD channel nn

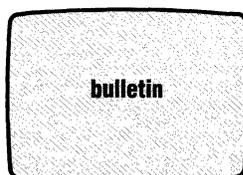
Done. . . The configuration menu will be displayed.

¹If you make a mistake and wish to clear the field, enter ctrl-y.

²FS = Factory Setting.

Figure 5-14. Selection 9: Herald Message

Prompt



Enter characters for the
bulletin.¹

CMOS

Enter up to 120 ASCII characters.

Definition

The bulletin can be used as an information message.

FS² = (none)

Done. . . The configuration menu will be displayed.

¹If you make a mistake and wish to clear the field, enter ctrl-y.

²FS = Factory Setting.

Figure 5-15. Selection 10: Bulletin Message

Herald Message

In this procedure you can define the Herald Message as shown in Figure 5-14. For more information on the Herald Message, refer to the section titled "User Connection Messages" in Chapter 3.

Bulletin Message

In this procedure you can define the Bulletin Message as shown in Figure 5-15. For more information on the Bulletin Message, refer to the section titled "User Connection Messages" in Chapter 3.

Prompt



Enter characters for the X.28 service prompt.¹

CMOS

Enter up to 16 ASCII characters.

Definition

The service prompt advises the user that he may enter an X.28 command.

FS² = *

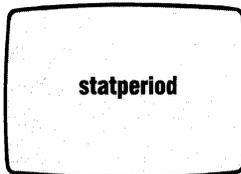
Done. . . The configuration menu will be displayed.

¹If you make a mistake and wish to clear the field, enter CTRL-Y.

²FS = Factory Setting.

Figure 5-16. Selection 11: X.28 Service Prompt

Prompt



Enter 0 to disable reporting; 1 through 6 for times of stat reporting.

CMOS

Values:
0 = Disable
1, 2, 3...6 = 10 to 60 minutes in 10-minute increments

Definition

You may still request statistics on demand, even if you disable periodic reporting. Note that the counters are reset to 0 after each periodic report. You must logout to initiate periodic reporting. (See Chapter 5 — Exit the Command Facility.)

Done. . . The configuration menu will be displayed.

Figure 5-17. Selection 12: Stat Period

X.28 Service Prompt

In this procedure you can define the prompt that is displayed when the user is in X.28 mode (see Figure 5-16). For more information on the Service Prompt, refer to the section titled "Escape to X.28 Mode".

Stat Period

In this procedure you will define how often the PAD will output the Statistics Report to the Command Port (see Figure 5-17). For a description of this report, refer to the section titled "Performance Statistics and Channel Activity" later in this chapter.

Prompt

Enter output autobaud sequence.

CMOS

Up to 4 ASCII characters

Definition

The sequence will be output to host when autobaud is enabled. To function, the channel option must be set to ring out. Also, the channel must be set to ABR. A channel will output this sequence upon an incoming call if:

- It is set to autobaud
 - It is set for ring-out
- (See page 3-30.)

FS¹ = CR

Done. . . The configuration menu will be displayed.

¹FS = Factory Setting

Figure 5-18. Selection 13: Host Autobaud

Host Autobaud

With this procedure, you can select up to four ASCII character(s) that will be output to the host for autobaud purposes as shown in Figure 5-18.

For a CR.CR autobaud sequence enter:

^M.^M

Each ^M entry equals a carriage return.

X.25 Control Center

A PAD that is managed by an XCC can be configured to place a call to the XCC to:

- Request a downline load of operating parameters (CMOS update)
- Report call accounting and event data

■ **Note:** One PAD must be physically attached to the CC to give the XCC access to the X.25 PDN (see Figure 1-8). This PAD is referred to there as the "local" PAD. Other PADs (those managed by the XCC) are referred to as "remote" PADs. Configuration of remote PADs is described in the following paragraphs.

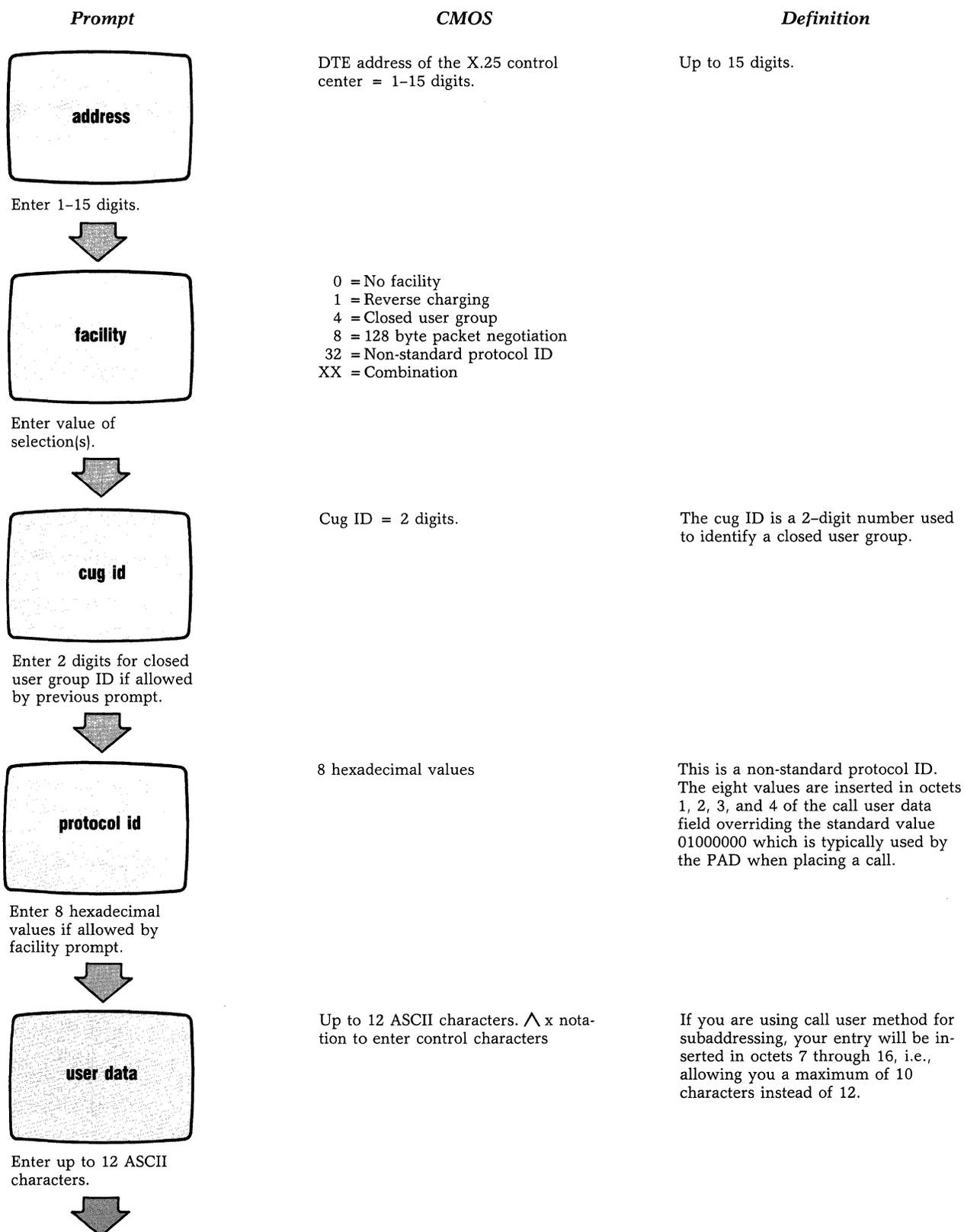
If you expect your PAD to call the XCC to request a CMOS update or to report call accounting and event data:

- The PAD Address field in trunk configuration (refer to the section titled "Trunk" in Chapter 5) must contain your PAD's own DTE address. The reason for this is that the XCC will verify that the address is included in its PAD address table, before it accepts a call.
- The entry in the Class Select field in trunk configuration (refer to the section titled "Trunk" in Chapter 5) must be compatible with the local XCC PAD and with all other PADs to be managed by the XCC. In addition, the Class Select field option 2 (Disable Class Select) should not be used in conjunction with the XCC.
- The Channel Option field in channel configuration (refer to the section titled "Channel" in Chapter 5) must include the value of 32, for each channel that is to report call accounting and event data.
- The CMDPORT configuration (refer to the section titled "Command Port" in Chapter 5) must be completed correctly. For example, for channels enabled to report call accounting and event data, the value entered for the Audit Log prompt must not be equal to 0.

After meeting the above requirement, select item 15 (XCC) from the Configure Menu. The following prompts will be displayed (where necessary, these prompts are described in more detail, following the illustrations). Figure 5-19 displays the XCC Prompts.

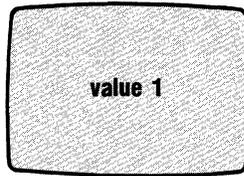
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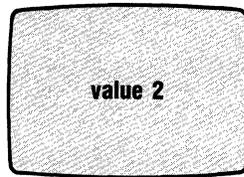


Done. . . The configuration menu will be displayed.

Figure 5-19. Selection 14: XCC

Prompt

Enter value of selection.



Enter <CR>.



Done. . . The configuration menu will be displayed.

CMOS

- 0 = Enable local switching between channels
- 1 = Disable local switching between channels
- 2 = Disable TACTR and TACTS on channels
- 4 = Reserved
- X = Combination

Definition

This value is reserved.

Figure 5-20. Selection 15: System PAR*Descriptions of XCC Prompts*

Address Prompt	If X.121 subaddressing is being used on the local XCC PAD, the last two digits of the Address field should represent the class/rotary assigned to the PAD channels that are connected to the XCC.
Facility Prompt:	This value must be equal to 4, or be added to 4, if you enter anything other than <CR> for the CUG ID prompt. For example, if you wanted to combine Facility values 1, 8, and 32, your entry would be 1 + 8 + 32 + 4, or 45. This value must be equal to or greater than 32, if you enter anything other than <CR> for the Protocol ID prompt.
User Data Prompt:	If call user data subaddressing is being used (refer to the section titled "Trunk" in Chapter 5), enter the XCC subaddress ID. The local XCC PAD will interpret positions 1 and 2 of the User Data field as the requested class rotary. If XCC access requires a trunk password, enter it in positions 1-4 for X.121 subaddressing, or in positions 3-6 for call user data subaddressing.

System Parameters

Selection 15 (shown in Figure 5-20) from the Configure Menu allows you to enable or disable local channel-to-channel calls, and to enable or disable remote loopback tests over the X.25 composite connection. This Configure Menu selection is called System Par, because it affects all channels on a PAD (the effect is system-wide).

When local switching is enabled, one terminal user can connect locally to another terminal user that is connected to the same PAD, without accessing the X.25 PDN.

Users connected to the PAD can be allowed or disallowed the ability to activate remote loopback tests (TACTR and TACTS). Refer to Chapter 6 for information on these and other PAD diagnostic tests.

Soft Switches

As described in Chapter 2, you can set some of the PAD's operating parameters using the Touch Panel. This paragraph explains the other method for setting operating parameters, through the PAD's Command Facility. To use the Command Facility method, select item 16 from the Configure Menu. (See Figure 5-21.)

The first prompt that appears in SYS 1 (which relates to the SYS 1 soft switch group), the second prompt is SYS 2 (related to the SYS 2 soft switch group, and third prompt is SYS 3 (related to the SYS 3 soft switch group).

Within each group there are eight selections. Each selection has a numerical value. For example, Selection 6 has a numerical value of 32. You enter a value, or a sum of values, to turn a selection or selections on.

For more information on how to set operating parameters, refer to the section titled "Using the Touch Panel to Set Operating Parameters."

CHANNEL CONTROL

With these commands, you can do the following:

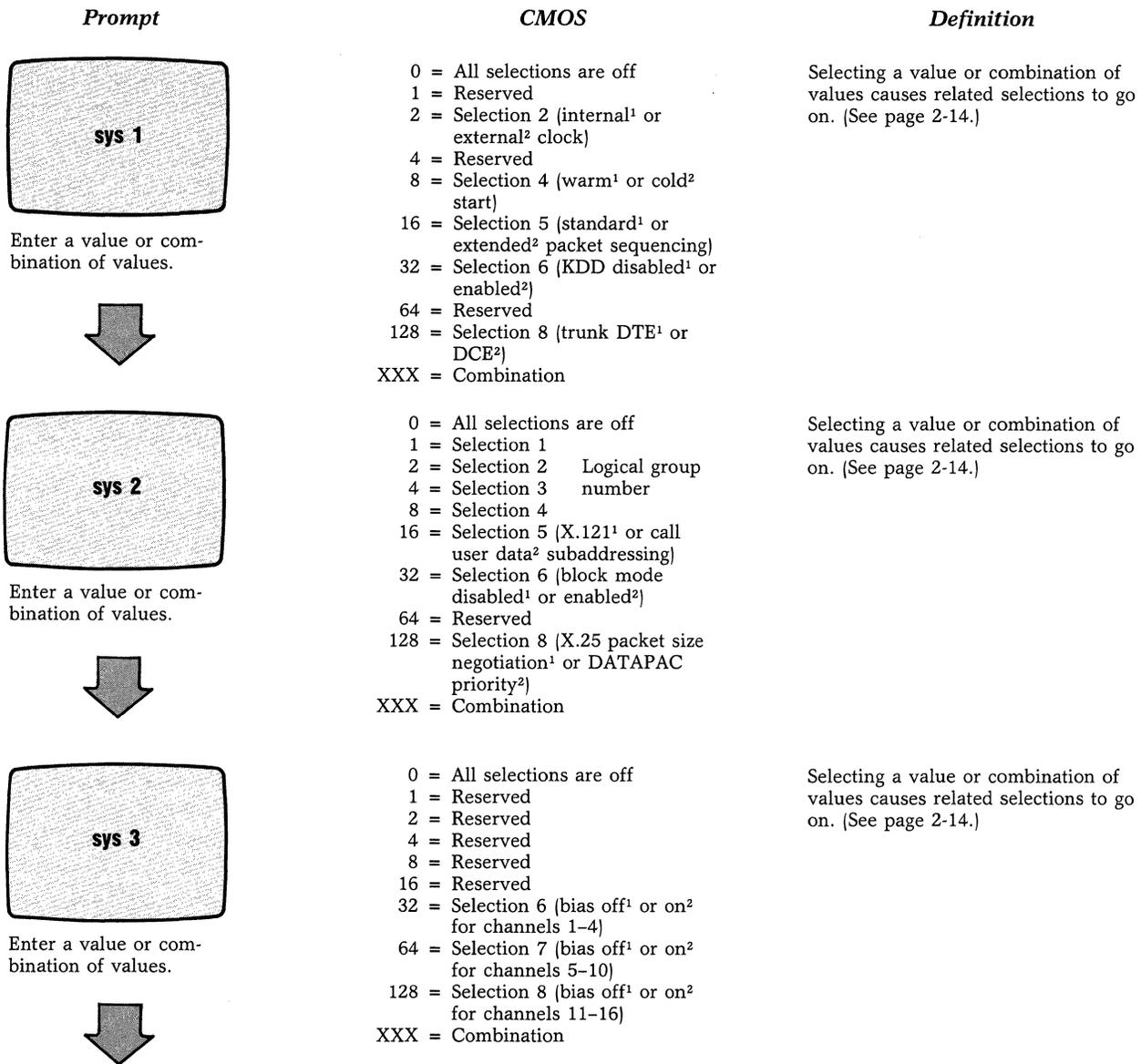
- Busy-out a channel
- Disconnect a call in progress and busy-out the channel
- Put a channel back in service.

Table 5-1 explains the action, reason, and effect of various selections.

Table 5-1.
Command Menu Selections for Channel Control

Command Menu Selection	Select from Menu		
	2. busyout	3. disconnect	4. reenable
Prompts	channel #: [**] ____	channel #: [**] ____	channel #: [**] ____
The reason for selection	To put a channel out of service. To protect an unused channel from unauthorized access.	Same as busyout	To cancel the busyout or disconnect action
The effect of selection	If a call is in progress, the command will not take effect until the call is cleared. This action causes a dial-in channel to raise its Busy Out (BO) lead. This causes a dial-in modem to take the phone line off-hook. The PAD will not accept calls on dedicated or dial-in channels that are busied-out until they are reenabled.	This selection is identical to busyout, except the command takes effect immediately.	This causes EIA leads to be scanned again. For dial-in channels, the Busy Out (BO) lead will be lowered. The PAD will accept calls from, or route calls to, the channel.

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Done. . . The configuration menu will be displayed.

¹For this selection, do not enter the related value. For example, for trunk DTE (in SYS 1), do not enter 128 by itself or in combination with other values.
²For this selection, enter the related value. For example, for block mode enabled (in SYS 2), enter 32 by itself or in combination with other values.

Figure 5-21. Selection 16: Soft Switches

Table 5-2.
Command Menu Selections for Trunk Monitoring and Control

Command Menu Selection	Select from Menu		
	5. trunk status	6. trunk down	7. trunk up
Prompts	trunk up or trunk down	initiated	initiated
The reason for selection	To inquire if both the frame and packet level are operational.	To logically disconnect the trunk.	To cancel the trunk-down action.
The effect of selection		In this state, the PAD responds with a DM to any incoming command until the trunk is up. The LD indicator will go on. ■ Note: This action is invalidated upon RESET or power down.	The PAD will try to establish the link using the LAPB setup procedure. The LD indicator will go off once the packet level is reestablished.

TRUNK MONITORING AND CONTROL

With these commands you can do the following:

- Inquire about trunk status
- Logically disconnect the trunk from the X.25 PDN
- Reenable X.25 trunk operation

Table 5-2 explains the action, reason, and effect of various selections.

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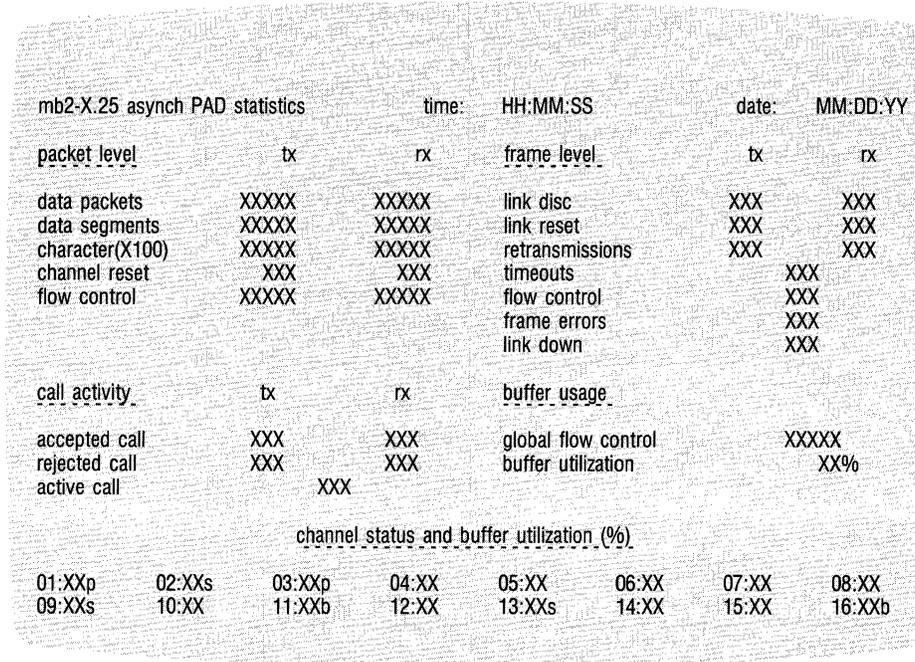


Figure 5-22. Format of the Performance Statistics Report

PERFORMANCE STATISTICS AND CHANNEL ACTIVITY

You may review, on demand, the Performance Statistics Report shown in Figure 5-22 and defined in Table 5-4. The same report can also be generated periodically by the PAD using the Command Port (refer to the section on "Stat Period" earlier in this chapter). The Performance Statistics Report allows you to:

- Monitor the PAD utilization.
- Monitor the Network usage.
- Monitor the X.25 trunk performance.
- Monitor channel activity and status.

Table 5-3 explains the action, reason, and effect of various selections:

Table 5-3. Command Menu Selections for Performance Statistics

Command Menu Selection	Select from Menu	
	8. list stats	9. reset stats
Prompts	See Figure 5-22	Are you sure? (y/n). done
The reason for selection	To retrieve PAD statistics report	To reset all the counters to zero

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Table 5-4.
Definition of the PAD Performance Statistics Report

Counter	Range of Values	Description
Data Packets	0 to 65, 535	This is the number of data packets received and transmitted over the X.25 trunk.
Data Segments	0 to 65, 535	A segment is a defined fraction of the packet size. It can be 16, 32, 64 or 128 octets. It cannot however, exceed the packet size.
Character (X100)	0 to 65, 535	This is the number of data characters the PAD receives or transmits over the X.25 trunk.
Channel Reset	0 to 65, 535	This is the number of reset packets received and transmitted over the X.25 trunk.
Flow Control	0 to 65, 535	This is the combined number of RNR packets transmitted and window blocks experienced without receipt of packet transmission authorization.
Link Disc	0 to 255	This is the number of times a PAD sends or receives a disk frame. The LINK DISC (TX) counter counts how many times the PAD initiates a DISC/UA sequence. The receive counter counts how many times the Network initiates a DISC/UA sequence.
Link Reset	0 to 255	This is the number of times the PAD performs an SABM/UA sequence.
Retransmissions	0 to 255	This is the number of frames retransmitted because of CRC errors or T1 expirations. This is added to the number of frames.
Timeouts	0 to 255	This is the number of times the T1 timer expired.
Flow Control	0 to 255	This is the number of RNR frames received or transmitted.
Frame Errors	0 to 255	This is the number of times the PAD receives bad frame check sequences (CRC).
Link down	0 to 255	This is the number of times the link assurance procedure failed. Bringing the link down using the Trunk Down command (selection 6 from the Command Menu) does not increment this counter.
Accepted Call	0 to 255	(TX) This is the number of times the PAD receives a Call Accept packet in response to a Call Request packet. (RX) This is the number of times the PAD sends a Call Accept packet in response to an Incoming Call packet.
Rejected Call	0 to 255	(TX) This is the number of times the PAD receives a Clear Indication packet in response to a Call Request packet. (RX) This is the number of times the PAD send a Clear Request packet in response to an Incoming Call packet.
Active Call	0 to 255	This is the number of SVCs now in use. It includes all SVCs in call setup, data transfer, and clear-pending states.
Global Flow Control	0 to 65, 535	This is the number of times the system exercises flow control on all asynchronous channels because the buffer utilization exceeded 62.5 percent.

(continued on next page)

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Using the Command Facility

*Table 5-4 (continued).
Definition of the PAD Performance Statistics Report*

<i>Counter</i>	<i>Range of Values</i>	<i>Description</i>
Buffer Utilization	00 to 99	Total buffer use (Instantaneous) = $\frac{\text{Total Number of Buffers in Use}}{\text{Total Buffer Pool Size}} \times 100\%$
Channel Status	(blank) ** p s b l	Channel Status: blank = Channel is free. ** = Channel is not installed, or I/O serial chip is defective. p = PVC is enabled for that channel. s = SVC is in progress. b = Channel is busied-out or logically disconnected. l = Channel is engaged in a local connection.
Channel Buffer Utilization	00 to 25	The percentage of Channel Buffer use for each channel (Instantaneous) = $\frac{\text{Number of Buffers Assigned to Channel}}{\text{Total Buffer Pool Size}} \times 100\%$

Table 5-5.
Command Menu Selections for System Initialization

Command Menu Selection	Select from Menu	
	10. reset pad	11. load cmos
Prompts	are you sure? (y/n)	are you sure? (y/n) logout
The reason for selection	Use this command to reinitialize or to cold-start the PAD. Use the command to restart the trunk.	Use this command to cause the PAD to request a total update of its CMOS (from the X.25 Control Center).
The effect of selection	Calls will be cleared. The previously set soft switch selections take effect. ¹ If soft switch group SYS1, selection 4 is on (COLD start), the factory default values will be reinstated. The CA Indicator will blink.	After executing LOAD CMOS, the PAD will place a call to the X.25 Control Center and request the CMOS update.

¹ Except the LGN/LCN numbering and the subaddressing method. Refer to the section titled "How To Operate the Touch Panel" in Chapter 2.

SYSTEM INITIALIZATION

System Initialization commands allow you to:

- Simulate the action of the hardware Reset Switch, thus causing PAD reinitialization.
- Initialize CMOS memory.
- Check the integrity of the CMOS memory.

Table 5-5 explains the action, meaning, and effect of various selections.

Using the Command Facility

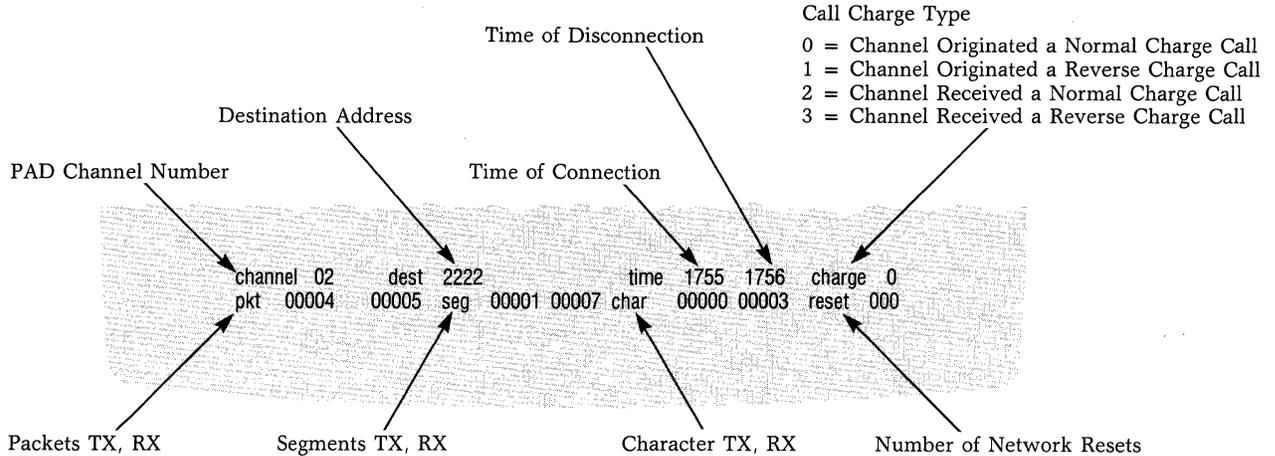


Figure 5-23. Call Accounting Record

CALL ACCOUNTING AND EVENT REPORTING

In addition to providing performance statistics (refer to the information on Performance Statistics and Channel Activity earlier in this chapter), you can configure the PAD to provide you with call accounting and events information.

Call Accounting

- A channel user can obtain call accounting information at the conclusion of a call. You enable this feature on a per-channel basis using the "Channel Option" (refer to the information on Channel earlier in this chapter).
- If enabled, the user will receive this information after the X.28 clear service signal, provided that the service signals are not disabled. Local calls, however, do not generate call accounting information.
- You can also obtain, using the Command Port, the call accounting records of all calls handled by the PAD. You enable this using the Command Port "audit log" (refer to the information on Channel earlier in this chapter).

Figure 5-23 shows the format of the call accounting information.

Event Reporting

If you enable the Command Port Audit Log parameter, the PAD will also output to the Command Port the following events information:

- Trunk down hh:mm
- Trunk up hh:mm

where hh:mm depicts the time the event took place, in hours and minutes.

EXIT THE COMMAND FACILITY

To exit the Command Facility, you enter the Logout Command. Table 5-6 shows the effects of the Logout Command.

*Table 5-6.
Command Menu Selections for Exiting the
Command Facility*

<i>Command Menu Selection</i>	<i>Select from Menu 12. logout</i>
Prompt	logout
The reason for selection	To exit the Command Facility.
The effect of selection	Allows the periodic output of the statistics report. Enables the output of the call accounting records via the Command Port. Enables the output of the events via the Command Port. The command Facility becomes accessible only to authorized users.

Chapter 6

Diagnostics and Troubleshooting

Contents

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INTRODUCTION

This chapter provides diagnostic information available on the PAD. The information includes a description of the Self-Test and the indicators on the front of the PAD. Troubleshooting information is also provided that will help you to locate the source of the problem.

SELF-TEST

The PAD executes a Self-Test at system initialization any time the system is reset. The Self-Test checks the operation of all system memory. When power is first turned on or the Reset keys are pressed, the system status display on the base module momentarily flashes. At the conclusion of the Self-Test (which takes five to ten seconds), a number of indicator states are possible. For a description of the indicators, refer to the "Indicators" section later in this chapter.

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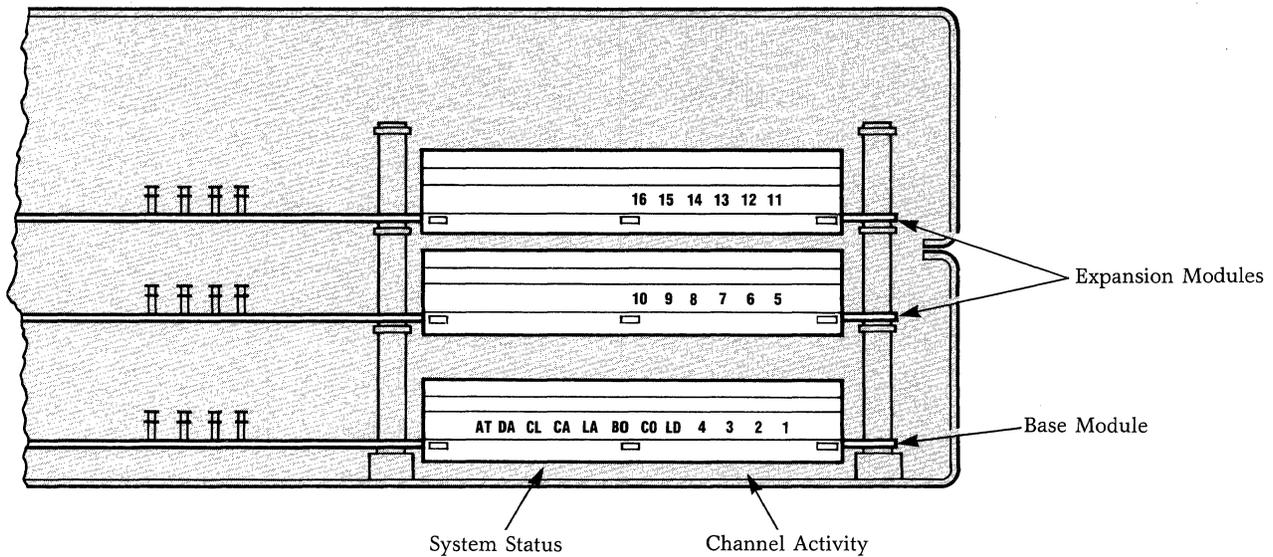


Figure 6-1. Indicators

DIAGNOSTIC LEVELS OFFERED BY THE PAD

The PAD offers you many levels of diagnostics:

- Performance Reports – which help you foresee problems before they actually cause your PAD to be out-of-service.
- You can have these reports on-demand or at fixed user-selectable intervals. In using these statistics for diagnostic purposes, you want to pay particular attention to the following:

- Link Disk
- Link Resets
- Retransmissions
- Time-Outs
- Frame Errors
- Link Loss

- Commands – to check the integrity of the configuration CMOS memory, the battery, and to reset the PAD.
- Tests – the terminal-Activated Channel Tests (TACT) can be initiated from the Command Port or from any of the PAD channels. These tests help to pinpoint any problems in the user or the Network connections.

Performance reports and commands are available through the Command Facility described in Chapter 5. The indicators and TACT are described in the next section.

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Table 6-1.
System Indicators on the Base Module

<i>Indicator</i>	<i>On</i>	<i>Off</i>	<i>Flashing</i>
AT (Active Model)	Normal Operation	Undefined problem	Undefined problem
DA (not used)	Undefined problem	Normal operation	Undefined problem
CL (Channel Loop-back)	Undefined problem	Normal operation	TACTR/TACTS Tests active
CA (Checksum Alarm)	CMOS or battery problem	Normal operation	Cold start performed ¹
LA (Link Alarm)	Undefined problem	Normal operation	Retransmission on link (to PDN)
BO (Buffer Overflow)	PAD is discarding data	Normal Operation	Over 62.5% buffer utilization
CO (Self-Test Failure)	When CA is also on and AT is also off, it indicates a bad FEATUREPAK cartridge. ² When CA and AT are also off, it indicates a RAM error.	Normal operation	A fault is detected in the CMOS RAM.
LD (Link Down)	Link is down	Normal operation	Undefined problem

¹ When the CMOS memory becomes corrupted, the PAD will automatically reload into CMOS the factory-set configuration values, regardless of the cold/warm start switch setting.

² If the FEATUREPAK cartridge is corrupted, the status of the indicators is random—they may all be flashing (call Codex Customer Service).

INDICATORS

After plugging in your PAD, some of the indicators will be visible through the front panel (see Figure 6-1). When you press a Touch Panel key during configuration of the PAD, the indicators monitor the configuration (see the section titled "How to Operate the Touch Panel" in Chapter 2). During operation of the PAD, these indicators monitor system status and channel data activity. Each expansion module has its own channel activity indicators. The significance of each indicator is described in Tables 6-1 and 6-2. Table 6-3 shows the correlation of the indicators to PAD Modules. ■ **Note:** During normal operating conditions, the AT Indicator is on, and all other indicators are off (except the channel indicators, which may be flashing /). During configuration of operating parameters, the indicators reflect soft switch selection settings (see Table 2-1).

■ **Note:** If all indicators are on, the PAD is in a constant reset condition and you should contact your local Codex representative. If all indicators are off, there is no power to the unit, or there is an undefined problem. See Table 6-4 to determine the nature of the problem.

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Table 6-2.
Channel Indicators on a Base or Expansion Module

<i>Indicators</i>	<i>On</i>	<i>Off</i>	<i>Flashing</i>
1, 2, 3, etc., Channel Activity	Constant data activity for Idle mode	Normal operation mode	Normal operation for Transmit/Receive

Table 6-3.
Indicators on PAD Modules

<i>PAD Models</i>	<i>Number of Expansion Modules</i>	<i>Display Locations</i>	<i>Display Functions</i>
65540 or 65541	1	Base Module	System Status Data Activity of Channels 1-4
65544 or 65545		Base Module	System status conditions Data activity of channels 1-4
65548 or 65549	2	Expansion Module	Data activity of channels 5-10
		Base Module	System status conditions Data Activity of channels 1-4
		1st Expansion Module	Data activity of channels 5-10
		2nd Expansion Module	Data activity of channels 11-16

```
*TACTL
in tact mode
ABABABABABABABABABABABABABABABABABABABABABABABABABABABABABABAB
tact complete
*
```

Figure 6-2. PAD User Dialogue for TACTL Test

TERMINAL-ACTIVATED CHANNEL TEST (TACT)

During normal operation, the PAD is connected to a variety of data communications equipment, such as, cables, modems, lines, and data terminals. To help you to find the origin of a problem quickly, Codex provides a diagnostic capability called Terminal-Activated Channel Test (TACT). TACT offers simple and easy-to-understand tests that can be performed using the dedicated Command Port or using any of the PAD's channels.

You can initiate any one of four different tests using the Codex extended commands (these commands are invalid when an SVC is in progress or when the channel is defined for PVC operation). The tests are: TACTL, TACTT, TACTR, and TACTS. These tests are nondisruptive, that is they may be performed while other channels are engaged in active sessions.

You can terminate any of the TACT tests at anytime by activating the BREAK key.

Two of these tests are local (between the PAD and the attached device) and can be initiated using the TACTL and TACTT Commands. The other two are remote. They make use of the X.25 trunk, which must be operational (that is, connected to a PDN or to another Codex PAD).

Refer to Chapter 4 for a description of TACT Commands.

TACTL

This command activates a loopback to test a local channel for channel reliability. The PAD acknowledges this test request with an "in-tact mode" service signal. All data the PAD receives from the device is transmitted back to the device. The X.25 trunk is not used in this test. Figure 6-2 illustrates the format of this test.

```
*TACTT
In tact mode
the quick brown fox jumps over the lazy dog 0123456789
the quick brown fox jumps over the lazy dog 0123456789
the quick brown fox jumps over the lazy dog 0123456789
the quick brown fox jumps over the lazy dog 0123456789
tact complete
*
```

Figure 6-3. PAD User Dialogue for TACTT Test

TACTT

You use this command to activate a loopback to test a local terminal. The PAD acknowledges the test request with an "in-tact mode" service signal. It then starts transmitting a continuous stream of fox messages to the device until the PAD detects a BREAK signal. This is a stress test for the device and channel connection. Figure 6-3 provides a sample for a fox message TACTT Test.

Test Equipment Setup for TACTL and TACTT Tests

Figure 6-4 shows the equipment setup to test a local unit.

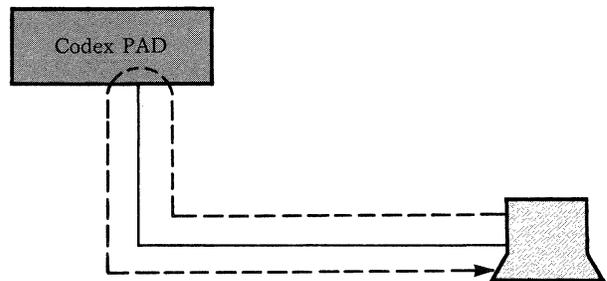


Figure 6-4. Equipment Setup for TACTL and TACTT Tests

```
*TACTR  
  
tact call placed  
  
com  
LLLLLLLLLLLLLLLL  
LLLLLLLLLLLLLLLL  
  
clr conf  
tact complete  
*
```

Figure 6-5. PAD User Dialogue for TACTR Test

TACTR

Use this command to activate a loopback to test a remote channel. The test demonstrates the reliability of the connection to the Network. On detecting this command, the PAD issues a call request over the X.25 trunk using its own address as the destination address. It is signaled to the user by the "tact call placed" service message.

On detecting the incoming test call, the PAD routes the call to the requesting channel. This creates a loopback path through the Network's node. It is signaled to the user by the "com" service message. If the call attempt fails, a regular clear service signal notifies the user. Once the com message is displayed, all data generated at the device is transmitted through this loopback path back to the device.

Figure 6-5 shows the format of the user/PAD dialogue used to test the remote unit.

```
*TACTS
tact call placed
com
the quick brown fox jumps over the lazy dog 0123456789
the quick brown fox jumps over the lazy dog 0123456789
the quick brown fox jumps over the lazy dog 0123456789
the quick brown fox jumps over the lazy dog 0123456789
the quick brown fox jumps over the lazy dog 0123456789
the quick brown fox jumps over the lazy dog 0123456789
the quick brown fox jumps over the lazy dog 0123456789
the quick brown fox jumps over the lazy dog 0123456789
clr conf
tact complete
*
```

Figure 6-6. PAD User Dialogue for TACTS Test

TACTS

You use this command to activate a system loopback test. It causes a path to be set up between the terminal, the PAD, and the PDN X.25 node. It does so in the manner described in the section titled "TACTR" in this chapter. The PAD then sends a continuous stream of fox messages that pass through the trunk, the node, and then back to the device. The test demonstrates the reliability of the connection to the Network and of the system as a whole. The test is terminated when the PAD detects a BREAK signal. Figure 6-6 shows the format of the user/PAD dialogue for this test.

Test Equipment Setup for TACTR and TACTS Tests

Figure 6-7 shows you the equipment setup for a test of the remote unit. ■ **Note:** The TACTR and TACTS Commands initiate a loopback test through the Network. They therefore require two switched virtual circuits.

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Diagnostics and Troubleshooting

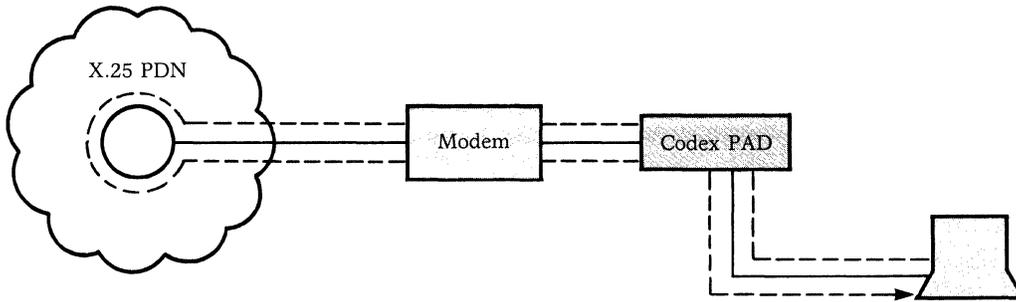


Figure 6-7. Equipment Setup for TACTR and TACTS Tests

OPERATOR TROUBLESHOOTING

Table 6-4 lists a few problems that you might experience, and provides some items to check for each problem.

Table 6-4.
Troubleshooting

<i>Problem</i>	<i>Probable Cause</i>	<i>Items to Check</i>
The unit does not operate when power is applied (fan does not operate).	Loss of power	Remove power cord plug from wall outlet for about two minutes. Reinsert plug in outlet. This resets the PAD power supply (tripped by a voltage surge). After disconnecting the power supply, test the fuse (see Figure 1-2). Replace the fuse if necessary, and investigate the cause of failure. Test the AC wall outlet.
The unit does not operate when power is applied (fan is operating, but indicators on the base module do not go on).	The problem is in the base module or power supply.	Simultaneously touch both Reset keys. If AT indicator is still off, replace base module or call Codex Customer Service. Reseat the outside connectors of the base module. Test the base module by trying a spare base module in its place. Test the power supply by trying a spare power supply in its place.
All indicators are on.	System is in a constant reset condition.	Replace the base module or call Codex Customer Service.
AT.	Undefined	Simultaneously touch both Reset keys. If AT indicator is still off, replace base module or call Codex Customer Service.
CO indicator is flashing.	Fault condition in the base module CMOS RAM.	Replace the base module or call Codex Customer Service.
AT and CA indicators on the base module are off. CO indicator is on.	Fault condition in the base module RAM.	Replace the base module or call Codex Customer Service.
CO and CA Indicators on the base module are on. AT indicator is off.	Fault condition in the FEATUREPAK cartridge	Replace the FEATUREPAK cartridge. Replace the base module or call Codex Customer Service.
CO indicator on the base module is on: other indicators may be on or flashing.	Hardware problem in the base module	Simultaneously touch both Reset keys. If CO is still on, replace the base module or call Codex Customer Service.
LD is on.	Link is down	Run TACTR or TACTS. If LD stays on, call Codex Customer Service.
BO indicator on the base module is on.	High error rate on the link caused a buffer overflow	Run TACTR or TACTS. Check the base module LA indicator, LA flashing indicates retransmissions.
CL indicator on the base module is flashing.	TACTR/TACTS are active	Enter BREAK to terminate the test and return the operation to the normal mode.

(continued on next page)

6502 X.25 Asynchronous PAD
Diagnostics and Troubleshooting

*Table 6-4 (continued).
Troubleshooting*

<i>Problem</i>	<i>Probable Cause</i>	<i>Items to Check</i>
CL indicator is flashing.	CMOS RAM is corrupted, and PAD is reloading factory-set configuration values into CMOS.	Under normal conditions, the CA indicator keeps flashing unless you change factory-set values. If you change the factory-set value of the cold/warm start selection of soft switch group SYS 1 (see Figure 2-10).
BO and CO indicators on the base module are on.	Problem with FEATUREPAK cartridge	Call Codex Customer Service.

Chapter 7 Configuration Sheets

Contents

Introduction	7-1
--------------------	-----

INTRODUCTION

The configuration sheets summarize all the parameters you can configure using the Command Facility. You should prepare these sheets carefully and completely before changing any configurations. Keep one copy of these sheets near the PAD unit and another copy for future reference. Each configuration sheet summarizes a different parameter of the Command Facility. The 16 parameters are shown in Figure 7-1.

**COMMAND FACILITY
COMMAND MENU**



configure menu

1. channel
 2. profile
 3. special echo
 4. remote par
 5. trunk
 6. svc/pvc
 7. address ID
 8. cmdport
 9. herald
 10. bulletin
 11. prompt
 12. stat period
 13. host autobaud
 14. xcc
 15. system par
 16. soft switches
- select:

Figure 7-1. Command Facility Command Menu

Configuration Sheets

Remarks	Asynchronous Channels							
	Channel	Profile	Call Option	Address ID Mnemonic	Channel Option	Class 1	Class 2	Remote PAR/ID
EIA 232-C Cables	1-8	Table 1		Table 2	00-99	00-99		
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							

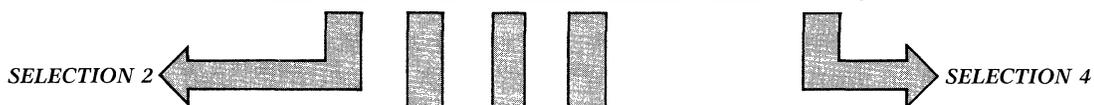


TABLE 1 – CALL OPTION

- 0 = Enable incoming calls
- 1 = Long form calls
- 2 = Abbreviated calls
- 4 = Auto call on "device ready"
- 8 = Auto call on CR
- 16 = Always pass call user data
- 32 = Incoming calls barred
- 64 = Extended EIA controls
- 128 = Clear on data loss, if SVC. Reset if PVC.
- XXX = Any combination

¹When this connection type is selected, extended EIA controls must be enabled. To enable extended EIA controls, enter call number 64 (extended EIA controls) in response to the call option prompt.

²See Table 3-2 for an explanation of "security".

³Option numbers 0 through 6 cannot be combined with each other. Option numbers 8 through 128 can be combined with each other, or with one of the 0 through 6 options.

TABLE 2 – CHANNEL OPTION

- 0 = Dedicated or dedicated with extended EIA controls enabled¹
- 1 = Support auto answer modems
- 2 = Ring-out or Ring-out with extended EIA controls enabled¹
- 3 = Auto answer
- 4 = Ring-out (with security)² or Raise DCD (with security)^{1, 2}
- 6 = Raise DCD
- 8 = Host port
- 16 = Priority channel
- 32 = Enable call accounting
- 64 = Disable X.28 extended mode
- 128 = Micro600 line interface option
- XXX = Combination of values³

Figure 7-2. Selection 1

6502 X.25 Asynchronous PAD

Configuration Sheets

Parameter Reference	Parameter	Assigned Parameter Value	Possible Parameter Values
1	x28acc		0 = Not possible 1 = Possible by character DLE (Control P) or . . . 2-127 = Decimal value of ASCII character used to access the X.28 mode
2	echo		0 = Disable echo 1 = Enable echo
3	data fwd		0 = No data forwarding 1 = Alphanumeric characters 2 = CR 4 = ESC, BEL, ENQ, or ACK 8 = DEL, CAN, or DC2 16 = EOT or ETX 32 = HT, LF, VT or FF 64 = All other characters in columns 0 and 1 of the ASCII chart XXX = Any combination of above values
4	idletimer		0 = No idletimer 1-255 = multiple of 0.5 seconds, i.e., max = 12.75 seconds
5	dv flow		0 = No flow control 1 = XON/XOFF flow control
6	s.signal		0 = No PAD messages or service prompt 1 = PAD outputs messages only 4 = PAD outputs service prompt only 5 = PAD outputs prompt and messages
7	break		0 = No action 1 = Interrupt packet sent 2 = Reset packet sent 4 = Indication of break PAD message 8 = Escape to X.28 mode 16 = Discard output to device XXX = Any combination of above values
9	cr pad		0 = None 1-127 = Number of padding characters after CR
10	l.fold		0 = No linefolding 1-255 = Number of characters that trigger linefolding
11	speed		0 = 110 bps 1 = 134.5 bps 2 = 300 bps 3 = 1200 bps 4 = 800 bps 5 = 75 bps 6 = 150 bps 7 = 1800 bps 8 = 200 bps 10 = 50 bps 12 = 2400 bps 13 = 4800 bps 14 = 9600 bps 32 = Autobaud (110-9600 bps, except 134.5 bps)
12	p.flow		0 = Device cannot exercise flow control over PAD 1 = Device can exercise flow control using XON/XOFF characters
13	autolf		0 = No line feed insertion 1 = LF after CR from remote DTE 2 = LF after CR sent to remote DTE 4 = LF after CR when echoing 5 = LF after CR to device when echo remote DTE sends CR 6 = PAD transmit LF when echoing or transmitting CR 7 = PAD transmit LF after all CR
14	lf pad		0 = No line feed padding 1-127 = number of nulls padding after line feed
15	edit		0 = No editing 1 = Editing enabled
16	c.del		0-127 = Decimal value of character used for character delete
17	l.del		0-127 = Decimal value of character used for line delete
18	l.disp		0-127 = Decimal value of character used for line display
19	dv.type		1 = Hard copy device 2 = Video display device
20	echomask		0 = No characters echoed 1 = Alphanumeric characters 2 = CR 4 = ESC, BEL, ENQ, ACK 8 = DEL, CAN, DC2 16 = ETX, EOT 32 = HT, LF, VT, FF 64 = All other control characters in columns 1 and 2 of the ASCII chart 128 = All remaining characters XXX = Any combination of above values

Figure 7-2 (continued). Selection 1

6502 X.25 Asynchronous PAD

Configuration Sheets

Parameter Reference	Parameter	Assigned Parameter Value	Possible Parameter Values
100	bits/char		0 = 5 bits 1 = 6 bits 2 = 7 bits 3 = 8 bits
101	dv parity		0 = Transparent parity 1 = Space 2 = Mark 3 = Even 4 = Odd 5 = Auto parity as determined by autobaud sequence
102	net parity		0 = Pass data as received 1 = Space 2 = Mark 3 = Even 4 = Odd
103	c.xon		0 = Ignored 1-227 = Decimal value of character for ASCII XON
104	c.xoff		0 = Ignored 1-127 = Decimal value of ASCII character for XOFF
105	special flow		0 = None 1 = Device can flow control PAD with RTS 2 = PAD can flow control device with CTS 4 = PAD issues BEL character to device in CTS flow control X = Any combination
106	count fwd		0 = No forwarding on character count 1-255 = Number of characters that will trigger data forwarding
107	escdelay		0 = No special handling 1-255 = The forwarding delay time after ESC input, selected in 0.5 second increments
108	c.break		0 = Normal break signal 1-127 = Decimal value of an ASCII character to be interpreted by the PAD as a break key
109	c.supp		0 = Disable mechanism 1-127 = Decimal value of the ASCII character used to trigger the echo suppression mechanism
110	c.subs		0 = No character is echoed 1-127 = Decimal value of an ASCII character used for substitution character
111	echoctrl		0 = Device input priority 1 = No priority 2 = Computer output priority 4 = Synchronize local field with incoming data formatting screens X = Selective combination
112	special echo ID		0 = Disable 1-3 = Echo sequence ID associated with that device profile
113	pagelength		0 = No auto page feed 1-255 = Number of lines per page
114	c.page		0 = Ignored 1-127 = Decimal value of the character to trigger the page function
115	ff pad		0 = No form feed padding 1-127 = Number of padding nulls that follow a Form Feed character
116	inactivity		0 = No disconnection on inactivity 1-255 = Timer value in 1-minute increments
117	x29acc		0 = X.29 access disallowed 1-127 = Decimal value of ASCII character to enable X.29 access

Figure 7-2 (continued). Selection 1

6502 X.25 Asynchronous PAD

Configuration Sheets

X.3 Parameters																				
Profile	x28acc	echo	data fwd	idletimer	dv flow	s.signal	break	discard output	cr pad	l.fold	speed	p.flow	autofl	lf pad	edit	c.del	l.del	l.disp	dv type	echomask
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	(See ¹)							N/A								(See ¹)	(See ¹)	(See ¹)		
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
	1	1	2	0	1	5	21		4	80	32	1	4	4	1	8	24	18	2	131
	0	0	0	20	0	0	0		0	0	12	0	0	0	0	0	0	0	1	255

← Default Profile 1, 3 through 8 (Terminal Profile)

← Default Profile 2 (Host Computer Profile)

Codex Enhanced Parameters																		
bits/char	dv parity	net parity	c.xon	c.xoff	special flow	count fwd	escdelay	c.break	c.supp	c.subs	echoctrl	special echo ID	pagelength	c.page	ff pad	inactivity	x29acc	Profile
100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	
			(See ¹)	(See ¹)				(See ¹)	(See ¹)	(See ¹)				(See ¹)			(See ¹)	
																		1
																		2
																		3
																		4
																		5
																		6
																		7
																		8
	2	5	0	17	19	0	0	0	0	26	42	0	0	0	0	0	0	
	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	

← Default Profile 1, 3 through 8 (Terminal Profile)

← Default Profile 2 (Host Computer Profile)

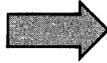
¹These parameters should not be assigned the same value.

SEE SELECTION 3

Figure 7-3. Selection 2

6502 X.25 Asynchronous PAD
Configuration Sheets

FROM SELECTION 2

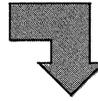


Sequence ID	Count	Special Echo			
		Echo Sequence Trigger Character	1st Echout Character	2nd Echout Character	3rd Echout Character
1		Any Graphic Character (^@ = CTRL @)			
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
2					
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
3					
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				

Figure 7-4. Selection 3

6502 X.25 Asynchronous PAD
Configuration Sheets

FROM SELECTION 1



Set Remote Parameters										
Remote Par/ID	1st Parameter Ref	Parameter Value	2nd Parameter Ref	Parameter Value	3rd Parameter Ref	Parameter Value	4th Parameter Ref	Parameter Value	5th Parameter Ref	Parameter Value
Define Up To 20 Parameters										
	1	2	3	4	5	6	7	8	9	10
1	:	:	:	:	:	:	:	:	:	:
2	:	:	:	:	:	:	:	:	:	:
3	:	:	:	:	:	:	:	:	:	:
4	:	:	:	:	:	:	:	:	:	:
5	:	:	:	:	:	:	:	:	:	:

Set Remote Parameters																				
11th Parameter Ref	Parameter Value	12th Parameter Ref	Parameter Value	13th Parameter Ref	Parameter Value	14th Parameter Ref	Parameter Value	15th Parameter Ref	Parameter Value	16th Parameter Ref	Parameter Value	17th Parameter Ref	Parameter Value	18th Parameter Ref	Parameter Value	19th Parameter Ref	Parameter Value	20th Parameter Ref	Parameter Value	Remote Par/ID
Define Up To 20 Parameters																				
11	12	13	14	15	16	17	18	19	20											
:	:	:	:	:	:	:	:	:	:	:	1									
:	:	:	:	:	:	:	:	:	:	:	2									
:	:	:	:	:	:	:	:	:	:	:	3									
:	:	:	:	:	:	:	:	:	:	:	4									
:	:	:	:	:	:	:	:	:	:	:	5									

Figure 7-5. Selection 4

6502 X.25 Asynchronous PAD
Configuration Sheets

Trunk Parameters											
PAD Address	Class Select	Password	In Call	Out Call	K Outstanding Frames	T1 Line Timeout	N2 Retransmissions	Link Assurance Timer	W Outstanding Packets	Packet Size 7 = 128 8 = 256	Segment Size Code 4 = 18 5 = 32, 6 = 64, 7 = 128, 8 = 256
1-15 Numeric Characters	Table 3	ASCII Characters	Table 4	Table 5	1-7	1-15	1-20	0-255	2-7	7, 8	4-8

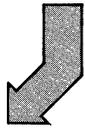


TABLE 3 — CLASS SELECT OPTIONS

- 0 = Use of call user data
- 1 = Use of X.121 subaddress field
- 2 = Disable class selection

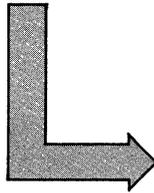


TABLE 5 — OUTGOING CALL CHARACTERISTICS

- 0 = Call packet with calling address field
- 1 = No calling address
- 2 = Append channel number to calling address
- 4 = 1980 call accept packet with option fields
- 8 = All calls reverse charge
- 16 = Use packet negotiation
- 32 = Use window negotiation
- XX = Any combination



TABLE 4 — INCOMING CALL CHARACTERISTICS

- 0 = No in call options enabled
- 1 = Accept reverse charge
- 2 = Trunk password required
- 4 = Accept fast select
- 8 = Allow use of LGN = 0 LCN = 0
- 16 = Restart if incoming call on undefined logical channel
- XX = Any combination

Figure 7-6. Selection 5

6502 X.25 Asynchronous PAD
Configuration Sheets

	Type of Virtual Channel	Logical Channel Numbers		PAD Channel Number
	SVC or PVC	00-15	00-255	1-16
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				

←If PCV, Define PAD Channel Number→

Figure 7-7. Selection 6

6502 X.25 Asynchronous PAD

Configuration Sheets

Address ID Definition						
Mnemonic	Address	Subaddress (Class)	Facility	Cug ID	Protocol ID	User Data
2 A/N	DTE Address 1-15 Numeric	01-99	Table 6	00-99	8 Hexadecimals	0-12 ASCII Characters
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

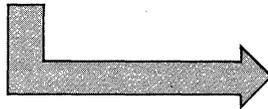


TABLE 6 – FACILITY OPTIONS

- 0 = No facility
- 1 = Reverse charging
- 4 = Closed user group
- 8 = 128 byte packet negotiation
- 16 = Throughput class
- 32 = Nonstandard protocol ID
- XX = Any combination

Figure 7-8. Selection 7

Configuration Sheets

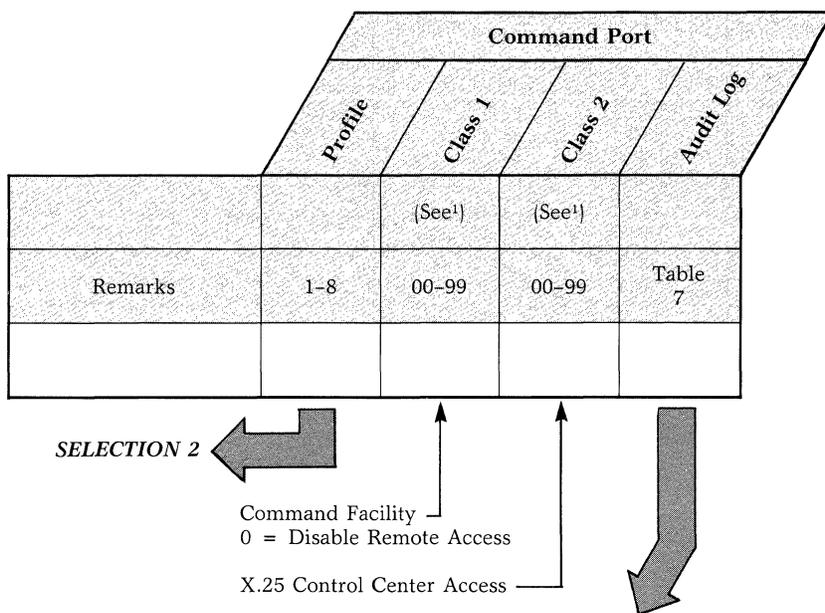


TABLE 7 – COMMAND PORT AUDIT LOG OPTIONS

- 0 = Disable call accounting and event reporting to both the X.25 Control Center and the Command Port
- 1 = Enable Command Port logging of all accounting records and selected events
- 2 = Send accounting data and all events to the X.25 Control Center
- 3 = Both 1 and 2

¹These parameters should not be assigned the same value

Figure 7-9. Selection 8

Configuration Sheets

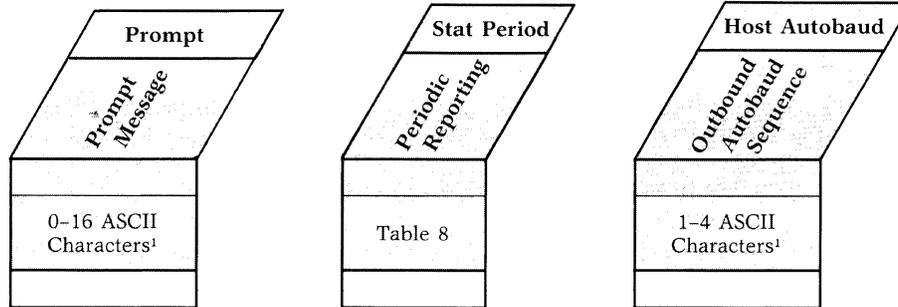
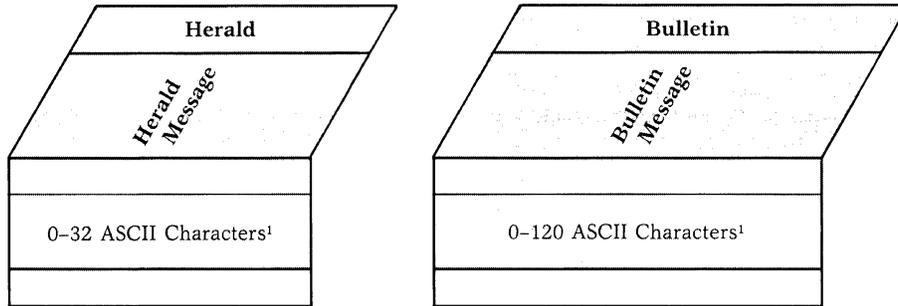


TABLE 8 – PERIODIC REPORTING OPTIONS

0 = Disable
 1-6 = Number of 10-minute intervals

¹To define a control character, enter \wedge followed by appropriate character.
 Example: CTRL-M <CR> = \wedge M

Figure 7-10. Selections 9 – 13

6502 X.25 Asynchronous PAD
Configuration Sheets

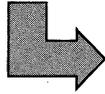
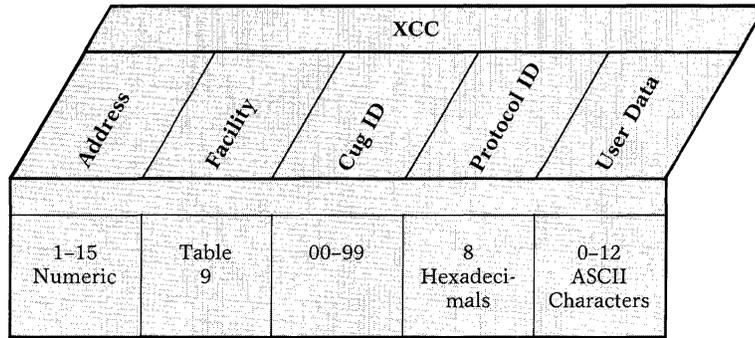


TABLE 9 – FACILITY OPTIONS

- 0 = No facility
- 1 = Reverse charging
- 4 = Closed user group
- 8 = 128 byte packet negotiation
- 32 = Non-standard protocol ID
- XX = Combination

Figure 7-11. Selection 14

Configuration Sheets

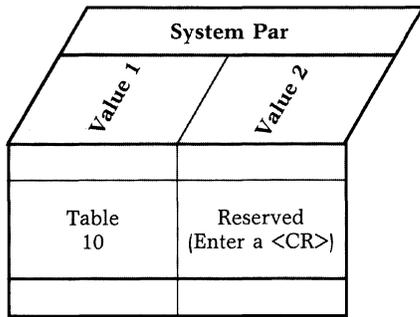


TABLE 10 – VALUE 1 OPTIONS

- 0 = Enable local switching between channels
- 1 = Disable local switching between channels
- 2 = Disable TACTR and TACTS on channels
- 4 = Reserved
- X = Combination

Figure 7-12. Selection 15

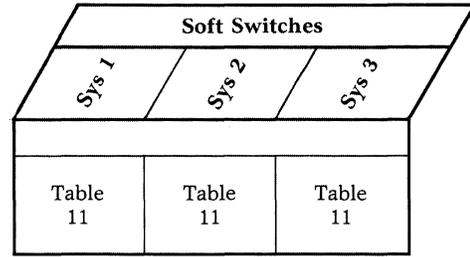


TABLE 11 – VALUES FOR SYS 1, SYS 2, SYS 3

- 0 = All positions are Off
- 1 = Switch position 1
- 2 = Switch position 2
- 4 = Switch position 3
- 8 = Switch position 4
- 16 = Switch position 5
- 32 = Switch position 6
- 64 = Switch position 7
- 128 = Switch position 8
- XXX = Combination of values

Figure 7-13. Selection 16

Chapter 8 Equipment Return Procedures

Contents

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Expiration of Lease	8-1
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Equipment Return	8-2
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Exceptions to Packaging Guidelines	8-3
District and Regional Codex Sales Offices ..	8-3
Regional Codex Customer Service Offices ...	8-6

GENERAL

Equipment returns to Codex fall under one of three categories: expiration of lease, factory repair, or service replacement. These categories and their equipment return guidelines are explained in the following sections.

Expiration of Lease

Customers who return equipment to Codex on expiration of the lease period should contact their district or regional Codex Sales Office for return authorization and instructions. A list of these offices follows. When you contact the sales office, you will be asked to provide the following information:

- Product name and description
- Serial number
- Customer order number
- Reason for return

Equipment Return Procedures
Factory Repair

Customers who return equipment to Codex for factory repair should telephone the Codex Return Service Coordinator at Mansfield, Massachusetts, (617) 364-2000, extension 3906, for return authorization and instructions. When you call Codex, you will be given a Return Material Authorization (RMA) control number. Mark this number clearly on the shipping container for ease of identification and faster service. The RMA control number is simply a shipment-control tool and does not affect the provisions of a sales or lease agreement. You will then be asked to provide the following information for each piece of equipment you return:

- Product name and description
- Serial number
- Customer order number
- Failure symptoms

Service Replacement

Any defective equipment and parts that were previously replaced by Codex Customer Service should be returned to the same regional service office that originally replaced the item. A list of regional Codex Customer Service Offices follows.

QUESTIONS ABOUT EQUIPMENT RETURN PROCEDURES

Customers who have questions about equipment return procedures should call the Codex Return Service Coordinator, (617) 364-2000, extension 3906, for advice and assistance. Customers who require either on-site service or unit-exchange service should telephone their regional Codex Customer Service Office for information and instructions.

REPACKAGING GUIDELINES FOR EQUIPMENT RETURN

Data communications equipment or parts that are to be returned to Codex for any reason must be properly packaged to prevent damage in shipment and handling.

If the original packing material and shipping container are available, reuse these items to return equipment. If these items are not available, package the equipment for shipment as follows:

- Secure movable and exposed parts before shipment so they will not become loose in shipment and cause damage or be damaged.
- Package cathode ray tubes (CRTs) and other fragile items securely in approximately 4 inches (10.2 cm) of foam cushioning, and enclose them in the original shipping container. If the original container is not available, obtain a suitable container from a shipping/packaging vendor.
- Do not use abrasive or dusty materials for cushioning.
- Ship all equipment in wooden crates or double-wall corrugated containers, or strap it to cushioned pallets. Package items weighing more than 18 pounds (8.2 kg) in double-wall or stronger containers.
- Use internal cushioning in conjunction with wooden crates to prevent the contents from shifting in the crate and suffering external mechanical damage or internal shock damage.
- When you return more than one item in the same shipping container, wrap each unit separately in at least 1/2-inch (1.27 cm) air-cell (bubble-pack) material and package it in a corrugated single-wall container. The package can then be shipped in a double-wall container with other similarly packaged items.
- Place each printed circuit (PC) card in an individual conductive bag, wrap the PC card in a double layer of 3/16-inch (0.48 cm) air-cell (bubble-pack) material, and ship it in a corrugated double-wall container. Alternatively, put each PC card in an individual conductive bag and then place it between layers of convoluted urethane foam in a shipping folder, only one PC card per folder.

Equipment Return Procedures
Specific Packaging Guidelines

In returning equipment to Codex, package the item as described below. The preferred, alternative, and minimally acceptable packaging guidelines are listed below:

- **Preferred.** Return the equipment in its original packing material and shipping container.
- **Alternative.** Wrap the equipment in sufficient 1/2-inch (1.27 cm) air-cell (bubble-pack) material to provide at least 2 inches (5 cm) of cushioning, and enclose it in a double-wall shipping container. You may also enclose the equipment in a bag, cushion it in at least 3 inches (7.6 cm) of foam-in-place and ship it in a double-wall container.
- **Minimally Acceptable.** Enclose the equipment in a bag, cushion it in at least 4 inches (10.2 cm) of flowable material such as expanded polystyrene (EPS) beads, and ship it in a double-wall shipping container.

Exceptions to Packaging Guidelines

The Codex Return Service Coordinator is available to answer your questions about packaging requirements. If you believe that packaging is required that deviates from the guidelines given above, please call the Codex Return Service Coordinator, Codex Corporation, Mansfield, Massachusetts, (617) 364-2000, extension 3906, for advice and assistance. Exceptions to these guidelines are allowed only with the permission of the Return Service Coordinator.

DISTRICT AND REGIONAL CODEX SALES OFFICES**ALABAMA**

2820 Columbiana Road
Suite 210M
Birmingham, AL 35216
Tel: (205) 979-0355

ALASKA

3601 C Street
Suite 200
Anchorage, AK 99503
Tel: (907) 562-3204

ARIZONA

8902 N. Central Avenue
Suite 101
Phoenix, AZ 85020
Tel: (602) 944-6940

CALIFORNIA

500 Airport Boulevard
Suite 200
Burlingame, CA 94010
Tel: (415) 342-9741

5001 Airport Plaza Drive
Suite 150
Long Beach, CA 90815
Tel: (213) 421-0086

6701 Fourth Avenue
Suite 100
Sacramento, CA 95817
Tel: (916) 451-3007

5333 Mission Center Road
Suite 344
San Diego, CA 92108
Tel: (619) 296-6283

17671 Irvine Boulevard
Suite 208
Tustin, CA 92680
Tel: (714) 838-5515

20720 Ventura Boulevard
Suite 340
Woodland Hills, CA 91364
Tel: (818) 992-4004

Equipment Return Procedures

COLORADO

7828 Vance Drive
Suite 280
Arvada, CO 80003
Tel: (303) 425-6345

CONNECTICUT

100 Western Boulevard
Salmonbrook Office Park
Glastonbury, CT 06033
Tel: (203) 633-9431/9432

30 Commerce Park
Milford, CT 06460
Tel: (203) 874-1965

FLORIDA

851 Douglas Avenue
Suite 117
Altamonte Springs, FL 32714
Tel: (404) 952-9330

2688 N.W. 99th Avenue
Coral Springs, FL 32714
Tel: (305) 344-8853

16109 W. Course Drive
Tampa, FL 33626
Tel: (813) 961-8323

GEORGIA

2121 Newmarket Parkway
Suite 130
Marietta, GA 30067
Tel: (404) 952-9330

HAWAII

See Tustin, California

IDAHO

355 N. Orchard
Suite 210
Boise, ID 83706
Tel: (208) 322-4800

ILLINOIS

150 N. Michigan Avenue
Suite 2100
Chicago, IL 60601
Tel: (312) 781-7320

1014 E. Algonquin Road
Suite 106
Schaumburg, IL 60195
Tel: (312) 576-2036

INDIANA

6525 E. 82nd Street SW
Suite 115
Indianapolis, IN 46250
Tel: (317) 842-7017

KANSAS

10000 W. 75th Street
Suite 106
Shawnee Mission, KS 66204
Tel: (913) 677-2002

LOUISIANA

3925 North I-10 Service Road
Suite 109-0
Metairie, LA 70002
Tel: (504) 885-7013

MARYLAND

Airport Square IV
939 Elkridge Landing Road
Suite 120
Linthicum, MD 21090
Tel: (301) 850-4546

MASSACHUSETTS

65 Dan Road
P.O. Box 469
Canton, MA 02021
Tel: (617) 821-1560

MICHIGAN

Sheffield Office Park
Suite 122
3310 W. Big Beaver Road
Troy, MI 48084
Tel: (313) 649-4230

MINNESOTA

8300 Norman Center Drive
Suite 560
Minneapolis, MN 55437
Tel: (612) 835-7927

Equipment Return Procedures

MISSOURI

231 South Bemiston
Suite 1230
St. Louis, MO 63105
Tel: (314) 863-1900

NEBRASKA

1722 St. Mary's
Suite 216
Omaha, NB 68102
Tel: (402) 444-1645

NEW HAMPSHIRE

125 E. Dunstable Road
Nashua, NH 03062
Tel: (603) 880-4378

NEW JERSEY

777 Passaic Avenue
Clifton, NJ 07012
Tel: (201) 470-9001

Plaza Office Center
Suite 409
Route 73 and Fellowship Road
Mount Laurel, NJ 08054
Tel: (609) 235-5871

NEW YORK

708 Third Avenue
New York, NY 10017
Tel: (212) 557-2700

656 Kreag Road
Pittsford, NY 14534
Tel: (716) 223-7800

5158 Old Kings Highway
Saugerties, NY 12477
Tel: (914) 338-3332

NORTH CAROLINA

3707 Latrobe Drive
Suite 450
Charlotte, NC 28211
Tel: (704) 366-9600

4411 W. Market Street
Suite 200-B
Greensboro, NC 27407
Tel: (919) 855-3865

OHIO

8078 Beechmont Avenue
Cincinnati, OH 45230
Tel: (513) 474-4411

6500 Busch Boulevard
Suite 210
Columbus, OH 43229
Tel: (614) 436-2370

7123 Pearl Road
Suite 108
Middleburg Heights, OH 44130
Tel: (216) 886-4444

OKLAHOMA

7136 S. Yale
Suite 300
Tulsa, OK 74136
Tel: (918) 494-0126

508 W. Vandament
Suite 100
Yukon, OK 73099
Tel: (405) 354-2212

OREGON

7185 S.W. Sandburg Road
Suite 200
Tigard, OR 97223
Tel: (503) 620-7276

PENNSYLVANIA

500 Sainte Claire Plaza
Pittsburgh, PA 15241
Tel: (412) 941-4235

TENNESSEE

5115 Maryland Way
Suite 40
Brentwood, TN 37027
Tel: (615) 377-0740

1355 Lynnfield Road
Suite 245
Memphis, TN 38119
Tel: (901) 767-3010

Equipment Return Procedures

TEXAS

8500 Mopac Expressway North
Suite 809
Austin, TX 78759
Tel: (512) 346-1941

9441 LBJ Freeway
Suite 214
Dallas, TX 75243
Tel: (214) 690-5221

8 Greenway Plaza
Suite 814
Houston, TX 77046
Tel: (713) 629-6910

UTAH

3285 E. Danforth
Salt Lake City, UT 84121
Tel: (801) 278-5402

VIRGINIA

1800 Diagonal Road
Suite 200
Alexandria, VA 22314
Tel: (703) 684-0400

7814 Carousel Lane
Suite 300
Richmond, VA 23229
Tel: (804) 747-1620

WASHINGTON

12835 Bellevue-Redmond Road
Suite 203
Bellevue, WA 98005
Tel: (206) 453-0510

WISCONSIN

10855 W. Potter Road
Wauwatosa, WI 53226
Tel: (414) 475-7533

**REGIONAL CODEX CUSTOMER
SERVICE OFFICES**

CALIFORNIA

L.A. District/Western Region
5001 Airport Plaza Drive
Suite 150
Long Beach, CA 90815
Tel: (213) 421-0086

GEORGIA

Atlanta Region
2121 Newmarket Parkway
Suite 130
Marietta, GA 30067
Tel: (404) 952-1759

ILLINOIS

Midwest Region
1014 E. Algonquin Road
Suite 104
Schaumburg, IL 60195
Tel: (312) 576-2171

MASSACHUSETTS

Boston District/Northeast Region
65 Dan Road
P.O. Box 525
Canton, MA 02021
Tel: (617) 821-1690

NEW JERSEY

Eastern Region
777 Passaic Avenue
Clifton, NJ 07012
Tel: (201) 470-0775

TEXAS

South Region
9441 LBJ Freeway
Suite 114
Dallas, TX 75243
Tel: (214) 690-3505

Chapter 9

Specifications and Ordering

Contents

Introduction	9-1
Physical Description	9-1
Environmental Limits	9-1
Primary Power Requirements	9-2
Emissions Control	9-2
Lithium Battery	9-2

INTRODUCTION

This chapter outlines the physical specifications of the PAD and provides part numbers for ordering purposes.

Physical Description

Standalone:

- **Height:** 5 1/2 inches (11.4 cm)
- **Width:** 15 1/2 inches (39.4 cm)
- **Depth:** 11 3/4 inches (29.8 cm)
- **Weight:** 8 pounds (3.6 kg)

Rack-Mounted with Upgrade Kit 65553:

- **Height:** 5 1/4 inches (13.3 cm)
- **Width:** 19 inches (48.3 cm)
- **Depth:** 11 1/2 inches (29.2 cm)

Environmental Limits

Operating Conditions

- **Temperature:** 32° to 114°F (0° to 45°C)
 - **Relative humidity:** 0 to 95% (noncondensing)
- Nonoperating Conditions

- **Temperature:** -40° to 176°F (-40° to 80°C)
- **Relative humidity:** 0 to 95% (noncondensing)

6502 X.25 Asynchronous PAD

Specifications and Ordering

Primary Power Requirements

U.S. 110/115 VAC nominal (230 – 255 VAC), 45 to 65 Hz

- **International:** 220/240 VAC nominal (170 – 270 VAC), 45 to 65 Hz

Lithium Battery

The lithium battery, located on the base module, supplies power to CMOS RAM for an accumulated power-down-life of two years. User-life of the battery is four years (not rechargeable).

Emissions Control

Complies with FCC Part 15, Subpart J, Class A, for control of radio-frequency interference.

Table 9-1.
Ordering Information for Codex X.25 PAD and Options

Model Number	Description
65540	4 channel unit with 115 VAC primary power. Includes base module with one EIA 232 composite interface, firmware cartridge and user manual.
65541	4-channel unit with 220 VAC primary power. Includes base module with one EIA 232 composite interface, firmware cartridge and user manual.
65542	4-channel unit with 115 VAC primary power. Includes base module with one X.21 composite interface, firmware cartridge and user manual.
65543	4-channel unit with 220 VAC primary power. Includes base module with one X.21 composite interface, firmware cartridge and user manual.
65544	10-channel unit with 115 VAC primary power. Includes base module with one EIA 232 composite interface, one hex channel expander module, firmware cartridge and user manual.
65545	10-channel unit with 220 VAC primary power. Includes base module with one EIA 232 composite interface, one hex channel expander module, firmware cartridge and user manual.
65546	10-channel unit with 115 VAC primary power. Includes base module with one X.21 composite interface, one hex channel expander module, firmware cartridge and user manual.
65547	10-channel unit with 220 VAC primary power. Includes base module with one X.21 composite interface, one hex channel expander module, firmware cartridge and user manual.
65548	16-channel unit with 115 VAC primary power. Includes base module with one EIA 232 composite interface, two hex channel expander modules, firmware cartridge and user manual.
65549	16-channel unit with 220 VAC primary power. Includes base module with one EIA 232 composite interface, two hex channel expander modules, firmware cartridge and user manual.
65550	16-channel unit with 115 VAC primary power. Includes base module with one X.21 composite interface, two hex channel expander modules, firmware cartridge and user manual.
65551	16-channel unit with 220 VAC primary power. Includes base module with one X.21 composite interface, two hex channel expander modules, firmware cartridge and user manual.
65552	Hex-Channel Expander Board
65553	Standard 19 inch Rack Mount Kit
65554	X.25 Software Cartridge
65555	EIA 232 Male-to-Male crossover cable for connecting a modem to a channel connector.
65556	EIA 232 Male-to-Female cable for connecting a modem to the composite link connector.

Appendix A

Factory Parameter Settings

PARAMETER VALUES

The PAD is conditioned on cold start with the following parameter values. (These parameters are different from the operating parameters that you can set, by modifying selections in the soft switch groups.)

- 1) All channels are:
 - Set to long form call only.
 - Set to dedicated connection.
 - Associated with device Profile 1.
 - Used for subaddressing:
Class 1 = 0
Class 2 = Channel number (i.e., Class 2 of Channel number 3 = 3)
- 2) The Trunk parameters are set to the following:
K = 7
T1 = 5
N2 = 10
W = 2
assr timer = 15
Packet size = 128 bytes
Segment size = 64 bytes
- 3) The Command Port parameters:
 - Are set to class 1 = 99.
 - Have the ability to make long-form or abbreviated calls.
 - Have the Command Port associated with device Profile 1.
- 4) The Herald Message is:
 mb2-x.25 asynch pad channel
- 5) The Bulletin Message is not defined.
- 6) The X.28 Prompt is:
 .

- 7) The Command Facility password is MX25.
- 8) Time and date are set to 0.
- 9) The PAD's own address is set to 00.
- 10) The PAD uses the X.121 subaddressing method.

DEVICE PROFILES

There are two different types of default device profiles. All eight profiles are initialized as follows:

<i>Profile</i>	<i>Type</i>	<i>Default Profile Number</i>
1	Terminal	1
2	Host Computer	2
3	Terminal	1
4	Terminal	1
5	Terminal	1
6	Terminal	1
7	Terminal	1
8	Terminal	1

The terminal type device profile is suitable for start/stop devices. The host type device profile is suitable for connecting host computers to the PAD channels. They are to be used where the PAD is front-ending the asynchronous host computer (see Table A-1 at the end of this appendix).

Terminal Profile

With the terminal profile, the following operations are available:

- The PAD will perform autobaud, up to 9600 bps (Parameter 11), and autoparity (Parameter 101).
- The user can access X.28 mode by the CTRL-P character (Parameter 1).
- The PAD will echo the terminal input (Parameter 2). The terminal should be set to full-duplex.

Factory Parameter Settings

- Data will be forwarded to the Network when the PAD detects a CR character input at the terminal (Parameter 3).
- The PAD and the device can exercise flow control, using XON/XOFF characters Ctrl-Q/Ctrl=S (Parameters 5 and 12).
- The terminal will receive all service signals and PAD messages (Parameter 6).
- When the BREAK key is pressed, the terminal will cause the PAD to transmit both a Break Indication packet and an Interrupt packet. It will also surge all data destined for the terminal (Parameter 7).
- The PAD will transmit four null characters following each CR character transmitted to the terminal (Parameter 9).
- The PAD will output data lines having a maximum length of 80 characters. They will automatically insert LF and CR after 80 characters output (Parameter 10).
- The PAD will transmit an LF character to the terminal when it detects a CR character from the terminal (Parameter 13).
- The PAD will transmit four null characters following each LF character transmitted to the terminal (Parameter 14).
- The following local editing functions are enabled during data entry mode (Parameter 15).

The Backspace key is used to delete a character (Parameter 16).

The CAN key is used to delete the user buffer (Parameter 17).

The Ctrl-R character is used to re-display the user's input (Parameter 18).

- The PAD will assume that the device type is a video display for service signals in the editing mode. That is to say, the sequence of BS SP BS characters will be transmitted to the device in response to a Backspace key (Parameter 19).
- The PAD will echo all terminal-transmitted characters except the following (Parameter 20).
ESC, BEL, ENQ, ACK, DEL, CAN, DC2, ETX, EOT, HT, LF, VT, FF, SO, SI, DLE, DC1, DC3, DC4, NAK, SYN, ETB, EM, SUB, FS, GS, RS, US.
- The user can set the PAD so that it will not echo his input, by preceding it with a Ctrl-Z. The PAD will then echo the character * for each character entered. To disable that mode, the user must again key the Ctrl-Z character (Parameters 109 and 110).

Host Computer Profile

The Host Computer profile supports the following operations:

- The PAD will support a fixed speed of 2400 bps for asynchronous channel connection to the host (Parameter 11).
- The PAD will not perform echoing or parity checking (Parameter 2).
- The PAD will not generate PAD messages or service signals to the host (Parameter 6).
- The PAD and the host can exercise flow control over each other using the RTS/CTS EIA method (Parameter 105).
- Data will be forwarded to the network when the 1-second idle timer expires (Parameter 4). This follows the last byte from the host computer.

6502 X.25 Asynchronous PAD

Factory Parameter Settings

Table A-1. Default Device Profiles

Parameters	Parameter Numbers	Parameter Values	
		Profile Number 1 Terminal Type	Profile Number 2 Host Computer Type
PAD Recall	1	1	0
Echo	2	1	0
Data Forward	3	2	0
Idle Timer	4	0	20
Device XON/XOFF	5	1	0
Service Signal	6	5	0
BREAK Handling	7	21	0
Discard Output	8	0	0
CR Padding	9	4	0
Line Folding	10	80	0
Speed	11	32	12
PAD XON/XOFF	12	1	0
Auto LF Insertion	13	4	0
LF Padding	14	4	0
Edit	15	1	0
Char Delete	16	8	0
Line Delete	17	24	0
Line Display	18	18	0
Device Type	19	2	1
Echo Mask	20	131	255
Bits per Character	100	2	2
Device Parity	101	5	0
Network Parity	102	0	0
XON Char	103	17	0
XOFF Char	104	19	0
Enhanced Flow Control	105	0	3
Data Fwd Count	106	0	0
ESC Timer	107	0	0
Sp Break Char	108	0	0
Temp Echo Supp Char	109	26	0
Echo Subst Char	110	42	0
Echo Control	111	0	0
Special Echo Seq ID	112	0	0
Page Length	113	0	0
Form Feed Character	114	0	0
Form Feed Padding	115	0	0
Inactivity Timer	116	0	0
X.29 Access Char	117	0	0

■ **Note:** The Codex-enhanced parameters are numbered 100 through 117. The CCITT parameters are numbered 1 through 20.

Appendix B ASCII Chart

Table B-1. ASCII Chart

<i>Control</i>		<i>Numbers Symbols</i>		<i>Upper Case</i>		<i>Lower Case</i>	
NUL 0	DLE 16	SP 32	O 48	@ 64	P 80	\ 96	p 112
SOH 1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113
STX 2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114
ETX 3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115
EOT 4	DC4 20	\$ 36	4 52	D 68	T 84	d 100	t 116
ENQ 5	NAK 21	% 37	5 53	E 69	U 85	e 101	u 117
ACK 6	SYN 22	& 38	6 54	F 70	V 86	f 102	v 118
BEL 7	ETB 23	' 39	7 55	G 71	W 87	g 103	w 119
BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120
HT 9	EM 25) 41	9 57	I 73	Y 89	i 105	y 121
LF 10	SUB 26	* 42	: 58	J 74	Z 90	j 106	z 122
VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123
FF 12	FS 28	, 44	< 60	L 76	\ 92	l 108	! 124
CR 13	GS 29	- 45	= 61	M 77] 93	m 109	} 125
SO 14	RS 30	. 46	> 62	N 78	> 94	n 110	~ 126
SI 15	US 31	/ 47	? 63	O 79	- 95	o 111	RUBOUT (DEL) 127

KEY

NAK

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ASCII Character
Decimal

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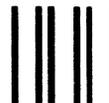
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