GA27-3145-2
File No. S370-09

Systems

Component Description for the IBM 3776 and 3777 Communication Terminals

IBM®

Federal Communications Commission (FCC) Statement

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions 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.

The FCC statement above applies to machines of the following types which are newly manufactured after January 1, 1981, and which will be used in the United States.

2502 Card Reader
3203 Printer Model 3
3262 Printer Models 2 and 12
3411 Magnetic Tape Unit
3501 Card Reader
3521 Card Punch
3776 Communication Terminal Models 3 and 4
3777 (all models) Communication Terminal
3782 Card Attachment Unit Model 1
3784 Printer Model 1

Machines subject to part 15 of the FCC Rules will bear appropriate compliance labels. Other communication terminals mentioned in this manual are either out of production or are not in new production.

Third Edition (January 1981)

This is a major revision of and obsoletes GA27-3145-1 [and Technical Newsletters GN27-3246, GN27-3247, and GN27-3258. See the Summary of Changes page for brief descriptions of changes made to this publication by revisions and Technical Newsletters. A change to the text or to an illustration is indicated by a vertical line to the left of the change.

Changes are made periodically to the information herein; before using this publication in connection with the operation of IBM systems or equipment, consult the latest *IBM System/370 and 4300 Processors Bibliography,* GC20-0001, for the editions that are applicable and current.

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Preface

This publication presents introductory and reference information about the IBM 3776 and 3777 Communication Terminals. It describes the capabilities and functions provided by these terminals for those concerned with planning for a data communications network or for integrating the terminals into an existing network. It is also a reference source for system and application programmers, and for personnel planning job setups for the 3776 and 3777 terminals. Although it describes the operating controls, this manual is not intended to provide detailed operating procedures. These controls are described here only to illustrate the capabilities, functions, and features of the 3776 and 3777 terminals. Application personnel planning job setups for these terminals will also require a copy of the appropriate *Operating Procedures Guide.* (See "Related Publications".)

It is assumed that the reader of this manual understands the concept and application of the IBM System/370 in a data communications environment, and is familiar with data link control procedures–Synchronous Data Link Control (SDLC) or Binary Synchronous Communication (BSC), whichever is used. General information about data link control procedures can be found in the *General Information* manuals for SDLC or BSC listed in "Related Publications". Specific information about BSC and SDLC required by system and application programmers is contained in this Component Description publication.

Information about publications concerning host processor programming systems can be found in the publication *IBM System/370 and 4300 Processors Bibliography,* GC20-0001. Other publications pertinent to the 3770 terminals are listed in "Related Publications".

Chapter 1 of this publication is an introduction to the IBM 3776 and 3777 Communication Terminals; Chapter 2 describes the 3776 Models 1 and 2/3777 Model 1 Communication Terminals; Chapter 3 describes the 3777 Model 2 Communication Terminal; and Chapter 4 describes the 3776 Models 3 and 4/3777 Models 3 and 4 Communication Terminals.

Chapter 5 describes the I/O devices attachable to the 3776 and 3777 terminals. Chapter 6 provides information about Binary Synchronous Communications (BSC) as it applies to the 3776 Models and 2/3777 Model 1 terminals. Chapter 7 provides information about System Network Architecture/Synchronous Data Link Control (SNA/SDLC) Communications as applied to the 3776 Models 1 and 2, and 3777 Model 1. Chapter 8 provides information about SNA/SDLC communications applied to the 3776 Models 3 and 4/3777 Models 3 and 4.

The appendixes supply reference information (codes, character sets, card specifications, throughput, and data format) and recommended handling procedures for IBM diskettes and magnetic tape.

Related Publications

- *Introduction to the IBM 3770 Data Communication System*, GA27-3144
- *Operating Procedures Guide: IBM 3776 Communication Terminals*, GA27-3107
- *IBM 3776 Communication Terminal Reference Summary*, GA27-3108
- *IBM 3776 Models 3 and 4 and IBM 3777 Model 3 Communication Terminals Operator's Guide*, GA27-3165
- *IBM 3777 Model 4 Communication Terminal Operator's Guide*, GA27-3309
- *IBM 3776 Models 3 and 4 and IBM 3777 Model 3 Communication Terminals Operator's Reference Summary*, GA27-3166
- *Operating Procedures Guide: IBM 3777 Model 1 Communication Terminal*, GA27-3124
- *IBM 3777 Model 1 Communication Terminal Reference Summary*, GA27-3125
- *IBM 3777 Model 2 Communication Terminal Operator's Guide*, GA27-3129
- *IBM 3777 Model 2 Communication Terminal Reference Summary*, GA27-3130
- *IBM 3203 Printer Component Description and Operator's Guide*, GA33-1515
- *IBM 3262 Printer Models 2 and 12 Component Description*, GA24-3737
- *IBM 3410/3411 Magnetic Tape Subsystems Component Description*, GA32-0022
- *IBM 3410/3411 Operator's Guide*, G232-0004
- *Component Description for the IBM 3771, 3773, 3774, and 3775 Communication Terminals*, GA27-3146
- *General Information–Binary Synchronous Communications*, GA27-3004
- *Synchronous Data Link Control General Information*, GA27-3093
- *Systems Network Architecture General Information*, GA27-3102
- *Introduction to Advanced Communication Function*, GC30-3033
- *IBM Remote Multiplexers and Communications Terminals Installation Manual–Physical Planning*, GA27-3006
- *IBM 3262 Printer Site Planning and Preparation Guide*, GA24-3734
- *IBM 3770 Physical Planning Template*, GX27-2917
- *Printer Forms Layout Sheets*, GX20-1816
- *Forms Design Reference Guide for Printers*, GA24-3488
- *IBM System/370 and 4300 Processors Bibliography*, GC20-0001
- *Planning and Installation of a Data Communication System Using IBM Line Adapters*, GA24-3435
- *IBM 3863 Modem Models 1 and 2; IBM 3864 Modem Models 1 and 2: Setup Instructions and User's Guide*, GA27-3216
- *IBM 3865 Modem Models 1 and 2 Setup Instructions and User's Guide*, GA27-3218
- *IBM 3872 Modem User's Guide*, GA27-3058
- *IBM 3874 Modem User's Guide*, GA33-0002
- *IBM 3875 Modem User's Guide*, GA33-0001

See also the "Related Publications" section in Chapter 7 of this manual for specific SNA manuals. See also the Bibliography section of *Introduction to the IBM 3770 Data Communication System*, GA27-3144.

Contents

Figures

Summary of Amendments for GA27-3145-2

Information has been added on the 3777 Model 4 and the 3262 Line Printer Models 2 and 12. These changes and additions affect mainly Chapters 1, 4, 5, and 8. Changes are indicated by a vertical bar to the left of the change.

Chapter 1. Introduction

The IBM 3770 Data Communication System is a family of multi-purpose keyboard/printer terminals (fixed-function or programmable) and attachable I/O devices. This manual describes the remote job entry (RJE) terminals that are part of the 3770 system:

- The IBM 3776 Communication Terminal Models 1 and 2 and the IBM 3777 Communication Terminal Model 1 are medium-to-high-speed RJE terminals that use either BSC or SDLC communications (or both under switch control), for general RJE applications.
- The IBM 3777 Communication Terminal Model 2 is a high-speed RJE terminal operating with the BSC MULTI-LEAVING support provided by certain host RJE subsystems. This terminal executes the workstation program generated by the host system for an IBM System/360 Model 20 Submodel 5.
- The IBM 3776 Communication Terminal Models 3 and 4 and IBM 3777 Communication Terminal Models 3 and 4 are medium-to-high-speed RJE terminals using the multiple logical unit (MLU) protocol. Systems Network Architecture (SNA) provides MLU protocol to interleave up to six independent data streams to and from the host.

References to "3770" in this manual, unless specifically noted otherwise, are intended to mean models of the 3776 and 3777.

Introductory information about these and other 3770 terminals is contained in *Introduction of the IBM 3770 Data Communication System*, GA27-3144. Component information, similar to that contained in this manual, for the general purpose 3770 terminals is contained in *Component Description for the IBM 3771, 3773, 3774, and 3775 Communication Terminals*, GA27-3146. Information for the programmable 3773, 3774, and 3775 Communication Terminals is contained in *IBM 3773, 3774, and 3775 Programmable Communication Terminals Programmer's Guide*, GC30-3028.

Figure 1-1 is a summary of the remote job entry terminals, attachable input and output media, and features offered by each of these terminals. The Extended Binary Coded Decimal Interchange Code (EBCDIC) is standard on all terminals.

Machine Type	Description (Basic Machine)	Specify Features	Other Attachable I/O Media	Special Features and Accessories
3776 Model 1 Model 2	Keyboard and Control Panel Printer –160,230, or 300 lpm using 94-, 64-, or 48 character set respectively (3776-1) –230, 300, or 400 lpm using 94-, 64-, or 48 character set respectively (3776-2) 4800 bps Maximum Line Speed Operator Selectable Dual 256- or 512-Byte Buffer Electronic Forms Control Horizontal Format Control Automatic Answering Data Compression/Expansion Terminal ID Operator Attention Speaker Variable Width Forms Tractor Dual Data Path Record Compression of Basic Exchange Diskette Records Transmission Reversal	Language Group Remote Power Off Keyboard Arrangement 48-, 64-, or 94- Character Set Print Belt in Standard Character Set, or 48 Character Set Print Belt (in EBCDIC) in HN Character Set 127 Character Set Print Belt (katakana)	Magnetic Diskette Storage (two Devices: 485,376 Bytes) †2502 Card Reader (150 or 300 cpm) 3501 Card Reader (50 cmp) †3521 Card Punch (50 cpm)	2400 bps Integrated Modem 4800 bps Integrated Modem Switched Network Backup Modem Fanout EIA-RS232C Interface CCITT V.24/.28 Interface CCITT X.21 Interface (nonswitched) Keylock Operator ID Reader Door Keylock Audible Alarm Communication Driver (Without Clocking) Communication Feature SDLC BSC Point-to-Point SDLC/BSC Switch Control BSC Multipoint Operation ASCII Additional Print Belts‡ Front (forms) Feed
3776 Model 3 Model 4	Keyboard and Control Panel Printer –160,230, or 300 lpm using 94-, 64-, or 48 character set respectively (3776-3) –230, 300, or 400 lpm using 94-, 64-, or 48 character set respectively (3776-4) 19.2 kbps Maximum Line Speed (20.4 kbps in World Trade) 1024-Character Display for Console Message Display and Operator Guidance Console Message Spooling into Terminal Storage Stored Job Procedures in Terminal Storage SNA/SDLC Communications with up to Six Concurrent Logical Unit Sessions Electronic Forms Control Automatic Answering Operator Attention Speaker Variable Width Forms Tractor Data Compression/Expansion Data Decompaction	Language Group Remote Power Off Keyboard Arrangement 48-, 64-, or 94- Character Set Print Belt in Standard Character Set, or 48 Character Set Print Belt (in EBCDIC) in HN Character Set 127 Character Set Print Belt (katakana)	Magnetic Diskette Storage (two Devices: 485,376 Bytes) 3411 Magnetic Tape Unit (1 Device) ⧧2502 Card Reader (150, 300, or 400 cpm) ⧧3521 Card Punch (50 cpm)	High-Speed Digital Interface EIA-RS232C Interface CCITT-V.24/V.28 Interface CCITT-V.35 Interface CCITT X.21 nonswitched Interface. High-Speed Local Attachment to a 3705-II using the V.35 Interface Feature Digital Data Service Adapter (DDSA) Keylock Operator ID Reader Door Keylock Audible Alarm ASCII Additional Print Belts‡ Front (forms) Feed Cryptographic (Encrypt/Decrypt) Mercury Battery‡

†Attach via the 3782 Card Attachment Unit. One card reader (2502 or 3501) can be attached. The 2502 may include the OMR feature. The 3521 Card Punch can have the Card Read and Card Print Special Features.

‡Purchase Only Accessories

⧧Attach via the 3782 Card Attachment Unit. The 3521 Card Punch can have the Card Read and Card Print Special Features.

Figure 1-1. IBM 3776/3777 Data Comunication Terminals Summary (Part 1 of 3)

Machine Type	Description (Basic Machine)	Specify Features	Other Attachable I/O Media	Special Features and Accessories
3777 Model 1	Keyboard and Control Panel 3203 Printer Attachment –530 to 1000 or 585 to 1200 lines per minute using 48-character set 19.2 kbps Maximum Line Speed (20.4 kbps in World Trade) Operator Selectable Dual 256- or 512-Byte Buffer Electronic Forms Control Horizontal Format Control Automatic Answering Data Compression/Expansion Terminal ID Operator Attention Speaker Variable Width Forms Control Dual Data Path Record Compression of Basic Exchange Diskette Records Transmission Reversal Supports up to fifteen 1416 Print Train Arrangements for the 3203 Printer Remote Power Off Data Decompaction	Language Group Keyboard Arrangement International Print Support (Includes two Katakana Print Train Arrangements and three Standard Character Sets available on the 3776. Replaces standard support.)	3203 Printer Model 3 (1000 lpm or 1200 lpm) 1416 Interchangeable Train Cartridges (3203 is part of minimum configuration.) Magnetic Diskette Storage (two Devices: 485,376 Bytes) 2502 Card Reader (150, 300, or 400 cpm)	EIA-RS232C Interface CCITT V.24/.28 Interface CCITT X.21 Interface (nonswitched) High-Speed Digital Interface High-Speed Local Attachment to a 3705-II using the V.35 Interface Feature CCITT - V.35 Interface Keylock Operator ID Reader Door Keylock Audible Alarm Communication Driver (Without Clocking) Communication Feature SDLC BSC Point-to-Point SDLC/BSC Switch Control BSC Multipoint Operation ASCII Additional 1416 Interchangeable Train Cartridges (For 3203 Printer)
3777 Model 2	Keyboard and Control Panel 3203 Printer Attachment –530 to 1000 or 585 to 1200 lines per minute using 120-, 48-character set 19.2 kbps Maximum Line Speed (20.4 kbps in World Trade) Dual 512-Byte Buffers for Each I/O Device Attached Electronic Vertical Forms Control Data Compression/Expansion Operator Attention Speaker Variable Width Forms Control Transparent/Nontransparent Communication in EBCDIC Supports up to fifteen 1416 Print Train Arrangements for the 3203 Printer MULTI-LEAVING Workstation Program Execution Remote Power Off	Language Group Keyboard Arrangement International Print Support (Includes two Katakana Print Train Arrangements and three Standard Character Sets available on the 3776. Replaces standard support.)	3203 Printer Model 3 (1000 lpm or 1200 lpm) 1416 Interchangeable Train Cartridge 2502 Card Reader (150, 300, or 400 cpm) 1024-Character Display Console Display Spooling 242,688 Bytes (1024-Character Display is a prerequisite feature.) 3521 Card Punch (50 cpm) (Attaches via the 3782 Card Attachment Unit) The 3521 can have the Card Read and Card Print Special Features. Diskette Input Device (One Device; 242, 688 Bytes)	EIA-RS232C Interface CCITT V.24/28 Interface High-Speed Digital Interface High-Speed Local Attachment to a 3705-II using the V.35 Interface Feature CCITT - V.35 Interface Keylock Operator ID Reader Door keylock Audible Alarm BSC Communication Driver (Without Clocking) BSC Communication Point-to-Point Switched or Nonswitched Additional 1416 Interchangeable Train Cartridges (For 3203 Printer)

‡Purchase-Only Accessories

Figure 1-1. IBM 3776/3777 Data Communication Terminals Summary (Part 2 of 3)

Machine Type	Description (Basic Machine)	Specify Features	Other Attachable I/O Media	Special Features and Accessories
3777 Model 3	Keyboard and Control Panel 3203 Printer Attachment –530 to 1000 or 585 to 1200 lines per minute using 120-, 48-character set 19.2 kbps Maximum Line Speed (20.4 kbps in World Trade) 1024-Character Display for Console Message Display and Operator Guidance Console Message Spooling into Terminal Storage Stored Job Procedures in Terminal Storage SNA/SDLC Communications with up to Six Concurrent Logical Unit Sessions Electronic Forms Control Automatic Answering Operator Attention Speaker Data Compression/Expansion Data Decompaction Supports up to fifteen 1416 Print Train Arrangements for the 3203 Printer International Print Support (Includes two Katakana Print Train Arrangements and three Standard Character Sets available on the 3776.) Remote Power Off	Language Group Keyboard Arrangement International Print Support (Includes two Katakana Print Train Arrangements and three Standard Character sets available on the 3776. Replaces standard support.)	3203 Printer Model 3 (1000 lpm or 1200 lpm) 1416 Interchangeable Train Cartridges (3203 is part of minimum configuration.) Magnetic Diskette Storage two Devices; 485,376 Bytes) 2502 Card Reader (150, 300, or 400 cpm) 3411 Magnetic Tape Unit (1 Device) †3521 Card Punch (50 cpm)	High-Speed Digital Interface EIA-RS232C Interface CCITT-V.24 V.28 Interface CCITT-V.35 Interface CCITT-X.21 Interface (nonswitched) High-Speed Local Attachment to a 3705-II using the V.35 Interface Feature Digital Data Service Adapter Keylock Operator ID Reader Door Keylock Audible Alarm ASCII Additional 1416 Interchangeable Train Cartridges (For 3203 Printer) Cryptographic (Encrypt/Decrypt) Mercury Battery‡
3777 Model 4	Keyboard and Control Panel 3262 Printer Models 2 and 12 Attachment Model 2: 364 to 650 lines per minute using 94-48 character set Model 12: 180 to 325 lines per minute using 94-48 character set 19.2 kbps Maximum Line Speed (20.4 kbps in World Trade) 1024-Character Display for Console Message Display and Operator Guidance Console Message Spooling into Terminal Storage SNA/SDLC Communications with up to Six Concurrent Logical Unit Sessions Electronic Forms Control Automatic Answering Operator Attention Speaker Data Compression/Expansion Data Decompaction The 3262 supports various print band arrangements including 116 character Canadian French and 127 character Katakana (see Note)	Language Group Keyboard Arrangement	3262 Printer Models 2 and 12 (650 lpm or 325 lpm) (3262 is part of minimum configuration Magnetic Diskette Storage (two Devices; 485,376 Bytes) 2502 Card Reader (150, 300 or 400 cpm) 3411 Magnetic Tape Unit (1 Device) †3521 Card Punch (50 cpm)	High-Speed Digital Interface EIA-RS232C Interface CCITT-V.24 V.28 Interface CCITT-V.35 Interface (WTC) High-Speed Local Attachment to a 3705-II using the V.35 Interface Feature (WTC) Data-Phone* Digital Services Interface Keylock Audible Alarm ASCII Additional 3262 Printer (any combination of the two models is permitted) Additional 3262 Interchangeable Print Bands are available: 48, 63, 64, 96, and 128 character bands plus 116 character Canadian French and 127 character Katakana (see Note)

†Attach via 3782 card Attachment Unit Model 1

‡Purchase-Only Accessories

*Trademark American Telephone & Telegraph Company

Note: Refer to the *IBM 3262 Printer Models 2 and 12 Component Description,* GA24-3737, for the latest information on print band availability.

Figure 1-1. IBM 3776/3777 Data Communication Terminals Summary (Part 3 of 3)

IBM 3776 Communication Terminal Models 1 and 2/ IBM 3777 Communication Terminal Model 1

The IBM 3776 Models 1 and 2 (Figure 1-2) are designed for medium-speed batch data applications such as remote job entry. The 3776 Models 1 and 2 (3776-1/3776-2) provide a range of printing speeds up to 400 lines per minute (see Figure 1-1), and can attach both card and diskette media for batch data input and output. An IBM 2502 Card Reader Model A1 (150 cards per minute) or Model A2 (300 cards per minute) can be attached via a 3782 Card Attachment Unit with optical mark read (OMR) special feature. An IBM 3521 Card Punch (50 cards per minute) with the Card Read Feature (punch checking or as a reader without 3501 or 2502) and the Card Print (interpret) special features can be attached via 3782-1 Card Attachment Unit. Two Diskette Storage Devices can also be attached for input and output. The 3776 Models 1 and 2 have dual 256- or dual 512-byte transmission buffers, switch selectable by the operator, to provide 2770 or 3780 compatibility (see Chapter 6 for more information).

The IBM 3777 Model 1 (Figure 1-3) is similar in function to the 3776, but has a different appearance. Instead of a console-mounted line printer, a standalone high-speed line printer attaches to the 3777 Model 1 (3777-1). The 2502 Model A1, A2, or the higher-speed Model A3 (400 cards per minute) can be physically mounted on the controller console. The same diskette storage attachments are offered as on the 3776 models. The 3777-1 is functionally designed for high-speed, remote job entry applications. With the high-speed printer (up to 1200 lines per minute), higher maximum line speed (up to 19,200 bps or 20,400 bps in World Trade countries), and higher speed card reader, the 3777-1 provides higher throughput than the 3776. Dual 256- or dual 512-byte buffering is selectable by the operator and provides 2770 or 3780 compatibility (see Chapter 6 for more information).

Because they are not a requirement for batch data applications, offline keyboard entry, buffer edit, and diskette update functions are not provided by the 3776 and 3777. The keyboard can be used for inquiry and for operator communication with the host processor.

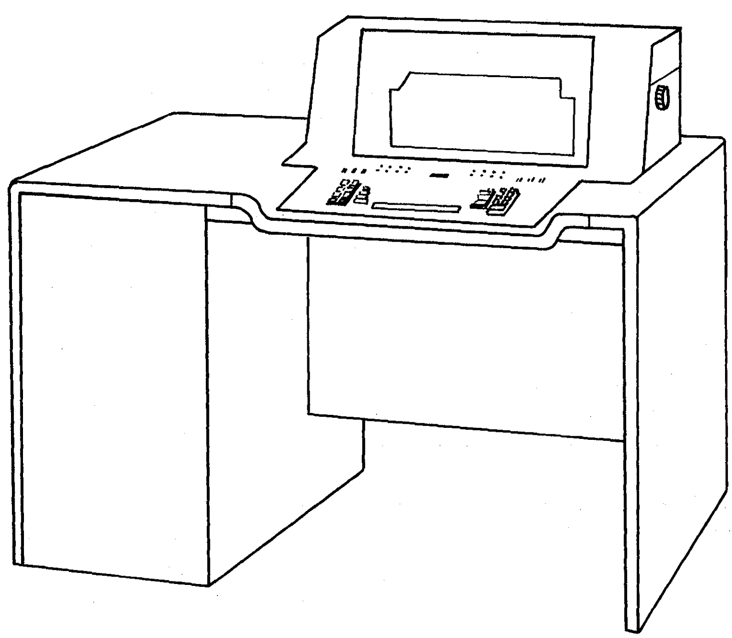


Figure 1-2. IBM 3776 Communication Terminal Model 1 or 2

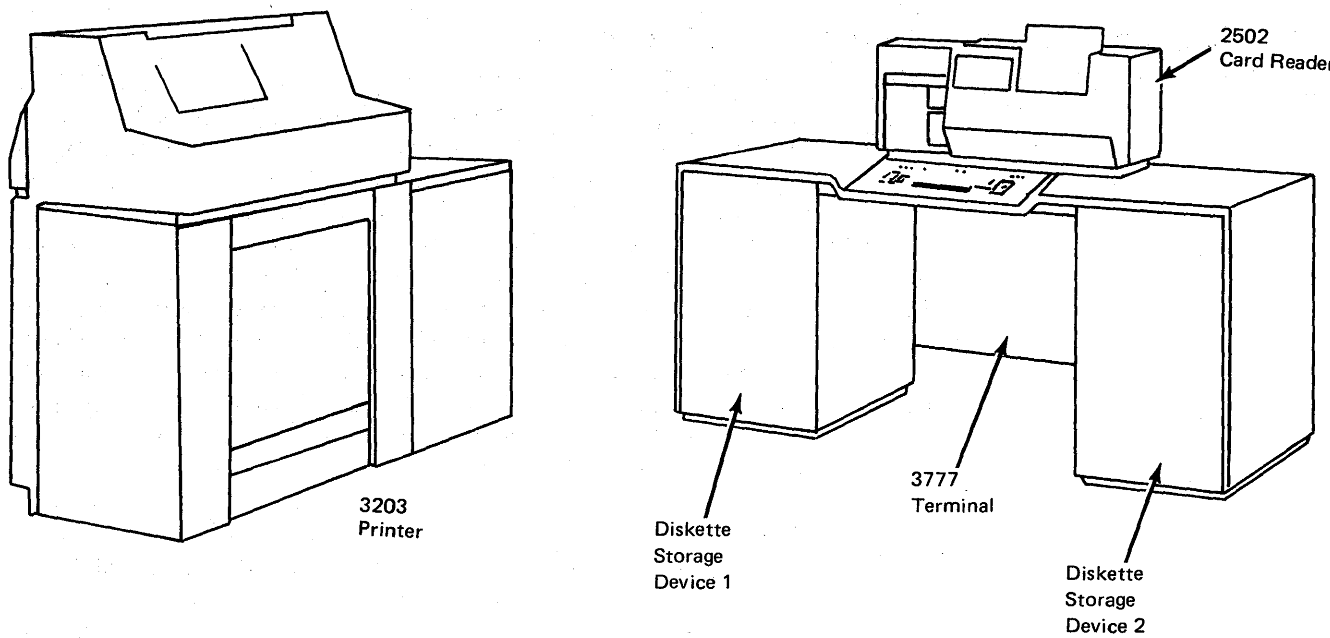


Figure 1-3. IBM 3777 Communication Terminal Model 1 Configuration

Dual data paths on the 3776-1, 3776-2, and 3777-1 allow concurrent online and offline operation. A 3776-1, 3776-2, or 3777-1 with the appropriate I/O attachments can concurrently (online) receive and print data. Offline, the terminals can: (1) read cards to an attached diskette, (2) (on 3776 models only) read from the diskette and punch data into cards, or (3) read from one diskette and write to the other diskette. Figure 1-4 is a summary of operations that can be performed by the 3776-1/3776-2/3777-1.

The Record Compression function reformats records from basic exchange diskettes for transmission by the 3776-1/3776-2/3777-1. If *two* Diskette Storage Device features are used with the Record Compression function, records from basic exchange diskettes can be compressed, blocked, and written onto a single diskette, in 3770 mode, for subsequent batch transmission. If *one* Diskette Storage Device feature is used with the record compression function, records from basic exchange diskettes can be compressed and blocked into 256- or 512-byte buffers for transmission. The buffer has a capacity of 512 bytes. But to maintain compatibility with the 3780, only 511 bytes can be used for data transmission.

A transmission reversal function of the 3776-1, 3776-2, and 3777-1 permits the operator at the terminal keyboard to interrupt host processor-to-terminal data transmission and start terminal-to-host processor data transmission. Upon completion of terminal-to-host processor transmission, host processor-to-terminal transmission may resume. This function depends on associated programming support provided in the host processor.

Refer to Chapter 2 for more information on the IBM 3776 Models 1 and 2/3777 Model 1 terminals and to Chapter 5 for I/O attachments.

IBM 3777 Communication Terminal Model 2

The IBM 3777-2 (Figure 1-5) is similar in appearance to the Model 1, but has a different application and I/O configuration. The 3777-2 functions as a BSC MULTI-LEAVING workstation under control of a remote-job-entry (RJE) subsystem in the host processor.

Model	Online	Offline
3776 Models 1 & 2	Batch: Diskette to Line Card Reader to Line Line to Diskette Line to Printer Line to Card Punch *Limited Keyboard to Line	Diskette to Printer Diskette to Card Punch Diskette to Diskette Card Reader to Card Punch Card Reader to Diskette Card Reader to Printer
	Dual Data Path Line to Printer and	Card Reader to Diskette –OR– Diskette to Card Punch –OR– Diskette to Diskette
3777 Model 1	Batch: Diskette to Line Card Reader to Line Line to Diskette Line to Pinter *Limited Keyboard to Line	Diskette to Printer Diskette to Diskette Card Reader to Diskette Card Reader to Printer
	Dual Data Path: Line to Printer and	Card Reader to Diskette –OR– Diskette to Diskette

*Can send keyboard data to the host processor for commands and logon/logoff

Figure 1-4. 3776 Models 1 and 2/3777 Models 1 Operations

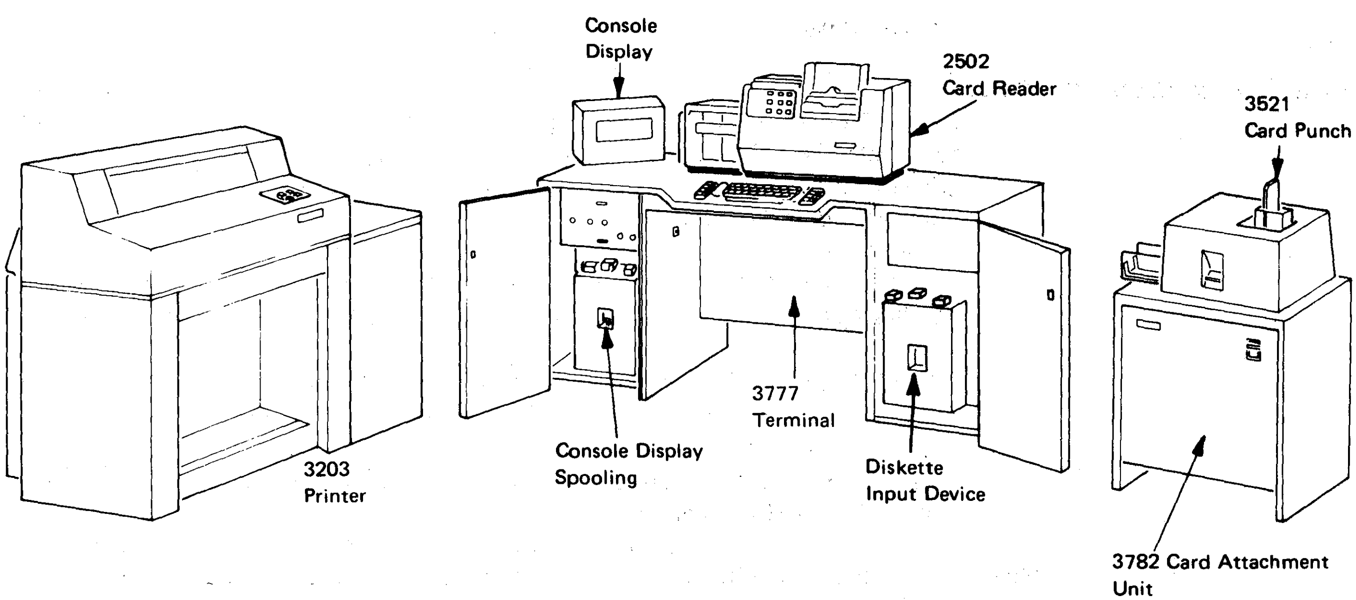


Figure 1-5. IBM 3777 Communication Terminal Model 2 Configuration

A minimum 3777-2 workstation configuration consists of (1) the 3777-2 console with keyboard/operator panel, (2) an IBM 3203 Printer Model 3 with speeds up to 1200 lines per minute, and (3) either an IBM 2502 Card Reader with speeds up to 400 cards per minute, or both the Diskette Input Device and the Console Display feature. The 3777-2 communicates with the host processor at line speeds up to 19,200 bits per second (up to 20,400 bits per second in World Trade countries) using BSC MULTI-LEAVING.

The keyboard and operator control panel on the basic 3777-2 are used for terminal setup and remote workstation function. The keyboard, in conjunction with the optional console display, provices a console function for the 3777-2.

In addition to the printer and card reader and/or Diskette Input Device, the 3777-2 can attach three other I/O devices as special features: (1) a 1,024-character Console Display for workstation console use (operator messages), (2) one Diskette Storage Device for spooling of console display messages, and (3) an IBM 3521 Card Punch with the Card Read feature (for punch checking only) and the Card Print (interpret) special feature via the 3782-1 Card Attachment Unit. Both input devices—the 2502 Card Reader and the Diskette Input Device—can be installed on the 3777-2 to permit alternating the job input source. (Both devices cannot be operated simultaneously.) An Operator ID Reader can also be attached.

The IBM 3777-2 provides the functions necessary to execute a BSC MULTI-LEAVING workstation program written for the IBM System/360 Model 20, Submodel 5 and generated by the host processor. See Chapter 3 for information about operating a workstation program for the 3777-2.

The RJE subsystem permits the remote terminal operator at the 3777-2 to submit jobs (the *job input stream*) that are sent over the BSC communication facilities for execution at the host processor site. After execution, the RJE subsystem sends the output of the jobs (the *job output stream*) back to the 3777-2 where it is directed to the appropriate output devices. Refer to Chapter 3 for a description of BSC MULTI-LEAVING and the host RJE subsystems that support BSC MULTI-LEAVING operation.

Basic Workstation Functions

The 3777-2 operates under the control of a host-generated workstation program. At the central site, the 3777-2 user generates a workstation program deck for the particular 3777-2 configuration at the remote site. This is the same program generated for an equivalent System/360 Model 20 Submodel 5 workstation. The workstation program can then be loaded into the terminal from this card deck. For faster program loading, the workstation program deck can be written onto a diskette associated with the Console Display Spooling feature or the Diskette Input feature, and the program loaded from the diskette.

After the operator loads the workstation program deck into the 3777-2 and logs on to the host processor, the workstation performs these basic functions:

- Handles data transfer from and to specific devices attached to the 3777-2
- Handles data transfer to and from the RJE subsystem at the central site, using the MULTI-LEAVING interface built into the workstation program
- Handles local commands from the operator for controlling workstation devices
- Transfers system commands from the workstation operator to the central site
- Transfers operator messages from the central site to the workstation operator

Refer to Chapter 3 for more information on the IBM 3777 Model 2 terminal and to Chapter 5 for I/O attachments.

IBM 3776 Communication Terminal Models 3 and 4/ IBM 3777 Communication Terminal Models 3 and 4

The IBM 3776 Models 3 and 4 (Figure 1-6), the IBM 3777 Model 3 (Figure 1-7), and the IBM 3777 Model 4 (Figure 1-8), are similar in appearance to the other respective 3776/3777 models but have additional RJE functions and expanded I/O configurations. Under control of an RJE subsystem in the host, the 3776-3, 3776-4, and the 3777-3, 3777-4 use the multiple logical unit (MLU) protocol of Systems Network Architecture (SNA) to interleave in two-way alternate data mode (formerly called half-duplex mode) up to six independent data streams to and from the host. (The 3776-3, -4/3777-3, -4 are hereafter referred to as the 3776/3777 MLU terminals.)

A minimum 3776/3776-4 terminal configuration consists of the terminal control unit with its integrated keyboard/operator panel and printer in conjunction with the standard 1024 character console display. The minimum 3777-3 and 3777-4 terminal configurations are similar except that the 3777-3 requires a 3203 Model 3 printer and the 3777-4 requires a 3262 Model 2 or 12 printer; the printers must be ordered separately. The terminals can communicate with the host processor at line speeds up to 19,200 bits per second (up to 20,400 bits per second in World Trade countries) using Synchronous Data Link Control (SDLC).

The 3776/3777 MLU terminals will also operate in two-way simultaneous data mode (also called full-duplex mode) on nonswitched duplex lines in point-to-point or multipoint configurations. In general, operating in two-way simultaneous data mode will tend to provide greater overall throughput—compared to operating in two-way alternate (half-duplex) data mode—at any given communications line speed when running input and output data concurrently. The 3777-3, -4 operating in two-way simultaneous data mode (duplex) at 19.2 kbps or 20.4 kbps on a terrestrial link may however, present a variance of from greater to degraded overall terminal throughput when compared to comparable operation in a two-way alternate data mode (half-duplex).

The keyboard and the operator panel are used with the console display for setting up the terminal, entering logon/logoff commands, entering host application commands, executing stored procedures, and executing offline utility procedures and other remote MLU workstation functions. The console display is also used to display messages sent to and received from the host. Messages from the host and certain messages entered by the operator are retained in terminal storage, which also stores customer-defined procedures and utilities that simplify the operator's tasks.

The following features are not available on the 3777-4:

- ID Card Reader
- Door Keylock
- Encrypt/Decrypt
- Dual Door Keylock
- High-Speed Digital Interface
- V.35 Interface/High Speed Local Attachment to 37705-II

The following I/O devices (special features) can be attached to the 3776/3777 MLU terminals: (1) an IBM 2502 Card Reader, (2) an IBM 3521 Card Punch with the Card Read (punch checking only) and Card Print (interpret) special features, (3) Diskette Storage Devices 1 and 2 with operator-removeable diskettes, (4) one IBM 3411 Magnetic Tape Unit Model 1, and (5) an Operator ID Reader. For data security, data flowing between the host processor and the 3776/3777 MLU terminal may be enciphered using the Encrypt/Decrypt special feature.

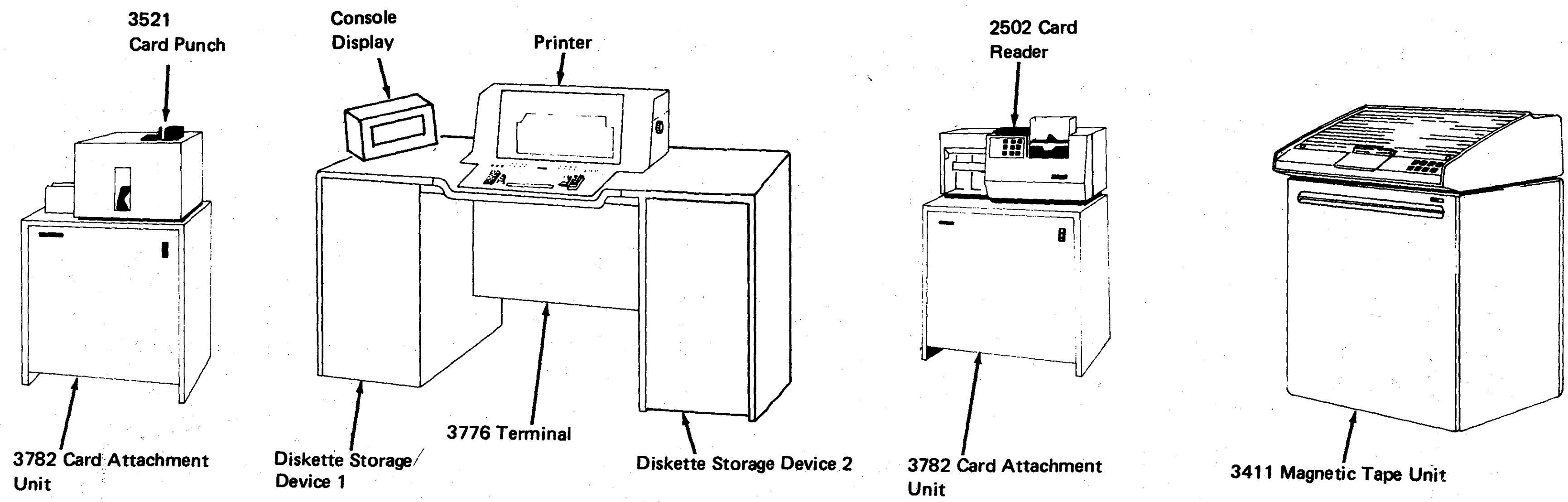


Figure 1-6. IBM 3776 Communication Terminal Model 3 or 4 Configuration

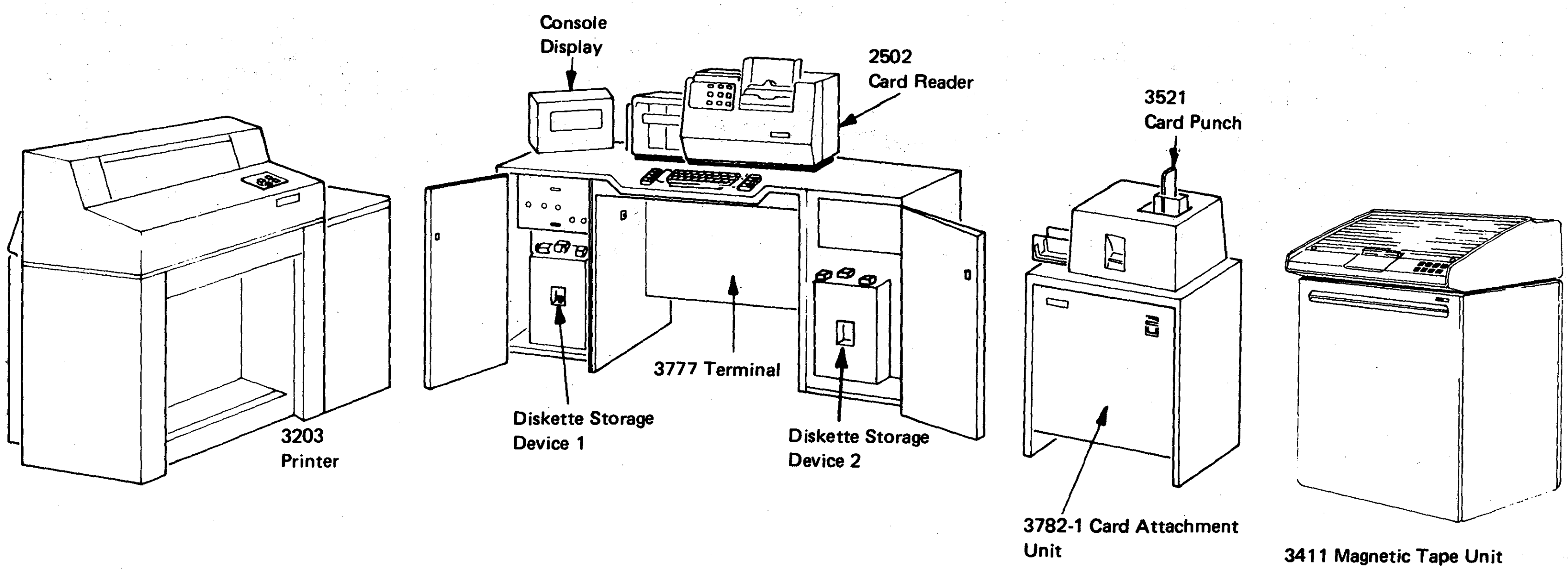


Figure 1-7. IBM 3777 Communication Terminal Model 3 Configuration

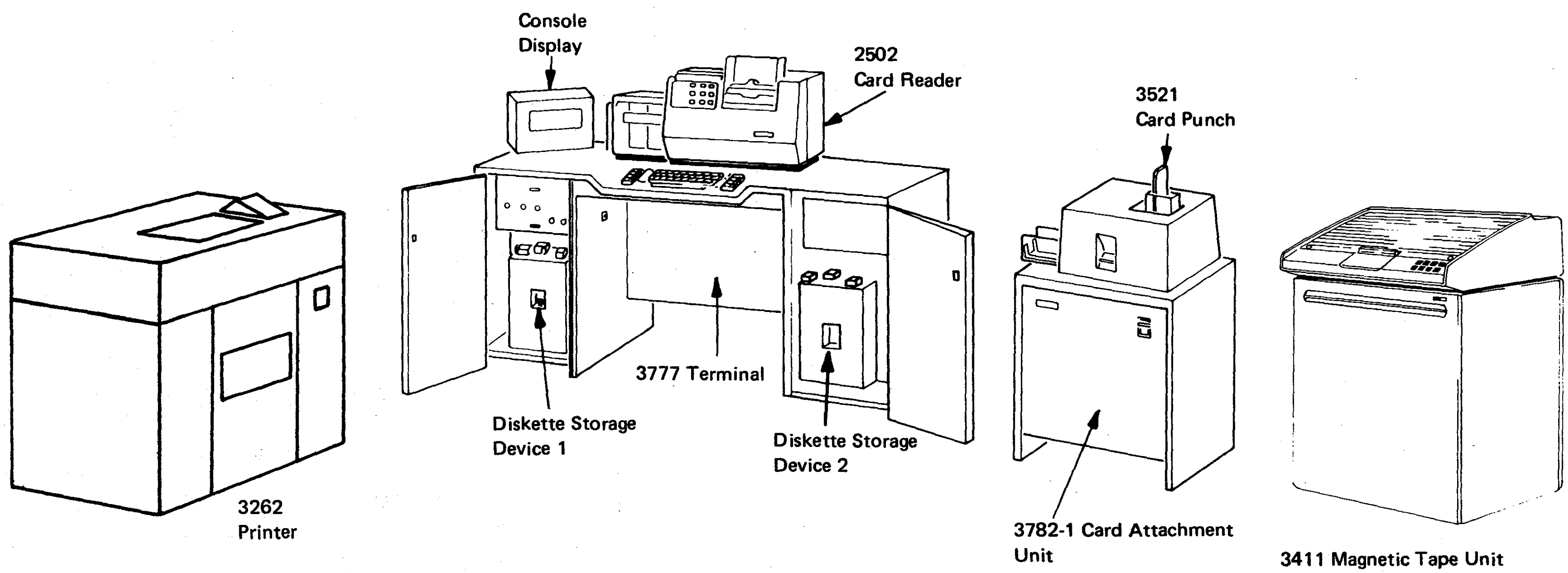


Figure 1-8. IBM 3777 Communication Terminal Model 4 Configuration

General Device Capacities

The console line printer for the 3776-3 or 3776-4 has a maximum speed of 300 lines per minute or 400 lines per minute, respectively. For the 3203 Model 3 printer attached to the 3777-3, the maximum speed is 1000 lines per minute, or 1200 lines per minute with the Speed Enhancement feature. For the 3262 Models 2 or 12 printer attached to the 3777-4, the nominal speeds are 650 lines per minute (Model 2) or 325 lines per minute (Model 12). Maximum print line length for these printers is 132 characters.

The 1024-character console display screen can display 16 lines of 64 characters each. The top 13 lines are used to display messages; the bottom 3 lines are used for operator entry and to display prompting and error messages. Console display messages from the top 13 lines are retained in terminal storage, which has a message capacity of about 1000 messages of 80 bytes each.

The storage capacity of the Diskette Storage Devices (1 and 2) is about 242K bytes on each diskette.

On the single 3411 Magnetic Tape Unit, nine-track recording density is either 800 or 1600 bits per inch. A half-inch (12.7 mm) wide tape reel, 10.5 inches (267 mm) in diameter, can hold 2400 feet of tape.

The 2502 Card Reader operates at 150, 300, or 400 cards per minute depending on the model. The 3521 Card Punch operates at a speed of 50 cards per minute.

Operating as a multiple logical unit, the 3776/3777 MLU terminals can transmit or receive up to seven request units (RUs), depending on buffer availability and RU size, in a single transmission that is uninterrupted by a line turnaround for a response. The 3776/3777 MLU terminals can also operate as a single logical unit using the same RU sizes as the 3776-1, 3776-2, or 3777-1 terminals.

Operating Features and Functions

This section summarizes the features and functions of the 3776/3777 multiple logical unit (MLU) terminals. Refer to Chapter 4 for more information on basic features and functions, special features, specify features, and accessories.

Stored Operator Procedures

A 3776/3777 MLU terminal can interleave up to six independent online data streams to and from the host processor concurrently with offline utility and job setup procedures. Therefore the operation of these terminals is highly flexible. To simplify the operator's task and to save time, procedures can be defined by the user and retained in terminal storage for subsequent retrieval and execution by the terminal operator. Some of the operator procedures and other terminal control information that can be predefined and stored for later retrieval include:

- Terminal initialization procedures
- Terminal configuration specifications
- Logon and logoff procedures
- Printer carriage control definitions
- Print train definitions
- Terminal-to-host job definitions
- Host-to-terminal job definitions
- Local I/O untility procedures

Refer to Figure 1-9 for a list of the online and local or offline operations.

Terminal	Online	Concurrent Local or Offline
3776 Models 3 & 4 and 3777 Models 3 & 4	Card Reader to Line Console to Line Diskette 1 to Line Diskette 2 to Line Magnetic Tape to Line Line to Card Punch Line to Console Display Line to Diskette 1 Line to Diskette 2 Line to Magnetic Tape Line to Printer (1 and 2*)	Card Reader to Card Punch Card Reader to Diskette 1 Card Reader to Diskette 2 Card Reader to Mag. Tape Card Reader to Printer (1 or 2*) Diskette 1 to Card Punch Diskette 2 to Card Punch Diskette 1 to Diskette 2 Diskette 2 to Diskette 1 Diskette 1 to Mag. Tape Diskette 2 to Mag. Tape Diskette 1 to Printer (1 or 2*) Diskette 2 to Printer (1 or 2*) Mag. Tape to Card Punch Mag. Tape to Diskette 1 Mag. Tape to Diskette 2 Mag. Tape to Printer (1 or 2*)

*3777 Model 4

Figure 1-9. 3776 Models 3 and 4/3777 Models 3 and 4 Operations

Terminal Initialization

During the power-on and initialization procedure, the operator is prompted to enter the current date and time of day. This information is subsequently appended to messages from and to the host processor. The user can predefine and store the following configuration and operation information and procedures to be automatically retrieved and applied or executed as part of the power-on procedure.

- Establish a communication link with the host processor
- Execute a logon procedure
- Select the default carriage control
- Select the default print train image for the controller
- Specify the host-to-terminal job definitions to be used
- Specify the 2502 to be a "hot" reader
- Specify a variable timeout period for intervention required
- Specify the maximum number of RUs per chain

Job Processing

Up to six concurrent SNA sessions may be specified using the logon procedure. Job input data to the host may be concatenated from the three input device types (card, diskette, and tape special features) and submitted as one job.

Data Transmission and Reception

The following are standard data communication functions of the 3776/3777 MLU terminals:

- Space and/or data compression and expansion with truncation of trailing blanks (inbound and outbound data streams)
- Decompaction of host-to-terminal data streams using a decompaction table generated at the host and sent to the 3776/3777 MLU terminal over the data link
- Transparent or nontransparent communications over the data link

Operator Interaction

The operator uses the terminal keyboard and the operator panel in conjunction with the console-display to communicate with the host processor and to initiate and control terminal operation. Using the keyboard, the operator can enter logon/logoff requests to the host, commands and messages to the application program in the host, and commands to control local terminal operations. Operator entered data is displayed on the lower lines of the console display. The lower lines of the display are also used for error and status messages to the operator and for prompts to the operator during the execution or definition of functions and procedures.

System messages received from and sent to the host are displayed on the top 13 lines of the console display screen. As system messages are received, they are time-stamped, displayed, and retained in terminal storage. The operator may use the page backward/page forward function in conjunction with the time stamp to retrieve and display previously-received messages that are stored in terminal storage. Messages may be printed, or copied to tape, cards, or another diskette at any time.

Refer to Chapter 4 for more information on the IBM 3776 Models 3 and 4/3777 Models 3 and 4 terminals and to Chapter 5 for I/O attachments.

Communication Facilities

Figure 1-10 shows the communication facilities and line speeds at which the various terminals can operate.

Private-line data channels may be half duplex or duplex. (The terms *half duplex* and *duplex* refer to the communications facilities.) Although most of the 3770 terminals operate only in two-way alternate data mode (also called half duplex mode when referring to the data mode), duplex private-line facilities can be used to reduce the line turnaround time. In multipoint duplex configurations using SDLC (not the 3777-2), duplex facilities may be fully used because one terminal can be transmitting while another terminal is receiving.

The 3776/3777 MLU terminals will also operate in two-way simultaneous data mode (also called duplex mode) on nonswitched duplex lines in point-to-point or multipoint configurations.

Data Circuit-Terminating Equipment (DCE)

Data Circuit-Terminating Equipment (DCE) is any equipment that converts the communication-terminal signals into a form suitable for transmission over a communication facility, and converts signals received from the communication facility into a form suitable for transfer to the communication terminal. The DCE may be a modem (MOdulator/DEModulator) or other type of signal-converter equipment.

The DCE required for communication may be supplied by IBM, the common carrier, or the user. The grade of channel and type of channel conditioning required by a particular DCE operating at a specific line speed must be as specified by the DCE supplier.

IBM integrated modems for use at line speeds of 2400 and 4800 bits per second are available for 3776-1 and 3776-2 terminals. Connection to the common-carrier switched network using these modems is via a customer-provided Data Access Arrangement (DAA) that is FCC-registered. These modems are described under "Integrated Modems" in Chapter 2.

For the grade of channel and type of channel conditioning required by the IBM integrated modems, refer to "Communication Services Selection" in the *IBM 3770 Data Communication System – Planning and Site Preparation Guide,* GA27-3103.

Interface Requirements

Common-carrier or user-supplied DCE interfaces must conform to the electrical characteristics as specified by EIA Standard RS-232C in U.S. and Canada or by CCITT Recommendation V.24/V.28, V.35 (on 3777 Models) or X.21 in World Trade countries. The DCE interface must also be compatible with the EIA/CCITT Interface feature or the High Speed Digital Interface feature on the 3776-3, 3776-4, and 3777 Models that is supplied when an IBM Integrated Modem is not used. The 3770 terminals connected to a switched network can automatically answer incoming calls, using either an external DCE or an integrated modem, if the DCE has this capability. The following circuits are utilized by the 3770:

EIA RS-232C/CCITT V.24/V.28 Interface

Connector Pin	*RS-232C/V.24/V.28 Designation*	*Circuit Description*
1	AA	Protective Ground
2	BA	Transmitted Data
3	BB	Received Data
4	CA	Request to Send
5	CB	Clear to Send
6	CC	Data Set Ready
7	AB	Signal Ground (Common Return)
8	CF	Received Line Signal Detector
11	*	Select Standby (U.K. Speed Select)
15	DB	Transmit Signal Element Timing
17	DD	Receive Signal Element Timing
18	CI*	Test
20	CD	Data Terminal Ready
22	DE	Ring Indicator
23	CH	Speed Selector

*Not standardized by EIA; used for external IBM modem attachment (Select Standby not used on 3777 models).

CCITT–V.35 Interface (World Trade countries only):

Connector Pin	*V.35 Designation*	*Circuit Description*
B	102	Signal Ground (Common Return)
C	105	Request to Send
D	106	Clear to Send
E	107	Data Set Ready
F	109	Received Line Signal Detector
H	108/2	Data Terminal Ready
R	104	Received Data A-Wire
T	104	Received Data B-Wire
V	115	Receiver Signal Element Timing A-Wire
X	115	Receiver Signal Element Timing B-Wire
Y	114	Transmitter Signal Element Timing A-Wire
a	114	Transmitter Signal Element Timing B-Wire
P	103	Transmitted Data A-Wire
S	103	Transmitted Data B-Wire

CCITT X.21 Interface (World Trade Countries Only)

Connector Pin	X.21 Designation	Circuit Description
1		Shield
2	T(a)	Transmit
3	C(a)	Control
4	R(a)	Receive
5	I(a)	Indication
6	S(a)	Signal Element Timing
8	G	Signal Ground
9	T(b)	Transmit
10	C(b)	Control
11	R(b)	Receive
12	I(b)	Indication
13	S(b)	Signal Element Timing

High-Speed Digital Interface (HSDI):

Connector Pin	HSDI Designation	Circuit Description
C	CS	Clear to Send
D	RS	Request to Send
E	SD	Send Data
F	DSR	Data Set Ready (Center Conductor)
F	RI	Ring Indicator (Outer Conductor)
J	SCT	Serial Clock Transmit
K	RD	Receive Data
L	SCR	Serial Clock Receive
M	AGC	AGC (Carrier–Center Conductor)
M	DTR	Data Terminal Ready (Outer Conductor)

Digital Data Service Adapter (DDSA)

Connector Pin	DDS Designation	Circuit Description
1		Ground
2	SI	Status Indicator (Not Used)
3	DT1	Received Data
4	DR1	Received Data
5	DT	Transmit Data
6	DR	Transmit Data
7-15	--	Not Used

Additional Information

Additional information about DCE interfaces and communication facilities can be found in the following publications or can be obtained from your IBM teleprocessing representative:

- *IBM Remote Multiplexers and Communications Terminals Installation Manual–Physcial Planning,* GA27-3006
- *Planning and Installation of a Data Communication System Using IBM Line Adapters,* GA24-3435
- *IBM 3863 Modem Models 1 and 2; IBM 3864 Modem Models 1 and 2: Setup Instructions and User's Guide,* GA27-3216
- *IBM 3865 Modem Models 1 and 2 Setup Instructions and User's Guide,* GA27-3218
- *IBM 3872 Modem User's Guide,* GA27-3058 (2400 bps)
- *IBM 3874 Modem User's Guide,* GA33-0002 (4800 bps)
- *IBM 3875 Modem User's Guide,* GA33-0001 (7200 bps)
- *IBM 5979 L11/12 Baseband Modem User's Guide,* GA11-8594 (9600 bps–World Trade only)

Facilities \ Models	3776-1/3776-2		3776-3/3776-4 3777 (All Models)†	
	United States	World Trade	United States	World Trade
Common-Carrier Switched Telephone Network; World Trade Public Switched Network (Point-to-Point)	1200 bps 2400 bps 4800 bps	600 bps 1200 bps 2400 bps	2400 bps 4800 bps	2400 bps 4800 bps
Common-Carrier Voice-Grade Private-Line Channel* (Point-to-Point or Multipoint) (Point-to-Point only, with 3777-2)	1200 bps 2400 bps 4800 bps	600 bps 1200 bps 2400 bps 4800 bps	2400 bps 4800 bps 7200 bps 9600 bps 19200 bps	2400 bps 4800 bps 7200 bps 9600 bps
Common-Carrier Private-Line Wideband Channel* (Point-to-Point)			19200 bps	20400 bps
Common-Carrier Private-Line Digital Data Communication Services (Point-to-Point or Multipoint) (Not available with 3777-1,2)			2400 bps 4800 bps 9600 bps	

*Or World Trade equivalent

†See 3777-1,2 exceptions under "Facilities."

Figure 1-10. Communications Facilities and Line Speeds

High-Speed Local Attachment to a 3705-II Communications Controller

With the V.35 Interface Feature installed, certain 3776/3777 terminals can be attached locally to a 3705-II Communications Controller using the appropriate line set feature of the 3705-II. This local attachment feature operates at 14,400 bps using either the half duplex or duplex line sets. The maximum cable length is 170 feet (51.8 meters). The V.35 Interface Feature cannot be installed with the EIA Interface Feature or the High Speed Digital Interface Feature.

*3705-II Feature**	*3776/3777 Models*	*Terminal Features*
Half-Duplex Line Set	3776-3/3776-4 3777-1/3777-2/3777-3/3777-4	Communication Driver
Full-Duplex Line Set	3776-3/3776-4 3777-3/3777-4	Communication Feature V.35 Interface

*The Line Interface Base must have the Business Machine Clock Special Feature.

The 3776/3777 models that are locally attached using a half-duplex line set and cable, can operate in two-way alternate data mode. The 3776-3/3776-4/3777-3 that are locally attached using a duplex line set and cable, can operate in two-way simultaneous data mode.

Chapter 2. 3776 Models 1 and 2/3777 Model 1 BSC/SDLC Remote-Job-Entry Terminals

This chapter describes the basic functions and features; the special and specify features, and the accessories of the 3776 Models 1 and 2/3777 Model 1 terminals. Refer to Chapter 5—"I/O Attachments" for a description of the cable-attached input/output devices.

Components

This section introduces the basic components of the 3776 Models 1 and 2/3777 Model 1 terminals. Refer to the "Functional Characteristics" section for more information.

Controller

The controller is contained in the terminal's base. It controls input and output operations, provides buffering for received and transmitted data, and provides the data link control.

The controller operates in three modes: online mode, local mode, and offline mode. After power on, or after completion of any job, the terminal is in local mode. From local mode, the controller can be placed in either offline mode or online mode. In online mode, the terminal can receive or transmit data over the communication facility. In offline mode, the terminal can be used for data transfer between attached I/O devices.

Mode of operation, device selection, and other parameters necessary to perform a job are under operator control. Forms control information (margins, vertical and horizontal tab stops, and forms length) for up to five different job definitions can be entered into the controller by the operator and remain available for selection without the need to re-enter the setup each time it is desired. Forms control is accomplished by control characters within the data.

Dual data path operation allows an online mode line-to-printer job to run concurrently with an offline card reader-to-diskette or diskette-to-diskette with the addition of those devices to the 3776-1/3776-2/3777-1. The online job can also run concurrently with an offline diskette-to-punch job with the addition of those devices to the 3776-1 or 3776-2.

3776 Console-Mounted Line Printer

The 3776 console-mounted line printer operates as a line printer only and is not designed as an interactive type printer. That is, it does not provide a print visibility feature nor a print position indicator. Four character sets are available for the 3776 printer. In addition to the three EBCDIC character sets available in 48-, 64-, or 94-character arrangements, another 48-character set (EBCDIC only) is available that is equivalent to the HN print train arrangement for the 3203 printer attached to the 3777 terminal. Two versions of the printer are available and provide the following maximum printing speeds:

3776 Model 1	.....	300 lpm using the 48-character set
		230 lpm using the 64-character set
		160 lpm using the 94-character set
3776 Model 2	.....	400 lpm using the 48-character set
		300 lpm using the 64-character set
		230 lpm using the 94-character set

The character set desired is optional, and must be specified at time of ordering. Additional print belts can be purchased and can be changed by the operator. The characters provided by each of these character sets are shown in Appendix B. The 48-, 64-, and 94-character set belts are interchangeable, and the printing speed automatically adjusts to the belt installed. Print belts cannot be exchanged between a 3776 Model 1 and a Model 2, however. Using the 48- or 64-character set belt, the 3776 converts the 26 lowercase alphabetic characters a through z to uppercase and prints them. The Katakana machines, those Katakana characters having codes equivalent to EBCDIC lowercase alphabetic characters are converted to uppercase alphabetic characters. Maximum line length is 132 characters.

The character set is contained on a continuously rotating metal belt. As the belt rotates, a comparison is made between the character in front of each hammer and the character that is to print in that position. When the desired character is in position to print, the hammer for that position is fired to force the paper and ribbon against the character face to print the character.

The printer uses a pin-feed forms tractor for feeding 1-part to 6-part edge-punched continuous forms. The tractors are adjustable to accept forms ranging from 3-1/2 to 15 inches wide. Line spacing of 6 or 8 lines per inch can be selected by the operator. Considerations for designing forms used with this printer can be found in *Forms Design Reference Guide for Printers,* GA24-3488.

A forms enclosure on the 3776 Models 1 and 2 facilitates stacking of continuous, fanfold forms.

3203 Printer (3777 Only)

A minimum configuration includes a 3777 Communication Terminal and a 3203-3 Printer. The 3203 Printer is described in Chapter 5 of this manual.

The 3203 printer uses the 1416 Interchangeable Train Cartridge to print at speeds up to 1000 lines per minute depending on which train cartridge is installed. With a special feature, the 3203-3 can print up to 1200 lines per minute. When any train is installed that does not contain the 26 lower-case alphabetic characters, these characters are converted to upper case and printed.

See Chapter 5 for more information about the 3203 printer and 1416 cartridges.

Keyboard

The keyboard used on machines in the U.S. and Canada has 44 character keys and a space bar, and other typewriter-like control keys. The arrangement of keys is similar to that on a typewriter keyboard. On either side of the typewriter-like keys are keys for controlling terminal operation. Lights located above the keys provide indications of terminal status and error conditions. This keyboard provides 88 characters in upper and lower-case shift, (refer to Figure 2-7).

Typamatic operation of the Space Bar and of the Backspace, Hyphen/Underscore, and CHAR ADV (Character Advance) keys causes repetitive functions, simply by holding the key down.

Keyboards for use in World Trade countries other than the United Kingdom have 47 graphic keys, providing 94 characters. The keyboard for the United Kingdom has an additional key (48 keys), and provides 94 characters in upper and lower-case shift. This keyboard does not provide typamatic operation of the Hyphen/Underscore key. Keyboard characters present on all keyboards are shown in Appendix B.

Nomenclature on keyboard control keys, lights, and switches is provided for the following languages:

English
French
German
Italian
Japanese
Spanish

Functional Characteristics (3776 Models 1 and 2/3777 Model 1)

This section describes the basic functions and features of the 3776 Models 1 and 2/3777 Model 1. Refer to the "Features and Accessories" section for descriptions of special and specify features and purchase-only accessories.

Controller

The controller uses two alternating buffers for temporary data storage. Either dual 256-byte or dual 512-byte alternating buffer operation is selectable by a switch on the keyboard. A change in buffer size can be selected only at power-on time, or after the SYSTEM RESET switch is pressed. Position of the select switch prior to power on or system reset determines the active mode. In order to maintain 3780 compatibility, the 512-byte buffer may contain 511 bytes of data for transmission. However, the buffer will be referred to as a 512-byte buffer in the remainder of this manual (see chart with Figure E-5). The buffers alternate in use between input and output, and accept data from the input device character-by-character (Figure 2-1).

During either offline or online operation, one buffer is always dedicated to input and the other to output. While one buffer is accepting input data, the other may be sending output data. When the input buffer fills and the output buffer empties, they exchange functions. This arrangement allows:

- A consistent line rate with variable I/O (input/output) rate
- Overlap of input and output operations
- Checking of data before output or transmission.

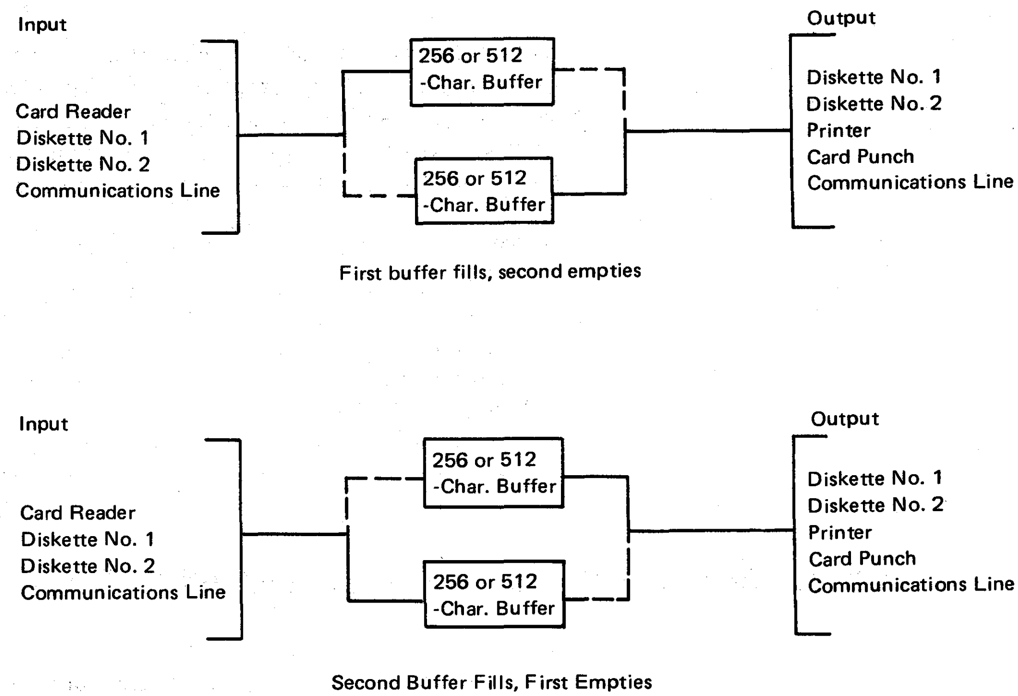


Figure 2-1. 3776-1/3776-2/3777-1 Dual Buffer Operation

Dual Data Path

Dual data path operation on the 3776-1/3776-2/3777-1 allows concurrent execution of a line-to-printer job and either (a) a card reader-to-diskette, or (b) a diskette-to diskette job. On the 3776, (c) a diskette-to-card punch job can be run concurrently with the line-to-printer job. The line-to-printer job (Job 1) uses either the dual 256-byte or dual 512-byte alternating buffers to accept data from the line and transfer it to the printer. A single 256-byte buffer (or 512-byte buffer if the EXTEND BUFFER switch is on) is used for data buffering between the input and output devices of Job 2. Job 1 and Job 2 can be started and stopped independently of each other by use of the keyboard START/STOP JOB and START/STOP DUAL keys.

Appendix D shows the throughput that can be expected using dual data path operations. The offline job (Job 2) throughput is less than it would be if the same job were run as Job 1, because of the single buffer Job 2 operation.

If the host processor should send a component selection for a device in use by Job 2, the selection will be rejected and the CPU SELECT light turns on. The operator may then stop Job 2 to make the device available to the line.

Job Control

Job controls allow setup and selection of a job running in either online or offline mode. After the terminal's power is turned on, and with the HOLD PRINT switch and Keylock off, the terminal is in local mode. To proceed with terminal operation, the operator must then set up the forms control for the job and define other parameters, or select them by use of the keyboard switches. Job control information, if desired, may be entered from the keyboard or if previously written on the diskette or punched into cards, be read into the controller from diskette or cards. These settings, however entered, remain in effect for the entire job.

Parameters, in addition to forms control, that may be specified or selected include:

- The input and output devices required for the job
- A data set name, if the job involves a Diskette Storage Device
- The beginning record number of the diskette data set, if other than the first one (cannot be specified for basic exchange diskettes)
- Transparent Mode: This causes card data to be transmitted in Transparent format.
- Compress: This causes space compression of basic exchange diskette data sets or of input data from a card reader (see "Space Compression/Expansion").
- Interpret or Inhibit Interpret (3776 only): Using the 3521 Card Print feature, Interpret must be specified to cause printing on the card while reading cards. Inhibit Interpret must be specified to inhibit printing while punching cards.
- Omit Readback Check (3776 only): This disables the 3521 Punch Checking to allow punching of internally scored or prepunched cards.
- Delete Diskette Records after Read: This deletes all records (except forms control information) from the diskette after the specified data is read.

The online and offline jobs that can be selected are:

Input	(to)	*Output*	*3776-1,-2*	*3777-1*
Card Reader	· ·	Card Punch	X	
Card Reader	· ·	Line	X	X
Card Reader	· ·	Printer	X	X
Card Reader	· ·	Diskette 1	X	X
Line	· ·	Card Punch	X	
Line	· ·	Printer	X	X
Line	· ·	Diskette	X*	X
Diskette 1	· ·	Line	X	X
Diskette 1	· ·	Card Punch	X	
Diskette 1	· ·	Printer	X	X
Diskette 1	· ·	Diskette 2	X	X
Diskette 2	· ·	Line	X	X
Diskette 2	· ·	Card Punch	X	
Diskette 2	· ·	Printer	X	X

*Continuation on diskette 2 is automatic if it is ready to operate.

Output device selection (other than for the console printer) can be overridden and the diskette device selected as the destination for received data by turning the DISK switch on. With the switch on, data received over the line is written on the diskette, regardless of component selection for the card punch.

Compression/Expansion, Decompaction

Throughput on machines may be increased by selecting Compress for the job (See "Job Control"). If this option is specified, consecutive space characters are removed from transmitted data from the card reader and reinserted in output data by the receiver.

Using BSC Space Compression/Expansion

When the terminal is transmitting in BSC and has read two or more consecutive space characters from a card reader, it will transmit an IGS (hex '1D'), followed by a character (binary number) specifying the number of omitted spaces. This binary number represents a minimum of 2 and a maximum of 63 spaces. If more than 64 consecutive spaces are read from the input device, a second IGS sequence is transmitted. In 512-byte mode, a maximum of 511 bytes will be transmitted (see chart with Figure E-5).

The binary numbers representing the omitted spaces are defined as follows:

Number of Spaces	*EBCDIC:* 0	1	2	3	4	5	6	7
2	0	1	0	0	0	0	1	0
3	0	1	0	0	0	0	1	1
.			.					
.			.					
.			.					
63	0	1	1	1	1	1	1	1

Both space compress and transparent mode operation cannot be specified for a job. Transparent mode will override Compress if both are specified.

These sequences can also be received in data from a host processor, and will cause reinsertion of the spaces (expansion) into printed data. On the 3776-1 or 3776-2, spaces will be reinserted into cards punched on an attached 3521 Card Punch; expansion is automatic and does not have to be specified for the job. Compressed data received onto an attached diskette device will be recorded as it is received and be expanded on subsequent output from the diskette to another attached output device.

Using SDLC Space or Data Compression/Expansion

When the 3776-1/3776-2/3777-1 is transmitting in SDLC from a card reader, a String Control Byte (SCB) character (see definition following) is transmitted in front of each string of data characters or instead of consecutive (repeated) space or data characters (called *compression*). The SCB character identifies the type of data string and contains the binary count of the number of characters that follow, or the number of space or data characters to be inserted (repeated) at the receiver (called *expansion*). The binary number represents a minimum of 1 and a maximum of 63. If more than 63 characters are involved, a second SCB character is transmitted.

String Control Byte (SCB) Definition:

Bits 0 and 1 identify the data string:

00 - No Compressed Characters. The binary count field (bits 2-7) contains the number of the bytes between this SCB and the next SCB.

01 - Compacted Data String (Host Processor to 3777-1 Only). The count field contains the number of the bytes between this SCB and the next SCB. Each byte in the string may represent two consecutive master characters or a single character in the compact code subset. Both kinds of bytes may exist in the same character string. The previously received host-created decompaction table is stored in the 3777-1 controller.

10 - Compressed Space Characters. The count field contains the number of space characters represented by this SCB. The next SCB follows in the next byte.

11 - Compressed Data Characters. The count field contains the number of times the data character following this SCB is to be repeated at the receiver. The next SCB follows the data character to be repeated.

Bits 2 through 7 contain a binary count of the data characters that follow, or space or data characters to be inserted at the receiver.

Example: Repeat the asterisk (*) character (X'5C') 21 times

SCB Character Bits

$$\begin{array}{cccccccc} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ \hline \end{array}$$

$$\underbrace{1\ \ 1\ \ \underbrace{0\ \ 1\ \ 0\ \ 1\ \ 0\ \ 1}_{\text{Binary 21}}}_{\text{X'D5'}}$$

Repeated Character Bits

$$\begin{array}{cccccccc} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ \hline \end{array}$$

$$\underbrace{0\ \ 1\ \ 0\ \ 1\ \ 1\ \ 1\ \ 0\ \ 0}_{\text{X'5C'}}$$

These data strings can also be received in data from the host processor, and will cause reinsertion of spaces or data characters (expansion) into printed data. On the 3776-1 or 3776-2, spaces or data characters will be reinserted into cards punched on an attached 3521 Card Punch. Expansion is automatic and does not have to be specified for the job. Compressed data strings received for an attached diskette device will be recorded as received and be expanded upon subsequent output from the diskette to another attached output device.

Using SDLC–Data Decompaction (3777 Model 1)

Compaction is a means of compressing pairs of certain contiguous nonduplicate characters into single 8-bit bytes for transmission, thereby increasing system throughput. The 3777-1 using SNA/SDLC can receive compacted data, decompact it, and print it. Compacted data cannot be sent to the diskette.

A compaction table generated at the host processor must first be transmitted to the terminal using a Type 3 FM Header. Compacted data received by the terminal, identified as a Compacted Data String in the SCB [see "String Control Byte (SCB) Definition" preceding], is then decompacted according to this table.

Procedures for generating the compaction table and for transmitting the table and compacted data to the terminal are contained in the programmer's guide for the particular host RJE subsystem that you are using.

Record Compression

Record Compress using one diskette storage device, permits the compression of Basic Exchange diskette records into buffers of 256 bytes or 511 bytes for transmission (see chart with Figure E-5). Using two special feature diskette storage devices permits offline compression of records on Basic Exchange data sets onto a single 3776-1/3776-2/3777-1 diskette for subsequent batch transmission. The compressed records are written on the diskette in 3770 mode. An IRS character separates the records. In SDLC mode, the FM header built to define the data will set the MEDIA byte to X'20' e.g. "card data" if the data set block length is 80 bytes or less; otherwise, the MEDIA byte is set to X'10' e.g. "disk data". The PROPERTIES byte of the FM header has the CMI bit set to indicate the data is compressed. Record compression cannot be used in SDLC mode on machines with the ASCII character set.

Problem Determination

The controller has built-in tests that run each time the power is turned on or the SYSTEM RESET switch is operated. These tests, when successfully completed, have checked the major portion of the controller and verified that the electronic circuits are operating properly. The terminal is then in local mode. The tests require a few seconds to run and leave the terminal in a state with the PROCEED indicator on; this informs the operator that operation can proceed. Any other indicator being on after the tests have run signals either that a failure occurred in the controller's electronic components, that one of the mode switches is on, or that the Keylock is turned off.

Problem determination tests selectable from the keyboard reside in the terminal. The operator can use these tests to isolate problems to the terminal or to the communication facilities. Communication-facility tests also include online tests provided by the host processor access method.

Error Logging

Information about errors encountered during normal operation is recorded in an error log that can be printed out by the Print Error Log function. When errors that cannot be corrected by operator action occur, or when intermittent internal machine errors that impede operation occur, the operator should call for a printout of the error log before turning the terminal's power off (the error log is lost when power is turned off). This information should be retained and given to the service representative, who will use it to isolate the cause of the problem.

Operator Attention Speaker

This device produces an audible tone to signal the operator that a procedural error has occurred, or that some input or output device requires attention. Upon hearing the tone, the operator can refer to the keyboard indicators, which will indicate the cause of the tone.

3776 Console-Mounted Line Printer

The console-mounted line printer can be specified as the output device for the following jobs:

Input	*to*	*Output*
Line	..	Printer
Card Reader	..	Printer
Diskette 1	..	Printer
Diskette 2	..	Printer

Before a job using printer output is started, margin settings and vertical and horizontal tab stops, if desired, must be entered and stored in the terminal. These settings may be selected at any time, and remain in effect until the settings are redefined, or until power is turned off.

The printer operates only as a line printer. Keyboard-entered data does not print as it is entered, as on other 3770 terminals, but the data entered can be printed out after it is entered and prior to transmission by use of the PRINT VIEW key. The printer cannot be selected for monitor printing of data.

Certain printer function characters can be received within data from the host processor to cause formatting of the data as it is printed on the console printer. The characters that can be recognized by the printer, and the operation they cause, are described in Chapter 6 (BSC) or Chapter 7 (SNA).

Vertical Forms Control

Vertical forms control allows the operator to specify the vertical format of forms by print areas and skip areas. Once the format is entered, automatic operation causes the forms to advance when specified text areas are completed. The procedure for entering the vertical forms control at the terminal is contained in the *Operating Procedures Guide.* Control characters used for vertical forms control are described in Chapter 6 (BSC) or Chapter 7 (SNA). Forms control can also be sent by the host processor, if the application program supports this capability.

Horizontal Format Control

Printer margins and horizontal tab settings are entered and stored in the terminal. The procedure for setting margins and horizontal tab stops is contained in the *Operating Procedures Guide.* These settings are defined during the forms definition procedure, and remain in effect until they are changed by the operator, or until power is turned off. Control characters used for horizontal format control are described in Chapter 6 (BSC) or Chapter 7 (SNA). Forms control can also be sent by the host processor, if the application program supports this capability.

Horizontal tab setup permits a Tab character to be used to skip areas within a line that are not to be printed. This is similar to typewriter operation, except that the tabbing is electronically controlled. An HT character is stored in the transmission buffer immediately following the last data character. Data for the next field then begins storing in the buffer immediately following the HT character.

The relationship between the print position indicated on the printer and the buffer position at which data is entered is not a one-to-one relationship. At the beginning of a job, or after data has been read out of the buffer, new data will always begin storing into the first buffer position. Data begins printing, however, at wherever the left margin is set, as defined by the forms definition. Several lines of data, each delineated by format control characters, can be contained in a single buffer.

Forms Enclosure

A combination forms stand and stacker enclosure on the 3776 Models 1 and 2 facilitates feeding and stacking of continuous, fan-fold forms. The acoustical stacker enclosure permits quieter operation of the console line printer.

3203 Printer (3777 Only)

See Chapter 5 of this manual for information about the 3203 printer.

Keyboard

The keyboard cannot be selected for keyboard entry jobs, but is enabled by pressing the SYS REQ key before an online job is started, or when the STANDBY light is on after a previous online job. A logon or logoff message may be keyed into the buffer, and this message will be sent to the host processor before any other data is received or transmitted. On SDLC machines, if a message is keyed in with the STANDBY light on without first pressing the SYS REQ key, the message is routed to the application program at the host processor. If the SYS REQ key is pressed before keying in the message, the message is routed to the System Services Control Point (SSCP) in the host processor. Limited buffer editing of the message is possible by use of the BUFFR BKSP and CHAR ADV keys. The buffer may also be printed out before transmission of the message by pressing the PRINT VIEW key. If the Operator ID Reader Feature is present, magnetic card data may be sent in addition to keyed data. Refer to "Operator ID Reader" in the "Features and Accessories" section in this chapter.

Note: Some BSC Operating Systems examine the data in a logon message to determine if the data following the message is compressed. A logon message entered from the 3776-1/3776-2/3777-1 is not compressed, and therefore, cannot be used with these Operating Systems preceding compressed data. If compressed data is to be transmitted, the logon message must be transmitted from the card reader or from the diskette using a standard card reader-to-line or diskette-to-line job.

Automatic 2502 Card Reader-to-Line Function

Whenever the 3776-1/3776-2/3777-1 terminal enters standby mode (an online job has just ended), a reader-to-line job is automatically started if the 2502 is ready, or is made ready. No START-JOB function is required. If the RVI or RECV REQT is received during a transmit job, the terminal will interrupt that job and must receive data before restarting the transmit job. Automatically started card reader-to-line jobs are set up only for the compress and nontransparent data. Using SDLC, compress will be reset if the Bind command specifies "Compression Not Allowed". If the operator desires to set up a noncompress or transparent reader-to-line job, this must be done with the normal job definition and start procedures. The 2502 must be made not-ready or the terminal must be in an offline mode at the time this job is started to prevent the 2502 from being automatically started. If the 2502 is involved in a dual job at the time standby mode is entered, the ready status of the 2502 is ignored. The dual job must be stopped before the card reader-to-line job can be automatically started.

Features and Accessories (3776 Models 1 and 2/3777 Model 1)

This section describes the special and specify features and accessories (purchase-only items) available for the 3776-1/3776-2/3777-1 controllers and the 3776 console printer. (Refer to the "Functional Characteristics" section for a description of the basic functions and features.) I/O devices that can be cable-connected to the controller, and special features for these devices, are described under "I/O Attachments" (Chapter 5).

Magnetic Diskette Storage

The Diskette Storage Devices are compact units contained in the terminal's base. Data is recorded on a small flexible operator-changeable diskette. The Diskette Storage Device can accept input data entered into the controller buffer either from the communication line during online operation, or from an attached card reader during offline operation. Batch data can be stored on the diskette during offline operation and subsequently transmitted to the host processor, resulting in increased throughput and reduced communication costs in many applications.

Two devices may be obtained with the 3776-1/3776-2/3777-1. The first Diskette Storage Device (Figure 2-2) is contained in the lower left side of the controller. The second is contained in an extension attached to the right side of the controller (Figure 2-3).

Diskettes used with the Diskette Storage Devices consist of a small flexible disk about 8 inches in diameter enclosed in a holder. Appendix F describes the diskettes used by the 3770, and describes diskette labeling and recommended handling procedures.

Each diskette provides a maximum of 242,688 bytes of data storage. With the addition of a second Diskette Storage Device, the following operations are possible:

- Read from diskette 1, write to diskette 2 (single data set or all active data sets).
- Automatic continuation of an online job from diskette 1 to diskette 2.
- Transmit from diskette 2, receive onto diskette 1.

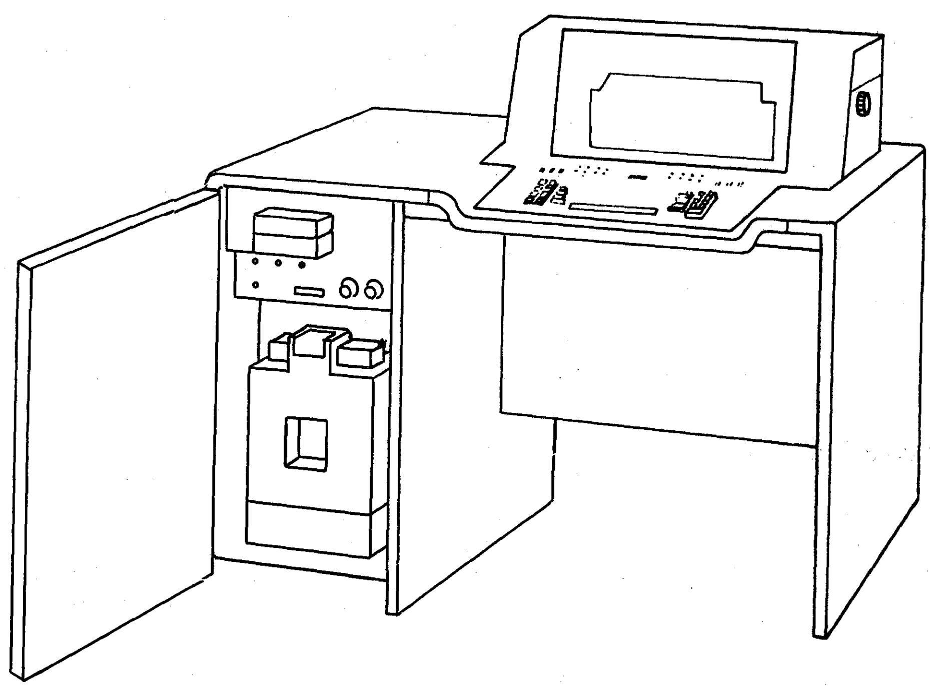


Figure 2-2. 3776-1/3776-2 With Diskette Storage Device 1

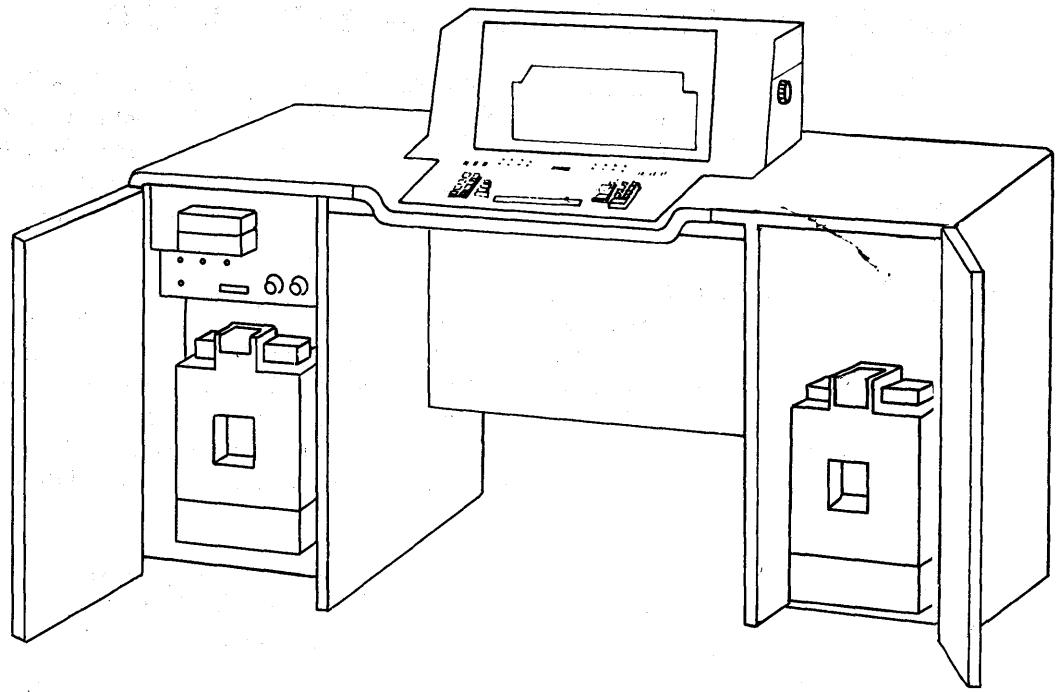


Figure 2-3. 3776-1/3776-2 With Diskette Storage Device 2

With diskette storage, forms control information can be stored on and recalled from diskette 1. If not stored on the diskette, forms control information is lost after power is turned off, and must be re-entered or re-read from the card reader after turning power on.

The ability to transmit from diskette 2 and receive onto diskette 1 during a single session with the host processor permits maintaining the integrity or format of data on the diskette used in diskette 2. With only one Diskette Storage Device, or if transmitting from diskette 1, any data received is written as a data set onto the same diskette. By transmitting data from diskette 2, any received data is then written onto diskette 1 thus preserving diskette 2 in its original condition. This type of operation is also useful when data to be transmitted is written in exchange format (see "Exchange Format" in this chapter). Since the 3770 cannot write on a diskette written in non-3770 exchange format in BSC mode, received data could not be written back onto the same diskette. By placing the exchange format on diskette 2 for transmission, and receiving data onto diskette 1, this operation can be accomplished without operator intervention.

Note: *The 3776 Models 1 and 2 and the 3777 Model 1 can not transmit unformatted transparent data on a disk-to-line job using SDLC.*

Diskette Records

A record written on the diskette occupies either two sectors or four sectors, depending on the setting of the EXTEND BUFFER switch at system reset or power on time. With the switch off, the dual 256-byte buffers are selected, causing each buffer of data to be written into two 128-byte diskette sectors. With the switch on, the dual 512-byte buffers are selected, causing each buffer to be written into four 128-byte diskette sectors. Records consisting of less than 256 significant bytes (512 bytes with Extended Buffer) cause NUL characters (hex '00') to be inserted following the significant data, padding the record out to 256 (or 512) bytes. As with any diskette of this type, defective sectors due to physical damage of the diskette will decrease the available storage capacity. Defective sectors are skipped over the first time they are encountered; thereafter, they are not used.

An excessive number of defective sectors can cause a significant decrease in storage capacity, and will degrade performance. On machines having two Diskette Storage Devices, data sets with an excessive number of defective sectors can be read from diskette 1 and written to diskette 2. Data on diskette 2 is "closed up" toward the beginning of the diskette by elimination of the bad sectors.

When receiving data over the communication line for writing on the diskette, data blocks from the host processor cannot exceed 256 bytes with the EXTEND BUFFER switch off, or 512 bytes with the switch on. Blocks containing less than 256 (or 512) bytes will be accepted and padded with NULs as they are written on the diskette. Diskettes written with the EXTEND BUFFER switch on cannot be read with that switch off. BSC transparent data can be written on the diskette, but any NUL characters at the end of the record being written will be lost when the diskette is read. The format of the output data, when the transparent diskette is read, is determined by the format of the output device as follows:

- Line—256- or 512-byte records depending on the setting of the EXTEND BUFFER switch and the number of NUL characters deleted.
- Printer—Depends on horizontal forms definition
- Punch—80-byte records.

Diskette Data Sets

Each group of records for a particular job is identified by a data set name that is entered by the operator or assigned by the terminal. On output from the diskette, all records written on the diskette under this data set name comprise the data for that job. During online operation, all data sets on the diskette or any specified data set can be transmitted. After transmission, all diskette data can be deleted if specified at job start time, to provide storage space for received data. If the diskette data is not deleted, additional data received from the line is assigned to the next available diskette area. If a data set name is not specified at the beginning of a card reader-to-diskette operation or a line-to-diskette operation, a data set name is assigned by the 3776-1/3776-2/3777-1. For a card reader-to-diskette operation, the name SC00 is assigned. For a line-to-diskette operation, the name SL00 is assigned. If additional data is received from the line, the numeric characters of either the system or operator-assigned name (unless "Ignore EOT/ETX or Ignore EDS" is specified) are incremented for each additional data set received. Operator-assigned data set names must be four characters, the first two characters alphabetic and the last two numeric. The 3776-1/3776-2/3777-1 can handle up to 18 different data sets on a single diskette. Data sets exceeding the diskette capacity can be continued on another diskette. During an online receive operation or an offline card-to-diskette operation, the controller signals the operator when the diskette capacity has been reached. The operator can continue the job after replacing the full diskette with another diskette. If a second Diskette Storage Device is present, continuation on the second diskette is automatic, if it is ready to operate.

Data Set Labels

Each data set on the diskette is identified in a Data Set Label, which is shown in Appendix E. A data set must be "closed" before it can be accessed for transmission, printing, punching, etc. A data set is closed (depending on the job) as follows:

- Card Reader to Diskette: EOF from the Card Reader.
- Line to Diskette (BSC): Block ended with ETX. 'Ignore ETX/EOT' should be specified by a CODE key function if it is desired that all data received from the line be

written as a single data set. In this mode, the ETX/EOT causes the data set to be closed, but it is reopened if additional data is received from the line.
- Line to Diskette (SDLC): When an EDS FM header is received.

Note: Closing a data set requires that the disk head seek to track 0 on the diskette, thereby affecting throughput based on the number of tracks to be crossed.

- Stop Job is signaled by the operator or the job aborts.

Data received from the line for writing on a diskette that already has data ready for transmission to the host processor is flagged in the Data Set Label as "inactive". This prevents the data set from being transmitted or included in any intervening job until the operator changes its status to active. The operator may also change the status of any data set to inactive, thereby excluding it from any transmit job. Whenever the diskette is selected by the line, the 'Delete after Transmit' option is reset by the terminal.

Segmented Data Sets

Up to 18 data sets with different names can be accommodated on the diskette. Each different data set name requires one of the 18 sectors reserved on track 00 for a label for that data set. Anytime a data set is closed, another data set created, and a *previous* data set reopened, an additional data set label sector (one of the 18) is used. Thus it is possible that, using only two data set names and by alternately closing and reopening these two data sets, all 18 data set label sectors can be used up. When the last sector is used, only the last opened data set is available for further entry. On machines having a second diskette device, data sets so written can be copied from diskette 1 to diskette 2, and all segments of the data set will be written continuously using one data set label. So, to ensure maximum utilization of diskette storage capacity, the foregoing must be taken into consideration when designing applications and job setups for the terminal.

If 'Ignore ETX/EOT' is inactive, a data set received from the line is closed as a result of a block ending with 'EDS' (using SDLC) or 'ETX' (using BSC). Another data set received from the line causes the numeric portion of the data set name to be incremented (for example, AA00 becomes AA01). This new name is stored in the active job definition.

With BSC, if 'Ignore ETX/EOT' is active, a data set previously closed is reopened when another data set with the same name is received. (The name of the previously-closed data set could have been assigned either by the terminal or the operator.)

With SDLC, if 'Ignore EDS' is active, a data set that was previously closed is reopened only when both the data set name *and* the FM header of the received data set matches the name and FM header of the closed data set. (The name of the previously-closed data set could have been assigned either by the terminal or the operator.) If the data set names or the FM headers do not match, a new data set is written; that is, the numeric portion of the data set name is incremented.

Multivolume Data Sets

When a diskette fills from the line, and the data set is continued on a second diskette (multivolume data set), a data set is opened on the second diskette using the same name as the one that filled the first volume (the name is not incremented), providing that the same name does not already exist on the second volume. If the same data set name already exists on the second diskette, NPR code 301 (diskette 1) or 313 (diskette 2) displays. The operator must then replace the diskette with one that does not contain the same name as the multivolume data set being written. This prevents mixing of different data sets and maintains data set integrity.

On SDLC exchange diskettes, data sets are created only from the line (Refer to Chapter 7—Outbound Diskette Data). These data sets may not be segmented. Also, since the OJDR data set is not present, there are 19 available data set labels.

Concatenated Data Set (Files)

Use the CODE Key function C (CODE/C) to set this option. While this option is set and a 'transmit all active data sets' job is started, data sets that appear consecutively on the diskette and have the same medium and subaddress fields will be concatenated using the CDS (Continue Destination Select) FM Header type 1.

If a data set with a different medium or subaddress is encountered, an EDS (End Destination Select) FM Header followed by a new BDS (Begin Destination Select) FM Header will be sent to the host.

This option can only be used with SNA host application programs that can receive concatenated data sets.

Diskette Create Function

New diskettes, or diskettes that have been used previously on other machines (IBM 3741 or 3742, for example), must be prepared for use on the 3776/3777 by performing the Diskette Create function before they can be *written* on. Diskettes previously written on other machines in exchange format can be read on the 3776-1/3776-2/3777-1, however, without performing the Diskette Create function (except for SDLC exchange). This function is under control of the keyboard CODE key. This procedure writes the Volume Label and Data Set Labels on track 00 of the diskette, as shown in Appendix E. Any data previously written on the diskette, including forms definition, cannot be accessed again.

Exchange Format

Exchange format refers primarily to the sequence in which records are written on the diskette. In order to improve throughput on the 3770, and to allow segmenting of data sets, this format is not used when writing a diskette in non-exchange format. For compatibility with non-3770 systems or devices, the 3770 can write and read diskettes using this format; however, throughput is reduced when data is transmitted from diskettes so written, as shown in Appendix D.

If a diskette is to be written in exchange format, it must be so specified during the Diskette Create procedure. Data transmitted from diskettes written in BSC exchange format by the 3770 is transmitted in 256-byte blocks (two 128-byte records per block), or in 512-byte blocks (four 128-byte records per block). The block length transmitted by the 3770 from a non-3770-created diskette or from a 3776-1/3776-2/3777-1 created SDLC exchange diskette is the same as the block length defined in the Data Set Label for the data set (1 to 128 characters).

Exchange diskettes written on a non-3770 IBM product can be read for transmission, but cannot be written on by the 3770 without first performing the Diskette Create function. Data previously written on the diskette cannot be accessed after this function is performed.

On machines with a second Diskette Storage Device (referred to as diskette 2), a 3770 diskette can be converted to a BSC exchange diskette by reading the 3770 diskette on diskette 1 and writing on diskette 2 in exchange format. Segmented data sets will be written as continuous data sets during this conversion. The diskette used in diskette 2 must have been previously prepared by the operator performing the Diskette Create function, with specification that the diskette be written in exchange format. Conversely, a diskette written in exchange format by the 3770 can be converted to a 3770 format diskette by reading the exchange diskette on diskette 1 and writing onto diskette 2 in non-exchange format. The diskette used in diskette 2 must have been previously prepared by use of the Diskette Create function, without specification that it be written in exchange format.

Exchange diskettes written on a non-3770 IBM product cannot be copied, nor can individual data sets. Non-3770 diskettes are read into the 3770 buffer one 128-byte sector at a time. When the buffer is written to the 3770 diskette, two or four sectors at a time are written; thus, the data set written onto the 3770 diskette would be doubled or quadrupled in size, unless Record Compression is used.

Diskette-to-Printer Operation

The AUTO switch is active only during a diskette-to-printer job. When the AUTO switch is on at the beginning of a job, the first diskette record prints and the machine stops. If desired, special instructions to the operator (such as type of forms to use for a job) can be placed in the first 256- or 512-byte diskette record for the data set. If the AUTO switch is turned on at the beginning of the job, only the first diskette record for the data set prints, and the machine halts to allow the operator to comply with the printed instructions before proceeding. When the AUTO switch is turned OFF, the remainder of the data set is printed without interruption if no unusual condition occurs. If the AUTO switch is OFF at the beginning of the job, the entire data set prints.

Audible Alarm

This special feature provides a louder signal than the Operator Attention Speaker. The alarm can be enabled or disabled by the operator. When enabled, and during any job not using keyboard input, the alarm sounds for any device-error or not-ready condition.

Keylock

This special feature provides a key-operated switch which can be turned off to disable the terminal. Online communication is possible with the Keylock off, if the terminal is placed in a ready state before turning the Keylock off, but any operator controls are disabled.

Operator ID Reader

This is a device that reads magnetic strips operator identification cards. The reader is mounted behind the hinged door on the left of the controller base (Figure 2-4).

The host processor can request user identification by sending a message to the printer. The operator must then initiate a SYS REQ operation. If data is keyed in, at least 41 positions must be left for ID card data. After data is keyed in, the operator activates the ID card reader using the code key function.

This function may be used only during the logon procedure. On BSC machines, when the badge is read, the buffer is sent to the host processor. On SDLC machines, further keying may be done following the badge data. If an operator ID card is read, however, no further use of the backspace buffer or print view keys will be permitted. The host processor must also provide checking and verification of received ID card data and take whatever action is necessary depending on the validity of the data. Data read from the ID card is not printed at the terminal.

Cards must be 3-7/8 by 2-1/8 inches, and between 0.007 and 0.045 inch thick. The magnetic strips must be encoded in the American Banking Association format, which provides for up to 40 characters, 37 of which are discretionary. Card format and character sets are shown in Appendix B.

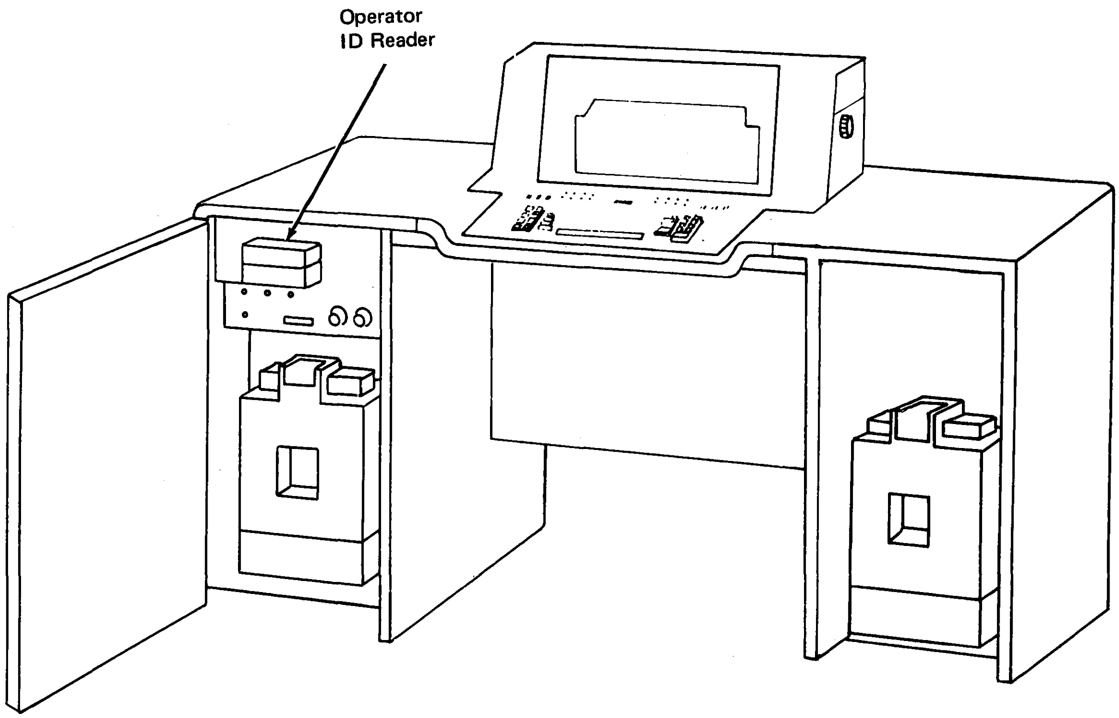


Figure 2-4. Operator ID Reader

Katakana Feature

This special feature provides a Katakana 127-character set on the 3776 console printer, and a Katakana keyboard. The character set is shown in Appendix B. Using this character set reduces printing speed to 80 lines per minute maximum on the 3776 Model 1, or 160 lines per minute maximum on the 3776 Model 2. The Katakana print belt can be interchanged with the optional 48- and 64-character set Japanese print belts on the 3776 Models 1 and 2 console line printer with a resulting increase in throughput.

When using a 48- or 64-character set print belt on a Katakana printer, the 3776 converts the EBCDIC equivalent of the lowercase alphabetic characters (a through z) to uppercase alphabetic characters before printing them. For example: EBCDIC hexadecimal '81' converts to hexadecimal 'C1'.

If characters in print data are not present on the line printer belt, a hyphen(-) prints.

Communication Driver

This special feature is required for communication with the host processor. In addition, one of the line control disciplines as described under "Communication Feature" must also be selected.

Communication Feature

This special feature provides the line control discipline, and is available in three versions: SDLC; BSC Point-to-Point; and SDLC/BSC Switch Control. The SDLC/BSC Switch Control version provides both types of line control, selectable by a switch on the terminal. If BSC multipoint operation is desired, the BSC Multipoint feature must also be installed in conjunction with the BSC Point-to-Point or SDLC/BSC Switch Control Communication feature. SDLC can operate either point-to-point or multipoint.

BSC Multipoint

This feature, installed in conjunction with the BSC Point-to-Point or SDLC/BSC Switch Control Communication feature, permits the 3770 terminal to be multi-dropped on the same non-switched communications facility with other appropriately featured 3770 terminals or with other compatible BSC terminals. With this feature, the terminal responds only to its specific address when polled or selected by the host processor.

Integrated Modems (3776 Models 1 and 2 Only)

Integrated modems (special features) are incorporated in the controller, eliminating the need for an EIA/CCITT Interface feature. Connection to common-carrier switched lines using these modems is via a common-carrier-supplied Data Access Arrangement. The 2400 bps Integrated Modems are compatible with appropriately featured integrated modems available for the IBM 3704 and 3705 Communications Controllers, and with an appropriately featured IBM 3872 Modem attached to the 3704 or 3705. The 4800 bps Integrated Modems are compatible with appropriately featured IBM 3874 Modems attached to a 3704 or 3705.

Note: A 2400 bps (or 4800 bps) Integrated Modem operating at half-speed is not compatible with an integrated or external modem with a rated speed of 1200 bps (or 2400 bps).

2400 bps Integrated Modem, Switched Network (U.S. and Canada)

This modem operates at 2400 bps over a switched network, and provides half-speed (1200 bps) capability. This modem supplies clocking for received and transmitted data, and can automatically answer and disconnect incoming calls in unattended operation.

2400 bps Integrated Modem, Point-to-Point

This modem operates at 2400 bps over half-duplex or duplex leased private line or privately-owned facilities. The modem supplies the clocking for received and transmitted data, and can alternately operate at half speed (1200 bps).

The Auxiliary Operator's Panel has a signal quality meter to check the quality of the received signal, and a control to equalize the received signal.

2400 bps Integrated Modem, Multipoint Tributary

This modem operates at 2400 bps on a duplex multipoint network. The modem supplies the clocking for received and transmitted data, and can alternately operate at half speed (1200 bps).

With this modem, a meter is provided on the Auxiliary Operator's Panel to check the quality of the received signal, and controls are provided to equalize the transmit and receive signals (see Figure 2-6).

2400 bps Integrated Modem, Switched Caducee Network (France)

This modem operates at 2400 bps over the French PTT Caducee Network and provides half-speed capability. The modem supplies clocking for received and transmitted data, and can automatically answer incoming calls. A TALK/DATA switch is provided on the Auxiliary Operator's Panel to allow alternate voice/data communications.

4800 bps Integrated Modem, Switched Network

This modem operates at 4800 bps over a switched network, and provides half-speed (2400 bps) capability. This modem supplies clocking for received and transmitted data, and can automatically answer and disconnect incoming calls in unattended operation.

4800 bps Integrated Modem, Point-to-Point

This modem operates at 4800 bps over half-duplex or duplex leased private lines or privately-owned facilities. The modem supplies clocking for received and transmitted data, and can alternately operate at half-speed (2400 bps).

4800 bps Integrated Modem, Multipoint Tributary

This modem operates at 4800 bps on a duplex multipoint network. The modem supplies the clocking for received and transmitted data, and can alternately operate at half speed (2400 bps).

Interface Features

On a 3770 terminal when an IBM Integrated Modem special feature is not used or is not available, *one* of the following attachment special features is required for attachment to user-supplied standalone Data Circuit-Terminating Equipment (DCE) or to an IBM standalone modem (also a DCE). Each of the interface features is mutually exclusive with the others.

Note: The DCE abbreviation formerly applied to the more general designation: Data Communication Equipment.

EIA RS-232C Interface (All Machines - U.S.A. and Canada)

This special feature provides an interface and a cable for attachment of standalone DCEs. The standalone DCEs provide an EIA RS-232C interface and clocking for operation over switched or nonswitched voice-grade communication facilities. This interface feature is also required on terminals connected to the host terminal containing the Modem Fan Out feature (see Figure 2-5). Refer to Chapter 1 for more infromation on communication facilities.

CCITT V.24/.28 Interface (All World Trade Machines)

This special feature provides an interface and a cable for the attachment of standalone DCEs. The standalone DCEs provide a CCITT V.24/.28 interface and clocking for operation over switched or nonswitched voice-grade communication facilities. This feature is also required on terminals connected to the host terminal containing the Modem Fan Out feature (see Figure 2-5). Refer to Chapter 1 for more information on communication facilities.

High-Speed Digital Interface (3777 Model 1)

This special feature provides an interface and a cable for the attachment of standalone DCEs which provide the High-Speed Digital interface. The standalone DCEs also provide their own clocking for synchronous point-to-point operation over a wideband communication channel. This interface feature operates at 19.2 kilobits per second (20.4 kbps in World Trade countries). Refer to Chapter 1 for more information on communication facilities.

CCITT V.35 Interface (3777 Model 1)

World Trade: This special feature provides an interface and a cable for the attachment of standalone DCEs which provide the CCITT-V.35 interface. The standalone DCEs also provide their own clocking for operation over a wideband communication channel at 20.4 kilobits per second. Refer to Chapter 1 for more information on communication facilities.

This special feature provides for direct high speed local attachment to a 3705-II at 14.4 kilobits per second with maximum cable length of 51.8 meters (170 feet).

U.S.A. and Canada: This special feature provides for direct high speed local attachment to a 3705-II at 14.4 kilobits per second with a maximum cable length of 51.8 meters (170 feet).

CCITT-X.21 Interface

This special feature provides an interface and a cable for the attachment of standalone DCEs that provide the CCITT-X.21 interface. The standalone DCEs also provide their own clocking for operation at 2400, 4800, or 9600 bits per second over nonswitched lines using SDLC procedures. This interface feature is available for attachment to nonswitched networks only. Refer to Chapter 1 for more information on communication facilities.

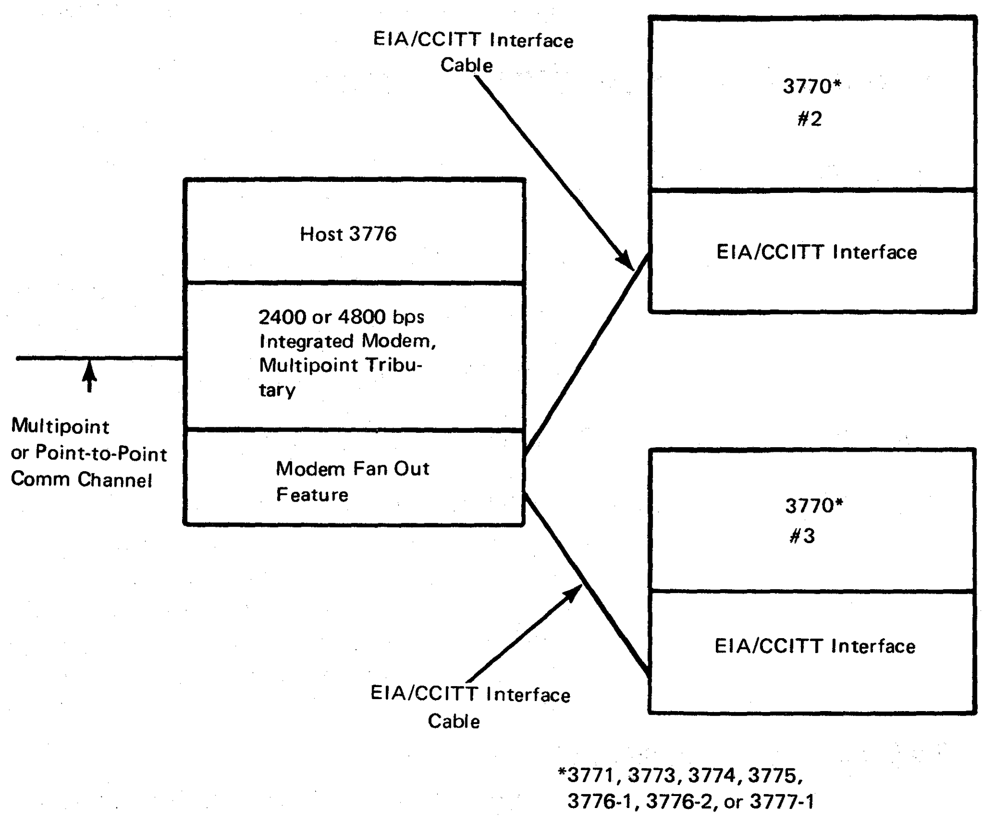


Figure 2-5. Modem Fan Out Configuration

Modem Fan Out (3776 Models 1 and 2 Only)

This special feature can be used with the 2400 bps or 4800 bps Integrated Modem (Multipoint Tributary) connected to a network configuration for multipoint operation. With this feature, up to three terminals can share a single modem located in the host 3776. Terminals connected to the host terminal (Figure 2-5) must have the EIA/CCITT Interface feature.

Switched Network Backup (U.S. and Canada–3776 Models 1 and 2)

This special feature can be used with the 2400 bps or 4800 bps Integrated Modem (Point-to-Point or Multipoint Tributary) and allows alternate use of switched network facilities as backup communication lines. Switched-network operation must be specified while in local mode. When the modem is connected to a switched network, calls must be dialed and answered manually. The same line control (non-switched point-to-point or multipoint) is used when operating on a switched network.

Door Keylock

This special feature adds a keylock to the right- or left-hand controller cabinet door. Two keys are provided with each lock.

ASCII

The ASCII special feature is available for use in the U.S. and Canada. Differences between EBCDIC-coded and ASCII-coded machines are described in Appendix G.

Additional Print Belts (3776 Only)

Additional print belts (purchase-only accessories) are available for the 3776 console-mounted line printer. Belts are available for the 48-, 64-, and 94-character sets for various countries, as shown in Appendix B. Print belts are not interchangeable between the 3776 Model 1 and Model 2. ASCII character set belts are also available for use in the U.S. and Canada.

| Additional Print Trains (3777/3203 Only)

See Chapter 5 for information about additional print trains.

Front Feed (3776 Only)

This special feature simplifies forms changes and reduces the operator set-up time required to renew the forms supply or to change the forms type. With the Front (forms) Feed Feature installed, the paper supply may be set on the floor directly under the keyboard to extend the height of the supply stack. Forms may be alternately loaded from the rear of the 3776 models. The forms stand/stacker enclosure at the rear remains a standard feature of the 3776 models with or without the Front Feed Feature.

Operating Controls (3776 Models 1 and 2/3777 Model 1)

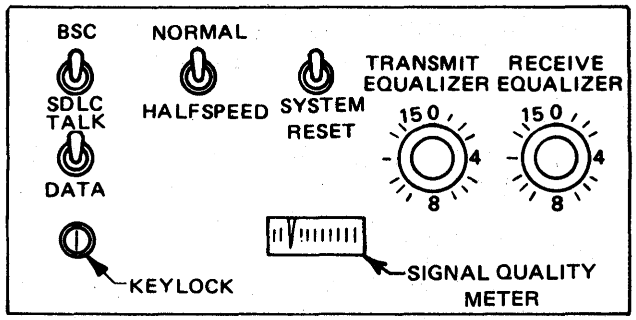
POWER ON/OFF Switch: This switch is located on the left side of the knee hole on the controller housing. It controls ac power to the terminal. When power is turned on, the bring-up diagnostics run and the terminal is left in local mode with the PROCEED indicator on. Any other indicator being on signals either a failure in the terminal's electronic components, that one of the MODE switches is on, or that the Keylock is off. The operator should proceed as described in the *Operating Procedures Guide.* If the tests complete successfully, the operator can continue with terminal operation.

Auxiliary Operator's Panel

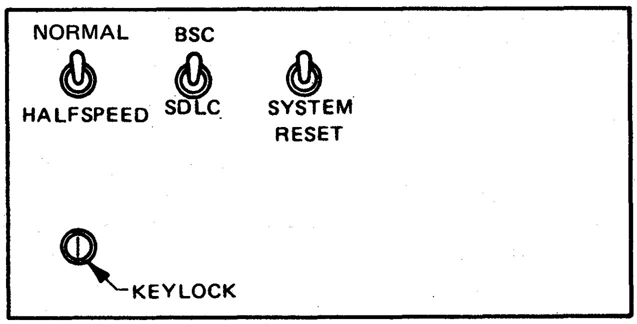
The auxiliary operator's panel (Figure 2-6) is located behind the door on the controller base. It contains the SYSTEM RESET switch and certain special-feature controls, as follows.

BSC/SDLC Switch: This switch is present on machines using the SDLC/BSC Switch Control Communication feature. The switch must be placed in the BSC position to communicate using BSC procedures (see Chapter 6), or in the SDLC position to communicate using SDLC procedures (see Chapter 7).

NORMAL/HALF-SPEED Switch: This switch is present on machines using the 2400 bps or 4800 bps Integrated Modem, and is present on all World Trade machines using the CCITT V.24/V.28 Interface feature. On the 3777-1, it is located to the left of the BSC/SDLC switch. Using an Integrated Modem, transmission is at the modems rated speed with the switch in the NORMAL position, or at half the rated speed with the switch in the HALF-SPEED position. On World Trade machines using either an Integrated Modem or an external DCE, line speed with the switch in the NORMAL position is at the DCE's maximum rated speed. With the switch in the HALF-SPEED position, line speed is half of the DCE's maximum rated speed, if the DCE used has this capability.



IBM 3776-1, -2



IBM 3777-1

Figure 2-6. Auxiliary Operator's Panel

TALK/DATA Switch (3776 Models 1 and 2 Only): This switch is present only on machines using the 2400 bps Integrated Modem, Switched Caducee Network (France). It must be set to TALK for voice communication, or to DATA for data communication.

Keylock: This is the key-operated switch for the Keylock special feature.

Signal Quality Meter (3776 Models 1 and 2 Only): This meter is present on machines using the 2400 bps Integrated Modem, Point-to-Point or Multipoint Tributary (see "Features and Accessories–Integrated Modems").

Transmit and Receive Equalizer Controls (3776 Models 1 and 2 Only): These rotary controls are present on machines using the 2400 bps Integrated Modem. The Receive Equalizer control alone is present on machines using the 2400 bps Integrated Modem, Point-to-Point (see "Features and Accessories–Integrated Modems").

SYSTEM RESET Switch: This switch causes the terminal to interrupt any operation in progress and leaves the terminal in the same power-on state as described under "POWER ON/OFF Switch."

Keyboard Switches, Keys, and Lights (Figure 2-7)

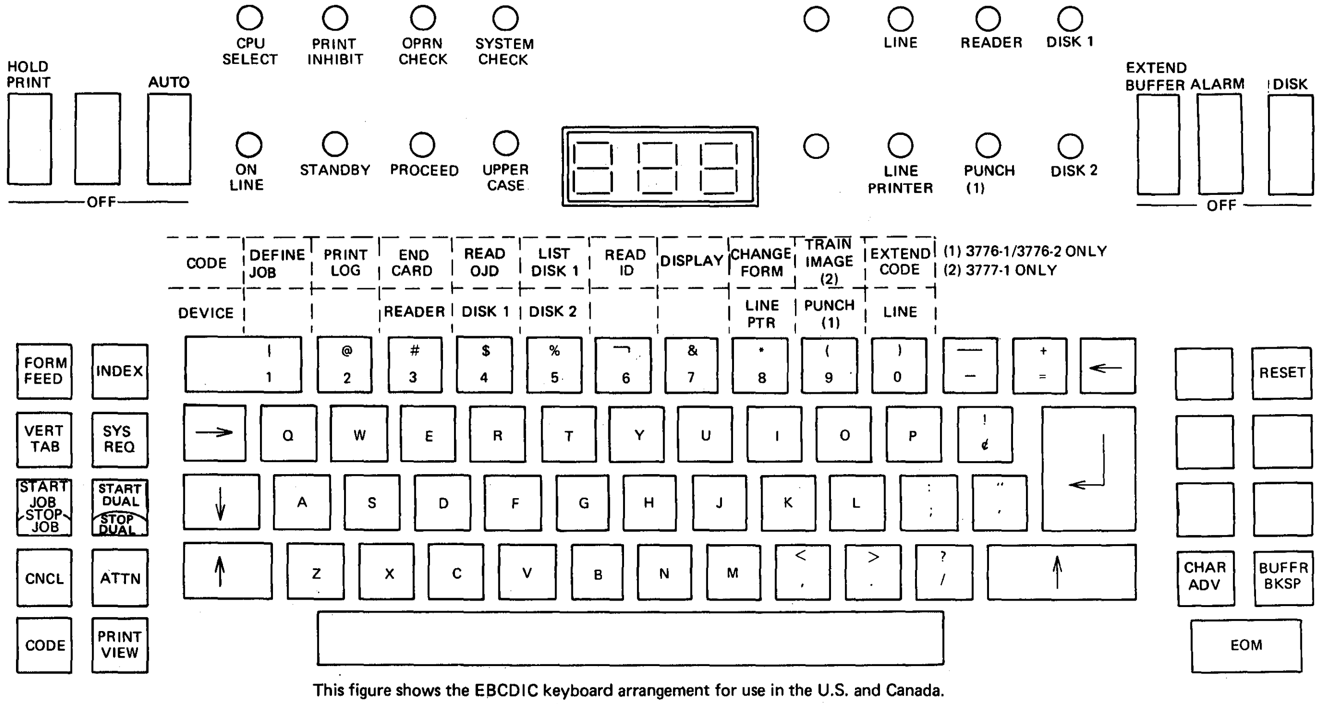


Figure 2-7. 3776-1/3776-2/3777-1 Keyboard

Switches

HOLD PRINT: Turn this switch on to load or adjust printer forms. When the switch is turned on, the printer stops printing, and releases the forms clamp after a 5 second delay to allow forms adjustment or loading.

Turning the HOLD PRINT switch on during a job using the printer holds up the entire job and causes a communication line time-out to occur after 3 minutes. Using BSC, when HOLD PRINT is turned on during a line-to-printer job, RESET must be pressed once every 3 minutes to keep the terminal from ending the job prematurely.

Using SDLC, if the switch is on, 'Intervention Required' is never sent to the host CPU, regardless of the output device being used.

Do not turn the switch on when you are defining a job. If you do, you may have to repeat all or part of the job parameter you were entering when you turned the switch on.

The switch must also be turned on when using the Change Forms (CODE/8) function, as described under "Using the CODE key".

When the terminal is in STANDBY mode, turn this switch on before doing a FORM FEED.

AUTO: This switch is active only during a diskette-to-printer job. When the switch is on at the beginning of a job, the first diskette record is processed, the job pauses, and code 260 displays in the readout indicators. Only complete lines are printed. If the first diskette record contains only a partial line or ends with a partial line, the incomplete line prints after the switch is turned off and the job resumes. When the switch is turned on during the job, the current record finishes printing and the job pauses with code 260 displayed in the readout indicators. The job resumes when the switch is turned off.

EXTEND BUFFER: Turning this switch on selects the dual 512-byte alternating buffers. With the switch off, the dual 256-byte alternating buffers are selected. Changing the switch setting has an effect only at power on or system reset time.

ALARM: Turning this switch on enables the Audible Alarm, if installed.

DISK: This switch forces all data received from the host processor to be written on an attached Diskette Storage Device regardless of any other component selection (except the console printer) received from the host processor. In SDLC mode, data received without an FM header must go to the printer. If the machine is jumpered for ASCII and the Bind is for EBCDIC, the host processor switch is ignored.

Keys

FORM FEED: This key causes the forms to advance to the first printing line on the next form, as defined by the job definition in effect, if the job is not running. When in STANDBY mode, turn on the HOLD PRINT switch before doing the FORM FEED.

INDEX: This key causes the forms to feed one line if the job is not running. The key is inoperative on ASCII machines.

VERT TAB: This key causes the printer forms to advance to the next predefined vertical tab stop, if the job is not running. If no vertical tab stops are defined, the key causes the printer to feed one line.

SYS REQ (System Request): This key can be used to initiate a logon message if the terminal is in local mode, or can be used to initiate a logoff message if the terminal is in standby mode. On SDLC machines, if the STANDBY light is on, a keyed message may be entered for transmission to the host application program without first pressing this key. Refer to "Functional Characteristics–Keyboard" earlier in this chapter.

START/STOP JOB: Pressing this key starts an online or offline job. With dual data path operation, the key is used to start the online job or Job 1 (see "Functional Characteristics–Controller" in this chapter). Pressing CODE in conjunction with this key stops the job.

START/STOP DUAL: Pressing this key starts the offline job (Job 2). (See "Functional Characteristics–Controller" in this chapter). Pressing CODE in conjunction with this key stops the job.

CNCL (Cancel): This key aborts a SYS REQ message operation, or deletes a message that is awaiting transmission.

When running an SDLC online job, the CNCL key operates as follows:

- When receiving, the terminal transmits a negative response to the host processor that requests a break in the data flow to the 3776-1/3776-2/3777-1.
- When transmitting, the terminal clears the contents of the buffer and transmits a Cancel request to the host processor if needed.

ATTN (Attention): For SDLC machines, this key causes transmission of an expedited Signal request to the host processor. The Signal request unit contains a Request-to-Send code to stop the host processor from sending so that the 3776-1/3776-2/3777-1 can begin sending to the host processor. The application program in the host processor may or may not honor the Request to Send. (See the chart on "SNA Network Commands" in Chapter 7 – "Programming Considerations – SNA/SDLC Communications".)

For BSC machines, pressing the ATTN key during a receive job, line-to-printer, line-to-punch (3776 only), or line-to-diskette job, causes an interrupt to be sent to the host processor in one of the following ways depending on a system card jumper:

1. No jumper. With no jumper installed, pressing the ATTN key causes the 3780 Carriage Stop function to be emulated. WACK will be sent at the first opportunity; either in response to a data block being received or in response to the next data block received. WACK will be sent continuously (in response to ENQ) until both buffers are emptied by the output device and for approximately 6 seconds thereafter. At this point, EOT is sent and the terminal goes to standby mode allowing the operator to start a transmit job. If a selection is received prior to (1) the operator keying a System Request. (2) starting an online job, or (3) at the same time the terminal is establishing a transmit job (ENQ received in response to ENQ sent), the selection (depending on device availability) is accepted.
2. Jumper. With a jumper installed, pressing the ATTN key causes an RVI to be transmitted in response to the next correctly-received data block. If the host processor honors the interrupt, the host processor must transmit EOT prior to transmitting any additional data. Once the receive job has ended, the terminal goes to standby mode and the operator may start a transmit job or enter a System Request message. If a selection is received prior to the operator starting a job or keying a System Request, the selection is accepted.

CODE, EXTEND CODE: These keys are used in conjunction with certain numeric or alphabetic keyboard keys to select functions such as:

- Define Job
- Change Form (Change current forms control)
- Print Error Log
- Communications Facilities Testing
- Stop Job or Dual
- End Card
- Display Modes of Operation and or I/O devices for jobs (in NPR)
- Create Diskette (Delete all data including forms control)
- Change Data Set Status (Active or Inactive or Multivolume)
- Write Jobs on Diskette
- Change Data Set Name or Status
- Change Data Set Medium and Subaddress
- Read Job Control from Diskette or Cards
- List Diskette Data Sets
- Clear Diskette (Delete all data except forms control)
- Read Operator ID Card
- Load train image buffer (3777-1 only)
- Set or Reset Switched Network Backup (SNBU)
- Print All Characters to Test Print Belt
- Select 6 or 8 lines per inch for printing
- Set concatenate Data Sets
- Set Manual or Auto Disconnect. This may be specified at any time. *Manual* may be specified to keep the line from disconnecting when the online job ends.
- Select Inquiry Mode Operation (see Chapter 6.)
- Set Ignore ETX/EOT (EDS in SDLC). This may be set to cause all received data to be written as a continuous data set regardless of ETX/EOT received.
- Set Monocase. This causes the 26 lowercase alphabetic characters a through z to be converted to uppercase characters.
- Set unattended operation, SDLC
- Reset Inquiry Mode, Ignore ETX/EOT, Monocase, and for SDLC machines, unattended mode.

Keys used in conjunction with the CODE and EXTEND CODE keys to select these functions are described in the *Operating Procedures Guide.*

PRINT VIEW: This key is active during job definition, following a SYS REQ when the operator is keying a message that will be routed to the system, or when entering an OLT message. The data entered will be printed followed by a sufficient number of line feeds to make the printed data visible on the printer.

RESET: Pressing this key resets the Audible Alarm, cancels a START JOB or an extended code entry prior to keying EOM. It may also be used to restore the buffer pointer to the next available position when entering a SYS REQ message or defining horizontal tab stops. Pressing CODE and RESET resets the SYSTEM CHECK or OPRN CHECK indicator, resets the NPR, and turns off the device indicator. On BSC machines, the RESET key may also be used to prevent a line abort when an operator recoverable error occurs. Refer to the *Operating Procedures Guide* for the 3776-1/3776-2, or 3777-1.

CHAR ADV (Character Advance): This key can be used to advance the buffer pointer (without printing) after backspacing or when a SYS REQ message or horizontal forms definition has been entered into the controller buffer.

BUFFR BKSP (Buffer Backspace): Pressing this key causes the buffer pointer to back up one position (one character space). Data is not destroyed when backspaced over, and can be printed out or corrected.

EOM (End of Message): Pressing this key terminates a SYS REQ message operation. This key also terminates a start job, extended CODE key, or job definition procedure.

Lights

Device Indicators: An indicator is provided for each I/O device. The device indicators are used to indicate the active devices for the selected job, not-ready conditions, and device errors. Certain device errors cause the device to lose its ready condition, and its associated light turns on and the Operator Attention Speaker sounds to inform the operator that the device needs attention.

Numeric Position Readout (NPR): This is a three-digit numeric display that provides different indications depending on the operation being performed. Message code numbers providing operator guidance and indicating system status and error conditions are displayed in the NPR. These code numbers, in conjunction with other operator panel indicators being on, are related to operating procedures described in the *Operating Procedures Guide.*

ON LINE: For BSC, this light is on whenever the communication line is selected as an input or output and the data link connection has been established. The light blinks while data is being transmitted or received, and turns off when the data link connection is broken.

For SDLC, this light is on when the terminal is bound in a session with the host processor, and turns off when the session is terminated.

STANDBY: For BSC, this light turns on when a job involving the communication line is started. The light remains on until transmission begins, and then turns off. It is off until the job ends, and then turns on. Another online job can be started after the light turns on again. For SDLC, this light turns on when in communicate mode and there is not an active line job. The light remains on until a job involving the communication line starts, and then turns off; it remains off until the job ends. When the STANDBY light turns on again, another job can be started.

CPU SELECT: For BSC, this light indicates that the terminal has rejected a line bid, an MPLC polling sequence, or an MPLC selection sequence from the host processor because the terminal is not ready to operate in line mode. For SDLC, this light indicates that the terminal has rejected a BIND, or that SIGNAL has been received from the host processor when the communication line is specified as the output device.

OPRN CHECK (Operation Check): This light turns on and the Operator Attention Speaker sounds when the operator has performed an incorrect procedure, or when some I/O device needs attention. A device light will also be on if an I/O device needs attention. A message code number will be displayed in the NPR.

This number corresponds to an explanation or procedure, as described in the *Operating Procedures Guide.*

PRINT INHIBIT: For BSC, this indicator is not used. For SNA/SDLC, this light turns on when the Inhibit Print command is received from the host processor and the SYSTEM REQUEST function is initiated. This light turns off when the SYSTEM REQUEST function is terminated, either by EOM or CANCEL. Receiving the Enable Print command from the host processor takes the terminal out of this mode of operation.

SYSTEM CHECK: This light turns on and the Operator Attention Speaker sounds when certain machine errors occur. A message code number will be displayed in the NPR indicating the cause of the error. If an I/O device caused the error, the appropriate device indicator turns on and the job is aborted.

PROCEED: This light is on all the time except when the keylock is turned off or the terminal is processing Operator ID Reader information.

UPPER CASE: This light turns on when the keyboard is in uppercase shift (Upper Shift key has been pressed).

Chapter 3. 3777 Model 2 BSC Multi-Leaving Workstation

The IBM 3777 Communication Terminal Model 2 provides the functions necessary to execute a BSC MULTI-LEAVING workstation program written for the IBM System/360 Model 20, Submodel 5. As a remote MULTI-LEAVING workstation, the 3777 Model 2 communicates with the System/360 or System/370 programming system through one of the remote-job-entry (RJE) subsystems that support BSC MULTI-LEAVING operation:

- OS/VS1 RES – (Remote Entry Services)
- OS/VS2 HASP – (Houston Automatic Spooling Program)
- OS/VS2 JES2 – (Job Entry Subsystem)
- OS/VS ASP – (Asymmetric Multiprocessing System)
- OS/VS2 JES3 – (Job Entry Subsystem)
- VM/370 RSCS – (Remote Spooling Communications Subsystem)

The RJE subsystem permits the remote terminal operator at the 3777 Model 2 to submit jobs (the *job input stream*) that are sent over the BSC communication facilities for execution at the host processor site. After execution, the RJE subsystem sends the output of the jobs (the *job output stream)* back to the 3777-2 where it is directed to the appropriate output devices. System/360 Model 20 I/O devices and their corresponding 3777 Model 2 devices are:

Device	*S/360-20*	*3777-2*
Card Reader	2501	2502-A1/A2/A3 (or Diskette Input Device)
Printer	1403	3203-3
Console	2152	Keyboard with Console Display
Card Punch	1442	3521/3782

The following devices that can attach to a S/360-20 operating as a BSC MULTI-LEAVING workstation have no corresponding 3777-2 devices:

2520 Card Read Punch
2203 Printer
2560 Multi-Function Card Machine

The following devices and features that can attach to a 3777-2 BSC MULTI-LEAVING workstation have no corresponding S/360-20 devices or features:

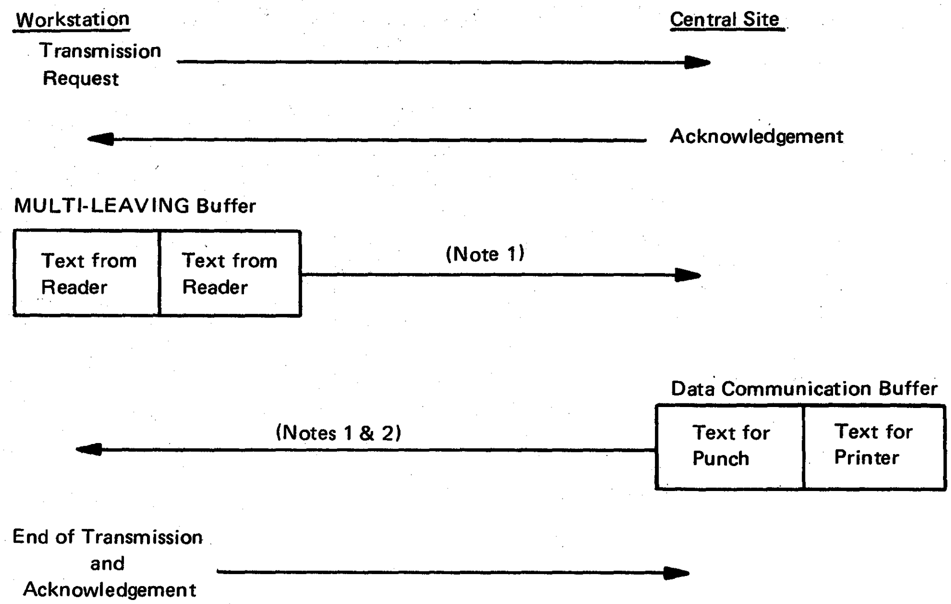
Console Display Spooling
Operator ID Reader
Audible Alarm

MULTI-LEAVING Concepts

MULTI-LEAVING is the fully synchronous, bidirectional transmission of a variable number of data streams between two computers using binary synchronous communications (BSC) facilities. For more information on MULTI-LEAVING protocols, see *OS/VS2 JES2 Logic*, SY24-6000.

As shown in Figure 3-1, MULTI-LEAVING is accomplished by:

1. Block-multiplexing of multiple device streams into one transmission block. This increases the amount of data that can be transmitted without line turnaround.
2. Using the BSC line control method of acknowledging one block of text with another block of text and avoiding turnaround inefficiencies.



Notes:

1. Block multiplexing of multiple device streams
2. Acknowledging text with text

Figure 3-1. Example of How MULTI-LEAVING Works

Basic Workstation Functions

The 3777 Model 2 operates under the control of its own workstation program. At the central site, the 3777-2 user generates a workstation program deck for the particular 3777-2 configuration at the remote site. (This is the same program generated for the equivalent System/360 Model 20 Submodel 5 workstation.) After the operator loads the workstation program deck into the 3777-2 and logs on to the host processor, the workstation performs these basic functions:

- Handles data transfer from and to specific devices attached to the 3777-2
- Handles data transfer to and from the RJE subsystem at the central site, using the MULTI-LEAVING interface built into the workstation program
- Handles local commands from the operator for controlling workstation devices
- Transfers system commands from the workstation operator to the central site
- Transfers operator messages from the central site to the workstation operator

Components of the 3777 Model 2 Workstation

The following standard and special feature components are available on the 3777 Model 2. A minimum workstation configuration includes the 3777-2, the 2502 or the Diskette Input Device, and the 3203. Figure 3-2 shows a maximum configuration.

Workstation Controller

The workstation controller is contained in the terminal's base. The terminal operator loads the workstation program into the controller during the IPL procedure. After the IPL and logon procedure, the workstation controls input and output operations, provides buffering for received and transmitted data, and provides the BSC MULTI-LEAVING data link control.

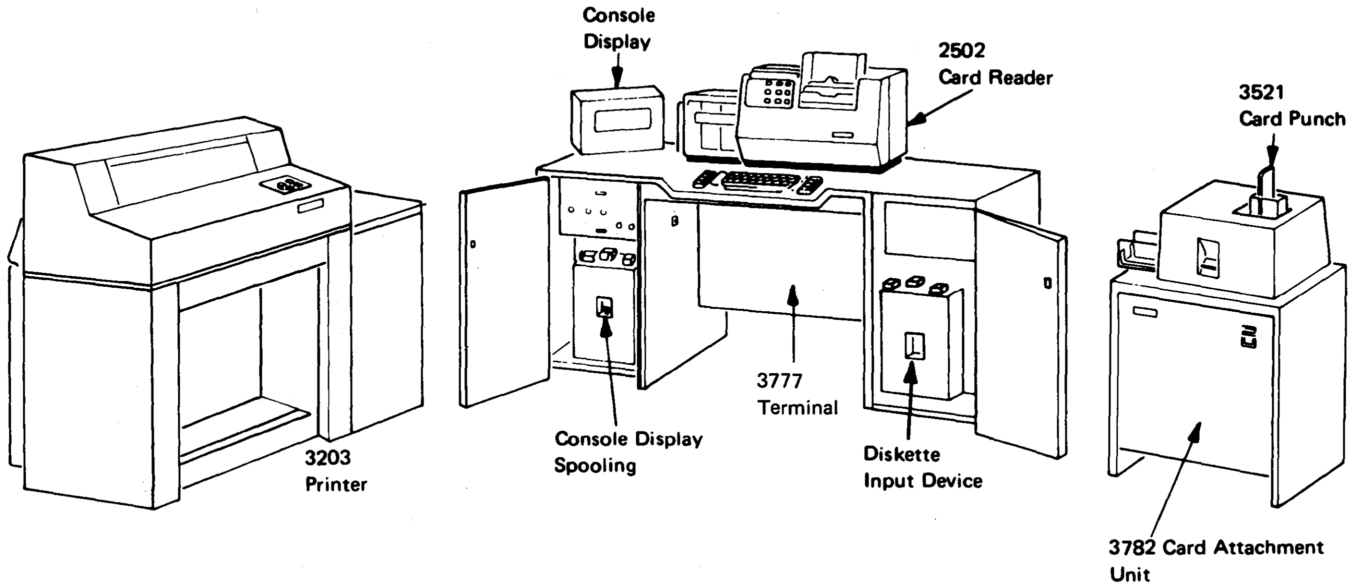


Figure 3-2. IBM 3777 Communication Terminal Model 2 Configuration

2502 Card Reader

The 2502 Card Reader special feature reads the workstation program deck during IPL, reads job entry decks into the system, enters system commands that are sent to the central site, and reads printer forms control cards. When reading 51- or 66-column cards, the 3777-2 fills in with blanks, padding the record to the length specified by the card read instruction. For more information on the 2502 Card Reader models, refer to Chapter 5 in this manual.

3203 Printer Model 3

The 3203 printer uses the IBM 1416 Interchangeable Train Cartridge to print at speeds up to 1000 lines per minute depending on which train cartridge is installed. With a special feature, the 3203-3 can print up to 1200 lines per minute.

Special print train arrangements may be loaded into the 3777 Model 2 using a deck provided with the 3777-2. The punched cards representing the print train image are identical to those used on the System/360 Model 20 and the 2922 Programmable Terminal. For more information on the 3203 printer and 1416 cartridges, refer to Chapter 5 in this manual. For more information on loading special print train arrangements, see the *IBM 3777 Model 2 Communication Terminal Operator's Guide,* GA27-3129.

Console Display Feature

The Console Display special feature can be attached to the 3777-2 to provide up to 1,024 characters of console display data for operator messages from the host processor and for operator-originated data. Information displayed on the screen is formatted into 16 lines of 64 characters each. For more information, refer to "Features and Accessories" in this chapter.

Console Display Spooling Feature

One Console Display Spooling special feature can be installed in the terminal's left base to provide magnetic diskette storage for operator console messages. With this feature installed, operator console messages can be written to the spooling diskette and retained on a temporary basis for message reference. The workstation program can be stored on the spooling diskette and used to IPL the 3777-2. The spooling diskette can be removed for more permanent retention into a chronological file for audit purposes. The diskette used by this feature is referred to in this manual as the "spooling diskette" to avoid confusion with the "input diskette" used by the Diskette Input Device. For more information, refer to "Features and Accessories" in this chapter.

Diskette Input Device

One Diskette Input Device special feature can be installed in the terminal's right base to allow basic exchange data sets on diskettes to be read as if they were cards. This input device can be installed in addition to or instead of the 2502 Card Reader. If both the 2502 and the Diskette Input Device are attached to the 3777-2, these two input devices can be operated alternately (but not simultaneously) for remote job entry. The 3777-2 can also use the Diskette Input Device for IPL if the Console Display Spooling feature is not installed. (If the 2502 is not attached, the diskette containing the workstation program deck must have been written on another 3777-2 that has both the 2502 and at least one diskette feature.) The diskette used by the Diskette Input Device is referred to in this manual as the "input diskette" to avoid confusion with the "spooling diskette" used by the Console Display Spooling feature. A diskette used to IPL the 3777-2 without the Console Display Spooling feature is referred to as the "IPL diskette". The IPL diskette can be created on a 3777-2 with only the Diskette Input Device feature (not the Console Display Spooling feature) and the 2502 Card Reader. For more information, refer to "Features and Accessories" in this chapter. Extended Forms Definition for the 3777 Model 2 may be used in conjunction with the Diskette Input Device. Standard forms definition provides for the definition and storage of five printer forms. Extended Forms Definition provides storage for an additional 936 printer forms definitions.

3521 Card Punch

The 3521 Card Punch can be attached to the 3777 Model 2 to provide punched card output with or without the interpret feature at 50 cards per minute. The 3521 attaches to the 3777-2 through the 3782 Card Attachment Unit Model 1. For more information, refer to Chapter 5 in this manual.

Keyboard

The keyboard used on machines in the U.S. and Canada has 44 character keys and a space bar, and other typewriter-like control keys. The arrangement of keys is similar to that on a typewriter keyboard. On either side of the typewriter-like keys are keys for controlling terminal operation. Lights located above the keys provide indications of terminal status and error conditions. This keyboard provides 88 characters in upper and lower case shift, (refer to Figure 3-6).

Typamatic operation of the Space Bar and of the Backspace, Hyphen/Underscore, and CHAR ADV (Character Advance) keys causes repetitive functions, simply by holding the key down.

Keyboards for use in World Trade countries other than the United Kingdom have 47 graphic keys, providing 94 characters. The keyboard for the United Kingdom has an a additional key (48 keys), and provides 94 characters in upper and lower-case shift. This keyboard does not provide typamatic operation of the Hyphen/Underscore key. Keyboard characters present on all keyboards are shown in Appendix B.

Nomenclature on keyboard control keys, lights, and switches is provided for the following languages:

English	Italian
French	Japanese
German	Spanish

Automatic conversion to upper case is executed during a SYS REQ entry. Characters a-z are converted to upper case. Other characters automatically converted vary by country:

Country	*Character (Lower Case)*	*(Upper Case)*
Portugal	ã	Ã
	ç	Ç
	õ	Õ
Brazil	é	É
	ã	Ã
	õ	Õ
	ç	Ç
Spain/Spanish Speaking	ñ	Ñ
Austria/Germany	ü	Ü
	ö	Ö
	ä	Ä
Denmark/Norway	å	Å
	æ	Æ
	ø	Ø
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System Generation of the IBM 3777 Model 2

The following programming systems and their respective remote job entry subsystems support program generation and terminal operation of the 3777 Model 2 as a BSC MULTI-LEAVING workstation:

OS/VS1 RES
OS/VS2 HASP
OS/VS2 JES2
OS/VS2 ASP
OS/VS2 JES3
VM/370 RSCS

This section tells the host system programmer how to code the remote terminal program generation parameters of the respective RJE subsystems to produce a terminal object card deck called the workstation program deck. The initial program load procedure at the 3777-2 uses this workstation program deck as its source deck to prepare the 3777-2 to operate as an IBM System/360 Model 20 Submodel 5 BSC MULTI-LEAVING workstation. (If the Console Display Spooling feature is attached, the workstation program deck can be written on the diskette and retrieved for subsequent IPLs rather than being read from the card reader.)

Introduction to Generation Parameters

Some of the parameters that are coded to generate a S/360 Model 20 Submodel 5 workstation program that will run in the 3777-2 are:

Card Reader	one 2502 (or Diskette Input Device) required—specify 2501
Printer	one 3203 Model 3 required—specify 1403
Card Punch*	one 3521 optional—specify 1442
Console (Display)	optional—specify 2152
Storage Size	must be coded 12K
Buffer Size	variable within 12K limits, 512 bytes is recommended for 3777 Model 2 **Note:** Some user installations may operate more efficiently at buffer sizes higher than 512.
Transparency of Line Transmission	depends on availability of feature in the host processor; transparent EBCDIC transmission is a standard feature on the 3777-2
Line Speed	2400, 4800, 7200, 9600, 19200 bps (or 20,400 bps) (14,400 bps when locally attached to 3705-II)

*If data is directed to a card punch, and no card punch is attached, the operation is ignored and the operator is not informed. This is compatible with System/360 Model 20 operation.

These and other parameters itemized on the following pages are coded as if for a S/360 Model 20 Submodel 5 (S/360 M20-5) using the I/O device numbers from that system rather than the I/O device numbers from the 3770 system.

System/360 Model 20 Functions Not Available on 3777 Model 2

The 3777 Model 2 does not execute some of the functions and instructions of the System/360 Model 20 Submodel 5:

S/360 M20-5	*3777 Model 2*
Time-Sharing Switch	No comparable function
Wait State Switch	No comparable function
Process Dial	PROCESS position only
Data Checking Operand Length Decimal Digit > 9 Valid Sign	The data checking functions listed are not done when executing S/360 M20-5 code. Such execution is not necessary because the workstation program is a running program that does not have these kinds of errors.
Any instruction that attempts a storage access beyond the end of storage (that is, a wraparound).	Execution of this type of instruction (where the beginning storage address is within the 12K limit) will cause unpredictable results if attempted on the 3777-2. If this occurs, turn off the power, then turn it on again.
Multiple printer CIO instructions before XIO, where the last one before XIO is CIO delay 1.	The CIO delay 1 instruction immediately before the XIO is ignored; the previous CIO delay is executed instead. The only CIO delay instruction that is ignored is CIO delay 1; any other number is executed the same as on the S/360 M20-5.

Purpose of This Section

The information in this section is intended to be an addition to and not a substitute for the information in the Programmer's Guide or User's Guide for the individual programming system/subsystem. The format of the information in this section varies. The intent is to follow the format of the individual Programmer's Guide or User's Guide.

OS/VS1 RES Generation

The following operands must be coded as shown to generate a 3777 Model 2 Workstation program deck for the BSC MULTI-LEAVING operation with OS/VS1 RES (Remote Entry Services). These and other operands that are necessary or optional to the proper generation and operation of BSC MULTI-LEAVING are described in *OS/VS1 RES System Programmer's Guide,* GC28-6878.

RTAM Generation

The following RTAM (remote terminal access method) generation macro instructions must be coded as shown for the 3777-2 (which is coded as if it were a S/360 M20-5 or IBM 2922 Programmable Terminal).

LINE Macro

LDESCR=(type,code)

type=0	for half-duplex; 2400-9600 bps, or
type=1	for full-duplex; 2400-9600 bps
type=2	for full-duplex; 19200 bps
code=0	for EBCDIC; no transparency, or
code=1	for EBCDIC; transparency

TERMINAL Macro

TDESCR=(w,t,d,f)

w=3	for 132-character printer width
t=3	for S/360 M20-5 or 3777-2

Note: If t≠ 3, terminal performance may be degraded.

RDRS=rd

RDRS=1	for S/360 M20-5, 2922, or 3777-2 (1 is the default value)

PTRS=pr

PTRS=1	for S/360 M20-5, 2922, or 3777-2 (1 is the default value)

PCHS=pu

PCHS=0	if the optional 3521 Card Punch is *not* installed, or
PCHS=1	if the optional 3521 Card Punch is installed (1 is the default value)

Note: The RDRS and PTRS operands must not be altered from their default values.

RTAM Macro

MLBFSIZ=mlbfsiz

A variable number that specifies the size of the MULTI-LEAVING buffers.

MLBSIZ=512 is the value recommended for the 3777 Model 2

User Option Card Parameters

The following user option parameters must be coded for the 3777-2 (which is coded as if it were a System/360 Model 20 Submodel 5 or an IBM 2922 Programmable Terminal with exceptions as shown).

Note: TPBUF may need to be increased if this is the first multileaving terminal. See the *OS/VS1 RES System Programmer's Guide,* GC28-6878.

Parameters for System/360 Model 20, 2922, and 3777 Model 2 Workstation Programs

&CORESIZ=12	for the 3777 Model 2
&LINESPD=xxxxx	2400, 4800, 7200, 9600, or 19200 (bps) for the 3777 Model 2
&PRTSIZE=132	for 3203-3 Printer on 3777-2
&PDEV(1)=1403	for the 3203 Model 3 printer attached to the 3777 Model 2
&SUBMOD=5	for the 3777 Model 2
&UADR(1)=3	if the optional 3521 Card Punch is installed on the 3777 Model 2 (3 is the default value)
&UDEV(1)=0	if the optional 3521 Card Punch is *not* installed on the 3777 Model 2, or
&UDEV(1)=1442	if the optional 3521 Card Punch is installed on the 3777 Model 2 (1442 is the default value)
&WDEV(1)=2152	if the optional Console Display feature is installed on the 3777 Model 2, or
&WDEV(1)=0	if the optional Console Display feature is *not* installed on the 3777 Model 2 (0 is the default value)
&XPARENT=NO	if the optional transparency feature is *not* installed in the host processor (YES is the default value)

Note: The &RADR(1) and &RDEV(1) parameters for the card reader must not be altered from their default values. Performance may be degraded if SUBMOD≠5.

Default Parameters

Some parameters must not be altered from their default values for proper generation and operation of the 3777 Model 2 as a BSC MULTI-LEAVING workstation. The default parameters by category are:

RTAM Generation

RDRS=1	in	TERMINAL Macro
PTRS=1	in	TERMINAL Macro

User Option Card Parameters

&RADR(1)=1	for S/360 M20-5, 2922, and 3777-2
&RDEV(1)=2501	Workstation Programs

Other Parameters

All the other operands and parameters for the System/360 Model 20 Submodel 5 and 2922 Programmable Terminal may be allowed to default or may be coded as desired for the 3777 Model 2, according to their description under "RTAM Generation" and "User Option Card Parameters" in the *OS/VS1 RES System Programmer's Guide,* GC28-6878.

OS/VS2 HASP Generation

The following parameters must be coded as shown to generate a 3777 Model 2 Workstation program deck for BSC MULTI-LEAVING operation with OS/VS2 HASP. These and other parameters that are necessary or optional to the proper operation of BSC MULTI-LEAVING are described in *OS/VS2 HASP II Version 4 Systems Programmer's Guide,* GC27-6992.

HASPGEN Parameters

The following HASPGEN parameters must be coded for a 3777-2 (which is coded as if it were a System/360 Model 20 Submodel 5 with exceptions as shown):

&MLBFSIZ

Explanation: Variable symbol within 12K limits.
Recommended 3777-2 value: &MLBFSIZ=512

Note: Establishes dual 512-byte buffers within the 3777-2 for the maximum number of I/O devices that may be attached. The value of the HASP GEN &MLBFSIZ parameter must match the value of the RMTGEN &MLBFSIZ parameter.

RMTnn (Remote Terminal)

Explanation: Ordinary symbols specify the characteristics of remote terminals used with HASP RJE in this format:

RMTnn=mmooppiillwtdf

For the 3777-2, specify:

w=3	for 132-character printer width
t=3	for System 360/20 Submodel 5 or 3777-2
d=4	for multileaving interface
f=1	if Console Display feature is not attached, or
f=3	if Console Display feature is attached

Note: Performance may be degraded if t≠ 3.

&BSCCPU

Explanation: Specifies inclusion, in HASP RTAM, of support for HASP MULTI-LEAVING RJE.

For 3777-2 code: &BSCCPU=YES

LINEmm

Explanation: Specifies the characteristics of data communication lines to be used by HASP RJE in this format:

LINEmm=aaalc

c=0	for EBCDIC	–	no transparency
c=1	for EBCDIC	–	transparency

&NUMTPBF

Explanation: Specifies the number of HASP transmission buffers. This number may have to be increased if this is the first multileaving terminal.

RMTGEN Parameters

The following RMTGEN parameters must be coded for the 3777-2 (which is coded as if it were a System/360 Model 20 Submodel 5 with exceptions as shown).

&CORESIZ=12	for the 3777 Model 2
&LINESPD=xxxxx	2400, 4800, 7200, 9600, or 19200 (bps)
&PDEV(1)=1403	for the 3203 Model 3 Printer attached to the 3777-2
&PRTSIZE=132	for the 3203 Model 3 Printer attached to the 3777-2
&SUBMOD=5	for the 3777 Model 2
&UADR(1)=3	if the 3521 Card Punch is installed on the 3777-2
&UDEV(1)=0 &UDEV(1)=1442	if the optional 3521 Card Punch is *not* installed, or if the optional 3521 Card Punch is installed (1442 is the default value)
&WDEV(1)=2152 &WDEV(1)=0	if the optional Console Display feature is installed, or if the optional Console Display feature is *not* installed (0 is the default value)
&XPARENT=NO	if the optional transparency feature is *not* installed in the host processor

Default Parameters

Some parameters must not be altered from their default values for proper generation and operation of the 3777 Model 2 as a BSC MULTI-LEAVING workstation.

&RADR(1)=1	for 2501 Card Reader on S/360 M20-5, and for 2502 Card Reader (or Diskette Input Device) on 3777-2
&RDEV(1)=2501	for the card reader attached to the S/360 M20-5, and for the card reader attached to the 3777-2 (2502 or Diskette Input Device)

Other Parameters

All the other parameters for the S/360 Model 20 Submodel 5 may be allowed to default or may be altered as desired, according to their description under "HASPGEN Parameters" and "RMTGEN Parameters" in the *OS/VS2 HASP II Version 4 Systems Programmer's Guide,* GC28-6992.

ASP Remote Job Processing Support

ASP Remote Job Processing (RJP) is designed to support the HASP II remote terminal packages. The same parameters included here for OS/VS2 HASP II generation to support the 3777 Model 2 BSC MULTI-LEAVING Workstation also apply to OS/VS2 ASP. For more information, refer to *IBM System/360 ASP Version 3 Asymmetric Multiprocessing System General Information Manual,* GH20-1173.

OS/VS2 JES 2 Generation

The following parameters must be coded as shown to generate a 3777 Model 2 Workstation program deck for BSC MULTI-LEAVING operation with OS/VS2 JES2. These and other parameters that are necessary or optional to the proper generation and operation of BSC MULTI-LEAVING are described in *OS/VS2 MVS System Programming Library: JES2,* GC23-0001 for VS2 Release 3.7 and GC23-0002 for VS2 Release 4.0.

Installing JES2

The following JES2 parameters must be coded for the 3777 Model 2 (which is coded as if it were a System/360 Model 20 Submodel 5 or a 2922 Programmable Terminal with exceptions as shown):

Specifying the JES2 Parameters

Parameter	*Value*	*Explanation*
&BSCCPU=	YES	specifies the inclusion of support for JES2 MULTI-LEAVING RJE in RTAM (for releases after VS2 Release 3.7, this parameter is unnecessary).
&MLBFSIZ=	512	specifies the MULTI-LEAVING buffer size, in bytes, for the 3777 Model 2 (512 is the *recommended* size).
&SPOLMSG=	number (max. 256)	specifies number of physical records to be reserved for operator messages and JES2 messages for each JES2 remote terminal.

Note: The value of the JES2 &MLBFSIZ parameter must match the value of the RMT &MLBFSIZ parameter.

JES2 Initialization

The following JES2 initialization parameters must be coded as shown for the 3777 Model 2.

RMTnnn (Remote Terminal)

terminal type = M20-5	specifies the 3777 Model 2.
CONSOLE/NOCON	
CONSOLE	specifies that the optional Console Display feature is installed on the 3777 Model 2.
NOCON	specifies that the optional Console Display feature is *not* installed on the 3777 Model 2. (NOCON is the default value)
MULTI/HARDWARE	
MULTI	specifies that the 3777 Model 2 will use the BSC MULTI-LEAVING interfaces.
NUMTPBF	specifies the number of JES2 transmission buffers. This number may have to be increased if this is the first multileaving terminal.

Remote Job Entry

The following JES2 remote job entry parameters must be coded as shown for the 3777 Model 2. RMT generation is the JES2 procedure for generating MULTI-LEAVING remote terminal processor (RTP) programs for remote job entry from programmable remote workstations.

RMT Parameters for the System/360 Model 20 and 3777 Model 2 BSC RTP Program

Parameter	*Value*	*Explanation*
&CORESIZ=	12	for the 3777 Model 2.
&LINESPD=	xxxxx	2400, 4800, 7200, 9600, or 19200 (bps) for the 3777 Model 2
&PDEV(1)=	1403	for the 3203 Model 3 Printer attached to the 3777 Model 2
&PRTCONS=	0 1 2	specifies the usage of the printer as an output console. If &WDEV(1) is not specified as 0, this parameter should be set to 0
&PRTSIZE=	132	for the 3203 Model 3 Printer attached to the 3777 Model 2.
&SUBMOD=	5	for the 3777 Model 2 (performance may be degraded if $\neq 5$).
&UADR(1)=	3	if the optional 3521 Card Punch is installed on the 3777 Model 2 (3 is the default value).
&UDEV(1)=	0	if the optional 3521 Card Punch is *not* installed on the 3777 Model 2, or
&UDEV(1)=	1442	if the optional 3521 Card Punch is installed on the 3777 Model 2 (1442 is the default value).
&WDEV(1)=	2152	if the optional Console Display feature is installed on the 3777 Model 2, or
&WDEV(1)=	0	if the optional Console Display feature is *not* installed on the 3777 Model 2 (0 is the default value).
&XPARENT=	NO	if the optional transparency feature is not installed in the host processor (YES is the default value).

Default Parameters

Some parameters must not be altered from their default values for proper generation and operation of the 3777 Model 2 as a BSC MULTI-LEAVING workstation. The default parameters by category are:

Installing JES2

&USASCII=NO

JES2 Initialization

CODEB/CODEA	in	LINEnnn parameter
USASCII/EBCDIC	in	LINEnnn parameter

Remote Job Entry

&RADR(1)=1	in	RMT Parameters
&RDEV(1)=2501	in	RMT Parameters

Other Parameters

All the other parameters for the System/360 Model 20 Submodel 5 and 2922 Programmable Terminal may be allowed to default or may be altered as desired for the 3777 Model 2, according to the descriptions in the *OS/VS2 MVS System Programming Library: JES2,* GC23-0001 for VS2 Release 3.7 and GC23-0002 for VS2 Release 4.0.

OS/VS2 ASP Generation

ASP Remote Job Processing (RJP) is designed to support the HASP II remote terminal packages. The same parameters that are coded for OS/VS2 HASP generation to support the 3777 Model 2 BSC MULTI-LEAVING Workstation also apply to OS/VS2 ASP generation. Refer to "OS/VS2 HASP GENERATION" in this section.

ASP Requirements for RJP Terminals

Care must be taken in generating the HASP II remote terminal packages to assure compatibility in specifications of devices and buffer sizes with those specified at ASP initialization time.

Devices supported on the various terminals are described in the *IBM System/360 and System/370 ASP Version 3 Asymmetric Multiprocessing System–General Information Manual,* GH20-1173. The System/360 Model 20 Submodel 5 I/O device numbers are used, as explained in the introduction to this section, when coding parameters for the 3777 Model 2.

For more information on ASP Remote Job Processing, refer to the *IBM System/360 and System/370 ASP Version 3 Asymmetric Multiprocessing System–System Programmer's Manual,* GH20-1292.

OS/VS2 JES3 Generation

The following parameters must be coded as shown to generate a 3777 Model 2 Workstation program deck for BSC MULTI-LEAVING operation with OS/VS2 JES3. These and other parameters that are necessary or optional to the proper generation and operation of BSC MULTI-LEAVING are described in *OS/VS2 MVS System Programming Library: JES3,* GC28-0608.

JES3 Initialization Card Parameters

The following JES3 initialization card parameters must be coded for the 3777 Model 2 (which is coded as if it were a System/360 Model 20 Submodel 5 with exceptions as shown).

CONSOLE (Operator Console) Card

The CONSOLE card defines the RJP (Remote Job Processing) console which is the Console Display feature if installed on the 3777 Model 2.

CONSOLE,JNAME= { consname } { termname }	for the 3777-2 RJP console, *termname* must match the N parameter on the RJPTERM initialization card.
,TYPE= { modelnum } { RJP }	TYPE=RJP must be specified for the 3777-2 Console Display feature.
,DEST= { destclas }	specify DEST=NONE for the 3777-2 Console Display feature to receive messages intended for the 3777-2.
,LL=nnn	specifies the length of the longest line that may be printed on this console. Specify 132 for the 3777-2 Console Display feature.

DEVICE (Device Definition) Card

The DEVICE card defines those devices used by JES3 and managed by JES3.

DEVICE,DTYPE= { CNSxxxx } { PRTxxxx } { PUNxxxx } { RDRxxxx } { RMTxxxx } { TAxxxx } { NJPLINE } { SYSMAIN } { username }	for the 3777 Model 2 I/O devices, specify each of these physical devices on a separate DEVICE card *only if* the JES3 default characteristics provided on the RJPTERM card are not acceptable.

RJPLINE (Remote Job Processing Line) Card

The RJPLINE card defines a single BSC line to be used by the JES3 global processor for remote job processing.

RJPLINE,N=linename	
,S= { linespeed } { 2400 }	specify 2400, 4800, 7200, 9600, or 19200 (bps) for 3777 Model 2.

RJPTERM (Remote Job Processing Terminal) Card

The RJPTERM card defines a single remote workstation terminal to the JES3 system.

RJPTERM,N=ddname	
,T=termtype	specify M205 for the System/360 Model 20 Submodel 5 and the 3777 Model 2.
,B= { buffsize } { 400 }	512 is the recommended buffer size for the 3777 Model 2; the default shown is for the S/360 M20-5. (See note.)
,C= { R }	if the optional Console Display feature is installed on the 3777 Model 2.
,C= { S }	if the optional Console Display feature is *not* installed on the 3777 Model 2.
RJPTERM,PR=numofprt	specify 1 for the 3203 Model 3 Printer attached to the 3777 Model 2.
,PRW= { recsiz } { 132 }	allow this parameter to default for the 3203-3 printer attached to the 3777-2
,PU= { numofpun } { 0 }	specify 1 if the optional 3521 Card Punch is installed on the 3777 Model 2. allow this parameter to default if the 3521 is *not* installed on the 3777-2.
,PUW= { recsiz } { 80 }	allow this parameter to default if PU=1 was coded for the optional 3521 Card Punch on the 3777 Model 2.
,RD= { numofrdr } { 0 }	specify 1 for the 2502 Card Reader or Diskette Input Device attached to the 3777 Model 2.

JES3 Remote Workstation Package Generation

The remote workstation package (RMT) used by JES3 is the one supplied with JES2. The same RMT Parameters for JES2 Remote Job Entry (as described under "OS/VS2 JES2 Generation" in this section) that are altered for the 3777 Model 2, are punched as part of the RMT generation parameter card deck, and are used for JES3 RMT generation.

Refer to "Chapter 3: Extended Services and Utilities" in the *OS/VS2 MVS System Programming Library: JES3,* GC28-0608, for the JES3 RMT generation procedure. The following parameters are specified as shown:

&BSCCPU=YES	specifies inclusion of BSC MULTI-LEAVING RJE support in RTAM
&MLBFSIZ=512	512 is the recommended MULTI-LEAVING buffer size, in bytes, for the 3777 Model 2 (See note.)

Other Parameters

All the other parameters for the System/360 Model 20 Submodel 5 may be allowed to default or may be altered as desired for the 3777 Model 2, according to the descriptions in the *OS/VS2 MVS System Programming Library: JES3,* GC28-0608.

Note: The value of the RMT &MLBFSIZ parameter must match the value of the RJPTERM,B parameter.

VM/370 RSCS Generation

The Remote Spooling Communications Subsystem (RSCS) is designed to support the HASP II remote terminal packages. The same parameters that are coded for OS/VS2 HASP generation to support the 3777 Model 2 BSC MULTI-LEAVING Workstation also apply to VM/370 RSCS generation. Refer to "OS/VS2 HASP Generation" in this section.

RSCS Requirements for RTP Program

The Remote Terminal Processor (RTP) program allows the 3777 Model 2, the System/360 Model 20 Submodel 5, and the 2922 Programmable Terminal to operate as remote workstations for MULTI-LEAVING operating systems such as HASP and ASP. A S/360 M20-5, 2922, or 3777-2 under control of the RTP program (identified as HASP/RTPM20) and communicating with RSCS can be viewed as a logical extension of the VM/370 spool system.

Devices supported on the various terminals are described in the *IBM Virtual Machine Facility/370: Remote Communications Spooling Subsystem (RSCS) User's Guide,* GC20-1816. The I/O device numbers for the System/360 Model 20 Submodel 5 are used, as explained in the introduction to this section, when coding parameters for the 3777 Model 2.

For more information on VM/370 data communication support of RSCS, refer to *IBM Virtual Machine Facility/370: System Programmer's Guide,* GC20-1807.

Care must be taken in generating the HASP II remote terminal packages to assure compatibility in specifications and buffer sizes with those specified at RSCS initialization time.

Functional Characteristics (3777 Model 2)

This section describes the basic functions and features of the 3777 Model 2. Refer to the "Features and Accessories" section for descriptions of special and specify features and purchase-only accessories.

Workstation Controller

The workstation program in the controller uses alternating buffers for temporary data storage. The buffer size is variable and is specified during generation of the workstation program at the host processor. The recommended size for the 3777 Model 2 is 512 bytes as specified in the &MLBFSIZ (MULTI-LEAVING buffer size) parameter or its equivalent in the RJE subsystem.

The alternating buffers (called MULTI-LEAVING buffers) allow concurrent input/output device operation and workstation job stream transmission to/from the host processor.

Job Control

After the terminal's power is turned on, and with the HOLD PRINT switch off and Key-lock on, the terminal is ready for initial program load (IPL) of the workstation program after the built-in tests run successfully. The IPL may be read from cards or from the diskette (if the workstation program deck had been previously written on the diskette SYSIPL data set). To proceed with workstation operation, the operator must align the forms and set up the forms control for the job and define other parameters, or select them by use of keyboard switches.

Parameters, in addition to forms control, that may be specified or selected include:

- Making ready the input and output devices required for the job
- Setting the train image for the 3203 printer/1416 cartridge
- Setting the lines per inch, 6 or 8 lpi, for the printer
- Setting the spooling diskette status: spool or no spool, retain or not retain operator messages, opening of spooling diskette
- Selecting Read Back Check on the 3521 Card Punch

After these and other parameters are set, the operator establishes a communication line and performs the logon or sign-on procedure to prepare the 3777-2 workstation for remote job processing.

Data and Space Compression/Expansion

Throughput on the 3777-2 workstation job streams may be increased by selecting Data and/or Space Compression/Expansion during the workstation program generation. If this option is specified, consecutive data or space characters are removed from transmitted data from the card reader and reinserted in output data at the host processor. Data or space compression can also be used in data received from the host processor, and will cause reinsertion (expansion) into printed or punched data. Expansion is automatic and does not have to be specified for a job whose data is compressed.

Problem Determination

The controller has built-in tests that run each time the power is turned on or the SYSTEM RESET switch is operated. These tests, when successfully completed, have checked the major portion of the controller and verified that the electronic circuits are operating properly. The terminal is then in local mode. The tests require a few seconds to run and leave the terminal in a state with the code 515 in the NPR; this informs the operator that the IPL must be done. Any other indicator being on after the tests have run signals either that a failure occurred in the controller's electronic components, that one of the mode switches is on, or that the Keylock is turned off, or that the printer is not ready.

Problem determination tests selectable from the keyboard reside in the terminal. The operator can use these tests to isolate problems to the terminal or to the communication facilities. Communication-facility tests also include online tests provided by the host processor access method. An online trace prints all online data sent and received including sense data.

Error Logging

Information about errors encountered during normal operation is recorded in an error log that can be printed out by the Print Error Log function. When errors that cannot be corrected by operator action occur, or when intermittent internal machine errors that impede operation occur, the operator should call for a printout of the error log before turning the terminal's power off (the error log is lost when power is turned off). This information should be retained and given to the service representative, who will use it to isolate the cause of the problem.

A storage dump facility prints the core storage and register storage contents of the workstation program.

Operator Attention Speaker

This device produces an audible tone to signal the operator that a procedural error has occurred, or that some input or output device requires attention. Upon hearing the tone, the operator can refer to the keyboard indicators, which will indicate the cause of the tone.

Keyboard

The keyboard is enabled for data entry by pressing the SYS REQ key provided the Console Display special feature is installed and the console is specified in the workstation program. A logon/sign-on or logoff message may be entered, displayed, and sent to the host processor. Limited editing of the message is possible by use of the CHAR BKSP and CHAR ADV keys. Refer to "Console Display Feature" and "Operator ID Reader" under "Features and Accessories" in this chapter for more information on keyboard operation with these features. Refer also to "Operating Controls" in this chapter for a functional description of individual keys, switches, and lights.

Features and Accessories (3777 Model 2)

This section describes the special and specify features and accessories (purchase-only items) available for the 3777 Model 2 controller. I/O devices that can be cable-connected to the controller, and features and accessories for these devices, are described under "I/O Attachments" in Chapter 5.

Console Display

The 3777 Model 2 can attach a 1024-character Console Display special feature for displaying messages sent from the host to the remote terminal operator and operator-initiated messages. This special feature shown in Figure 3-3 can display 16 lines with 64 characters in each line. The top 14 lines are used to display messages. The bottom two lines are reserved for data as it is keyed in or data requested by the 3777-2 operator.

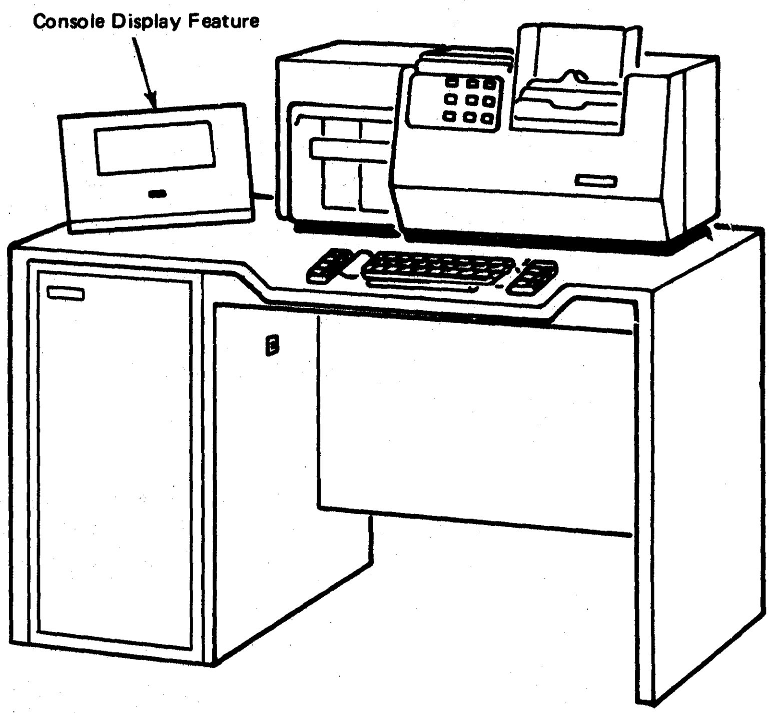

Figure 3-3. 3777 Model 2 Console Display Feature

Messages

Messages are displayed from top to bottom as they are received from the host or sent from the 3777-2. When the operator finishes keying a message, it is moved up on the screen as the most recent message. If the Console Display Spooling feature is also attached (see "Console Display Spooling" in this section), messages are also written on the spooling diskette. If a message is too long for one line, the display overflows to the next line and indents the overflow line for ease of viewing. When the display screen is full of messages, the most recent message wraps around to the top of the screen and displays over the oldest message on the screen. The most recent message received from the host processor is identified by an asterisk (*) in the left-most display position followed by a blank line.

Hold Mode

The operator can put the display in hold mode to prevent new messages from displaying. While in hold mode, another message received turns on the MSG ALERT light but is not displayed. The message is written onto the spooling diskette if the spooling feature is attached. The REL key may be used to release the display from hold mode. If the spooling feature is attached, the latest screenful of messages appears. Any new messages will then begin displaying. If many have been received, they will be displayed quite rapidly. To prevent this, the REL ONE MSG key may be pressed (instead of the REL key) to display one message at a time. When all received messages have been displayed, the MSG ALERT light turns off. The display is still in hold mode and the REL key must be used to release the display.

Retrieving Previous Messages

After messages are received and written on the spooling diskette, the operator can retrieve and display them using the MSGS BACK and MSGS ADV (Messages Back/Advance) keys. Pressing either of the "MSGS" keys puts the Console Display in hold mode, which prevents the display of system messages received from the host processor. (Any messages received in hold mode are written on the spooling diskette.)

The operator has the option of selecting the previous or next screen full of messages to be displayed using the most recently-displayed message as the reference point, or from the same reference point, searching backward or forward on the spooling diskette a maximum of 99,999 messages before starting the retrieval and display.

After viewing the selected messages, the operator has two options. (1) Pressing the REL key releases hold mode and the latest screenful of messages appears. (2) Instead of REL, the operator may press the MSGS ADV key to display a screenful of messages at a time, advancing through the messages. When all messages have been displayed, hold mode is released and the MSG ALERT light is turned off.

Keyboard Input

The 3777-2 operator may use the keyboard in conjunction with the Console Display feature to enter (1) system commands and requests to the host processor and (2) local commands and requests to the 3777-2 controller. Refer to the *Operator's Guide* or *User's Guide* for the respective Remote Job Entry subsystem for system commands and requests. Refer to the 3777-2 *Operating Procedures Guide* for local commands. Local commands and requests include the following:

- Forms Definition information for the 3203 Model 3 Printer
- Print Train Arrangement Number in the Print Image Buffer
- Lines per inch setting
- Workstation Program Status
- Console Display Spooling Status
- Communication Line Statistics
- Commands to the 3777 Model 2

Keyboard Input–System Requests

The operator presses the SYS REQ key to enter the request. (If the Console Display feature is not attached, the 3777-2 ignores the SYS REQ key.) System request messages from the operator to the host are displayed on the bottom two lines of the display as they are keyed in. The character position that will receive the next keyed character is indicated by a small horizontal bar called a *cursor* beneath the character position. The 3777-2 converts lowercase alphabetic characters (a-z) to uppercase before displaying them (see Appendix B for the character set(s) used by the Console Display feature).

If the operator makes a keying error, the CHAR BKSP (Character Backspace) and CHAR ADV (Character Advance) keys can be used to edit the keyed data before pressing the EOM key to execute the command. The CHAR ADV key is typamatic.

After the operator finishes keying and editing the command, pressing the EOM key begins execution of the command, and moves the keyed entry up on the screen, out of the operator-originated area and into the system messages area where it is displayed as the most recent message. If the Console Display Spooling feature is attached, the system request message is also written on the spooling diskette with other spooled messages.

Console Display Spooling

The Console Display Spooling special feature uses a magnetic diskette storage device to spool system messages. The spooling diskette storage device is a compact unit contained in the terminal's left base (Figure 3-4). System messages are recorded (spooled) on a small flexible operator-changeable diskette. Messages are written to the spooling diskette from the buffer as it fills from the communication line. The spooling diskette feature, in conjunction with other I/O devices and features, permits:

- Retrieving and displaying previously-received messages
- Printing messages, at the operator's convenience, for a hard copy chronological file
- Retaining messages in a diskette chronological file by removing the spooling diskette when it is full and inserting another
- Writing new messages over old ones when the spooling diskette is full
- Storing the workstation program on a diskette and executing the IPL from the diskette, which is faster than from the card reader

Diskette Create Function

New diskettes, or diskettes that have been used on other machines, must be prepared for use on the 3777-2 by performing the Diskette Create function before they can be written on by the Console Display Spooling feature. This function is under control of an operator procedure that writes the Volume Label and Data Set Label(s) on track 00 of the diskette as shown in Appendix E. Any data previously written on the diskette cannot be accessed again.

When performing the Create function, the operator has the option of specifying that the IPL data set (SYSIPL) be written on the diskette as the first data set. The operator specifies a load address, loads the workstation program deck into the card reader, and the data is written on the diskette. The system messages data set (SYSMSGS) is written next, allocating the rest of the diskette tracks to one system messages data set. (If the SYSIPL data set is not written on the diskette, the SYSMSGS data set is allocated to the entire diskette data storage area.)

Spooling Diskette Records

System messages received from the host processor are written into a buffer until the most recent message overflows the 256-byte buffer. The most recent message is not inserted, the rest of the buffer is padded with NUL characters (Hex '00'), and the buffer is written

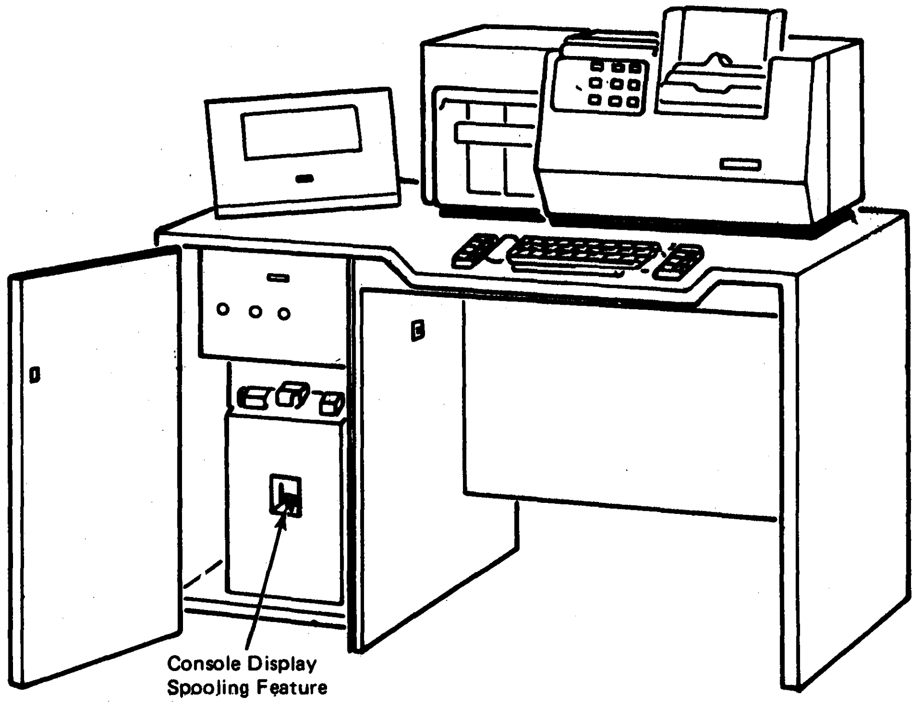

Figure 3-4. 3777 Model 2 Console Display Spooling Feature

onto 128-byte sectors on the spooling diskette in 3770 nonexchange mode. Each time a buffer of messages is written onto the spooling diskette, a buffer of zeroes is written following it. The next buffer of messages overlays the buffer of zeroes from the previous write operation and writes a buffer of zeroes. Thus, data integrity of messages already on the spooling diskettes is maintained. The buffer of zeroes marks the end of messages on the spooling diskette. A new buffer is started with the message that caused the overflow.

To estimate the number of messages that can be contained on the spooling diskette, use the following:

1. Buffer size is 252 bytes for messages.
2. To each message, add two control bytes.
3. Messages are not segmented across buffers.
4. With no SYSIPL, a maximum of 962 buffers are written. If defective sectors exist, this number decreases.

Since messages vary in length, only an approximate number can be computed.

As with any diskette of this type, defective sectors caused by physical damage to the diskette will decrease the available storage capacity. Defective sectors are skipped over the first time they are encountered; thereafter, they are not used. An excessive number of defective sectors can cause a significant decrease in storage capacity, and will degrade performance.

Spooling Diskette Data Sets

As mentioned previously, under "Diskette Create Function", the 3777-2 writes records into one or two spooling diskette data sets identified at Create time as SYSIPL (optional) and SYSMSGS.

Retain Data Set Function

If the RETAIN Disk mode light is on (set by the operator), when the spooling diskette fills with messages, the 3777-2 stops writing messages, closes the SYSMSGS data set, sounds the Operator Attention Speaker, and displays a code in the NPR. The operator replaces the full spooling diskette with another, performs the Create function (if necessary) on the next spooling diskette, and returns the 3777-2 to continue writing system messages on the next spooling diskette.

If the RETAIN DISK light is not on when the spooling diskette becomes full, the new messages will be written over old messages starting at the Beginning of Extent address.

Close Data Set Function

At any time, whether the RETAIN DISK light is on or off, the operator may select the Close Data Set (END) function. This function writes any buffered messages to the spooling diskette and closes the SYSMSGS data set. After closing the data set, the operator may remove the spooling diskette and insert another, or may reopen the data set and let the 3777-2 continue writing system messages on the rest of the spooling diskette.

No Spool Function

This function, selected by the operator, turns on the NO SPOOL light and prevents the writing of system messages on the spooling diskette. In this mode, system messages are displayed as they are received, but are not written on the spooling diskette.

Print Messages Operation

When the LIST DISK code function is executed, the contents of the spooling diskette can be printed on the 3203 printer. The printout begins with the volume label, the SYSIPL (if present) and SYSMSGS, data set label(s), followed by the SYSMSGS data set in chronological sequence. The printout may be stopped at any time.

During a spooling diskette operation if the Display is in hold mode, any system messages received cannot be written on the spooling diskette, but are held in the buffer. The MSG ALERT light turns on (similar to Display hold mode). After the operation ends, the spooling diskette must be opened. Any held messages are then displayed and written on the spooling diskette.

Diskettes

Diskettes used by the Console Display Spooling feature and the Diskette Input Device consist of a small flexible disk about 8 inches in diameter enclosed in a holder. Appendix F describes the diskette used by the 3777 Model 2, and describes diskette labeling and recommended handling procedures.

Diskette Input Device

The Diskette Input Device special feature uses a magnetic diskette storage device to read basic exchange data sets from input diskettes as if they were 80-character cards. The input diskette storage device is a compact unit contained in the terminal's right base (Figure 3-5). Eighty-character card-image records are written on a basic exchange diskette by a terminal or machine other than the 3777-2. The basic exchange diskette is then transferred to the 3777-2 Diskette Input Device where it is read as the job input source.

Either (a) the 2502 Card Reader or (b) the Diskette Input Device and the Console Display feature is a prerequisite feature to the 3777-2. One of the above must be part of the minimum workstation configuration. If both the 2502 and the Diskette Input Device are

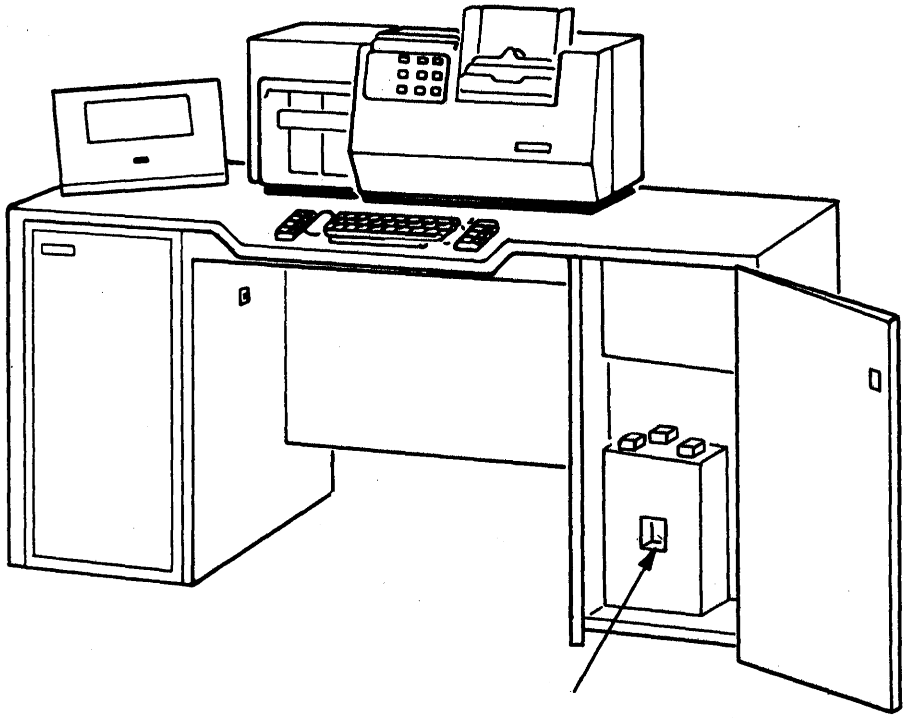

Figure 3-5. 3777 Model 2 Diskette Input Device Feature

attached to the 3777-2, the operator can alternate the job input source between cards and basic exchange diskettes. However, both of these input devices cannot be operated simultaneously.

The IPL diskette may be created on the Diskette Input Device if the Console Display Spooling feature is not attached. The IPL diskette format is the same as if it were created on the console Display Spooling feature (labels are written for SYSIPL and SYSMSGS data sets). The Diskette input feature includes the Extended Forms Definition feature. Extended Forms Definition cannot be ordered alone. With the Extended Forms Definition feature, 936 additional forms definitions may be written on the IPL diskette preceding the workstation program. (Five printer forms definitions are a basic feature of the 3777-2.) If the Console Display Spooling feature is not attached, the 3777-2 can use the Diskette Input Device to read the diskette containing the workstation program deck during an IPL procedure. (If the 2502 is not attached the IPL diskette must have been written on another 3777-2 with a 2502 Card Reader and at least one diskette device feature.)

Input Diskette Data Sets

The records on the input diskette must be read and processed by the 3777-2 as if they were cards. Consequently, the data sets must be the basic exchange type with a maximum block length of 80. Input diskette data sets may be continued from one diskette volume to another using the multivolume indicator in the data set label. These data sets may be written on another 3770 terminal (other than a 3777-2) or on another machine or terminal that can create a basic exchange data set. The data sets can be printed offline using the functional test deck or diskette supplied with the 3777-2.

List Diskette Function

When the LIST DISK code function is executed, the labels of the input diskette can be printed on the 3203 printer. The printout begins with the volume label, followed by the card-image data set labels. The printout may be stopped at any time. If the IPL diskette is used, the volume label is printed, followed by the SYSIPL and SYSMSGS labels.

Door Keylock

This special feature adds a keylock to the controller cabinet door. Two keys are provided.

Keylock

This special feature provides a key-operated switch on the Auxillary Operator's Panel behind the cabinet door. This switch can be turned off to disable the terminal operation through the keyboard and must be on to start operations at the keyboard.

Audible Alarm

This special feature provides a louder signal than the Operator Attention Speaker. The alarm can be enabled or disabled by the operator. When enabled, the alarm sounds for any device error or not-ready condition.

Operator ID Reader

This special feature device reads magnetic stripe operator identification cards (or badges). The ID reader is mounted behind the controller cabinet door, above the Auxiliary Operator's Panel. This feature is enabled by a CODE key function, and uses the SYS REQ data format as if it had been keyed in. After the ID card data is read into the buffer, the 3777-2 generates an EOM and sends the data to the host processor.

Data from the ID card is not displayed, printed, or written on the spooling diskette to maintain security of the badge data at the terminal. However, the workstation program treats the ID card data the same way as keyed data; there is no special security treatment of badge data by the program. This CODE key function is not allowed if the line trace facility is being used, since the data would be printed.

Cards must be 3-7/8 by 2-1/8 inches, and between 0.007 and 0.045 inch thick. The magnetic stripe must be encoded in the American Banking Association format, which provides for up to 40 characters, 37 of which are discretionary. Card format and character sets are shown in Appendix B.

Katakana Character Set

Keyboard

This specify feature provides a 127-character keyboard for the 3777 Model 2 controller. The Katakana character set is shown in Appendix B.

Print Train Arrangements

The International Print Support specify feature for the 3777 Model 2 includes buffer storage for the 107- and 127-character Katakana print train arrangements. (With this feature installed, the 3777-2 also has buffer storage for print train arrangements equivalent to the 48-, 64-, and 94-character sets available for EBCDIC print belts used on the 3776 console line printer.) A corresponding 1416 Interchangeable Train Cartridge for the 3203 Model 3 Printer must also be ordered for each arrangement you want to print. This specify feature replaces the standard character set storage in the 3777-2. Refer to "IBM 3203 Printer Model 3" in Chapter 5 for more information.

Interface Features

When an IBM Integrated Modem special feature is not used or is not available on a 3770 terminal, *one* of the following attachment special features is required for attachment to user-supplied standalone Data Circuit-Terminating Equipment (DCE) or to an IBM standalone modem (also a DCE). Each of the interface features is mutually exclusive with the others.

Note: The DCE abbreviation formerly applied to the more general designation: Data Communication Equipment.

EIA RS-232C Interface

This special feature provides a cable and interface compatible with EIA Standard RS-232C, for attachment to common-carrier or user-supplied Data Circuit-Terminating Equipment (DCE) or to IBM standalone modems connected to a common-carrier switched network or common-carrier voice-grade private-line channel (maximum line speed—19.2 kbps).

CCITT V.24/.28 Interface

This special feature for World Trade countries provides a cable and interface compatible with CCITT Recommendation V.24/V.28 for attachment to a switched or nonswitched voice-grade communication facility (maximum line speed—9600 bps).

High-Speed Digital Interface

This special feature on the 3777 Model 2 is used to connect the terminal to common-carrier-supplied or user-supplied Data Circuit-Terminating Equipment (DCE), or to IBM standalone modems. The High-Speed Digital Interface feature permits point-to-point synchronous operation at 19.2 kilobits per second (20.4 kbps in World Trade countries) on a wideband communication channel. This feature provides an interface and a cable for attachment to the DCE.

CCITT V.35 Interface

This special feature for World Trade countries provides a cable and interface compatible with CCITT Recommendation V.35, for attachment to common-carrier supplied or user-supplied Data Circuit-Terminating Equipment (DCE). This feature permits operation at 20.4 kilobits per second on a wideband communication channel.

V.35 Interface/High-Speed Local Attachment to 3705-II

This special feature for all countries provides a cable and interface for direct local attachment (without modems) of a 3777-2 to a 3705-II Communications Controller. This feature attaches a 3777-2 to a Half-Duplex Line Set Feature in the 3705-II for two-way alternate data mode operation at 14,400 bps. Business machine clocking is provided by a special feature of the line interface base in the 3705-II. The maximum cable length is 51.8 meters (170 feet). This interface feature cannot be installed with EIA Interface Feature or the High-Speed Digital Interface Feature.

Operating Controls (3777 Model 2)

POWER ON/OFF Switch: This switch is located on the left side of the knee hole on the controller housing. It controls ac power to the terminal. When power is turned on, the bring-up diagnostics run and the terminal is left with all lights off except code 515 in the Numeric Position Readout (NPR) indicators. Any other indicator being on signals either a failure in the terminal's electronic components, or that the HOLD PRINT switch is on, or the Keylock is off, or the printer is not ready. If the bring-up diagnostics run successfully, the operator can initialize the terminal and establish a communication line. The operator should proceed as described in the 3777 Model 2 *Operating Procedures Guide.*

Auxiliary Operator's Panel

The auxiliary operator's panel (Figure 3-6) is located behind the door on the controller base. It contains the SYSTEM RESET switch and certain special feature controls, as follows:

NORMAL/HALF-SPEED Switch: This switch is present on all World Trade machines using the CCITT V.24/V.28 interface. With the switch in the NORMAL position, line speed is at the external Data Communication Equipment's (DCE) maximum rated speed. With the switch in the HALF-SPEED position, line speed is half of the DCE's maximum rated speed, if the DCE used has this capability.

SYSTEM RESET Switch: This switch causes the terminal to interrupt any operation in progress and leaves the terminal in the same power-on state as described under "POWER ON/OFF" switch. The SYSTEM RESET switch does not erase the error log, the line statistics, or the forms definitions.

Keylock: This is the key operated switch for the Keylock special feature.

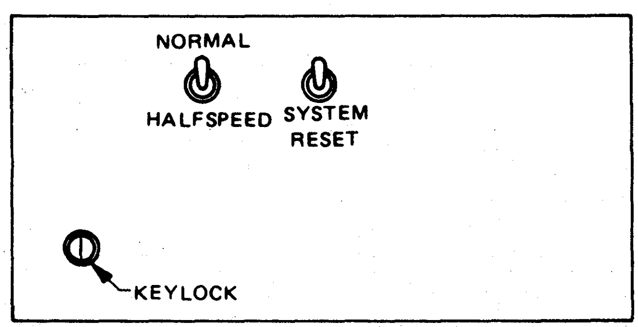

Figure 3-6. Auxiliary Operator's Panel

Keyboard Switches, Keys, and Lights (Figure 3-7)

Switches

HOLD PRINT: Turning this switch on suspends printing so that forms on the 3203 printer can be adjusted or inserted. This switch must also be turned on to change the lines per inch setting, to change the print train image, or to change the forms definition. When this swtich is turned off, printing resumes.

MSG ATTN (Message Attention): The setting of this swtich determines whether or not the Operator Attention Speaker sounds when a message is displayed. In the MSG ATTN position, the speaker sounds when each message is first displayed to alert the operator to an unsolicited message. If the operator has made an inquiry and is expecting a response or if many messages are received, this switch should be turned off.

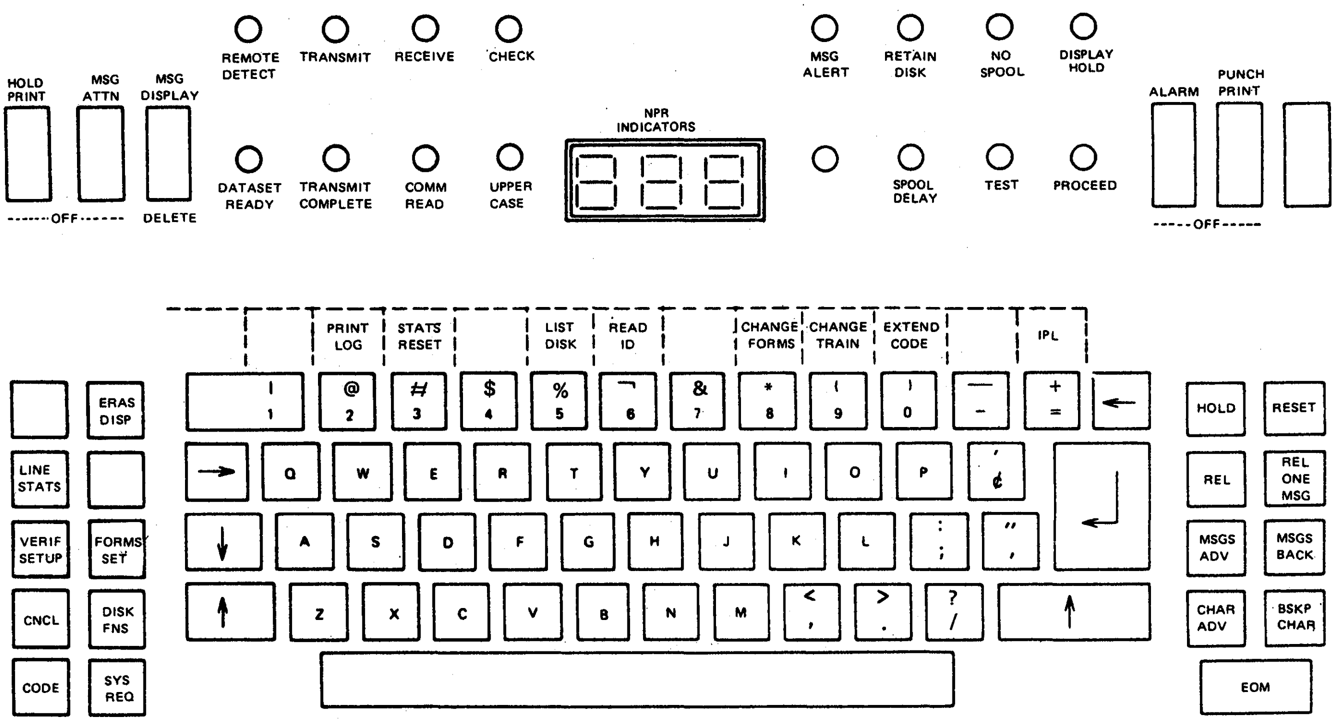

Figure 3-7. 3777 Model 2 Keyboard

MSG (Message) DISPLAY/DELETE: The setting of this switch determines whether or not the message selected by the operator is deleted when using the Message Compare/ Delete EXTEND CODE function. In the DISPLAY position, the selected message is displayed and written on the spooling diskette (if the Console Display Spooling feature is attached). In the DELETE position, the selected message is not displayed or written on the spooling diskette. This function prevents potentially unimportant messages such as "UNIT CHECK" from filling the display or the spooling diskette.

ALARM: Turning this switch on enables the Audible Alarm feature, if installed, to sound when the Operator Attention Speaker sounds. The Audible Alarm is a louder and continuous signal.

PUNCH PRINT: Turning this switch on causes cards to be printed (interpreted) as they are punched (the 3521 must have the Card Print feature). The switch may be changed at any time. Refer to "3521 Special Features" in Chapter 5 for more information.

Keys

ERAS DISP (Erase Display): Pressing this key erases the entire display (system messages and operator-originated data).

LINE STATS (Statistics): This key causes the line statistics to be displayed (or printed if the Console Display feature is not attached). Statistics displayed/printed are: blocks sent and received successfully; CRC errors; NAKs received; read timeouts; and lost data.

VERIFY SETUP: Pressing this key displays (or prints, if the Console Display feature is not attached) the current forms definition, print train image number, lines per inch setting, operational status of the spooling diskette, number of basic exchange data sets read successfully from the input diskette, and the NPR code of any input diskette error. The information displays on the bottom two lines.

FORMS SET: Pressing this key allows the operator to change the active vertical forms definition for the 3203 printer. The operator may enter keyed responses to prompts in the NPR. Channels not defined, are set to line number one. Maximum form length is 255 lines.

CNCL (Cancel): Pressing this key cancels a keyed request or CODE key function (SYS REQ key not involved). The CNCL key discards any data keyed in as part of a SYS REQ message. The PROCEED light remains on until the EOM key is pressed (see "Operating Characteristics–Keyboard Input").

DISK FNS (Diskette Functions): Pressing this key allows the operator to select one of four spooling diskette functions or the create IPL function: Create Diskette (two variations); Close Data Set; Set/Reset Retain Mode, or No Spool (see "Features and Accessories–Console Display Spooling").

CODE: This key, pressed in conjunction with other keyboard keys, permits selection of the following functions:

- Print Error Log
- Reset Line Statistics Counters to Zero
- List Diskette–Prints the volume label, data set label(s), and the system messages data set from the spooling diskette or prints the volume label and data set labels from the input diskette.
- Enable Operator ID Reader
- Change Forms Definition, Train Image, and 8/6 Lines Per Inch setting
- Select a Print Train Image for the 3777-2 Controller
- Select Extended Code Functions (Refer to EXTEND CODE description)
- Execute an Initial Program Load (IPL) from Cards or Diskette (Operator can define forms definitions, train image, 8/6 lines per inch, and spool diskette setting.)
- Begin Diskette Input (Read Diskette)–Starts reading one or all active basic exchange data sets on the Diskette Input Device.
- End Diskette Input (Stop Diskette)–If the 3777-2 is reading the input diskette when this function is executed, the 3777-2 stops reading at the end of the current record. An End of File indicator is sent unless no EOF is specified.
- Reset NPR Error Indication & CHECK Light
- End FORMS SET Operation
- Reset 3203 Ripple Print Operation
- Reset Communication Facilities Test
- Stop Printing of List Diskette function
- Select 8 or 6 lines per inch for printing
- Disable/Enable Read Back Check on 3521 Card Punch

EXTEND CODE: This key, pressed in conjunction with the CODE key and a numeric key, permits selection of the following functions:

- Stop Workstation Program
- Restart Workstation Program
- Print All Characters to Clean 3203 Printer Belt (3203 Ripple Print)
- Delete Message from Display and Spooling Diskette
- Set Values–Setting of DATA and REGISTER DATA/ADDRESS dials on System/360 Model 20 Operator Console
- Test Communication Facilities
- Dump Storage–Performs storage dump of S/360 Model 20 program on 3203 printer
- Print Line Trace–Prints all online data (degrades performance)

Keys used in conjunction with the CODE and EXTEND CODE keys to select these functions are described in the 3777 Model 2 *Operating Procedures Guide.*

SYS REQ (System Request): This key is active only if the Console Display feature is attached. This key is used to enter and display local commands to the workstation program in the 3777-2 or system commands to the RJE subsystem in the host processor.

HOLD: Pressing this key prevents the display of new messages and turns on the DISPLAY HOLD light. If messages are received while the display is in hold mode, they are written on the spooling diskette (if attached) and the MSG ALERT light turns on. Pressing the REL key returns the Console Display to normal display mode.

RESET: Pressing this key resets the Audible Alarm; returns the Console Display cursor to the next position to be keyed after pressing BKSP CHAR; and resets operator error codes in the NPR.

REL (Release): Pressing this key releases the Console Display from hold mode. Display hold mode can be entered by pressing the HOLD, or MSGS BACK keys. When the REL key is pressed, the MSG ALERT and DISPLAY HOLD lights are turned off and messages continue displaying. If the Console Display Spooling feature is attached, the most recent screenful of messages is displayed.

REL ONE MSG (Release One Message): This key is active only when the Console Display is in hold mode (the DISPLAY HOLD light is on). Pressing this key displays, one at a time, messages that were received since the Console Display entered hold mode. When the last held message is displayed, the MSG ALERT light is turned off, but the Console Display remains in hold mode until the REL key is pressed.

MSGS ADV/MSGS BACK (Messages Advance/Messages Back): These keys are active only if the Console Display Spooling feature is attached and the SYSMSG data set is open. Pressing one of these keys puts the Console Display in hold mode and permits the operator to retrieve and display previously-received messages. Using the most recently displayed message as a reference point, the operator enters a 1- to 5-digit number. Messages start displaying from the selected message. If no number is entered, the next screenful (MSGS ADV) or the previous screenful (MSGS BACK) of messages appears on the display.

CHAR ADV/BKSP CHAR (Character Advance/Backspace): These keys are active when data entered from the keyboard is being displayed. These two keys may be used to edit keyed data. Pressing the BKSP CHAR key causes a non-destructive backspace (one space at a time) over previously-keyed characters. Pressing the CHAR ADV key causes non-destructive spacing over previously keyed characters. CHAR ADV is a typamatic key.

EOM (End of Message): This key is pressed during a SYS REQ message operation to terminate the keying, start execution of the command, and move the message up on the display as the most recent message. Pressing this key also terminates selection and begins execution of CODE functions, MSGS ADV/BACK, FORMS SET, and DISK FNS requests.

Lights

The following six lights in the left upper part of the operator panel are used to indicate the operation of the data link: REMOTE DETECT, DATASET READY, TRANSMIT, TRANSMIT COMPLETE, RECEIVE, and COMM READ.

REMOTE DETECT: This light, when on, means that the line connection has been made and that the remote (host) modem is operational (the carrier detect response has been received).

DATASET READY: This light is on when the 3777-2 communication driver is enabled, and the local (terminal) modem is operational.

TRANSMIT: This light is on when a response or data is being transmitted and turns off when the transmission stops.

TRANSMIT COMPLETE: Turns on when a transmission completes and remains on until the next transmission starts.

RECEIVE: This light is on when a response or data is being received and turns off after received data stops.

COMM (Communication) READ: Turns on when the terminal is ready to receive and a read command has been received. Turns off when received data stops or after a read time-out has elapsed.

CHECK: This light turns on and the Operator Attention Speaker sounds when an error occurs, or some I/O device has an error or needs attention. A code number appears in the NPR to identify the error or condition. This number corresponds to an explanation or procedure described in the 3777 Model 2 *Operating Procedures Guide.*

UPPER CASE: This light turns on when the keyboard is in uppercase shift (Upper Shift key has been pressed).

Numeric Position Readout (NPR): This is a three-digit numeric display that provides different indications depending on what other lights are on and the operation being performed. Code numbers providing operator guidance (prompts) and indicating system status and error conditions are displayed in the NPR. These code numbers, in conjunction with other operator panel lights, are described in the 3777 Model 2 *Operating Procedures Guide.*

MSG (Message) ALERT: Turns on when a system operator message is received that cannot be displayed because the Console Display is in hold mode. The Console Display enters hold mode when the HOLD, or MSGS BACK key is pressed. The MSG ALERT light does not turn off until all held messages have been displayed.

RETAIN DISK (Diskette): This light is turned on by the Set Retain mode diskette function. When on, this light means that the diskette containing system messages (SYSMSGS data set) is to be saved and not overwritten. When the diskette becomes full, a code number appears in the NPR and the Operator Attention Speaker sounds. The operator removes the diskette and replaces it with another one.

SPOOL DELAY: When the SPOOL DELAY light is on, it means that the 3777-2 is attempting to write messages onto the diskettes, but is prevented from writing. If the diskette has not been opened or if a diskette error occurs, this light is on (not flickering).

NO SPOOL: This light is turned on by a diskette function (DISK FNS) and means that system messages are displayed but are not being written on the diskette (the SYSMSGS data set is not open).

TEST: This light is on during communication facilities testing (line trace or wrap test).

DISPLAY HOLD: This light is turned on by pressing the HOLD key and means that no new system messages will be displayed while in hold mode. If any system messages are received while in hold mode, they are written on the diskette (if attached and SYSMSGS is open) and the MSG ALERT light turns on. Pressing the REL key turns off the DISPLAY HOLD light and removes the Console Display from hold mode. If the Console Display Spooling feature is not attached, the message is held in the buffer; therefore, the buffer is not free to receive new line data.

PROCEED: This light is active only during a SYS REQ message operation and means that the message data can be keyed in.

Chapter 4. 3776 Models 3 and 4/3777 Models 3 and 4 SNA Multiple Logical Unit Terminals

This chapter describes the basic functions and features, the special and specify features, and the purchase-only accessories for the 3776 Models 3 and 4/3777 Models 3 and 4 terminals. Refer to "Chapter 5 -I/O Attachments" for a description of the cable-attached input/output devices available with the 3776/3777 MLU terminals.

The following features are not available on the 3777-4:

- ID Card Reader
- Door Keylock
- Encrypt/Decrypt
- Dual Door Keylock
- High-Speed Digital Interface
- V.35 Interface/High Speed Local Attachment to 3705 II

For system generation and system programming considerations, refer to Chapter 8.

The 3776/3777 MLU terminals can operate as medium and high-speed remote job entry terminals when attached through a data link to a host processor site. The MLU terminals communicate with the system control program through the network control program and one of the following RJE subsystem components in the host processor:

Host System Control Program	*Single LU Operation*	*Multiple LU Operation*
DOS/VS POWER/VS	DOS Release 33	DOS Release 34
OS/VS1 RES	VS1 Release 5	VS1 Release 6
OS/VS2 MVS JES2	MVS SU 3	MVS SU 25
OS/VS2 MVS JES2/NJE	MVS SU 19, 22	MVS SU 23
OS/VS2 MVS JES3	MVS/SNA RJP SU 26	MVS/SNA RJP SU 26
NCP/VS	NCP Release 5.0	NCP Version 5
ACF/VTAM	ACF/VTAM Release 2.0	ACF/VTAM Release 2.0
ACF/VTAME	ACF/VTAME	ACF/VTAME
TCAM	TCAM Release 10 (leased) ACF/TCAM Version 2 (switched)	ACF/TCAM Version 2 Release 2

The RJE subsystem permits the remote terminal operator at the 3776/3777 MLU terminal to submit jobs that are sent over the SDLC communication facilities for execution at the host processor site. After execution of the job, the RJE subsystem sends the output of the job back to the 3776/3777 MLU terminal where it is directed to the appropriate output device(s). Depending on the job and the terminal configuration, the operator may select the input device or assign the output device from the following lists:

Input Devices	*Output Devices*
Card Reader	Card Punch
Diskette Device 1	Diskette Device 1
Diskette Device 2	Diskette Device 2
Magnetic Tape Unit	Magnetic Tape Unit
	Line Printer 1
	Line Printer 2 (3777-4)

Multiple Sessions

The 3776/3777 MLU terminals can operate with the RJE subsystem as a single-logical-unit terminal but with operational changes (at the terminal) from the operation of the 3776-1/3776-2/3777-1 terminal models. The 3776/3777 MLU terminals are designed to operate as multiple-logical-unit terminals using the SNA protocols for more than one logical unit in a physical unit.

Figure 4-1 shows single LU configuration with one session between the host processor application program (host LU) and the various input and output devices at the terminal. Figure 4-1 also shows a multiple LU configuration with six sessions (maximum) between the host processor application program and the various I/O devices at the terminal.

Concatenated Input Data

Another feature of the 3776/3777 MLU terminals (in addition to the multiple session capability) is the ability to concatenate input data from more than one device or multiple data sets/files from the same device or both into a single input stream. Figure 4-2 shows an example of concatenated data. A "Continue Destination Selection" (CDS) FM header is sent between data sets if the record lengths are not the same and one of the record lengths is greater than 80 (for exchange data, CDS will be sent whenever the lengths change regardless of the length), or if the properties of the data change. (For example, card data is sent compressed followed by diskette data sent not compressed.)

For "card medium" input data (when actual data is transmitted from either the tape or diskette) if the record length is less than or equal to, 80 bytes, the user can specify that CDS and record length (ERCL) definitions also be used-for the transmission of data. The TIP parameter or STATUS command parameter "Record Length-Extended Definition = YES" sets this mode of operation. This mode will then permit variations in record size of from 1 to 255 bytes to be so noted by the use of the appropriate FM Header Type 1 functions (CDS and ERCL).

If the extended definition option is not specified, card medium inbound data that is less than or equal to 80 bytes will be transmitted as 80 byte records.

The host RJE subsystem must be able to receive concatenated data separated by CDS FM headers.

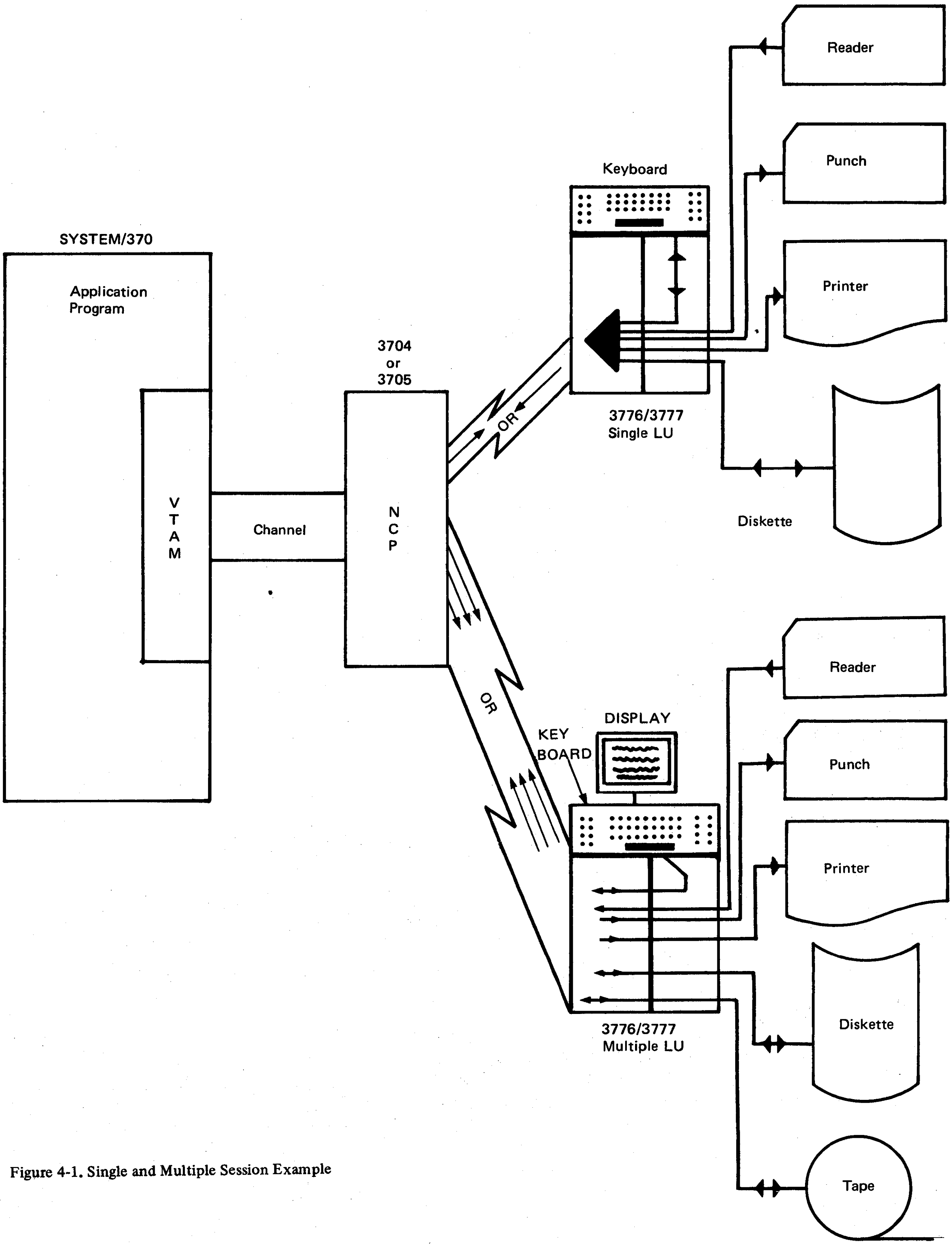

Figure 4-1. Single and Multiple Session Example

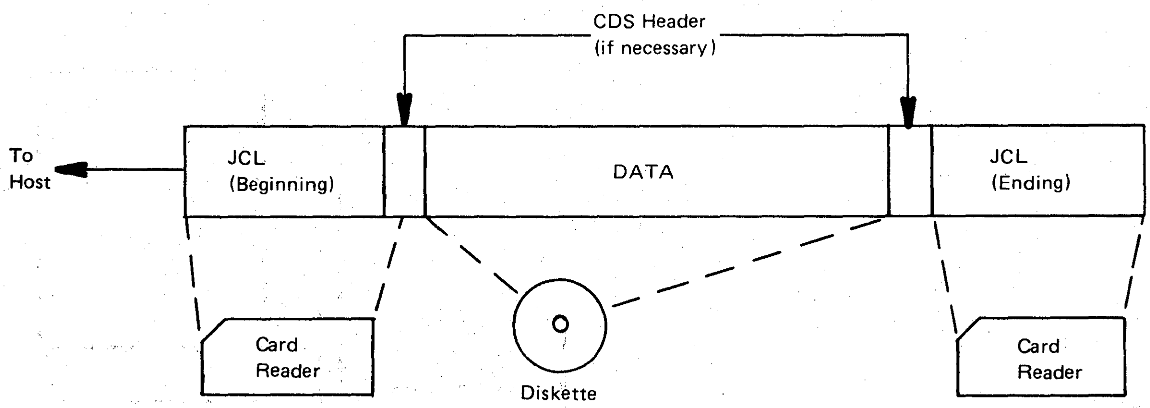

Figure 4-2. Concatenated Data Example

Functional Characteristics (3776 Models 3 and 4/3777 Models 3 and 4)

This section describes the standard features and functions of the 3776 Models 3 and 4/3777 Models 3 and 4. Refer to the "Features and Accessories" section in this chapter for a description of the special and specify features and accessories.

The keyboard/operator panel, console display, and the console-mounted line printer are standard features of the 3776-3/3776-4 terminals, and are mounted on the controller base.

For the 3777-3, the 3203 Printer Model 3 special feature is part of the minimum configuration; for the 3777-4, a 3262 Printer Model 2 or 12 is part of the minimum configuration (see Chapter 5 - "I/O Attachments").

3777 Model 4 Exception Summary

The following sections describe function and feature variations applicable to the 377-4.

Procedure Definition Prompts

The 3777-4 may have two 3262 printers attached. Therefore, the prompts on a 2-printer 3777-4, where a choice is allowed, includes the second printer as an option. The first 3262 printer (address X'60') is always designated PR. The second 3262 printer (address '61') is always designated P2.

Print Trains

Print train definitions are included on a 3777-4 IPL diskette for compatibility with other models of the 3777 terminal. However, the train definitions are not used with the 3262 printers and may be deleted. The TRAIN command can be used on the 3777-4 to define a print train image for model compatibility.

User Save/Restore

Save and restore procedures may be accomplished between the 3777-4 and the 3776-3, -4 or between the 3777-4 and the 3777-3 if the 3776-3, -4 is at EC level 320988 or above and the 3777-3 is at EC level 320987 or above. The user save/restore function may require more time because some reformatting must take place. The following chart illustrates reformatting conditions assuming that the previously mentioned EC level conditions are met.

Saved On	Restored On: 3777-4	Restored On: 3776-3,-4/ 3777-3
3777-4	Not Reformatted	Reformatted*
3776-3,-4/ 3777-3	Reformatted**	Not Reformatted

* Part of the reformatting alters any procedure that specifies P2 as the output device to specify PR.

** The carriage name in the TIP for P2, if the 3777-4 has two printers attached, is blank. No procedure is altered to specify P2 as the output device.

Trace

Trace data is always written to printer 1 (PR). Printer 2 (P2) cannot be used to print trace data.

Forms Length

The 3262 printer can have a 127 line (maximum) forms length. The 3777-4 accepts values greater than 127 lines (for compatibility) when carriage procedures are defined. However, an error message is displayed if an attempt is made to send a value greater than 127 to the 3262 printer.

Forms Alignment

The 3777-4 and the 3262 each have their own line counter. With both line counters set to channel 1 and the form on the 3262 aligned at the first print line at the start of a job, the two line counters will remain synchronized. However, if the operator stops the printing and performs a line or form feed operation using 3262 keys, the two line counters will lose synchronization. Refer to the *3777-4 Operator's Guide,* GA27-3309, for the procedure to re-synchronize the counters.

Power On

If power is not on the 3262 Printer(s) when the 3777-4 is powered on, one or both of the following messages are displayed:

PR-SET FORMS INCOMPLETE/PRINTER ERROR
P2-SET FORMS INCOMPLETE/PRINTER ERROR

The preceding messages also display if the 3262 power comes on and the system default carriage control specified in the TIP is incorrect.

Features

The 3777-4 does not offer the following features:

- ID Card Reader
- Encrypt/Decrypt
- Door Keylock
- Dual Door Keylock
- High-Speed Digital Interface
- V.35 Interface/High Speed Local Attachment to 3705 II

Controller

The terminal controller has the following major functions:

- Terminal Control - The controller receives, routes, and transmits commands, messages, and data between the terminal operator, or I/O devices and the host processor (remote job processing) or from I/O device to I/O device (local job processing).
- Terminal Storage - The controller contains buffers for communication line data streams and local I/O data flow; stores system messages for subsequent retrieval by the operator; stores job, utility, and test procedures for operator retrieval and execution; and stores status and error information.

Remote Job Processing

During remote job processing, the operator is concerned with operating the attached devices, submitting jobs, and controlling the output from the host application program.

Jobs can be submitted at any time as long as a session is available to transmit the data. (There may be up to 6 active sessions. The number of active sessions is controlled by the operator via the logon procedure and in conjunction with the host transmitting Activate Logical Unit commands for multiple sessions.) The terminal reads job input data from the 2502 Card Reader, the Diskette Storage Device(s), or the 3411 Magnetic Tape Unit.

As an option, the user can specify that the terminal continually test the card reader and attempt to read cards (see "Terminal Operator Commands"). When the card reader is operating under these conditions, it is said to be "hot" and the Card Reader HOT light is on.

When data is directed to a diskette from the line, the user can specify whether the data is to be written as received from the line or whether it is to be written in standard print or card format—that is, one print record or card image of up to 128 bytes, including the print control character (machine code or ANSI code). If more than 127 print characters are received, print positions after 127 are truncated from the record when written on the diskette.

Local Job Processing

In addition to submitting jobs for processing by a host application, the operator can also control the local transfer of data between the attached devices. Utilities may be defined and executed to control the assignment of devices and specify information required for proper device operation. In general, the operator can perform these functions concurrently with the transmission of data to and the receipt of data from the host application. The local functions are described under "Terminal Operator Commands." Local job processing may degrade remote job processing throughput.

For complex and repetitive copy operations, the necessary definitions and parameters can be pre-defined and stored in terminal storage for subsequent execution(s). For more information see "Terminal Operator Command - Utility Commands."

Data and Space Compression/Expansion

Throughput on the 3776/3777 MLU job streams may be increased if the user specifies Data and/or Space Compression/Expansion in the Bind command. If this option is specified, the terminal removes consecutive data or space characters from data transmitted from the card reader, diskette, or tape unit to the host. Removed characters are reinserted at the host. Data or space compression can also be specified for data received from the host and will cause reinsertion (expansion) into printed or punched data at the terminal. Expansion is automatic and does not have to be specified for a job whose data is compressed. For more information on compressed data strings, refer to "Functional Characteristics - Compression/Expansion" in Chapter 2. The 3776/3777 MLUs will, if transparency is specified and compression is allowed, send transparent data compressed (TRN,SCB,DATA).

Data Decompaction

Compaction is a means of compressing pairs of certain contiguous master characters into single 8-bit bytes for transmission, thereby increasing system throughput.

The 3776/3777 MLU terminals can receive compacted data, decompact it, print it, punch it, record it on tape, or record it on diskette in device image format (punch card or print line) if specified. Compacted data cannot be sent to a T-format diskette (line-image recording). A compaction table generated at the host processor must first be transmitted to the terminal using a Type 3 FM header. Compacted data received by the terminal, identified as a compacted data string in the string control byte (SCB), is then decompacted according to this table.

For more information on SCBs, refer to "Functional Characteristics - Data Decompaction" in Chapter 2. Procedures for generating the compaction table and for transmitting the table and compacted data to the terminal are contained in the programmer's guide for the particular host RJE subsystem installed.

Problem Determination

The controller has built-in tests that run each time the power is turned on or the SYSTEM RESET switch is operated. These tests, when successfully completed, have checked the major portion of the controller and verified that the electronic circuits are operating properly.

The tests require several seconds to run and leave the terminal in a state with the code 900 in the NPR and the PROCEED light on. This informs the operator that the Terminal Initialization Procedure has been done. Any other NPR numbers being on after the tests have run signals either that a failure occurred in the controller's electronic components, or that the Keylock is turned off.

Problem determination tests are selectable from the keyboard and reside in the terminal. The operator can use these tests to isolate problems to the terminal or to the communication facilities. Communication-facility tests also include online tests provided by the host access method. A user-selectable online trace function prints all information frame (I-Frame) data sent and received including sense data.

Error Logging

Information about errors encountered during normal operation is recorded in an error log that can be printed out by the List Log Utility. When errors that cannot be corrected by operator action occur, or when intermittent internal machine errors that impede operation occur, the operator should call for a printout of the error log. Error log data is stored in terminal storage every 10 minutes or at remote power off time. Log counters are cleared when the error log is printed. This information should be retained and given to the service representative, who will use it to isolate the cause of the problem.

Operator Attention Speaker

This device produces an audible tone to signal the operator that some input or output device requires attention. There will also be an audible tone if the MSG ATTN switch is on and a console message is received. Upon hearing the tone the operator should use the Operator Action procedure to determine the cause (see "Operator Action Key" under "Operating Controls" in this chapter).

Keyboard/Console Display

The 1024-character Console Display screen displays 16 lines of 64 characters each (see Figure 4-3). The 3776/3777 MLU uses the bottom three lines for operator keying, displaying of system information, and prompting for information required for the execution of commands and error recovery. The rest of the screen area is usually used to display console messages between the terminal and the host application or the system services control point (SSCP).

In addition, the top 13 lines contain information (spool messages, status messages, and error messages) regarding terminal-initiated operations such as host input. In some cases, the top 13 lines are used to display operator-requested information, for example on the DISPLAY command. Lower case alphabetic characters (a-z) are converted to upper case characters before displaying. No overstrikes are permitted. When the cursor is beneath a character, any new data keystroke causes the new character to replace the old.

Characters that may be displayed are listed in Appendix B. If a character is keyed or received from the host processor that is not on this list, a blank is displayed.

Messages

Each message is displayed as it is received and is also written into terminal storage for subsequent operator retrieval. Each message is indented one position with the most recent message containing > in the first position. A blank line follows the most recent message to aid readability.

Each message that is not from the host application program is timestamped with the day of the month, the hour, and the minute (ddhhmm). The timestamp occupies the positions 3-8 and is followed by a blank.

If the message is a console message to the host (SSCP or APPL REQ) or from the host (SSCP only), the session number on which the message was sent appears in positions 9-11. The session number appears as S=n where n is a number from 1 to 60. The actual message begins in position 13. If the message is to the host, position 12 is a > and position 13 is a blank and the message actually starts in position 14. If a message exceeds 51 characters in length it is continued on the next line. The message is divided at the last space character before the 51st character (or between the 51st and 52nd positions if there is no space) and indented 13 positions. If the second line is more than 51 characters, it is continued on the following line. If the message is a console message from the host application program, the message occupies positions 2-64 on the line. If the message exceeds 62 characters in length, it is continue on the next line. The message is divided at the last space character before the 62nd character.

The display fills from top to bottom. When the screen is full, the next message is displayed over the oldest. The most recent message 'wraps around' with each successive message moving down, until the display is again full. The next message is displayed on the top line(s). For information on copying spooled messages from terminal storage, see the "List Spooled Messages" utility command under "Terminal Operator Commands" in this chapter.

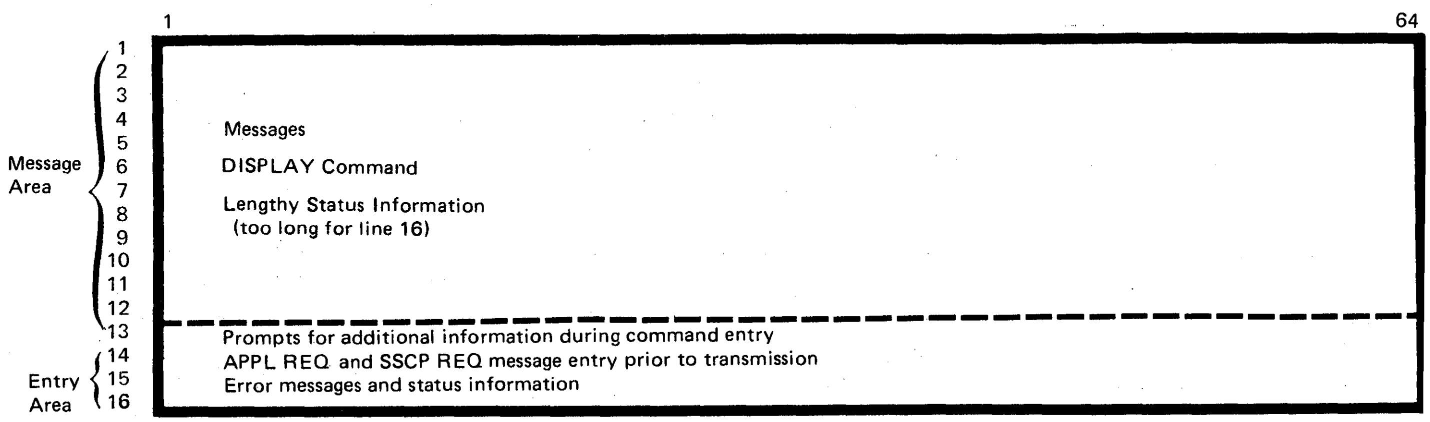

Figure 4-3 Console Display Areas and Uses

Message Area of Display Screen

The message area of the screen (top 13 lines) which is used to display messages to and from the host application and the SSCP, may be controlled by the operator with several function keys. This area is also used to display information messages to the operator from the terminal.

Using HOLD Key

The HOLD key places the display in hold mode, that is, if another message is received while the display is in hold mode, it is not displayed and the MSG ALERT light is turned on. Messages received while the screen is in hold mode are written in terminal storage. The DISPLAY HOLD light is turned on whenever the display is in hold mode.

Using PAGE FWD/PAGE BACK Keys

The PAGE BACK key also places the console display in hold mode (turning on the DISPLAY HOLD light). The PAGE FWD/PAGE BACK keys are used to display messages not on the display. PAGE BACK is used to display the screenful of messages previous to those on the display. PAGE FWD is used to display the screenful of messages later than those on the display. The entire message area (13 lines) is used for each function.

PAGE FWD may be used to display messages received when the display was in hold mode. Hold mode is automatically released (and the MSG ALERT and DISPLAY HOLD lights turned off) when the most recent message is displayed.

The REL key also releases hold mode and turns off the DISPLAY HOLD and MSG ALERT (if on) lights. The most recent messages are displayed.

The ERASE DISP key may be used to erase the message area of the screen (top 13 lines).

Using FIND Command

The operator uses this command to display a screenful (page) of messages from terminal storage. To display the desired message, the operator specifies the "message received" time. For more information, see "Terminal Operator Commands - FIND Message" later in this chapter.

Other Uses of the Message Area

The message area of the display is also used by the DISPLAY, STATUS, and by other commands to display definitions, commands, status, and statistical information about the terminal operation (see "Terminal Operator Commands" later in this chapter).

ENTRY Area of Display Screen

The bottom three lines of the screen are used for operator keying, for prompting information required for the execution of commands and error recovery, and for error messages. The top two lines of the entry area are used for prompting and the entry of data. Keyboard entry is always monocase.

The cursor is moved to the first field of the entry area when the operator presses the APL REQ, SSCP REQ, or TERM REQ keys. The bottom line displays either the name of the command currently being defined and associated information or error messages associated with the procedure specification. The console may be used concurrently with other jobs that may be active.

Using APPL REQ Key

The data entered by the operator after pressing the APPL REQ key is sent to the host application (if a session is available) after the operator presses the EOM key. The operator is also prompted to specify a session number or "any" session. The data entered is then moved to the message area of the screen and is spooled to terminal storage along with other messages to and from the host processor. Message length is limited to 120 characters.

Note: The New Line (   ) key performs the same function as the EOM key.

Using SSCP REQ Key

The data entered by the operator, after pressing the SSCP REQ key and specifying the desired session, is transmitted to the SSCP as a logon or logoff message after the operator presses the EOM key. The data entered is then moved to the message area.

After pressing the SSCP REQ key (and possibly entering data in the entry area), the operator may enter information from the ID reader. If the ID reader is used, the data read by the reader is not displayed; it is appended to the end of any data entered in the entry area and transmitted to the SSCP. Total message length is limited to 120 characters.

Note: SSCP will return a message "Sequence error" if a Logoff command is entered for a session that does not exist.

Using TERM REQ Key

After pressing the TERM REQ key, the operator is prompted to enter a command name (see "Terminal Operator Commands"). Then the operator presses the EOM key. Depending on the command, the operator may have to enter additional information prior to execution of the command. The terminal automatically prompts the operator for the required data.

If there is more than one field of information to be entered, the operator uses the TAB key to move from one field to the next. As the operator uses the TAB key, the field just completed is checked for validity by the terminal. When the operator has entered all required information for the displayed prompts, the EOM key is pressed to store or execute the specified command. If all the prompts for this command have not been displayed, pressing the EOM key displays the next series of prompts.

Using CNCL KB Key

The operator may use the CNCL KB key to cancel the APPL REQ or SSCP REQ operation if the EOM key has not been pressed. CNCL KB may also be used to cancel a TERM REQ if all required data to begin command execution has not been entered (prior to the last EOM). The CNCL KB key is also used to cancel the displaying of operator action messages.

If the APPL REQ, SSCP REQ, TERM REQ, or OPR ACTN key is pressed while the entry area is in use for a function, this action has the same effect as if the CNCL KB key were pressed followed by the prompts associated with the particular function key.

Using the OPR ACTN Key

The operator may use this key to determine what should be done when the OPERATOR ACTION light is on. After the operator presses this key, a message is displayed in the entry area to help the operator to correct the situation.

Line Printer

The 3776-3 and 3776-4 terminals use the same standard console-mounted line printers that are used by the 3776-1 and 3776-2 terminals. These console-mounted line printers use print belts to print data.

The 3777-3 terminal uses the same special feature printer, the 3203 Model 3, that is used by the 3777-1 and 3777-2 terminals. On the 3203-3, print trains are used to print data. For more information on the 3203-3 printer, refer to Chapter 5. The 3777-4 terminal uses the 3262 Printer Models 2 and 12. The 3262 uses print bands to print data. For more information on the 3262-2 or 12 printer, refer to Chapter 5 and Appendix B.

The following information in this section applies to all printers except as noted.

The line printer can be specified as the output device for the following jobs:

Input	*to*	*Output*
Line	..	Printer (1 and 2)*
Card Reader	..	Printer (1 and 2)*
Diskette 1	..	Printer (1 and 2)*
Diskette 2	..	Printer (1 and 2)*
Tape Unit	..	Printer (1 and 2)*

*3777-4

Before starting a job using printer output, the user can specify a Carriage Control definition to be used (see "Vertical Forms Control") or allow current forms control to be used (see "Terminal Operator Commands" following in this chapter).

Printer carriage control characters can be received within data from the CPU to cause formatting of the data as it is printed. The characters that can be recognized by the printer, and the operations they cause, are described in Chapter 7.

Vertical Format Control

Vertical format control allows the operator to specify the vertical format(s) of forms by print areas and skip areas. The Carriage Control definition command is used to enter the format, which is stored in terminal storage (see "Terminal Operator Commands - Definition Commands for Stored Procedures").

The operator invokes a specific format by executing any of the following commands that use the printer as an output device, with the carriage control format named in the procedure: HOSTOUT, OUTPUT, PRINT, UTILITY, or COPY command.

Once the format is applied to the printer, automatic operation causes the forms to advance when specified. Refer to "Printer Control Characters" following in this section for a list of the characters and codes used by the 3776/3777 MLU terminals. Vertical format control information may also be sent with data from the host application program.

Horizontal Format Control

Since the 3776/3777 MLU does not support SHF (Set Horizontal Format) or HT (Horizontal Tab), horizontal formatting must be accomplish via blank compression (or a series of blanks) transmitted from the host.

Printer Control Characters

Each record of print medium data written to a basic exchange diskette data set, or the tape unit may contain a control character.

This control character is recognized and processed when the data is subsequently being written to the printer from either the diskette or the tape unit.

For format-F records (fixed length) this character is the first byte of the logical record.

For format-V records (variable length-tape only), it will be the fifth byte of the logical record, immediately following the record descriptor word.

Two options are available—Machines or ANSI code:

Machine Code

Print and Then Act-Code in Hexadecimal	*Action*	*Act Immediately (No Printing)-Code in Hexadecimal*
01	Print only (no space)	
09	Space 1 line	0B
11	Space 2 lines	13
19	Space 3 lines	1B
89	Skip to channel 1	8B
91	Skip to channel 2	93
99	Skip to channel 3	9B
A1	Skip to channel 4	A3
A9	Skip to channel 5	AB
B1	Skip to channel 6	B3
B9	Skip to channel 7	BB
C1	Skip to channel 8	C3
C9	Skip to channel 9	CB
D1	Skip tp channel 10	D3
D9	Skip to channel 11	DB
E1	Skip to channel 12	E3
0F*	Set Vertical Format	
1F*	Set Vertical Format Defaults	
2F*	Set six lines per inch	
3F*	Set eight lines per inch	

* These are special codes used by 3776/3777 MLU terminals for spooling data.

ANSI Code

Instead of machine code, the operator may specify control characters defined by the American National Standards Institute (ANSI). They are as follows:

Code	*Action Before Printing a Line*
b	Space one line (blank code)
0	Space two lines
-	Space three lines
+	Suppress space
1	Skip to channel 1
2	Skip to channel 2
3	Skip to channel 3
4	Skip to channel 4
5	Skip to channel 5
6	Skip to channel 6
7	Skip to channel 7
8	Skip to channel 8
9	Skip to channel 9
A	Skip to channel 10
B	Skip to channel 11
C	Skip to channel 12
V*	Set Vertical Format
W*	Set Vertical Format Defaults
X*	Set six lines per inch
Y*	Set eight lines per inch

* These are special codes used by 3770 MLU for spooling data

Forms Enclosure (3776 Only)

A combination forms stand and stacker enclosure on the 3776 Models 3 and 4 facilitates feeding and stacking of continuous, fan-fold forms. The acoustical stacker enclosure permits quieter operation of the console-mounted line printer. If desired, an optional front feed feature (see "Features and Accessories") is available.

International Print Support (3777 only)

International Print Support for the 3777 Model 3 includes train definitions for the 107- and 127-character Katakana print train arrangements. The 3777-3 also has train definitions for print train arrangements equivalent to the 48-, 64-, and 94-character sets available for EBCDIC print belts used on the 3776 console line printer. A corresponding 1416 Interchangeable Train Cartridge for the 3203 Model 3 Printer must also be ordered for each arrangement you want to print. When a substitute character is ordered to replace a character in a standard train used on a 3203-3 attached to the 3777-1, the substitute character assumes the card and bit codes of the character it replaces. Refer to "IBM 3203 Printer Model 3" in Chapter 5 for more information.

Terminal Operator Commands

The terminal operator uses the commands described in this section to control the online and local operation of the terminal (detailed instructions for entering these commands is provided in the "Operating Procedures Guide"). Related Commands are grouped together where possible; some commands could be listed in more than one group. The sequence of commands within groups follows the anticipated execution sequence at a terminal installation.

- System Job-Processing Commands

  Enter/Verify Cryptographic Key (KEY)
  Enable Communications (ENABLE)
  Initiate Host Input Data (INPUT)
  Printer Set Up (PRINT)
  Assign a Host Output Destination (OUTPUT)
  Cancel Device Operation (CANCEL)
  Request Shutdown (RSHUTD)

- Definition Commands for Stored Procedures

  Define the Terminal Initialization Procedure (TIP)
  Define a System Services Control Point Message (SSCP)
  Define a Host Input Procedure (HOSTIN)
  Define a Host Output Relationship (HOSTOUT)
  Define Printer Carriage Control (CARRIAGE)
  Define a Print Train Image (TRAIN) (3777-3 Only)
  Define a Copy Procedure (UTILITY)

- Procedure-Related Commands

  Execute a Stored Procedure (EXECUTE)
  Display Definitions and Status (DISPLAY)
  Dummy Devices for Procedure Definition (DUMMY DEV)
  Save User Procedures (USERSAVE)
  Restore User Procedure (USERREST)

- Terminal Utility Commands

  Copy Data (COPY)
  Create Diskette (CDISK)
  Create Diskette Data Set (CDATASET)
  Change Data Set Label (CDLABEL)

Delete Diskette Data Set (DELETE)
List Diskette Labels (LISTDISK)
List Spooled Messages (LISTSPOL)
List Error Log (LISTLOG)
Save/Restore Diskette or Tape (SAVEREST)
Find a Message (FIND)
Write/Print Tape Volume Label (TLABEL)
Control Tape (TAPE)

- Miscellaneous Commands

  Set/Change Security Code (SECURITY)
  Set Date and Time (SET)
  Terminal Status (STATUS)
  Execute Tests (TESTS)
  Power off (POWEROFF)
  Line Trace (TRACE)
  Line Statistics (LINE)
  Tape Statistics (TSTAT)

The operator initiates these commands by:

- Pressing the TERM REQ key
- Keying the command name as prompted
- Pressing the EOM key
- Keying (specifying) any additional information when prompted to do so
- Pressing the EOM key.

Additional information entered may be either optional or required depending on the particular command. The amount of additional keying may vary from none to extensive data set and device control specifications. The EOM key causes the displaying of additional prompts, if required, or terminates the operation if there are no more prompts.

In the following general descriptions of terminal operator commands, "specify" and "specifying" refer to the action of keying in responses to the displayed prompts after the command name has been entered. The keyed responses are either executed or stored when the EOM key is pressed for the last series of prompts.

When a command directs output to a printer on a 3777-4 with two 3262 printers attached, a prompt for printer selection is displayed.

System Job-Processing Commands

The following operator commands have an immediate effect on the terminal and data communication system (host processor-data link-terminal) when executed.

Enable Communications (ENABLE)

The ENABLE command initiates communication with the host processor (no additional prompting is required if the line is currently disabled). The operator uses ENABLE:

- If enable host communications was not part of the Terminal Initialization Procedure (TIP)
- If a previously enabled line was disabled
- Following a communication line problem

- Following a change to switched network backup
- Following a change from normal to half speed or vice versa

Enter Cryptographic Key (KEY)

The KEY command is used to enter the terminal's master encrypting key. See "Cryptographic (Encrypt/Decrypt) Feature" in this chapter. The master key protects the data encrypting keys in the sessions and must be consistent with the key specified at the host processor.

Before using the KEY command, the Cryptographic Key Lock switch on the auxiliary operator's panel must be set to ENABLE, and the communication line must not be enabled.

KEY Specify Data

The operator can enter the 16-digit cryptographic key in groups of 4 hexadecimal digits. Asterisk characters are displayed instead of the hexadecimal digits as the master key is entered.

Initiate Host Input Data (INPUT)

INPUT is used to prepare the terminal to transmit data to the host application program. The operator may specify that data from up to six devices or data sets be concatenated in one transmission. The operator may also specify the starting record number for diskette or tape input.

INPUT Specify Data

The operator specifies the following information for the INPUT command:

- A session number or that the terminal should assign a session
Session must be Bound to allow specified medium (see "Bind Session" in Chapter 8)
- Medium type and medium subaddress for data to be sent (see "FM Header Type 1" in Chapter 8)
- The input device (card reader, diskette or tape unit)
- Transparent or nontransparent data transmission (data compression is controlled by a Bind command parameter)

Card Reader Specifications

For input data from the card reader, the operator specifies:

- Whether a card reader-to-line operation will automatically start if the reader is ready or made ready (card reader is "hot")
- Additional input (card reader, diskette, or tape unit) or no additional input (the operator cannot specify additional input if the card reader is specified "hot")

Diskette Specifications

For input data from one of the diskette devices, the operator specifies:

- A data set name or all active data sets to be transmitted
- A specific volume ID, if desired
- Delete or retain data set after transmission
- A starting diskette record number or use the first record to begin diskette data transmission
- Additional input (from card reader, diskette, or tape unit) or no additional input

Tape Unit Specifications

For input data from the tape unit, the operator specifies:

- A specific volume ID, if desired
- A data set name (labeled tape), or a file number (unlabeled tape), or start reading tape from current position (unlabeled tape)
- Disposition of the tape reel after data transmission: leave, rewind, or rewind and unload

Tape Data Set Name (Labeled Tape) Specifications

If the tape input data is from a labeled tape, the operator specifies:

- A starting tape record number or use record number 1 to begin tape data transmission
- Additional input (from card reader, a diskette, or tape unit) or no additional input

For labeled tape, the terminal reads the record size, block size, and record/block format information from the tape label.

Tape File Number (Unlabeled Tape) Specifications

If the tape input data is from an unlabeled tape, the operator specifies:

- Fixed or variable-length tape records
- Record size and block size
- A starting tape record number or use record number 1 to begin tape data transmission
- Additional input (from card reader, diskette, or tape unit) or no additional input

Additional Input Specified

Only valid and physically-attached devices are displayed and can be specified in the first command prompt or when an additional input device is specified in subsequent prompts. In either case, the appropriate device prompt is displayed or repeated for additional input specification by the operator. After input No. 6 is defined, the "Additional Input" prompt will no longer appear because 6 is the maximum number of allowable inputs. Additional input cannot be specified following a "hot" card reader specification.

No Additional Input - End of Command Specification

When the host input data specification is complete, the operator specifies "no additional input" (EOM), and the input operation begins. The input job may be aborted immediately if one of the following occurs:

1. The specified session is not "bound"
2. No session is available
3. The medium is not supported on the specified session

If the input job is valid for a specified or an internally assigned session, the following will occur:

1. If the session is currently active transmitting or receiving, a message "HOSTIN QUEUED TO SESSION" is posted and the job will start when the session becomes free

   -or
2. The job begins executing immediately with appropriate messages ("INPUT START", "INPUT ABORTED...", "INPUT ENDED...") displayed as the job progresses

Assign a Host Output Destination (OUTPUT)

The OUTPUT command is used by the operator to assign a particular physical output device or data set to a particular SNA medium type and medium subaddress combination (byte 2 in the FM header). "Medium type" and "medium subaddress" is also referred to as medium/subaddress. Actual data flow, however, does not begin until the host sends an FM Header requesting this medium subaddress.

If the medium/subaddress is not already assigned to a device or data set, the specified relationship takes effect immediately. If the particular medium/subaddress already has a device or data set assignment, the current relationship may be displayed by the operator using the DISPLAY command.

OUTPUT Specify Data

The operator specifies the following information for the OUTPUT command:

- Medium type and medium subaddress
- Output device (a diskette, tape unit, card punch, or printer)
- Whether the specification should remain active after use

Printer Device Specifications
If the output device is the printer, the operator specifies:

- The user name (if any) of the carriage control procedure (defined by the CARRIAGE command) to be applied to the printer
- The user name of the 3777 print train image procedure (defined by the TRAIN command or one of the 15 standard train images, for example an HN, etc.) to be applied to the printer (3777-3/3203 only)

The name of a CARRIAGE procedure need not be specified if a Set Vertical Format control sequence is received from the host processor. If the printer already has a carriage control and print train assignment (3777-3), the terminal displays the user names of the current procedures.

Tape Device Specifications
If the output device is the tape unit, the operator specifies:

- Data set name, file number, or (for an unlabeled tape) write starting at the current tape position
- Fixed or variable-length records (maximum length=255)
- Record size
- Block size
- Disposition of the tape reel after the data transmission: leave, rewind, or rewind unload.
- High or low density recording (for first use of unlabeled tape)
- Printer control characters in hexadecimal machine code or in characters defined by ANSI (for print medium) or no control characters

Tape Data Set Name Specifications
If the output tape is labeled, the operator specifies:

- A validation of the volume identification to make sure the correct volume is mounted
- Expiration date

Diskette Device Specifications
If the output device is a diskette, the operator specifies:

- A validation of the volume identification to make sure the correct volume is mounted
- Data set name or that the terminal should assign the name
- Old or new diskette data set
- Release or retain unused diskette space after operation
- That data be written in device image format (card or print medium-128 bytes/record maximum including carriage control information) or as received from the line

(Device image format is written in a basic exchange data set; line image format is written in a T type data set.) These data sets may not co-exist on the same volume.

Print Medium Specifications
If the output data is in the print medium format and the output device is a basic exchange diskette, the operator specifies:

- The printer control characters are in machine code or ANSI code or there should be no control characters

Old Diskette Dataset Specifications

If the output data is written to an existing data set, the operator specifies:

- That data should overlay existing data or be written after existing data

New Diskette Data Set Specifications

If the operator specifies a new data set for output, the operator can also specify the header (label) information to be used to create the data set:

- Record size (varies depending on card image, print image, or line image format)
- Data set space allocation (may be allocated by terminal as needed rather than by operator)
- Multivolume indicator setting (only one volume, continued data set, or last volume) or that the terminal should assign the correct value
- Expiration date

Punch Output

No specifications required, however, if:

- Interpret desired - use punch print switch
- Read back check desired - use PUNCH command

Note: The user may accept the default value for RECORD SIZE if desired when using diskette or tape as the output device. If so, the contents of the ERCL field of the FM Header will be used if the medium is card or exchange. For card medium, an ERCL=00 results in a record length of 80. For tape, the minimum record length is 18 bytes so receipt of an ERCL < 18 will result in rejection of the FM Header (X'1008'). For print medium, the record length is set to 132 or 133 (127 or 128 for diskette) depending on whether or not print control characters are to be included in the output data stream.

Printer Set Up (PRINT)

The PRINT command is used to specify the carriage control and train image (3777-3 only) to be used by the printer.

PRINT Specify Data

The operator specifies the following information for a PRINT command:

- The user name (if any) of the carriage control procedure (previously defined by the CARRIAGE command)
- The user name of the 3777 print train image procedure (previously defined by the TRAIN command, or one of the 15 standard trains, for example an HN, etc.)
- Set line counter to 1

The operator need not specify any name for a carriage control procedure if the print data stream received from the host processor includes a Set Vertical Format control sequence.

Specify Punch Check Option (PUNCHECK)

PUNCHECK is used to specify whether or not the 3521 Card Punch performs the read back check as cards are punched. The 3521 must have the Punch Check special feature installed.

Cancel Device Operation (CANCEL)

The operator uses this command to stop the operation currently associated with the active device specified or the device associated with a medium subaddress. All resources associated with the operation are then free to be used for other operations.

Device Specified

If a device is canceled for a host input operation, a Cancel command and/or an Abort Destination Selection FM header will be sent to the host if necessary.

If a device is canceled for a host output operation, the "Component Not Available" negative response (Hex '0825') will be sent to the host if necessary.

Medium/Subaddress Specified

If the operator specifies a particular output medium/subaddress, the current host output destination, if any, associated with that medium/subaddress is canceled. And the "Component Not Available" negative response (Hex '0825') will be sent if necessary. The destination device or data set assigned to that medium/subaddress is free to be used with other operations.

To reassign a destination device or data set to the "canceled" medium/subaddress, the user must enter an OUTPUT command or execute a HOSTOUT procedure.

If the operator specifies a particular input medium/subaddress, a Cancel command and/or an Abort Destination Selection FM header is sent to the host, if necessary. The current device or data set assigned to that medium/subaddress and all other devices or data sets associated with the host input operation are free to be used with other operations.

Request Shutdown (RSHUTD)

The terminal operator uses the RSHUTD command to send a request to the host processor to stop traffic on one or more sessions and to close the session(s). Host reaction to the receipt of RSHUTD is application dependent; the user should refer to the appropriate application program user's guide if this information is required.

RSHUTD Specify Data

The operator specifies the session(s) (1-6) requested to be closed (or that all sessions be closed) for the RSHUTD command.

Definition Commands for Stored Procedures

With these commands, the user can:

- Assign a user name to the procedure
- Specify (or define) a new procedure with extensive data set and device control characteristics
- Change an existing procedure
- Delete an existing procedure from terminal storage
- Store the new or changed procedure in terminal storage
- Retrieve and invoke the user-named procedure by entering the EXECUTE command followed by the name of the procedure, when prompted or by having the name of a procedure imbedded within another procedure. For example, EXECUTE *-hostoutname,* where a Printer Carriage Control procedure name is imbedded in the HOSTOUT definition.

Types of Definition Commands

Two types of definition commands are used:

- Function or procedure specifications - The user may completely define or specify all of the options available or information necessary for successful execution at a later time. The user may specify only part of the information. In this case, when the operator invokes the procedure for execution, prompts are displayed so that any missing information can be specified before actual execution. Examples of this type are HOSTIN and UTILITY.
- Device control specifications - The user may define the characteristics of a device and how it is to be used for subsequent operations. Examples of this type are CARRIAGE and TRAIN.

Meanings of Words

In the following general discussion, the word "user" describes the person who plans, develops, and may actually do the keying to specify the following definition - type procedures. The "operator" refers to the person responsible for day-to-day terminal operation. As explained previously, "specify and specifying" refer to the action of keying in responses to displayed prompts (optional or required). For definition commands, the combination of keyed responses, called the "procedure" is stored in terminal storage as the last action of command entry. The end result may involve an "assignment", a "relationship", or a "definition", but is called a "procedure" when stored in terminal storage. The operator applies or invokes the stored procedure with any command that requires one of the previously defined procedures.

Specifications Common to Definition Commands

The following operator prompts and options are common to all definition-type commands except the Terminal Initialization Procedure.

Stored Procedure Name

On the first command prompt (after pressing TERM REQ and entering the command name) the user enters the user name assigned to the procedure and specifies whether it is to be added, changed, or deleted.

Add a New Procedure

If the user chooses to add a new procedure to terminal storage, the terminal displays the successive prompts for specifying (defining) the procedure. The user need not specify all the information necessary for successful execution of the procedure, but can store a partially-defined procedure. When the terminal operator retrieves the procedure, with the EXECUTE command, prompts are displayed to request the missing information before actual execution.

Change an Existing Procedure or Definition

If the user chooses to change a procedure, (except for TRAIN) the terminal retrieves and displays the existing procedure prompts. The user can alter the previously defined information. After the desired changes are made (the last prompt is displayed) the user presses the EOM key to terminate the procedure and store the altered definition.

Delete an Existing Procedure

If the user chooses to delete a procedure from terminal storage on the first prompt, an additional "assurance" prompt is displayed with the name of the procedure to be deleted. The user has an opportunity to change the "delete" decision or to tell the terminal to proceed with the deletion. If the delete decision is changed, the named procedure is returned to terminal storage.

Define the Terminal Initialization Procedure (TIP)

With the TIP command, the user can specify and store a terminal initializing procedure to be executed, including specific configuration characteristics to be in effect at power-on and system reset time. Unlike other definition - type commands, TIP is not invoked by the operator with the EXECUTE command. TIP is automatically retrieved from terminal storage and invoked by the terminal at power-on and system reset time. Any SSCP procedure(s) defined as part of TIP are executed by the terminal after the host has issued an ACTIVATE PHYSICAL (ACTPU) followed by an ACTIVATE LOGICAL (ACTLU) for each session desired if the operator has specified that communications be enabled for the prompt after power on. After entering "TIP", the user can specify the following.

Communication Specification

The operator specifies the following communication related options for the TIP command:

- Nonswitched (leased) or switched communication line
- Request to Send Permanent or Controlled
- NRZI (Not Return to Zero-Inverted) data encoding
- Attended or Unattended mode of operation

Switched Line Specifications

For a switched line, the operator can specify:

- CDSTL (Connect Data Set to Line) or DTR (Data Terminal Ready)
- Answertone

Nonswitched (Leased) Line Specifications

For a nonswitched line, the operator can specify:

- Full-Duplex Mode (two-way simultaneous data mode) or Half-Duplex Mode (two-way alternate data mode)
- Pass Limit—the maximum number of RUs that can be sent inbound for each respond opportunity

The full-duplex data communication capability of the terminal requires that the communication facilities be full duplex and that the 3705 Communications Controller has the compatible full-duplex communication feature. At the host processor, the programming systems must also have the full duplex communication capability.

Communications Adapter Specifications
The operator specifies the following information for the communications adapter:

- Communications adapter is enabled or not enabled (default) at power on time
- ID (Including SDLC terminal address)
- SDLC EXTENDED XID (Exchange Identification)
- Timer Interval (1-99)
- Number of RUs per chain

Device Control Specifications

The operator can specify the following information for controlling devices:

- The user name (if any) of the procedure for the default carriage control to be active (defined by the CARRIAGE command). For a 3777-4 with two printers, a carriage control specification can be made separately for each printer.
- The user name of the procedure for the default printer train image to be loaded into the 3777-3 (defined by the TRAIN command or one of the 15 standard train images). If no name is specified, an AN train is assumed.
- Whether or not (default) the 2502 Card Reader-to-line job is automatically started if the reader is ready or made ready ("hot" card reader).
- Information for the actual data transmission.
- Multiple signal interrupt.
- Full SNA spool monitor.

Procedure Options

SSCP Procedures to be Executed: The user may specify an SSCP PROC name (defined by the SSCP command) to be executed for any of the 1 through 6 sessions whenever that session is activated by the host (ACTLU received by terminal). This provides an auto logon capability.

HOSTOUT Definitions to be in Effect: The user can specify the user names of up to 5 procedures for host output definitions (defined by the HOSTOUT command) to be in effect at power on or system reset.

After the prompt has been answered, the user presses the EOM key to end the command and store the TIP definition in terminal storage.

Define an SSCP Message (SSCP)

The SSCP command is used to specify and store one message to be sent to the system services control point in the host processor. (Logon and logoff messages are the types of messages sent to the SSCP from the terminal.) The stored SSCP message (or messages) can be sent automatically as part of the TIP definition. For example, logon SSCP messages could be sent automatically when a session is activated by the host (ACTLU).

When ready to close down, the operator can use the EXECUTE command to send a stored SSCP logoff message to the host processor. To enter and immediately send a message to the SSCP in the host, the operator presses the

SSCP REQ key (instead of TERM REQ). Refer to "SSCP REQ Key" under "Operator Controls" following in this chapter.

Session numbers assigned by the TIP definition command override the session number assigned by the SSCP definition command.

SSCP Specify Data

The operator can specify the following information for SSCP messages in the SSCP command:

- The user name assigned to this SSCP message procedure
- The message is to be added, changed, or deleted
- On which session numbers (1-6 or all active sessions) the message is to be sent (an active session is one that has received an ACTLU command)
- The text of the actual message (maximum length=122 characters)

Define a Host Input Procedure (HOSTIN)

The HOSTIN command is used to specify and store a procedure for a host input operation that is to be frequently retrieved and executed. HOSTIN may include several input (to a maximum of 6) device and data source specifications and may involve concatenation of input data from more than one device or data set. For a host input operation to be executed immediately, refer to the INPUT command under "System Job-Processing Commands."

HOSTIN Specify Data

The operator specifies the following information for the HOSTIN command:

- The user name assigned to this HOSTIN procedure
- Whether the procedure is to be added, changed, or deleted

Add a New HOSTIN Procedure

If the user wants to add a new HOSTIN procedure to terminal storage, the remaining prompts and their respective options are the same as those specified for the INPUT command (see "Initiate Host Input Data" under "System Job-Processing Commands").

Define a Host Output Relationship (HOSTOUT)

The HOSTOUT command is used to specify and store the assignment of a particular physical output device or data set to a particular medium type/medium subaddress (medium/subaddress) combination (byte 2 in the type 1 FM header). The names of up to 5 host output definitions to be made effective at power on or system reset time, can be specified in the Terminal Initialization Procedure. For a host output assignment to take effect immediately, refer to the OUTPUT command under "System Job-Processing Commands."

The Medium/subaddress (sent in the FM header) is the only information that is common to both an output task specified at the host and an output device specified at the terminal. The HOSTOUT command ties a host task to a terminal device.

Host Task	*(Logical Device)* *Medium/Subaddress*	*(Physical Device)* *Terminal Device*
Printer 1	P0	Line printer
Printer 2	P1	Diskette 1

Host

Terminal

Refer to Chapter 8 for more information on the host RJE subsystems that define the tasks and the Type 1 FM header that carries the medium/subaddress information to the terminal.

HOSTOUT Specify Data

The operator specifies the following information for the HOSTOUT command:

- The user name assigned to this HOSTOUT procedure
- Whether the procedure is to be added, changed, or deleted

Add a New HOSTOUT Procedure

If the user wants to add a new HOSTOUT procedure to terminal storage, the remaining prompts and their respective options are the same as those defined for the OUTPUT command (see "Assign a Host Output Destination" under "System Job-Processing Commands").

Define Printer Carriage Control (CARRIAGE)

The CARRIAGE command is used to specify and store the printer carriage control information (procedure) to be used by subsequent operations. To apply this stored procedure to the printer device, the user name of the desired CARRIAGE procedure can be specified in the OUTPUT and PRINT (immediate) commands, in the HOSTOUT and UTILITY (definition) commands, and in the COPY (utility) command. In the TIP definition command, the user can also specify the user name of the default CARRIAGE procedure to be effective at power-on time.

CARRIAGE Specify Data

The operator specifies the following information for the CARRIAGE command:

- The user name assigned to this CARRIAGE procedure
- Whether the procedure is to be added, changed, or deleted

If the user wants to add a new procedure, the default values are displayed for the following parameters, which the user can modify for the new procedure. If the user wants to change an existing procedure, the current values of these parameters are displayed, which the user can modify.

- Lines per page (default=66)
- Lines per inch (default=6)
- Last print line (default=62)

The user can specify multiple line numbers for each vertical tab stop. Up to 60 line numbers can be specified per carriage control definition.

Define a Print Train Image (TRAIN)

The TRAIN command is used to define and store a print train image. The train image is used by the 3777-3 terminal controller during printer operations with the 3203 printer/1416 train combination.

Twenty standard train images are provided with the MLU terminal. With the TRAIN command, the user can replace the 20 standard train images or define additional train images or delete any or all of them. To apply this stored procedure to the printer device, the user name of the desired TRAIN procedure can be specified in the OUTPUT or PRINT immediate commands, in the

HOSTOUT and UTILITY definition commands, and in the COPY utility command. In the TIP definition command, the user can also specify the user name of the default TRAIN procedure to be effective at power-on time.

TRAIN Specify Data

The operator specifies the following information for the TRAIN command:

- The user name assigned to this TRAIN procedure
- Whether the procedure is to be added, or deleted

Specifications to Add or Change a Procedure
When adding a procedure, the operator specifies the following information:

- The source (the card reader, a diskette device, or the magnetic tape unit) of the train image definition information
- The data set name (if a diskette or labeled tape is the source)
- The file number if an unlabeled tape is the source
- The block size for a unlabeled tape

Define a Copy Procedure (UTILITY)

The UTILITY command is used to specify and store a copy operation. This command may involve several device or data set specifications and the concatenation of data from several sources (up to 6 devices or data sets) to be copied on another device or data set. For a copy operation to be executed immediately, refer to the Copy Data (COPY) utility command.

UTILITY Specify Data

The operator specifies the following information for the UTILITY command:

- The user name assigned to this UTILITY procedure
- Whether the procedure is to be added, changed, or deleted

Specifications to Add a Procedure
When adding or changing a utility procedure, the operator specifies:

- The input (from) device: the card reader, a diskette device, or the tape unit
- The output (to) device: a diskette device, the tape unit, the card punch, or the printer

Tape Output Specifications
If the tape unit is the output device, the operator specifies:

- If print medium output, whether machine control codes, ANSI control codes, or no control codes should be used
- Data set name, file number, or write starting at current position
- Fixed or variable length records
- Record size and block size
- Disposition of tape after operations: leave, rewind, or rewind and unload
- High or low-density recording (for first use of unlabeled tape)
- If writing on a labeled tape: the expiration date, or the operator can validate the volume identification (if desired) to make sure the correct volume is mounted.

Diskette Output (Basic Exchange Data Set) Specification
If a basic exchange diskette is the output device, the operator specifies:

- The operator can validate the volume ID (if desired) to make sure the correct volume is mounted.
- Data set name or that the terminal should assign the name
- Old or new diskette data set
- If print medium output, whether machine control codes, ANSI control codes, or no control codes should be used
- Release or retain unused diskette space after operation
- For an old diskette set: new data should overlay or be written following existing data

New Diskette Data Set Specifications
If a new diskette data set is the specified output device, the user can also specify this header information for the create function:

- Expiration date
- Record size (varies with input source)
- Space allocated or let terminal assign space
- Multivolume indicator setting (only volume, continued data set, last volume of continued data set, or let system assign)

Printer Output Specifications
If the printer is the output device, the operator specifies:

- The user name of the carriage control procedure (defined by CARRIAGE command) to be used
- The user name of the 3777-3 print train image procedure to be used (defined by the TRAIN command)
- Carriage control characters in machine code or ANSI code (if required)

Diskette Input Specifications
For input data from one of the diskette devices, the operator specifies:

- The name of data set to be copied or copy all active data sets
- Whether a specific VOL ID is required
- Delete or retain data set after operation
- The starting record number or start with record 1
- Additional input or no additional input

Tape Input Specifications
For input data from the tape unit, the operator specifies:

- Whether a specific VOL ID is required
- Name of data set (labeled tape) or file number to be copied or copy from current position (unlabeled tape)
- Disposition of tape after operation (leave, rewind, or rewind and unload)

Tape Data Set Name (Labeled Tape) Specifications If a labeled tape is specified for input, the terminal reads the record size, block size and the format from the tape label. The user can also specify:

- The starting record number or start the copy operation with the record 1
- Additional input or no additional input

Tape File Number (Unlabeled Tape) Specifications
If an unlabeled tape is specified for input, the user must also specify:

- Fixed or variable length records

- Record size (maximum=255 bytes)
- Block size (maximum=4000 bytes)
- The starting record number or start the copy operation with record 1
- Additional input or no additional input

Card Reader Input Specifications

If the input data source is the card reader, the operator also specifies:

- Additional input or no additional input

If the user specifies a valid, additional input device on this or any previous "additional input" prompt, the appropriate input device prompts are displayed. If no additional input is specified, the command entry process ends and the procedure is stored in terminal storage.

Terminal Storage Space Used by Definition Commands

The definitions and procedures are stored in 480* sections of terminal storage specifically reserved for them. Console display messages are stored (spooled) in another portion of terminal storage not included in these 480 sections (see "List Spooled Messages" under "Terminal Utility Commands" in this section). Each of the 480 sections of terminal procedure storage has 32 bytes. The sections are allocated on an as required basis except for the Terminal Initialization Procedure and the space for procedure names which are always allocated. Sections required for each type of procedure (including overhead for pointers, etc.) are as follows:

Sections Always Allocated

- Terminal Initialization Procedure - 8 Sections
- Procedure Name Headers - 80 Sections

The procedure names are allocated 3 names per section. Up to 240 definitions are possible.

Sections Allocated as Required By User

• Train Definition	8 Sections
• Carriage Control Definition	3 Sections
• SSCP Message	1 Section for first 28 bytes of message 1 Section for each additional 28 bytes of message
• Host Input Procedure	1 Section per device defined**
• Host Output Definition	2 Sections printer 1 Section if not printer
• Utility Procedure	1 Section for each input device**; 2 Sections if output device is the printer; 1 Section if output device is not the printer

* The 20 IBM-supplied train images are stored in and occupy some of this space.

** For the Host Input and Utility procedures, a maximum of six input devices or data sets can be defined. Two sections are used for a tape input or output specification if the data set name is greater than eight bytes.

Example of Procedure Storage Allocation

	TIP PROCEDURE	8 Sections
	Name Headers	80
10	TRAINS (5 IBM supplied and 5 user defined)	80
38	CARRIAGE CONTROL DEFINITIONS	114
18	SSCP MESSAGES	
	6 messages with less than 28 characters	6
	12 messages with 57-84 characters	36
20	HOSTIN PROCEDURES	
	13 procedures with 1 device input	13
	5 procedures with 2 device inputs	10
	2 procedures with 4 device inputs	8
25	HOSTOUT DEFINITIONS	
	15 definitions with Printer specified	30
	10 definitions with Printer not specified	10
9	UTILITY PROCEDURES	
	5 procedures with 1 input, output is printer	15
	2 procedures with 3 inputs, output is printer	10
	2 procedures with 3 inputs, output is not printer	8
120	Totals	428

Total space available = 480 Sections
Total space used = 428 Sections

Total procedure name headers available = 240
Total headers used = 120

Procedure-Related Commands

The operator uses the procedure-related commands to:

- Execute a stored procedure
- Display procedure information previously stored
- Display terminal status information
- Save and restore procedures

Execute a Stored Procedure (EXECUTE)

The EXECUTE command is used by the operator to retrieve a previously-defined procedure from terminal storage and apply it to the appropriate terminal operation. This command in conjunction with the definition command saves repetitive keying or specifying of frequently-used assignments, definitions, operations, and relationships.

EXECUTE Specify Data

The operator specifies the following information for the EXECUTE command.

- The user name of the stored procedure to be applied or executed
- For a HOSTIN, the starting record number to be used for the first diskette or tape operation

For a UTILITY, the starting record number applies to any input or combination of inputs. The terminal reads and counts records until the starting record number is reached and then data will be written to the output device. The starting record number for tape or disk input will be the sum of the starting record number in the utility procedure plus the starting record number indicated in the EXECUTE command minus one.

If the operator specifies no starting record number, the record number specified in the procedure is used to start the diskette or tape operation.

Executing Input and Utility Procedures

If an input or utility procedure to be executed has an undefined field, such as data set name or an unspecified file number, only the screens that had missing responses are displayed for completion or change by the operator. The prompts are displayed in the same sequence as in the definition command and in most cases the operator must specify the missing information before executing the procedure.

After execution of an input starts a procedure message displays in the message area of the display. As the operation completes, other messages may be displayed.

Executing Output Procedures

The operator should be aware that the execution of a HOSTOUT procedure activates a previously-defined assignment of a device or data set to a medium type/medium subaddress. When the destination selecting FM header is received from the host processor, the particular device or data set should be ready to receive the accompanying data.

Display Definitions and Status (DISPLAY)

The DISPLAY command is used by the operator to display various types of terminal data. Data requested is displayed in the message area of the screen.

Types of Data Displayed

The operator can request specific types of data to be displayed by this command. The data types are as follows:

- The names of all definitions and procedures (N)
- Status of Devices (D)
- Status of Sessions (S)

Display the Names of Stored Procedures:

The operator can specify that the terminal display the names of all the stored procedures.

- HOSTOUT procedures
- HOSTIN procedures
- UTILITY procedures
- TRAIN definitions
- CARRIAGE control definitions
- SSCP message definitions

Display Device Status

If the operator specifies that device status information be displayed, the status of all physical and currently active devices attached to the terminal is displayed in the message area. The types of status information displayed for each device follows:

- Busy or Not Busy
- Medium Type assigned to this device
- Medium Subaddress assigned to this device
- Session associated with the device

- Data Set Name associated with the assigned medium/subaddress, or File Number associated with the assigned medium/subaddress
- Carriage Control definition (name) assigned if printer
- Train Image definition (name) assigned if printer (on 3777-3 only)
- User of Device - host input, host output, or utility operation.

Display Session Status

If the operator specifies that session status information be displayed, a screenful of summary data for all sessions is displayed in the message area (the operator is prompted to page to the next screenful for data on individual sessions). The types of status information displayed for each session include:

Session Number
Device Assigned
Medium Type
Medium Subaddress
Data Set Name
File Number
Active State
Bracket State
Destination Selection status
Intervention Required
Purge State
Chaining State
Send or Receive mode
Bound State
Bind Data
Output Suspended
Input Interrupted
Decompaction Status

The operator may also display the actual contents of the decompaction table.

Console Display Placed in Display Hold Status

When data requested by this command is displayed in the message area of the screen, the Console Display is put in display hold status and the DISPLAY HOLD light turns on. If a system message arrives before the DISPLAY command is completed, the MSG ALERT light turns on to notify the operator that a system message was received and stored, but not displayed.

Dummy Devices for Procedure Definition (DUMMYDEV)

The DUMMYDEV command allows the operator to define and store procedures that require any attachable I/O device, even if the particular device is not attached to the terminal where the procedure is defined. With this command, a terminal with a smaller I/O configuration can be used to define and store procedures for any possible I/O configuration of a 3776/3777 MLU terminal.

After the procedures are defined on the smaller configuration, the USERSAVE and USERREST commands can be used to transfer the procedures to the terminal(s) with the larger I/O configuration for actual procedure execution.

Save User Procedures (USERSAVE)

The USERSAVE command is used to transfer the user-defined procedures from terminal storage to one of the diskette devices, to the tape unit, or to the card punch. This command can be used to make backup copies of all the user defined procedures and to make copies of the procedures for other locations.

USERSAVE Specify Data

The operator specifies the following information for the USERSAVE command:

- The output (to) device: a diskette device, the tape unit, or the card punch
- If tape output: the file number (and density if it is first use of an unlabeled tape)
- If disk output: the data set name and data set information

Restore User Procedures (USERREST)

The USERREST command is used to restore to terminal storage user-defined procedures that were transferred by a previous USERSAVE command. This USERREST command completely replaces the old set of procedures in terminal storage with a new set of procedures. With these two commands, USERSAVE & USERREST, a number of sets of procedures can be maintained and used, one for each major application area of the terminal.

USERREST Specify Data

The operator specifies the following information for the USERREST command:

- The input (from) device: a diskette device, the tape unit, or the card reader
- If tape input: the file number and disposition after use
- If disk input: the data set name and VOL ID name is desired

Note: After a USERREST, the procedure area may not be used until the next power on.

Terminal Utility Commands

The operator commands in the utility group are used to execute local terminal-supplied procedures such as copy data, modify data set definitions, and list pertinent terminal information. Utility commands are initiated (press TERM REQ and enter the command name) in the same manner as the other immediate commands.

Copy Data (COPY)

The COPY utility is used to transfer data from one or more (up to 6) locally-attached input devices to a locally-attached output device. (The SAVEREST utility can also be used to transfer local data from *one* input source.)

COPY Specify Data

The operator specifies the following information for the COPY command:

The specifications entered by the operator are the same as for the Define a copy procedures (UTILITY) command. The chief differences are that all required information must be specified for the COPY command and, as an immediate-type command, COPY executes as soon as the last specification is entered and the EOM key is pressed.

Create Diskette (CDISK)

The CDISK utility is used to write a diskette volume label.

CDISK Specify Data

The operator specifies the following information for the Create Diskette command:

- Diskette device 1 or 2
- Volume identification
- Data set type: basic exchange or T type
- Owner identification

Note: All existing data sets are deleted.

Create Diskette Data Set (CDATASET)

The CDATASET is used to create a data set on an initialized diskette (Create Diskette utility performed.)

CDATASET Specify Data

The operator specifies the following information for the Create Diskette Data Set command:

- Diskette device 1 or 2
- Data set name
- Record size (basic exchange default=128 T type default=256)
- Expiration data
- Space allocated
- Multivolume indicator setting (only/continued/last)
- Bypass indicator setting (active or bypass)
- Write protect indicator setting

Change Diskette Data Set Label (CDLABEL)

The CDLABEL utility is used to change information in the specified diskette data set label.

CDLABEL Specify Data

The operator specifies the following information for the Change Diskette Data Set Label command:

- Diskette device 1 or 2
- Current data set name to be changed
- New data set name (Leave blank if the name is not changed)
- Expiration date
- Bypass indicator setting (active or bypass)
- Write protect indicator setting
- Copy verify indicator setting
- Multivolume indicator
- Volume sequence number for a multivolume data set
- The record size, space and type are displayed but may not be changed

Delete Diskette Data Set (DELETE)

The DELETE utility is used to delete an existing diskette data set.

DELETE Specify Data

The operator specifies the following information for the DELETE command:

- Diskette device 1 or 2
- Name of data set to be deleted

An "assurance" prompt is displayed to make certain the desired action is being taken.

List Diskette Labels (LISTDISK)

The LISTDISK utility is used to display or print the volume label and data set labels for each data set on a diskette.

LISTDISK Specify Data

The operator specifies the following information for the LISTDISK command:

- Input source: diskette 1 or 2
- Output to display or printer

List Spooled Messages (LISTSPOL)

The LISTSPOL utility is used to transfer system messages from terminal storage to one of the locally-attached output devices.

System messages are stored (spooled) in an area of terminal storage which has a message capacity of about 1000 messages of 80 bytes each. When the message area is 80% full an operator awareness message is displayed in the entry area of the screen. The operator can use the LISTSPOL utility to save or list the system messages. The spooled messages are overlaid when the storage area is full.

LISTSPOL Specify Data

The operator specifies the following information for the LISTSPOL command:

- Output (to) device (a diskette device, the tape unit, the card punch or the printer) no device need be specified to allow an erase-only operation
- Erase or retain messages in the terminal storage area after the transfer

List Error Log (LISTLOG)

The LISTLOG utility is used to list the contents of the error log on the printer. The error log generally consists of 3-position counters which count specific types of errors that occur while the terminal is running.

Save/Restore Diskette (SAVEREST)

The SAVEREST utility is used to duplicate a diskette. On a SAVE operation an entire diskette is read as input, on a sector basis without regard to any label information (except the volume label must be valid). The entire diskette (original Data & Data Set Labels) is written on output to either the diskette or tape. (The COPY utility can be used to concatenate input from more than one source on local data transfers.)

SAVEREST Specify Data

The operator specifies the following information for the SAVEREST command:

- Input (from) device (diskette or tape unit)
- Output (to) device (diskette or tape unit)
- Input file number and disposition (if tape)
- Output file number and density for first usage (if tape)

Note 1: If the tape unit is the "from" or "to" device, one file is copied.

Note 2: If a diskette is the "from" or "to" device, the entire diskette is copied.

Find a Message (FIND)

The operator uses this command to display a screenful (page) of system messages that have been previously received and stored in terminal storage. In conjunction with the PAGE BACK and PAGE FWD keys, the operator can display any or all of the messages in terminal storage.

To display the desired message(s), the operator specifies a "message received" time in response to the first command prompt. The screen displays the first message received or transmitted at or after the specified time followed by a screenful of the succeeding messages. If the specified time is in the future, a screenful of the most recently received messages is displayed. The display is placed in hold mode (Display Hold indicator on) when this command is executed.

Write/Print Tape Volume Label (TLABEL)

TLABEL is used to specify the information to be written on a tape volume label or to list the labels of an existing labeled tape.

TLABEL Specify Data

The operator specifies the following for a TLABEL command:

- Write a new tape label or print the labels of a labeled tape
- Volume ID and owner ID (if writing new volume label)
- High or low density recording

Control Tape (TAPE)

TAPE is used to change or control the position or status of the tape reel on the 3411 Magnetic Tape Unit.

TAPE Specify Data

The operator specifies the following information for the TAPE command:

- One of the following tape control commands
  Backspace file
  Backspace record
  Erase record gap
  Forward space file
  Forward space record
  Rewind
  Rewind and Unload
  Write tape mark
- The number of times (maximum=255) the specified tape control command is to be repeated

Miscellaneous Commands

Using these commands, the operator can:

- Execute various test procedures
- List statistical data about the terminal operations and
- Perform other miscellaneous functions

Execute Tests (TESTS)

The TESTS command is used to execute either the Ripple Print, Clean Print, or Wrap test. This command can be executed only when the device to be tested is not in use. The TEST light is on during execution of the Wrap test.

Note: The 3777-4 does not execute the Clean Print test

Line Trace (TRACE)

The TRACE command is used to start or stop the printing of all communication line information frame (I-Frame) data received or transmitted. If the printer is being used for another operation, the trace data is intermixed with data for the other operation. Trace data is printed in 8-character groups, 8 groups to a print line. An R to the left indicates a received buffer; a T indicates a transmitted buffer; the session number, 1-6, follows the T or R. Operator ID reader data is not printed if it is secure data and is indicated by an "S" following the "T"; only the header information (TH/RH) is traced. A dash (-) character after the T or R indicates a negative response.

Note: A two-printer 3777-4 always directs trace data to the first (PR, X'60') printer.

Line Statistics (LINE)

The LINE command is used to display and optionally print the operational statistics for the communication line and/or to reset the counters to zero. The statistics are displayed in the message area of the screen. During execution of the LINE command, the Console Display is put in display hold status (see "Display Definitions and Status" under "Procedure-Related Commands").

Tape Statistics (TSTAT)

This command is used to print operational statistics for the magnetic tape unit.

Terminal Status (STATUS)

Using this command, the operator can verify or change the status of these communication specifications:

- Attended or unattended mode of operation
- Full-or half-speed data rate*
- Whether switched network backup (SNBU) is to be used
- Multiple signal interrupt
- Full SNA Spool Monitor

*Become effective after an ENABLE command.

Power Off Terminal (POWEROFF)

Using this command, the operator may specify that the terminal should be powered off when current activities terminate and that current log information be updated. The POWEROFF command aborts all online operations.

Note: The 3262 Printer (3777-4) must be powered off manually.

Set Date and Time (SET)

This command is used to set or correct the date (month, day, year) and time (hours, minutes, seconds) that is maintained by the terminal. The day of the month and the hour and minute (ddhhmm) are appended to all messages displayed in the message display area of the screen. (The operator is also prompted to enter the date and time at power on.)

Set/Change Security Code (SECURITY)

Using this command, the operator can enter from one to eight (1-8) characters, which the terminal scrambles and stores as a security code. The security code protects terminal operation from alternation by unauthorized personnel. Any keyboard character, including the space bar, can be entered as valid input to the security code. For further protection, the security characters are not displayed as they are entered.

Effect of Security Code on Terminal Operation

After the security code is entered and stored, it affects the following terminal operator commands:

Procedure Definition Commands: When the operator enters any of the following commands and attempts to add, change, or delete a stored procedure, a prompt is displayed: 'enter security code to complete function':

CARRIAGE
HOSTIN
HOSTOUT
SSCP
TIP
TRAIN
UTILITY

The operator has three tries to enter the valid security code (if one already exists) or to enter a new security code.

Enter Cryptographic Key (KEY) Command: When entering the KEY command, the security code is required before the master cryptographic key can be entered or changed.

Restore User Procedures (USERREST) Command: When the operator enters the USERREST command, a security code is required after the prompt is displayed containing the warning that a power off/power on sequence is required.

Invalidating Security Code Requirement

The operator has the option to invalidate the SECURITY command. After this option is specified, any further attempts to use the SECURITY command will be invalid until the procedure area of terminal storage is restored either by: (1) a USERREST command of new procedures without the invalidate option, or (2) installation of a new terminal storage element (diskette).

Features and Accessories (3776 Models 3 and 4/3777 Models 3 and 4)

This section describes the special and specify features and accessories (purchase-only items) available for the 3776/3777 MLU terminals. (Refer to the "Functional Characteristics" section for a description of the basic functions and features.) Input and output devices that can be cable-connected to the controller, and special features for these devices, are described under "I/O Attachments" in Chapter 5.

The following features are not available on the 3777-4:

- ID Card Reader
- Door Keylock
- Encrypt/Decrypt
- Dual Door Keylock
- High-speed Digital Interface
- V.35 Interface/High Speed Local Attachment to 3705 II

Magnetic Diskette Storage

The Diskette Storage Devices are compact units contained in the terminal's base. Data is recorded on a small flexible operator-changeable diskette. The Diskette Storage Device can accept input data entered into the controller's buffers either from the communication line during an online host output operation, or from an attached 2502 Card Reader, an attached 3411 Magnetic Tape Unit, or from another Diskette Storage Device during an offline or local utility operation. Output data from a "read diskette" operation can go to the card punch, another diskette device, the printer, the tape unit, or the host processor.

Two diskette devices can be ordered as special features on the 3776/3777 MLU terminals. The first Diskette Storage Device is contained in the lower left side of the controller. The second is contained in an extension attached to the right side of the controller. Each diskette provides a maximum of 246,272 bytes of data storage.

Operations

Depending on whether one or two diskette devices are attached, and the availability of other attached I/O special features, the following diskette operations are possible:

- Read from diskette 1, write to diskette 2 (single data set or all active data sets).
- Read from diskette 2, write to diskette 1 (single data set or all active data sets).
- Automatic continuation of an online or offline job (writing or reading) from diskette 1 to diskette 2 and from diskette 2 to diskette 1.
- Transmit to another I/O device type (or the line) from diskette 1, receive onto diskette 2 from another device type or the line.
- Transmit to another I/O device type (or the line) from diskette 2, receive onto diskette 1 from another device type or the line.

The ability to concurrently transmit data from one diskette and receive data on the other diskette is possible when 2 or more sessions are active. The ability to buffer card medium and print medium data on a diskette during a host output job permits maintaining the availability of the card punch or printer for high priority jobs. The individual operations are:

Online Operations	*Local or Offline Operations*
Diskette 1 to line	Card Reader to Diskette 1
Diskette 2 to Line	Card Reader to Diskette 2
Line to Diskette 1	Diskette 1 to Card Punch
Line to Diskette 2	Diskette 2 to Card Punch
	Diskette 1 to Diskette 2
	Diskette 2 to Diskette 1
	Diskette 1 to Magnetic Tape Unit
	Diskette 2 to Magnetic Tape Unit
	Diskette 1 to Printer 1 or 2*
	Diskette 2 to Printer 1 or 2*
	Magnetic Tape Unit to Diskette 1
	Magnetic Tape Unit to Diskette 2

* The 3777-4 can have two 3262 printers attached.

To use a Diskette Storage Device as a logical line printer or card punch, the operator executes an OUTPUT or HOSTOUT command to assign a diskette device to a particular medium/subaddress. During the subsequent host output operation, card medium or print medium data can be written on the assigned diskette device. Card-image data on a basic exchange diskette can be transmitted on a host input operation as if it came from an actual card reader.

Diskette Records

A record written on a 3776/3777 MLU diskette occupies one, two, or four sectors depending on the data set type specified by the operator and the buffer size in the Bind command parameter. Records consisting of less than 128 (or 256 or 512) significant bytes are padded with null characters (hex '00'). Refer to "Appendix E - Data Formats" for more information.

Diskette Record Sizes

The following record types and associated maximum lengths are available:

Data Set Type	*Range*	*Record Type*	*Length*
Basic Exchange	1-128	Card Medium	128
		Print Medium	128
		Exchange Medium	128
SDLC T Type *	256,512	Line Image	512 max.

* T-type data sets can be written only from the line and are written in 3770 nonsequential format. T-type data sets can also be read and transmitted to the host (see "Appendix E - Data Formats").

Diskette Data Sets

Each group of records for a particular job is identified by a data set name that is entered by the operator or assigned by the terminal. On output from the diskette, all records written on the diskette under this data set name comprise the data for that job. During a host input (online) operation, all data sets on the diskette or any specified data set can be transmitted. After transmission, data can be deleted if specified in the user command.

Terminal-assigned names are created by appending the current time to the letters SL. Operator-assigned data set names may be up to eight characters. The 3776/3777 MLU can handle up to 19 different data sets on a single diskette. Data sets exceeding the diskette capacity can be continued on another diskette. During an online receive operation or an offline card-to-diskette operation, the controller signals the operator when the data set capacity has been reached. The operator can continue the job after replacing the full diskette with another diskette if multivolume was specified by the operator command.

If a second Diskette Storage Device is present and not in use for an online or local operation, continuation on the second diskette is automatic, when specified, and multivolume data sets are allowed. When the data set capacity has been reached on the second diskette, continuation on the first diskette is automatic. This first-to-second-to-first operation continues until the data set is complete or a device becomes unavailable.

Diskette Data Set Usage

The following table shows the relationship between the operations and the data set types:

Operation	*Basic Exchange*	*SDLC T Type*
Host Input	Yes	Yes (Card Medium only)

Host Output	Yes	Yes
Utility Input (from)	Yes	Yes
Utility Output (to)	Yes	No

Basic exchange diskettes are written in a sequential format; T type diskettes are written in the 3770 nonsequential format. Using T-type diskettes, the 3776/3777 MLU performance will not match the T-type diskette performance of other 3770 terminals. For more information on formats and compatibility, refer to "Appendix E - Data Formats."

Diskette Usage Considerations

Diskettes may be used as input or output devices for local utility operations and for sending data to and receiving data from the host processor. Once a diskette device is in use for one of these operations, it is unavailable for any other use until the data set in use is closed or the device is cancelled by the operator.

Thus, a disk device that is sending data, cannot be interrupted to receive data.

The usage specifications available for diskette input and output are included in the descriptions of the operator commands that initiate the various operations. Refer to the section "Terminal Operator Commands" in this chapter.

Data Set Labels

Each data set on the diskette is identified in a Data Set Label, which is shown in Appendix E. A data set must be "closed" before it can be accessed for transmission, printing, punching, etc. A data set is closed (depending on the job) in one of the following ways.

- Card Reader to Diskette: EOF from the Card Reader (if no additional input)
- Magnetic Tape Unit to Diskette: EOF from the Tape Unit (if no additional input)
- Line to Diskette: When an EDS FM header is received
- CANCEL command is executed by the operator
- The job comes to an abnormal end

Note: Closing a data set requires that the disk head seek to track 0 on the diskette, thereby affecting throughput based on the number of tracks to be crossed.

As stated before, up to 19 data sets with different names can be accommodated on the diskette. Each different data set name requires one of the 19 sectors reserved on track 00 for a label for that data set. Anytime a data set is created, an additional data set label sector (one of the 19) is used.

When a data set fills from the line, and the data set is continued on a second diskette (multivolume data set), a data set is opened on the second diskette using the same name as the one that filled the first volume. If the Volume Sequence Number field has an entry in the Data Set Label on track 00 of the first diskette, the Volume Sequence Number is updated on the second diskette.

When you read a multivolume data set, the following messages appear under the operator action.

- Message Dn 344 appears on the initial read as follows:

```
Dn 344  MULTIVOL DSNAME = dsname
        CONT (Y,N)=
```

- Message Dn 345 appears when all data from the first diskette has been read and a volume switch is needed; it also appears on each additional volume switch.

  Dn 345 MOUNT FOR DSNAME = dsname

For nonsequenced volumes, the Dn 345 message will appear even if the correct volume is in the drive for the volume switch. The operator must open and close the drive to continue the operation.

Basic Exchange Format

Basic Exchange format refers primarily to the sequence in which records are written on the diskette. For compatibility with non-3770 systems or devices, 3776/3777 MLU can write and read diskettes using the basic exchange format.

If a diskette is to be written in basic exchange format, it must be so specified during the Diskette Create procedure. Data transmitted from diskettes written in SDLC T type format by the 3770 is transmitted in 256-byte blocks (two 128-byte records per block), or in 512-byte blocks (four 128-byte records per block).

Basic exchange diskettes written on a non-3770 IBM product can be read for transmission.

Diskette Create Function

New diskettes, or diskettes that have been used previously on other machines (IBM 3741 or 3742, for example), must be prepared for use on the 3776/3777 by performing the Diskette Create function before T-format data sets can be written on them. Diskettes previously written on other machines in basic exchange format can be read by the 3776/3777 MLU as shown in Appendix E.

Other diskette utility commands are briefly described under "Terminal Utility Commands" in the section "Terminal Operator Commands." Detailed instructions on how to use the diskette utilities will be provided in the *Operating Procedures Guide.*

Diskettes

Diskettes used with the Diskette Storage Devices consist of a small flexible disk about 8 inches in diameter enclosed in a holder. Appendix F describes the diskettes used by the 3770, and describes diskette labeling and recommended handling procedures.

Data Set Allocation

When the diskette is the output device, data set space for new data sets is allocated based on the response to the SPACE = prompt in the procedure. When a number is entered in response to SPACE=, the first free area sufficient to encompass that number of records is used. When the system is to assign space, the largest available area will be used.

Starting Record Number

For Basic Exchange format, the starting record number is the nth record in the data set. For T- format, the record number refers to T-format records, or request units (RUs), and does not correspond to the number of output, print or punch records contained in the RUs. When "all active read" is specified, the starting record number is ignored.

Operator ID Reader

This special feature device reads magnetic stripe operator identification cards (or badges). The ID reader is mounted behind the controller cabinet door, above the Auxiliary Operator's Panel. This feature is enabled for any console read (Proceed light on). It is normally only used for a SSCP REQ function and uses the SSCP REQ data format is if it had been keyed in. After the ID card data is read into the buffer, the 3776/3777 MLU generates an EOM and sends the data to the host processor.

Secure data from the ID card is not displayed, printed, or written in terminal storage to maintain security of the badge data at the terminal.

Cards must be 3-7/8 by 2-1/8 inches, and between 0.007 and 0.045 inch thick. The magnetic stripe must be encoded in the American Banking Association format, which provides for up to 40 characters, 37 of which are discretionary. Card format and character sets are shown in Appendix B.

Front Feed (3776 Only)

This special feature simplifies forms changes and reduces the operator set-up time required to renew the forms supply or to change the forms type. With the Front (forms) Feed Feature installed, the paper supply may be set on the floor directly under the keyboard to extend the height of the supply stack. Forms may be alternately loaded from the rear of the 3776 models. The forms stand/stacker enclosure at the rear remains a standard feature of the 3776 models with or without the Front Feed Feature.

Audible Alarm

This special feature provides a louder signal than the Operator Attention Speaker. The alarm can be enabled or disabled by the operator. When enabled, and during any job not using keyboard input, the alarm sounds for any operator attention condition.

Door Keylock

This special feature adds a keylock to the right- or right and left-hand controller cabinet door. Two keys are provided with each lock.

Keylock

This special feature provides a key-operated switch on the Auxiliary Operator's Panel behind the cabinet door. This switch can be turned off to disable the terminal operation through the keyboard and must be on to start operations at the keyboard.

ASCII

The ASCII special feature is available for use in the U.S. and Canada. Differences between EBCDIC-coded and ASCII-coded machines are described in Appendix G.

Cryptographic (Encrypt/Decrypt) Feature

The Encrypt/Decrypt special feature on the 3776/3777 MLU terminals is part of the IBM Cryptographic Subsystem used in System/370 SNA networks to protect information from unauthorized users. The Cryptographic Subsystem is a combination of software and hardware that protects information transmitted between the host application program and the MLU terminal. Three IBM products provide this level of data security and combine to form the IBM Cryptographic Subsystem:

- Programmed Cryptographic Facility Program Product 5740-XY5 for OS/VS1 and OS/VS2 MVS
- Encrypt/Decrypt Feature, Program Number 5735-RC2, for ACF/VTAM
- Encrypt/Decrypt Feature for the 3776-3/3776-4/3777-3 Terminal

These three products use the Data Encryption Standard (DES) of the National Bureau of Standards (Federal Information Processing Standard #46, January 15, 1977). A key-driven DES algorithm in the host processor and in the terminal uses a complex series of transpositions and substitutions to disguise the meaning of data.

Cryptographic Subsystem Functions by Product

The three products of the subsystem provide the following functions or services:

OS/VS1 or OS/VS2/MVS Programmed Cryptographic Facility

The Programmed Cryptographic Facility in the host processor's system control program provides:

- A macro for invocation by the ACF/VTAM Encrypt/Decrypt feature or installation application for the use in encrypting data for transmission over communication lines.
- A key generation utility to generate and store (in encrypted form) logical keys that are used in data encryption and decryption.
- Management functions to enhance the security of cryptographic keys, and to manipulate these keys with minimum user involvement.
- An assembler macro interface to the encryption/decryption algorithm enabling a user to protect data by means of the user application programs.

The Programmed Cryptographic Facility provides a user with the ability to encrypt and decrypt data. Using this product in conjunction with the ACF/VTAM Encrypt/Decrypt feature and the Encrypt/Decrypt feature on the 3776/3777 MLU terminal, the user can encrypt and decrypt transmitted data. Using this product in conjunction with user application programs, the installation has the ability to encrypt and decrypt stored data.

In a communications environment, when data is to be encrypted for transmission to the MLU terminal, the access method or application program calls the key management function, indicating the terminal that has requested encryption. The key management function is requested to generate a unique operational key that is encrypted under the host system master key. This operational key is used as the session key and is also encrypted under the terminal master key (the key previously generated by the key generation function to be associated with the particular MLU terminal now under consideration). The session key is transmitted to the MLU terminal (in the Bind command) where it is stored. All data thereafter transmitted to the terminal during the session is encrypted, and all data received from the terminal is decrypted under the session (operational) key.

For more information on the cryptographic subsystem, refer to the following manuals:

Programmed Cryptographic Facility General Information Manual, GC28-0942

IBM Cryptographic Subsystem: Concepts and Facilities, GC22-9063

ACF/VTAM Encrypt/Decrypt Feature

The Encrypt/Decrypt feature in the host processor's access method performs the following functions:

- Operates with ACF/VTAM during sessions between a 3776/3777 MLU terminal and a VTAM application program.
- Allows the user to define a logical unit as requiring session level cryptography.
- Permits encryption and decryption of messages during logical unit to logical unit sessions. Selected messages or all messages in a session may be specified for encryption.
- Permits applications to select encryption on a session basis.

The ACF/VTAM Encrypt/Decrypt feature operates in conjunction with and communicates with the Programmed Cryptographic Facility program product. Together they perform data encryption/decryption using the appropriate macros. This ACF/VTAM feature also requests key management functions of the Programmed Cryptographic Facility.

With this feature installed, the ACF/VTAM system may be defined to require encryption/decryption. ACF/VTAM may also be defined to allow an application to request encryption on a session basis. Within a particular session, either all messages or specified messages transmitted by ACF/VTAM may be encrypted.

3776/3777 MLU Terminal Encrypt/Decrypt Feature

The Encrypt/Decrypt feature on the terminal performs the following functions:

- Enables data transmitted over communication lines to be protected.
- Encrypts and decrypts data using a hardware/software implementation of the Data Encryption Standard.
- Protects session data encrypting keys by a user-entered controller master (logical) key.

The 3776/3777 MLU terminals use a hardware/software implementation of the Federal Data Encryption Standard algorithm to encrypt/decrypt data messages. Encrypted messages received from the host processor are decrypted before being routed to their destination at the terminal. Messages sent to the host are encrypted just before being sent over the data link to the host processor.

Note: Depending on line speed and device speed, throughput may be degraded when using the Cryptographic feature. The user is responsible for restoring the master key at the terminal if it is lost for any reason (for example, as a result of maintenance).

Preparing the Terminal for Cryptographic Sessions

To prepare the terminal to send and receive encrypted data, the following actions must occur at the terminal:

1. The operator uses the physical key to set the Cryptographic Key Entry keylock to the ENABLE position.
2. Using the KEY command (see "Terminal Operator Commands"), the operator enters the master cryptographic key (logical) for the terminal (KLU).

The terminal master key (KLU) protects the unique data encrypting keys used by the sessions and was previously generated by the key generation function of the Programmed Cryptographic Facility in the host processor. Once the terminal master key is properly entered, it cannot be displayed or printed and is sustained by a mercury battery when normal line power is not present. A mercury battery for the Encrypt/Decrypt feature is available as a purchase-only accessory from IBM.

Establishing a Cryptographic Session with the Host

Figure 4-4 shows an example of establishing a cryptographic session.

1. The host indicates that session level cryptography is required by setting bits in Byte 26 and 27 of the BIND command (see "SNA Network Commands" in Chapter 8).

   The host takes the unique session key (KS), encrypts the session key under the terminal master key, EKLU (KS), and sends it to the terminal in bytes 28-35 of the BIND command.

2. The terminal generates a seed value (N). The seed value is encrypted under the session key, EKLU (KS) to generate a test value, EKS(N), which is sent back to the host in bytes 28-35 of the positive BIND response.

   Note: If the BIND command is accepted by the terminal, the process continues as in step 2 and 3 (following). If the terminal does not accept the BIND command, it sends a negative BIND response of "CRYPTO Component Failure" or "Invalid Session Parameter" instead of the positive response.

3. Before sending encrypted data RUs, the host sends a Cryptographic Verification (CRV) command to the terminal.

   The CRV command verifies that both the host and the MLU terminal have the same cryptographic feature and that both are using the same session key.

   The host takes the test value, EKS(N), received in the BIND response from the terminal, and, using its decryption and encryption functions, generates a test value, EKS(N-bar) to return to the terminal.

4. The terminal uses the session key (encrypted under the terminal master key) to decrypt the test value, EKS(N-bar), received from the host in the CRV command. The result of this decryption is a seed (or test) value (N) that is compared to the original value of N that was sent to the host in the BIND response.

   If the two values of N compare, the terminal returns a positive response to the CRV command and is enabled to perform its cryptographic function on RU data.

   If the two values of N do not compare, the terminal returns a negative response, Parameter Error to the host.

If the CRV command is received in a session not designated for the cryptographic function, the terminal returns the negative response, "Function Not Supported" to the host.

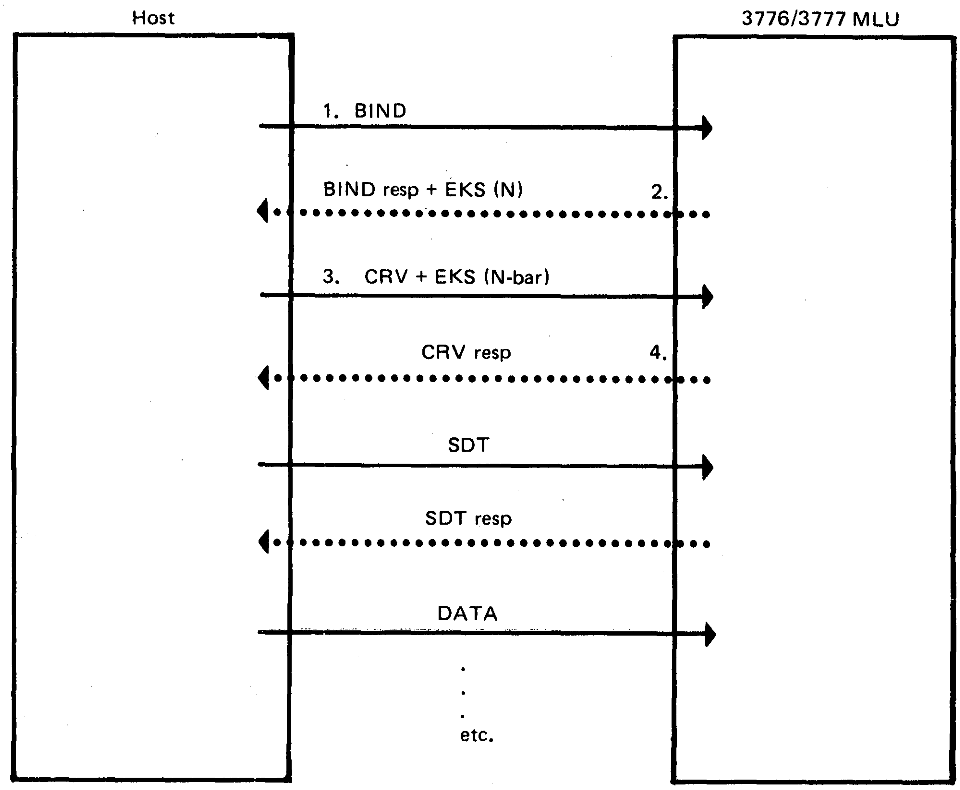

Figure 4-4. Example of Establishing a Cryptographic Session

Inbound Cryptographic Data (MLU to Host)

After the BIND and CRV commands have been properly received and responded to, the terminal encrypts the RU portion of all data messages inbound to the host for the specified session. All inbound RUs are padded, if necessary, to produce an RU length that is a multiple of eight. This is a restriction imposed by the Cryptographic Subsystem and means that RUs may arrive at the host with from one to seven padding bytes. If padding is necessary, the terminal sets the Padded Data Indicator in the request header (RH) and includes a count of the number of pad characters in the last byte.

Outbound Cryptographic Data (Host to MLU)

The host processor has the option to selectively encrypt data messages bound for the terminal in a cryptographic session. The MLU terminal examines the Encrypted Data Indicator in the request header to determine which RUs to decrypt. If byte 26 of the BIND command specified "Mandatory Crypto", the terminal decrypts all RUs regardless of the setting of the Encrypted Data Indicator. The host handles padding in the same manner as the terminal.

Communication Features

An SDLC communication driver is a standard feature on the 3776/3777 MLU terminals. The SDLC communication driver can operate either over single or multi-drop line connections and does not have a business machine clock. One of the following attachment special features is required for attachment to user-supplied standalone Data Circuit Terminating Equipment (DCE) or to an IBM standalone modem (also a DCE). (The DCE abbreviation formerly applied to the more general designation: Data Communication Equipment).

EIA RS-232C Interface (U.S.A. and Canada)

This special feature provides an interface and a cable for the attachment of standalone DCEs. The standalone DCEs provide an EIA RS-232C interface and their own clocking for operation at speeds between 2400 bps and 19.2 kbps when connected to the 3776/3777 MLU terminals. This special feature operates over switched or nonswitched communication facilities.

CCITT V.24/V.28 Interface

This special feature for World Trade countries provides an interface and a cable for the attachment of standalone DCEs which provide a CCITT V.24/V.28 interface. The standalone DCEs also provide their own clocking. The special feature of the 3776/3777 MLU terminals operates over switched or nonswitched voice-grade communication facilities at speeds between 2400 and 9600 bits per second.

CCITT V.35 Interface

World Trade: This special feature provides an interface and a cable for the attachment of standalone DCEs that provide the CCITT-V.35 interface. The standalone DCEs also provide their own clocking for operation over a wideband communication channel at 20.4 kilobits per second.

This special feature provides for direct high speed local attachment to a 3705-II at 14.4 kilobits per second with maximum cable length of 51.8 meters (170 feet).

U.S.A. and Canada (not 3777-4): This special feature provides for direct high speed local attachment to a 3705-II at 14.4 kilobits per second with a maximum cable length of 51.8 meters (170 feet).

CCITT X.21 Interface (World Trade)

This special feature provides an interface and a cable for the attachment of standalone DCEs that provide the CCITT-X.21 interface. The standalone DCEs also provide their own clocking for operation at 2400, 4800, or 9600 bits per second over nonswitched lines using SDLC procedures. This interface feature is available for attachment to the Japanese NTT DDC Nonswitched Network only.

High-Speed Digital Interface (not 3777-4)

This special feature provides an interface and a cable for the attachment of standalone DCEs which provide the High-Speed Digital Interface. The standalone DCEs also provide their own clocking for operation at speeds up to 19.2 kilobits per second (20.4 kbps in World Trade countries) when connected to the 3776/3777 MLU terminals. This special feature operates over a wide band communication channel.

Digital Data Service Adapter (DDSA-U.S.A. only)

This special feature provides for attachment to the Digital Data Service network for SDLC transmission at 2400, 4800 or 9600 bits per second. This attachment feature can operate over single or multi-drop line connections.

V.35 Interface/High-Speed Local Attachment to a 3705-II

This special feature for all countries provides a cable and interface for direct (without modems) local attachment of a 3776-3/3776-4/3777-3 to a 3705-II Communications Controller. This special feature attaches to a Half-Duplex Line Set Feature in the 3705-II for two-way alternate data mode operation at 14,400 bps. On the 3776-3,-4/3777-3, this feature can be attached to a Full-Duplex Line Set Feature in the 3705-II for two-way simultaneous data mode operation; also at 14,400 bps. The maximum cable length is 51.8 meters (170 feet). A special feature of the Line Interface Base in the 3705-II provides business machine clocking. This V.35 Interface Feature cannot be installed with the EIA Interface Feature or the High-Speed Digital Interface Feature.

Switched Network Backup (U.S. and Canada)

This specified option can be used with the Point-to-Point or Multipoint Tributary line configurations and allows alternate use of switched network facilities as backup communication lines. Switched-network backup operation must be specified in the STATUS command. When the modem is connected to a switched network, calls must be dialed and answered manually. The same line control (non-switched point-to-point or multipoint) is used when operating on a switched network.

When this option is specified, SNBU will override the permanent REquest-To-Send interface signal and two-way simultaneous data mode (formerly called full duplex mode) without having to change the Terminal Initialization Procedure (TIP).

Switched network backup operation is not a feature within the 3776/3777 MLU terminal. However, when this mode of operation is selected with these terminals through the use of appropriate attached modems and communications facilities, these terminals operate in half-duplex data communications (two-way alternate).

Katakana Feature

This specify feature provides a Katakana 127-character set for the 3776 console-mounted line printer, and the 3776/3777 MLU Console Display, and a Katakana keyboard for the 3776/3777 MLU. The character set is shown in Appendix B. Using this character set reduces printing speed to 80 lines per minute maximum on the 3776 Model 3, or 160 lines per minute on the 3776 Model 4. The Katakana print belt can be interchanged with the optional 48- and 64-character set Japanese print belts on the 3776 Models 3 and 4 printer with a resulting increase in throughput.

When using a 48- or 64-character set print belt on a Katakana printer, the 3776 converts the EBCDIC equivalent of the lowercase alphabetic characters (a through z) to uppercase alphabetic characters before printing them. For example: EBCDIC hexadecimal '81' converts to hexadecimal 'C1'.

If characters in print data are not present on the line printer belt, a hyphen(-) prints.

Additional Print Belts (3776 only)

Additional print belts (purchase-only accessories) are available for the 3776 console-mounted line printer. Belts are available for the 48-, 64-, and 94-character sets for various countries, as shown in Appendix B. Print belts are not interchangeable between the 3776 Model 1 and Model 2 nor the Model 3 and Model 4. Belts are interchangeable between the 3776 Model 1 and Model 3 or the Model 2 and Model 4. ASCII character set belts are also available for use in the U.S. and Canada.

Additional Print Trains (3777-3/3203 only)

See Chapter 5 for the IBM 1416 Print Train Arrangement available for the IBM 3203 Printer Model 3.

Additional Print Bands (3777-4/3262 Only)

Additional print bands are available for the 3262 line printer. Bands are available for the 48-, 63-, 64-, 96-, and 128-character sets plus the 116-character Canadian French and 127-character Katakana sets.

Operating Controls (3776 Models 3 and 4/3777 Models 3 and 4)

POWER ON/OFF Switch: This switch is located on the left side of the knee hole on the controller housing and controls ac power to the terminal. When power is turned on, the bring-up diagnostics run and the terminal is left with all lights off except code 900 in the NPR indicators. Any other NPR being on signals a failure in the terminal's electronic components or that the Keylock is off. If the tests run successfully, the PROCEED light is turned on and the operator is prompted in the entry area of the display to specify the current date and time and whether or not the communications adapter should be enabled. If the communications adapter is to be enabled, the logon messages (SSCP messages) will be sent to the host processor as part of the terminal initialization procedure when the terminal receives an ACTLU command from the host. The operator should proceed as described in the *Operating Procedures Guide* for the 3776-3/3776-4/3777-3 and the *Operating Procedures Guide* for the 3777-4.

Auxiliary Operator's Panel and Battery Enclosure

The auxiliary operator's panel (Figure 4-5) is located behind the door on the controller base. It contains the SYSTEM RESET switch and certain special feature controls, as follows:

Key Entry Enable/Disable Keylock (not 3777-4): This keylock must be in the ENABLE position for the operator to enter the terminal's master (logical) cryptographic key (see "Terminal Operator Commands—KEY Command"). The KEY ENTRY switch must be in the DISABLE position at all other times. If this switch is in the ENABLE position at power-on/off time, the terminal's master cryptographic key may be destroyed.

SYSTEM RESET Switch: This switch causes the terminal to interrupt any operation in progress and leaves the terminal in the same power-on state as described under "POWER ON/OFF" switch. The SYSTEM RESET switch does not erase the error log, the line statistics, or the stored procedures. The current status of the machine remains in effect.

Keylock: This is the key-operated switch for the Keylock special feature (see

"Features and Accessories"). This switch must be on for operations initiated at the terminal.

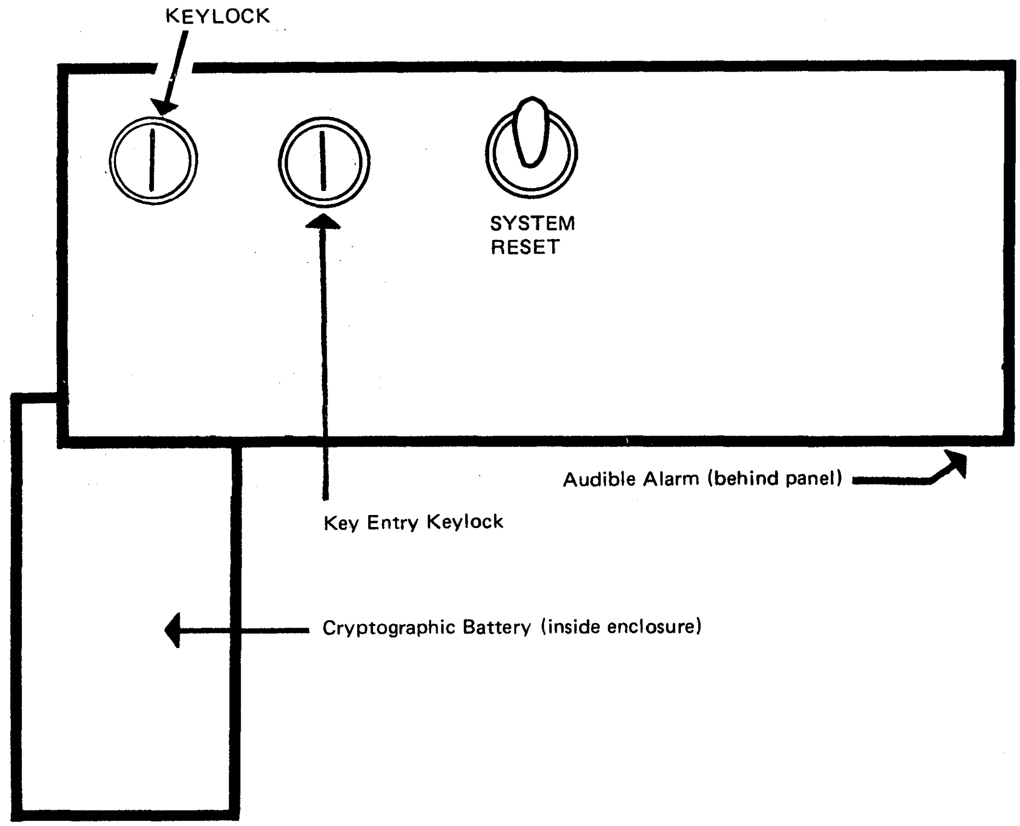

Figure 4-5. 3776/3777 MLU Auxiliary Operator's Panel and Battery Enclosure

Keyboard Switches, Keys, and Lights (Figure 4-6 & 4-7).

Switches

ALARM: Turning this switch on enables the Audible Alarm feature, if installed, to sound when the Operator Attention Speaker sounds. The Audible Alarm is a louder and continuous signal.

PUNCH PRINT: Turning this switch on causes cards to be printed (interpreted) as they are punched (the 3521 must have the Card Print feature). The switch may be changed at any time. Refer to "3521 Special Features" in Chapter 5 for more information.

MSG ATTN (Message Attention): The setting of this switch determines whether or not the Operator Attention Speaker sounds when a message is displayed. In the MSG ATTN position, the speaker sounds when each message is first displayed to alert the operator to an unsolicited message. If the operator has made an inquiry and is expecting a response or if many messages are received, this switch should be turned off.

CARR REST (Carriage Restore) (3776 MLU only): This key causes the forms on the printer to advance to the first printing line on the next form, as defined by the carriage control definition in effect. This key cannot be used when the printer is in ready.

CARR SPACE (Carriage Space) (3776 MLU only): This key causes the forms on the printer to feed one line. The printer must not be ready.

PRTR START (Printer Start) (3776 MLU only): This key indicates to the system that the printer is prepared for operation. Print operations cannot be executed unless the printer is in the ready condition.

PRTR STOP (Printer Stop) (3776 MLU only): This key indicates to the system that the operator wants to stop the printer. The printer stops after the operation currently in progress is completed. The printer must be stopped for any manual operation such as aligning forms or using the CARR REST or CARR SPACE Keys.

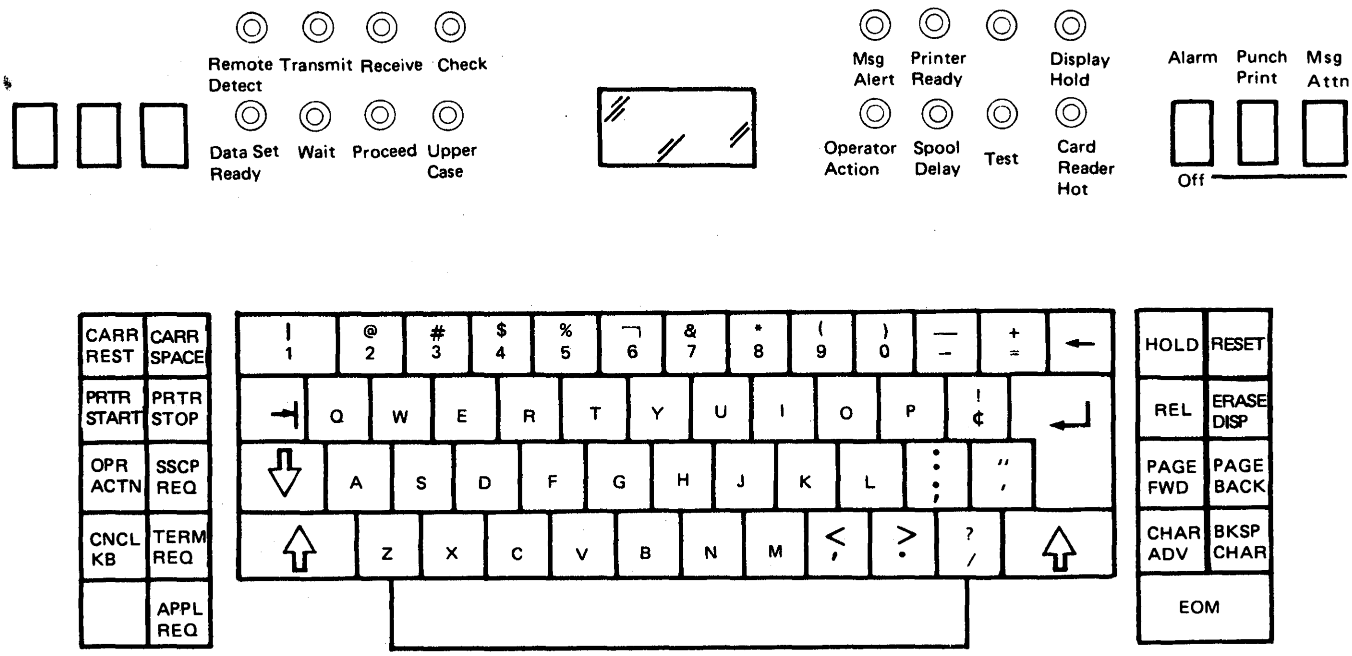

Figure 4-6. 3776 Models 3 and 4 Keyboard

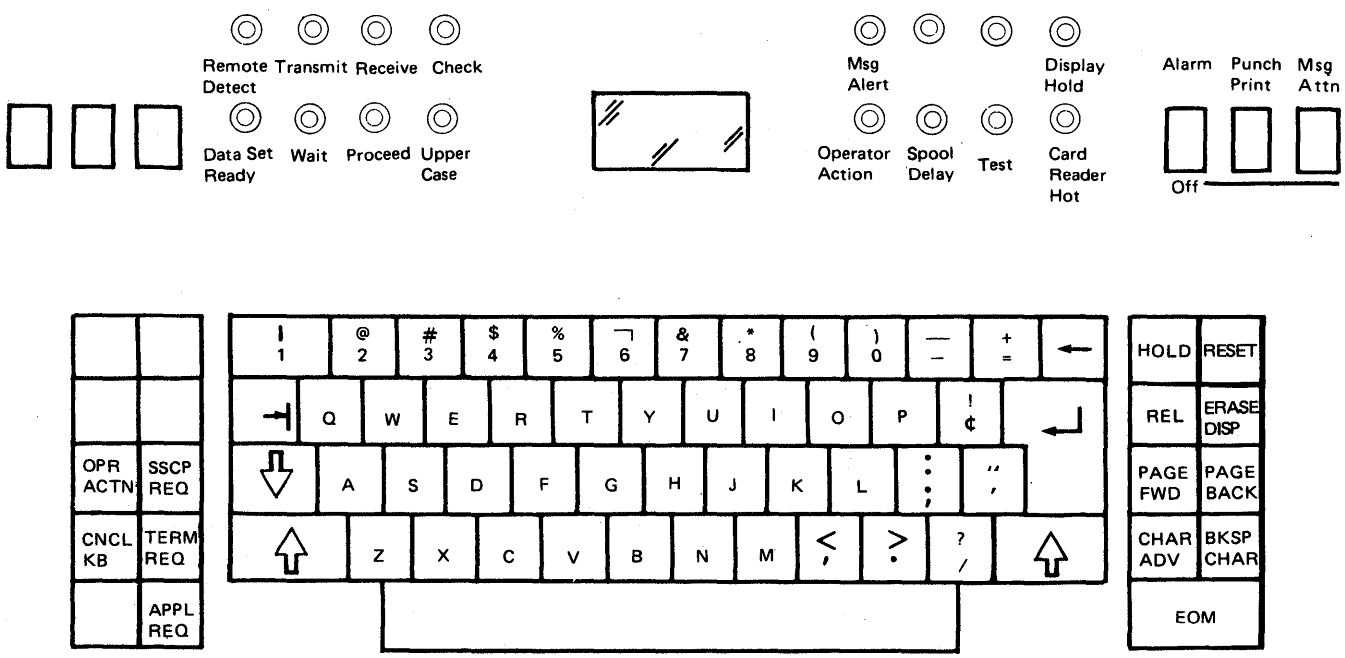

Figure 4-7. 3777 Models 3 and 4 Keyboard

OPR ACTN (Operator Action): This key is used by the operator to determine what should be done when the OPERATOR ACTION indicator is on. This may involve, for example, device intervention. A unique identifying number is also included with each message. When all operator action conditions have been handled, the OPERATOR ACTION indicator is turned off. The bottom three lines of the display (called the entry area) are used to communicate with the operator and any other function using the entry area is cancelled by the OPR ACTN key.

SSCP REQ (System Session Control Point Request): This key allows the operator to key in a message for transmission to the SSCP in the host. The PROCEED indicator comes on and the operator specifies the session on which the message is to be sent and the text of the message. The message may be up to 122 characters in length.

The operator indicates the end of message by pressing EOM. The message is then sent to the SSCP and moved to the message area of the display.

After pressing SSCP REQ and possibly keying data, the operator may use the ID reader to enter additional information. The data read by the ID reader is not displayed. Maximum message length is 120 characters. If the bottom three lines are in use by another function when this key is pressed, the other function is cancelled.

If presentation is inhibited (INP received from the host), the message is overlaid with asterisks when moved to the message area of the display.

APPL REQ (Application Request): This key allows the operator to key in a message for transmission to the host RJE application program.

The PROCEED indicator comes on and the operator enters a message with a maximum length of 120 characters.

The operator indicates the end of message by pressing EOM. The message is then sent to the host application and moved to the message area of the display. If the bottom three lines are in use by another function when this key is pressed, the other function is cancelled.

If presentation is inhibited (INP received from the host), the message is overlaid with asterisks when moved to the message area of the display.

TERM REQ (Terminal Request): This key allows the operator to key in a command to initiate a local or system operation or to define and store a procedure. The operator specifies the command to be executed in response to a prompt in the entry area of the display. (The PROCEED light comes on to indicate that the command can be entered). If more information is required for command execution, the operator is also prompted to supply the required information. The operator presses EOM after the last series of prompts to begin command execution. If the entry area of the display is being used by another function, the other function or command is cancelled when the TERM REQ key is pressed.

CNCL KB (Cancel Keyboard): Pressing this key cancels a keyed request started by the OPR ACTN, SSCP REQ, APPL REQ, or TERM REQ key. The CNCL KB function discards any data keyed in as part of one of the request and turns off the PROCEED light. To be effective, the CNCL KB key must be pressed before the EOM key is pressed for the last series of prompts.

HOLD: Pressing this key prevents the display of new messages and turns on the DISPLAY HOLD light. If messages are received while the display is in hold mode, they are written in terminal storage and the MSG ALERT light turns on. Pressing the REL key returns the Console Display to normal display mode.

RESET: Pressing this key resets the Audible Alarm. This key also returns the Console Display cursor to the next position to be keyed after pressing CHAR BKSP.

REL (Release): Pressing this key releases the Console Display from hold mode. Display hold mode can be entered by pressing the HOLD or PAGE BACK keys. When the REL key is pressed, the MSG ALERT and DISPLAY HOLD lights are turned off and the most recent screenful of messages is displayed.

ERASE DISP (Erase Display): Pressing this key erases the message area (the top 13 lines) of the display.

PAGE BACK/PAGE FWD (Page Backward/Page Forward): These keys allow the operator to retrieve and display previous messages. The first use of PAGE BACK places the display in hold mode. PAGE FWD may then be used to display messages received one screenful at a time. If all messages received are displayed, hold mode is released automatically and MSG ALERT and DISPLAY HOLD indicators are turned off. PAGE FWD is valid only when the display is in hold mode.

CHAR ADV/CHAR BKSP (Character Advance/Character Backspace): These keys are active when the PROCEED light is on and data entered from the keyboard is being displayed. These two keys may be used to edit keyed data. Pressing the CHAR BKSP key causes a non-destructive backspace (one space at a time) over previously-keyed characters. Pressing the CHAR ADV key causes non-destructive spacing over previously keyed characters. CHAR ADV is a typamatic key.

Note: The standard backspace ( ) key is also typamatic and performs the same function as the CHAR BKSP key.

EOM (End of Message): This key is pressed during an SSCP REQ, APPL REQ, or TERM REQ key operation to perform the following functions depending on the request type.

- SSCP REQ or APPL REQ - Pressing the EOM key (1) moves the entered message to the message area of the display, (2) sends the message to the host, and (3) stores the message in the spool area of terminal storage.
- TERM REQ - Depending on the type of command, pressing the EOM key (1) causes the display of additional prompts (if required), or (2) stores the defined procedure if the last series of prompts have already been displayed, or (3) executes the function.

Note: The Return key ( ) performs the same function as the EOM key.

Tab key ( ): The operator uses the Tab key when entering terminal operator commands. Pressing the Tab key moves the cursor from one prompting field to another in the entry area of the display.

Lights

The following lights in the left upper part of the operator panel are used to indicate the operation of the data link: REMOTE DETECT, TRANSMIT, RECEIVE and DATASET READY.

REMOTE DETECT: This light, when on, means that the line connection has been made, and the communication adapter has received a valid frame within the last 25 seconds.

TRANSMIT: This light is on when an SDLC frame is being transmitted and turns off when the transmission stops.

RECEIVE: This light is on when an information frame (I-Frame) is being received and turns off after received data stops.

DATASET READY: This light is on when the communication driver is enabled, and the local (terminal) modem has activated the Data Set Ready (DSR) interface lead.

WAIT: This light is on when the terminal is waiting for the completion of any I/O operation, or is not performing any other function.

PROCEED: This light is turned on to indicate that message data or prompted data can be keyed into the entry area of the display. The PROCEED light is turned off by the the CNCL KB or EOM key (after the last series of prompts).

UPPER CASE: This light turns on when the keyboard is in uppercase shift (Upper Shift key has been pressed).

Numeric Position Readout (NPR): This is a three-digit numeric display that provides different indications depending on what other lights are on and the operation being performed.

MSG (Message) ALERT: This light turns on when a system message is received that cannot be displayed because the Console Display is in hold mode. The Console Display enters hold mode when the HOLD or PAGE BACK key is pressed, or when a local operation or function requires the whole screen (message area and entry area). The MSG ALERT light does not turn off until all hold messages are displayed.

PRINTER READY (3776 MLU only): This light is on when the 3776 console-mounted line printer is in a ready condition.

DISPLAY HOLD: This light is turned on by pressing the HOLD key or PAGE BACK key or entering the PAGE command and means that no new system messages will be displayed while in hold mode. If any system messages are received while in hold mode, they are written in terminal storage and the MSG ALERT light turns on. Pressing the REL key turns off the DISPLAY HOLD light and removes the Console Display from hold mode. This light also comes on when the display is being used by a command that requires the message area of the screen.

OPERATOR ACTION: This light indicates that a situation has occurred that requires some action by the terminal operator. The Operator Attention Speaker also sounds when the OPERATOR ACTION light turns on. To respond to this light, the operator presses the OPR ACTN key to display information describing the situation. The operator may display information regarding all current operator action conditions.

SPOOL DELAY: This light indicates that the terminal is attempting to write system messages into terminal storage but is prevented from writing. The messages are queued in a buffer until terminal storage can be used.

Note: This light also turns on when an intervention required (OPERATOR ACTION light on also) condition occurs on the output device for a list spool operation. Operations in progress may not be able to continue or end until either the list spool function is able to run by correcting the output device error or by cancelling the list spool function. Other operations are affected only if they require the use of the spool (for example: An OUTPUT RESUMED message is displayed).

TEST: This light is on during communication facilities testing (wrap test).

CARD READER HOT: This light is on if the "hot card reader" option is specified in an operator command. The terminal is always trying to read cards. If ready or made ready, the 2502 will start reading cards as soon as the "card input" job is moved to the top of the job queue in the terminal. The operator does not need to perform an execute function for the subsequent card reader input.

Note: This light does not come on until the "hot card reader" job is at the top of the reader queue and not unless a session supporting card input has been established with the host.

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Chapter 5. I/O Attachments

This chapter describes the special feature input and output devices that can be cable-connected to the terminal controller and the special features for those devices.

IBM 3203 Printer Model 3

The IBM 3203 Printer Model 3 (Figure 5-1) is a standalone high-speed printer that is cable-connected to the 3777 controller. Maximum print speed of the 3203 is as follows:

1000 lpm using the 48-character set
951/297 lpm using the 52-character set*
870 lpm using the 60-character set
843/530 lpm using the 63-character set (ASCII)*
530 lpm using the 120-character set
717/530/297 lpm using the 107 Katakana character set*
530/297 lpm using the 127 Katakana character set*

***Note:** These trains are multilevel trains. Some characters in the set print faster than others. Refer to the *IBM 3203 Printer Component Description and Operator's Guide,* GA33-1515, for more information on preferred character set trains.

3203 Printer Characteristics

Maximum print line length is 132 characters. Horizontal spacing is 10 characters per inch. Vertical spacing is six or eight lines per inch under control of the terminal operator. Carriage skipping speed is up to 18 inches per second.

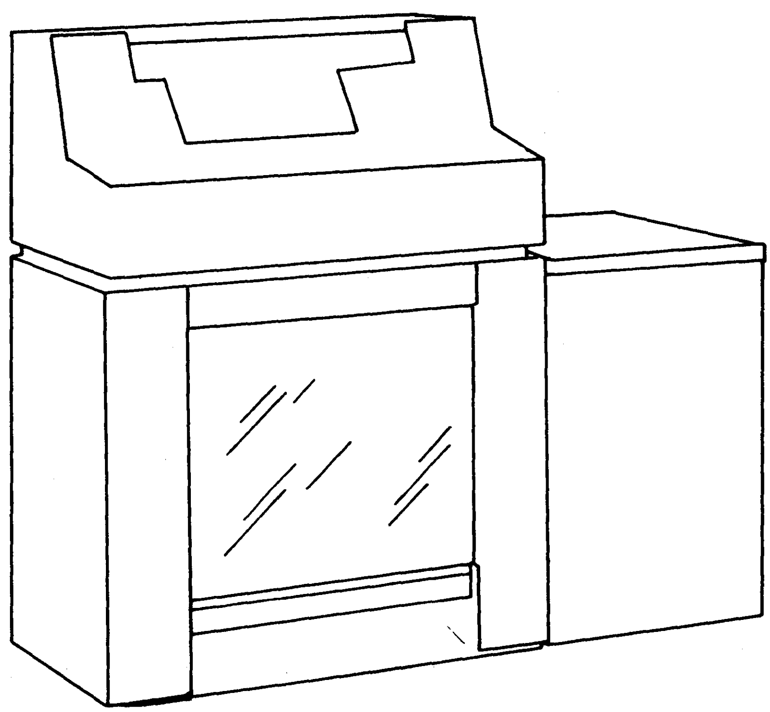


Figure 5-1. IBM 3203 Printer Model 3

The 3203 Printer is mechanically similar to the 1403 Printer Model N1. The character set is contained in a continuously rotating train within the interchangeable print cartridge. As the train rotates, it is continuously cleaned by a vacuum system built into the 3203. Inking is supplied by a fabric ribbon. Continuous edge-punched forms are fed by pin-feed forms tractors which are adjustable to accept forms ranging from 3 1/2 to 20 inches wide. Forms can vary in length from 3 to 24 inches. When the 3203 is attached to a 3777-1, the maximum 3203 form length is 127 lines. When the 3203 is attached to a 3777-2, the maximum 3203 form length is 24 inches. Design considerations for forms used with the 3203 Printer can be found in the publication *Forms Design Reference Guide for Printers,* GA24-3488.

The usage meter on the 3203 begins running when printing begins and stops running when the 3203 stops printing.

For more detailed information on the components, operation, and requirements of the 3203, refer to the *IBM 3203 Component Description and Operator's Guide,* GA33-1515.

3203/1416 Character Set Trains

The printer uses the IBM 1416 Interchangeable Train Cartridges which can be changed by the operator. Fifteen print train arrangements for the 3203/1416 are supported by the 3777 controller with the basic standard character set storage; eleven arrangements are supported with the optional International Print Support feature. The power-on default arrangement for EBCDIC on the 3777 is the AN print train arrangement. for ASCII, the default arrangement is GN (not on the 3777-3). The corresponding 1416 Interchangeable Train Cartridge(s) must be ordered for the 3203 Printer.

Standard Character Set Trains

Included with the basic 3777 controller is storage for 15 print train arrangements for the corresponding 1416 train cartridges (for the 3777-3 the international print support specify feature trains are also included):

Arrangement	*Description*	*Character Set/Size*
AN	48 "A" Graphics	48 Graphics
HN	48 "H" Graphics	48 Graphics
PN	PL/1	60 Graphics
QN	PL/1–Scientific–Preferred	60 Graphics, 45 Preferred
RN	FORTRAN/COBOL Commercial	52 Graphics, 47 Preferred
GN	ASCII	63 Graphics
SN	Text Printing–Commercial	84 Graphics, 78 Preferred
TN	Text Printing–Scientific	120 Graphics
QNC	PL/1–Commerical–Preferred	60 Graphics, 45 Preferred
OAA	Alphameric	48 (5 "A" + 43 OCR-A)
PCS-AN	Preferred Character Set	48 "A", 3-level set
PCS-HN	Preferred Character Set	48 "H", 3-level set
ODA	Numeric	48 (38 "A" + OCR-A numeric)
OAB	Alphameric	48 (repr. of OCR-B graphics)
ONA	Numeric	48 (35 "A" + OCR-A numeric + 3 special characters)

When a substitute character is ordered to replace a character in one of the standard trains used on a 3203-3 attached to a 3777-1, the substitute character assumes the card and bit codes of the character it replaces.

The user may create his own train images. For the 3777-2, refer to "Loading the UCS Train Image from Cards" in the *3777-2 Operator's Guide,* GA27-3129. For the 3777-3, refer to "Define a Print Train Image – TRAIN" in the *3776-3,4 and 3777-3 Operator's Guide,* GA27-3165.

International Print Support Feature Trains

An optional International Print Support specify feature is available on the 3777 and replaces the standard support with storage for 11 print train arrangements for the corresponding 1416 train-cartridge (for the 3777-3 the international print support and the standard trains are included).

Arrangement	*Description*	*Character Set/Size*
AN	48 "A" Graphics	48 Graphics
HN	48 "H" Graphics	48 Graphics
PN	PL/1	60 Graphics
QN	PL/1–Scientific–Preferred	60 Graphics, 45 Preferred
RN	FORTRAN/COBOL Commercial	52 Graphics, 47 Preferred
PCS-HN	Preferred Character Set	48 "H", 3-level set
KAT-107	Katakana Character Set	107
KAT	Katakana Character Set	127
AN-Modified	Equivalent to 3776/48-Char.	48
PN-Modified	Equivalent to 3776/64-Char.	64
SN-Modified	Equivalent to 3776/94-Char.	94

3203 Speed Enhancement Feature

This special feature on the 3203 Model 3 increases the maximum print speed to 1200 lines per minute with a 48-character print set. A special feature on the 3777 is required to support the Speed Enhancement feature on the 3203. Print speed increases are as follows:

Character Set	*3202-3 Without Speed Enhancement*	*3203-3 With Speed Enhancement*
48	1000 lpm	1200 lpm
60	870	1020
84/107	717	815
120/127	530	585

IBM 3262 Printer Models 2 and 12

The IBM 3262 Printer Models 2 and 12 (Figure 5-2) are line printers that attach to the 3777-4 via a direct communication loop. Two 3262 printers, in any combination of models, can be attached to the 3777-4. One 3262 is required; the second is an optional feature.

Nominal print speeds of the 3262 are as follows:

Print Band	Nominal Rated Speed (lpm)	
Characters per Set	*Model 2*	*Model 12*
48	650	325
63*	625	310
64	465	230
96**	364	180

Refer to Appendix B and to the *IBM 3262 Printer Models 2 and 12 Component Description,* GA24-3737, for more information on character sets and code charts.

*A general-purpose, optimized, 63-character print band may improve performance over the standard 64-character set print band. The degree of improvement depends on the data character content of the data stream presented to the printer.

**94 characters are printable.

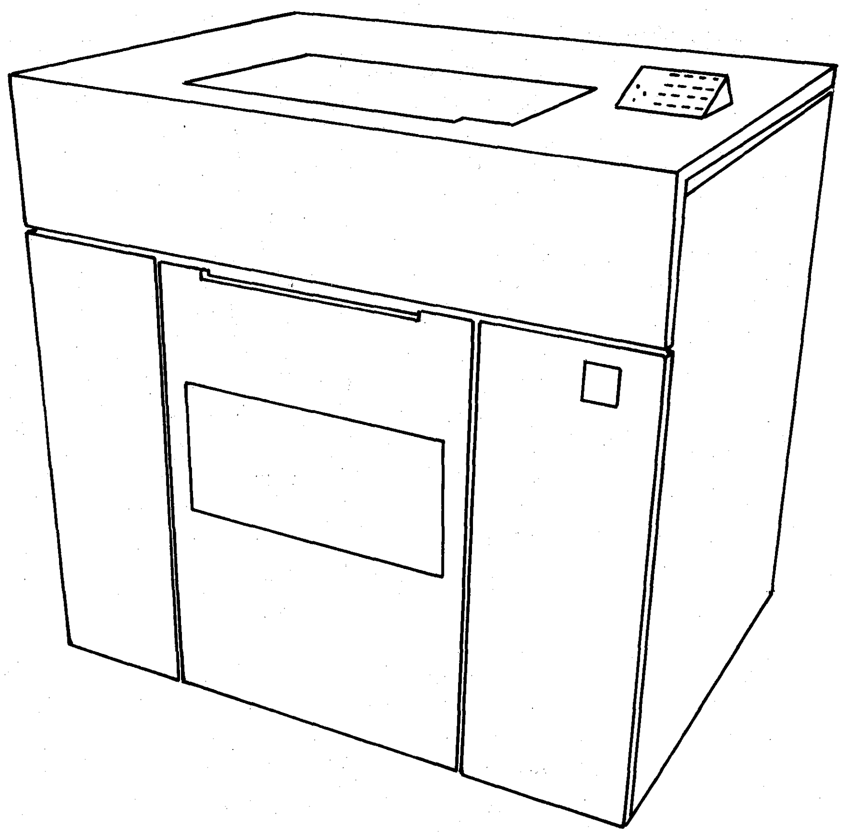


Figure 5-2. IBM 3262 Printer Models 2 and 12

3262 Printer Characteristics

The maximum print line length is 132 characters spaced 2.54 mm (0.1 in) on centers. The maximum forms length is 127 lines. Vertical line spacing is either 6 or 8 lines per inch. Forms skipping is up to 508 mm (20 in) per second. Printing up to six-part forms and card stock forms is possible; however, multiple-part forms over four parts should be tested in operating conditions to verify that the results are satisfactory. For additional forms design considerations, see *Forms Design Reference Guide for Printers,* Order No. GA24-3488. Forms specifications follow:

Width (overall)	Maximum	406 mm (16 in)
	Minimum	89 mm (3.5 in)
Length	Maximum	356 mm (14 in)
	Minimum	76 mm (3 in)
		Minimum fold-to-fold length is 152 mm (6 in)

Maximum forms thickness 0.51 mm (.02 in)

Printing Method

A continuously-rotating steel band with 288 etched characters travels in front of the print hammers, forms, and ribbon. As the print band moves, every character passes in front of every hammer position. Timing marks on the print band synchronize the printer electronics and mechanism. When the desired character is in the correct position to print, the hammer strikes the form from the back against the character to be printed.

Printer Addresses and Selection

A single 3262 printer attached to a 3777-4 must have a loop station address of X'60' and is specified for commands by PR. If two 3262s are attached, the loop station addresses must be set to X'60' and X'61' respectively. The second printer (address X'61') is specified for commands by P2. When a function uses a printer as the output device and does not specify address selection for a two-printer 3777-4, the first 3262 (X'60' is always used.

Print Command

The PRINT command can change printer forms parameters only when the 3262 is not busy. The 3262 is considered busy even when it is not printing, if it is selected as an output device.

IBM 2502 Card Reader

Three models of the 2502 (Figure 5-3) are available for attachment to the various 3776/3777 models, as shown in Figure 5-4. Models A1, A2, and A3 provide card reading at 150, 300, and 400 cards per minute, respectively. For attachment to a 3776 the 2502 is mounted on a 3782 Card Attachment Unit as shown in Figure 5-3. The 3782 contains the power supply and other electronic circuitry, and is cable-connected to the 3776 controller. Attached to a 3777, the 2502 is mounted on the controller console.

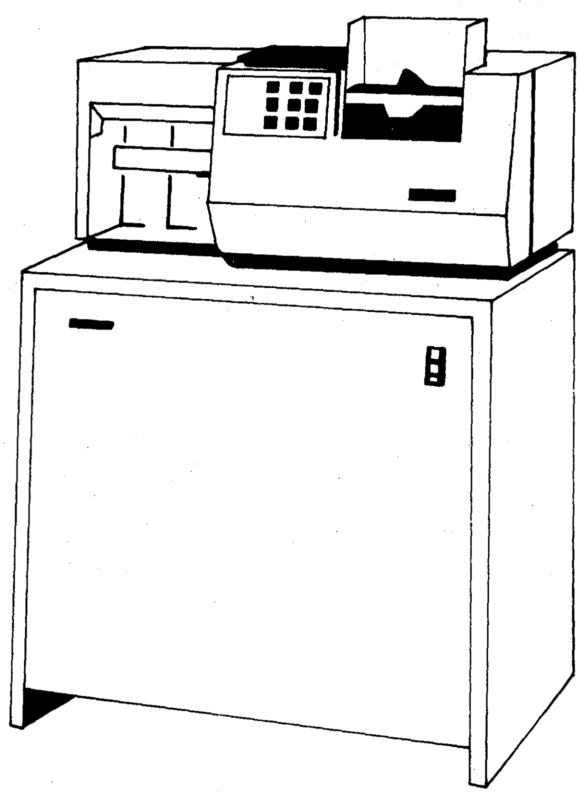


Figure 5-3. IBM 2502 Card Reader Model A1, A2, or A3/3782 Card Attachment Unit, Model 2

Terminal Type-Model	Can Attach 2502 Model:	Speed (Cards/Minute)
3776-1 3776-2	A1 or A2 (Via 3782 Card Attachment Unit Model 2)	A1 – 150 A2 – 300
3776-3 3776-4	A1, A2, or A3 (Via 3782 Card Attachment Unit Model 2)	A1 – 150 A2 – 300 A3 – 400
3777-1 3777-2 3777-3 3777-4	A1, A2, or A3 (Console-Mounted)	

Figure 5-4. 2502 Attachment to 3776/3777 Terminals

Special features for the 2502 permit reading of 51- and 80-column cards interchangeably, or of 66- and 80-column cards interchangeably. The operator can easily change the machine to read either standard 80-column cards or one of the short-length cards. Both short-length cards cannot be read by the same machine, however. An Optical Mark Read feature (not available with the 3776-3, 3776-4, or 3777) equips the machine to read hand-marked or machine-marked cards in addition to punched cards. This feature can be used with any length (51-, 66-, or 80-column) cards.

Card codes and specifications for punched and marked cards are shown in Appendix C.

2502 Functional Characteristics

The 2502 feeds cards on command from the 3770 controller and reads card data to the buffer column-by-column. Each command from the controller transfers an entire card's data. The controller translates the card code to the 3770 internal code and stores it into the buffer. From the buffer, the 3770 terminal can read the data out to the communication line or to a locally attached output device.

Validity Checking

Each card column is checked for multipunches or multimarks in rows 1 through 7. An invalid code detected stops the 2502 and turns on the VALIDITY CHECK light. The READER light on the 3776-1, 3776-2/3777-1 terminal's console turns on to signal the operator that the 2502 requires attention. The validity check is also logged in the 3776/3777 error log. An NPR 244 is displayed on the 3776-1/3776-2/3777-1/3777-2. An error message is displayed on the 3776-3/3776-4/3777-3/3777-4.

BSC Nontransparent Operation (3776-1,2/3777-1)

In BSC nontransparent operation, blank card columns are compressed when they are encountered between data fields (if the job definition specifies space compress), or stripped off (truncated) if they appear toward the column-80 end of the card. Elimination of the blank columns takes place before the data enters the controller's buffer and thus conserves buffer space for storage of useful data. On output to a card punch at the remote host processor (online mode), or to an attached card punch or printer (offline mode), the blanks are reinserted into the output data stream, or expanded. Data written to the diskette device is not expanded, but will be expanded on output from the diskette device to the card punch (or by the host processor, if desired).

With the Optical Mark Read feature (not available with the 3776-3, 3776-4, or 3777) both punches and marks can be read from the same card by use of the "mark read transfer" character. Punches must be contained on the left side of the card, and marks on the right side. The mark read transfer character is punched at the end of the punched-data field, and causes the 2502 to switch to mark-read mode for the remainder of the card.

Using fully punched or marked cards, the number of characters transferred to the controller's buffer is as follows:

Card Size	*Punched Data*	*OMR Data*	*OMR and Punched Data*
80 Column	80 Characters	40 Characters	See Note
66 Column	66 Characters	33 Characters	See Note
51 Column	51 Characters	26 Characters	See Note

Note: The number of characters transferred to the buffer depends on the position of the "mark read transfer" character. For a description of reader operation when both punches and marks are being read, refer to "Type-of-Data Selection" and "Mode Switch" under the discussion of the OMR special feature.

For blank fields of two or more columns between data fields, a count sequence is inserted into the buffer in place of the blank columns. This sequence is an IGS character followed by a count of the blank columns removed, as described under "Operating Characteristics—Space Compression/Expansion." On output at the host processor, or on output to an attached card punch, blanks compressed and replaced by this count sequence are reinserted into the output data stream. (This section does not apply to the 3777 Model 2,3,4 or the 3776-3,4.)

BSC Transparent Operation

In transparent mode operation, blank columns are not stripped from data but are read into the buffer wherever they appear in the card. When short-length cards (51 or 66 columns) are used in this mode of operation, each buffer block contains one card of data, regardless of which card length is used or of the number of blank columns in the card; data blocks transmitted to the host processor always contain either 51 or 66 data characters, depending on which card length is used. When 80-column cards are used in this mode of operation, three cards of data (240 data characters, assuming fully punched cards) are contained in each transmission block. On the 3776-1/3776-2/3777-1 using the 512-byte buffers, six cards (480 data characters) are contained in each block. (This section does not apply to the 3777 Model 2, 3, or 4 or the 3776 Models 3, 4).

SDLC Nontransparent Operation

This mode of operation is the same as BSC nontransparent with the exception that duplicate characters can be compressed as well as blank card columns (see "Operating Characteristics–SLDC Compression/Expansion" in the appropriate chapter).

SDLC Transparent Operation

In this mode of operation, blank columns are stripped from the end of the card. Useful data is preceded by a TRN character (X'35') and a one-byte binary count of the transparent data. Following the data is an IRS character ('1E'). Short cards are handled in the same manner; therefore, multiple cards can be read into a single buffer.

For MLU Models, both Transparent and Compressed data streams are permissable (TRN,SCB,DATA...).

End of File

An EOF (end of file) switch on the 2502 operator's panel controls the EOF signal to the controller. When the EOF switch is ON and the last card is read, an end-of-file signal is sent to the controller causing the transmission frame or block for this buffer load to be flagged as the last block or frame of the job.

The EOF switch should be turned ON when the last batch of cards for the job is placed in the hopper. If the EOF switch is OFF when the last card feeds out of the hopper, the ATTENTION indicator turns on and the Operator Attention Speaker sounds. Unless the operator presses NPRO, places more cards in the hopper, and presses the START key within three minutes, the controller aborts and ends the job.

2502 Special Features

51-Column Interchangeable Feed Feature

This special feature allows the 2502 card reader to feed 51-column cards. The operator can easily change the 2502 from 80-column card processing to 51-column card processing and vice versa. 51-column and 80-column cards cannot be intermixed. Installation of the feature does not affect normal 2502 operations and does not change the card feed rate of 150, 300, or 400 cards per minute.

This feature can be installed in the field. A 2502 cannot have both this feature and the 66-Column Interchangeable Feed feature.

66-Column Interchangeable Feed Feature

This special feature allows the reader to feed 66-column cards. Otherwise, this feature is identical to the 51-column feature.

This feature can be installed in the field. A 2502 cannot have both this feature and the 51-Column Interchangeable Feed feature. 66-column and 80-column cards cannot be intermixed.

3777 Model 2 Short Card Considerations

Host RJE subsystems that support the 3777-2 require that 80 columns of data (or the compressed equivalent) be transmitted for each card. Therefore, if a 51- or 66-column card is read, the 3777-2 fills in with blanks to pad the record to 80, or to the length specified by the card read instruction.

Optical Mark Read (OMR) Feature

This special feature (not available with the 3776-3, 3776-4, or 3777) provides the 2502 with a mark-read unit at the read station. This unit enables the 2502 to read vertical nonreflective marks, such as number-2 pencil marks, from mark positions in the mark-read field of the cards. Mark reading is controlled by a switch on the 2502 operator's panel. Mixed punched and OMR cards are not permitted in BSC Transparent mode. A companion OMR feature is also required on the 3782 Model 2.

Marking the OMR Card: Figure 5-5 shows a mark constraint. Every mark position used for the application must contain a mark constraint printed in reflective ink that will not be read by the 2502 (see "2502 OMR Card Specifications" in Appendix C).

To enter mark data on the card, mark from dot to dot in each appropriate position, making certain that the mark falls between the constraint lines.

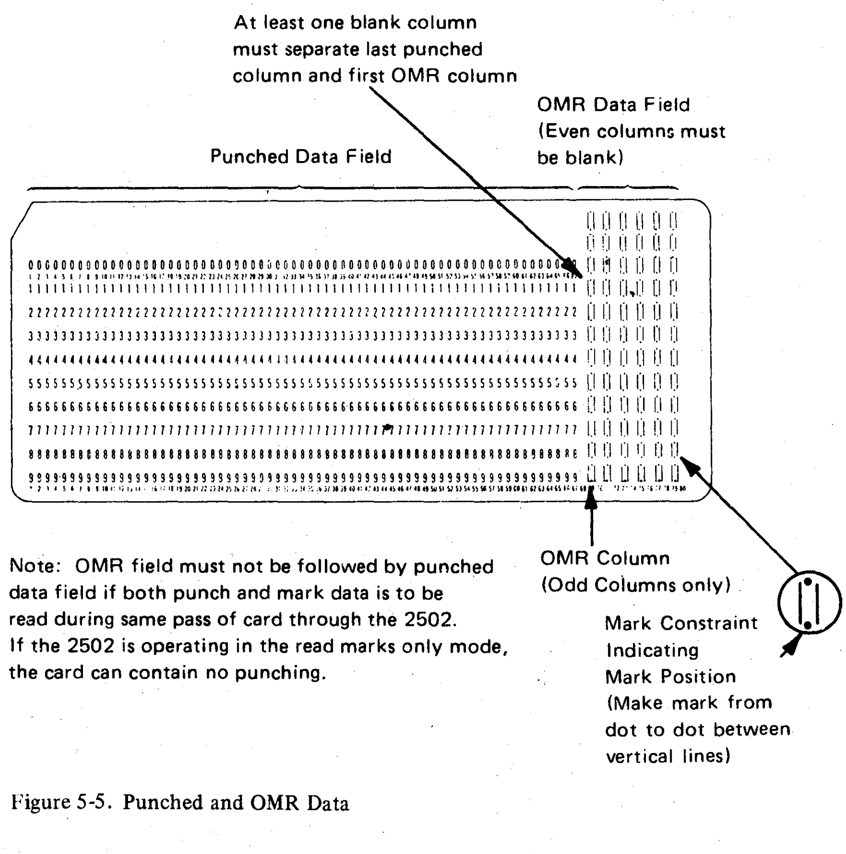


Figure 5-5. Punched and OMR Data

OMR specifications indicate the reflectance measurement required for reading marks, and for not reading erasures. Generally, heavy lines made carefully with a number 2 pencil are satisfactory. Erasures must be made carefully and completely to prevent the mark from being read. A card can contain nonreflective printing on the left of the card if there is a "mark read transfer" character at the right of all nonreflective printing and the Mode switch is set as its M/P setting (see "2502 Operator's Panel–Mode Switch" in this chapter). This transfer character is the EBCDIC IFS character (card code 11-9-8-4, hex '1C').

Mark-Read Data Validity: The 2502 treats a column of OMR data exactly as it treats a column of punched data, applying the same rules for data validity.

Type-of-Data Selection: A three-position switch on the 2502 operator's panel (see Figure 5-5) controls whether punches only, punches and marks, or marks only are to be read from the cards. If both punches and marks are to be read, the 2502 reads punched holes from the left of the card until it encounters a "mark read transfer" character (IFS) ending the punched-data field. The reader remains in mark-read mode for the remainder of the card, and switches to punch-read mode on the following card. The IFS character (X'1C') is treated as a data character. It is sent on the communication line or written on the output device. Combination cards (containing both punches and marks) should not be read in transparent mode.

The transfer character must be followed by at least one blank column. If the transfer character is punched in an even-numbered card column, it must be followed by two blank columns (since OMR data must be located in odd-numbered columns). For example, if the transfer character is punched in column 50, columns 51 and 52 are blank, and the first marked column is column 53.

Mark Reject: Each 2502 equipped with the OMR feature is also equipped with an offset-stacking feature. Whenever an undefined character (light mark or poor erasure) is detected while the 2502 is in mark-read-mode, the card containing the undefined character is offset (toward the operator) about 0.7 inch from other cards in the stacker. Data from the card containing the undefined character is not transmitted to the output device.

2502 Operator's Panel

The following keys, lights, and switches are located on the 2502 card reader operator's panel (Figure 5-6).

START Key: Pressing this key causes a card to feed from the hopper to the cornering station and places the card reader in a "ready" status if the 2502 is assigned by the job definition and has cards in the hopper.

On the 3776-1,2/3777-1 terminals, a card reader-to-line job is automatically started when the 2502 is made ready, the terminal is in standby mode, and the 2502 is not involved in a dual job. Under these conditions, the START-JOB procedure is not necessary (see "Automatic Card Reader-To-Line Function" in Chapters 2 and 4). The 3777-2 starts reading cards and transmits them (as multileaving data if output data is being received) to the host if the 3777-2 is online and diskette input is not being utilized. On MLU terminals, a card reader to line job may be started as stated above if the user has specified the reader as "hot".

STOP Key: Pressing this key stops the card reader after the card passing the read station is completely read and placed in the stacker. A signal is sent to the controller indicating that the card reader has lost its "ready" status.

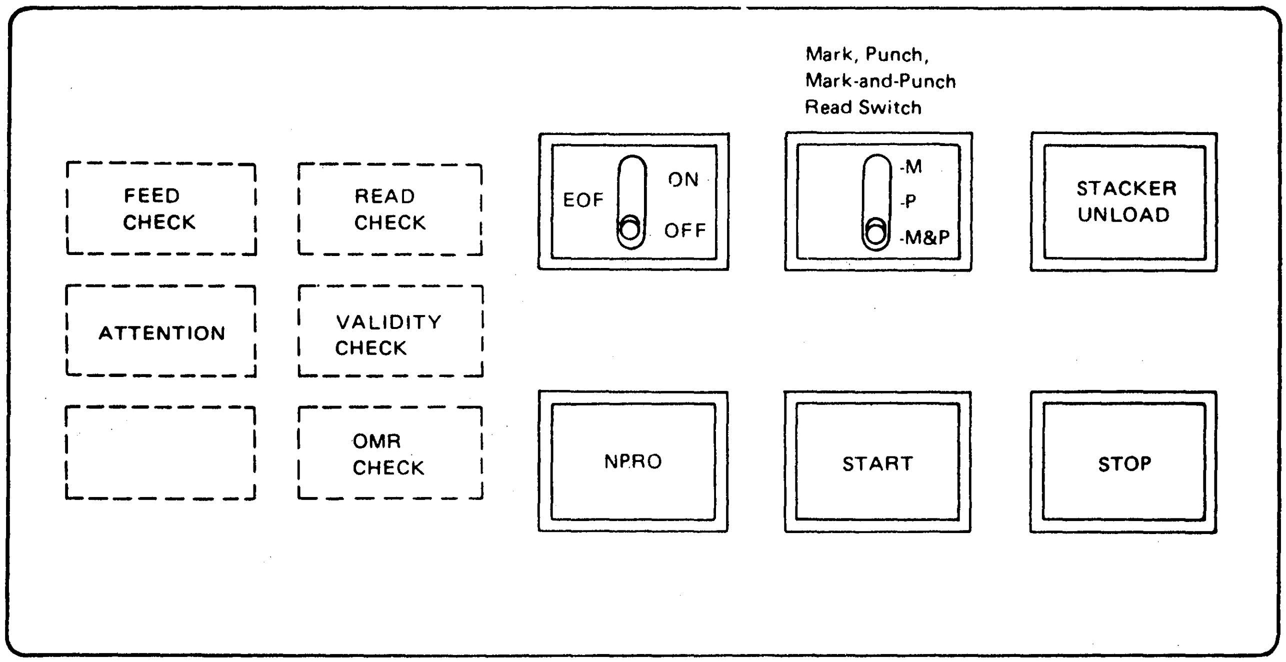


Figure 5-6. 2502 Operator's Panel

STACKER UNLOAD Key: Pressing this key causes the card reader to stop for about 30 seconds (Model A1) or 15 seconds (Model A2) to allow time for unloading the stacker or adding cards to the hopper.

NPRO (Non-Process Run Out) Key: Pressing this key causes cards to be ejected from the card path without being read and resets any error conditions.

EOF (End of File) Switch: This switch should be set to the OFF position while any cards in the file being used are yet to be loaded into the hopper. When placing the last cards in the hopper, set the EOF switch to the ON position. When the last card has been read without error, the card reader signals an end-of-file condition to the controller or user-written program.

Mode Switch: This switch is present only on machines having the Optical Mark Read special feature. The switch has three positions:

M (Marks). Set the switch to this position when cards to be read contain marks only.

P (Punches). Set the switch to this position when cards to be read contain punches only. These cards may have marks and nonreflective printing in any location on the card.

M/P (Marks/Punches). Set the switch to this position when cards to be read contain punches followed by marks.

ATTENTION Light: This light turns on to indicate that the 2502 is not ready; it may indicate either a full stacker, an open cover, or a stacker jam, or that all cards have been read and the EOF switch is OFF (see "2502 Card Reader Operation–End of File").

READ CHECK Light: When on, this light indicates either that the card did not feed properly through the read head, the card punches are not in registration, or a card reader sensor failed.

FEED CHECK Light: When on, this light indicates that a card did not feed properly from the hopper.

VALIDITY CHECK Light: This light indicates that an invalid code (multipunch or multimark in card rows 1–7) was read.

OMR CHECK Light: This light indicates a mark that is too light, a poorly made erasure (or smudge), or that the OMR read unit lamp has overheated.

IBM 3501 Card Reader (3776 Models 1 and 2 Only)

The 3501 card reader (Figure 5-7) is a small tabletop unit that can be attached to the 3776 Model 1 or 2 for reading cards at a rated speed of 50 cards per minute. The reader is cable-connected to the 3770 controller. The 3501 can be placed on the work surface of the 3776; otherwise, a table or stand for the card reader must be provided by the user.

Card codes and specifications for punched cards are shown in Appendix C. No special features are available for the 3501 card reader.

3501 Functional Characteristics

The 3501 feeds cards on command from the terminal's controller and reads card data to the buffer column-by-column. Each command from the controller transfers an entire card's data. The controller translates the card code to the 3770 internal code and stores it into the buffer. From the buffer, the terminal can read the data out to the communications line (online mode) or to the selected output device (offline mode).

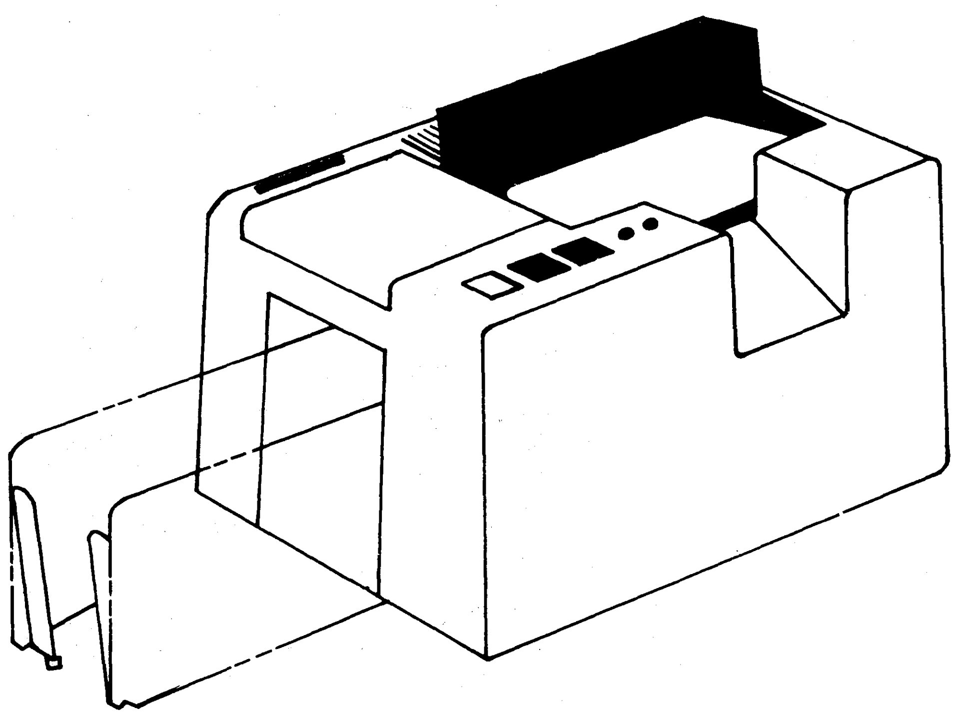


Figure 5-7. IBM 3501 Card Reader

Validity Checking

Each card column is checked for multipunches in rows 1 through 7. An invalid code detected stops the 3501, and the READER light on the 3776-1/3776-2 terminal's console turns on to signal the operator that the 3501 requires attention.

BSC Nontransparent Operation

In BSC nontransparent operation, blank card columns are compressed when they are encountered between data fields (if space compression is specified by the operator), or stripped off if they appear toward the column-80 end of the card (whether or not space compression is specified). Elimination of the blank columns takes place before the data enters the buffer and thus conserves buffer space for storage of useful data. On output to a card punch at the remote host processor (online mode), the blanks are reinserted into the output data stream, or expanded.

Cards continue to read and store into the buffer as long as sufficient buffer space remains to contain an entire card's data, plus one space for the IRS character to indicate end-of-card. If less than 81 positions remain, the buffers alternate and the next card stores in the next buffer, regardless of the number of blank card columns in the next card. If card data is being compressed, an attempt is made to write the next card into the current buffer regardless of the number of spaces remaining. When overflow occurs, the buffer is terminated with the last full card stored, and the card causing the overflow is stored in the next buffer.

For blank fields of two or more columns between data fields, a count sequence is inserted into the buffer in place of the blank columns. This sequence is an ESC character followed by a count of the blank columns removed, as described under "Operating Characteristics–Space Compression/Expansion." On output at the host processor, or on local output to an attached card punch, blanks compressed and replaced by this count sequence are reinserted into the output data stream.

BSC Transparent Operation

In transparent mode operation, blank columns are not compressed or stripped from data but are read into the controller's buffer wherever they appear in the card. In this mode, three cards (six cards using 512-byte buffers) are contained in each buffer of data. Data blocks transmitted to the host processor always contain 240 bytes (480 bytes using 512-byte buffers), assuming fully punched cards.

SDLC Nontransparent Operation

This mode of operation is the same as BSC nontransparent with the exception that duplicate characters can be compressed as well as blank card columns (see "Operating Characteristics–SDLC Compression/Expansion" in the appropriate chapter).

SDLC Transparent Operation

In this mode of operation, blank columns are stripped from the end of the card. Useful data is preceded by a TRN character (X'35') and a one-byte binary count of the transparent data. Following the data is an IRS character ('1E'). Short cards are handled in the same manner; therefore, multiple cards can be read into a single buffer.

End of File

The last card of a file must be punched with /*EOF (five characters) to indicate end-of-file to the controller. The five characters must be punched into a separate card containing these five characters in the first five columns with the remainder of the card blank.

3501 Operator Controls

Lights

Two lights on the operator's panel are used to indicate ready and check conditions of the 3501. Both lights being on indicates that the card reader is ready; and one light off indicates a check condition. Check conditions indicated by the lights are: invalid punch (multipunch in rows 1 through 7), card feed failure, card jam, or empty hopper.

Keys

Two unlabeled keys, a green key and a red key, are used to start and stop the 3501 card reader. The green (start) key places the 3501 in a ready condition if the card reader is assigned by the job definition and has cards and card weight in the hopper. The red (stop) key stops the card reader and drops the ready condition to allow unloading the stacker or placing more cards in the hopper.

IBM 3521 Card Punch

The 3521 Card Punch (Figure 5-8) can be attached to a 3776 (all models), 3772-2, 3777-3, or 3777-4 to provide punched-card output into 80-column cards at 50 cards per minute. The 3521 is attached via a 3782 Card Attachment Unit Model 1, which is cable-connected to the terminal's controller.

Special features for the 3521 provide punch-checking capability, card reading (3776-1 and 3776-2 only), and printing (interpreting) on the card.

3521 Functional Characteristics

(This section does not apply to the 3777 Model 2.) The 3521 operates under control of the 3770 terminal's controller. Data reads out of the controller's buffer byte-by-byte for punching.

BSC Nontransparent Operation

In this mode of operation, data is formatted in the buffer for punching by IRS characters, which signal the end of a card. On readout to the card punch, the IRS character causes punching to be suspended for the remainder of the card, and punching can resume in column 1 of the next card. If IRS characters are not used to format card data received from the host processor, 80 columns are punched. Assuming that full-buffer loads of data (256 bytes) are received, three full cards (240 bytes) and one partial card (16 bytes) are punched for each buffer. On the 3776 using the 512-byte alternating buffers, six full cards (480 bytes) and one partial card (32 bytes) are punched for each buffer.

Data that was compressed (BSC Space Compression) is expanded on output from the controller's buffer to the 3521. The spaces that were compressed (as explained under "Operating Characteristics–BSC Space Compression/Expansion") are reinserted into the data stream to the card punch.

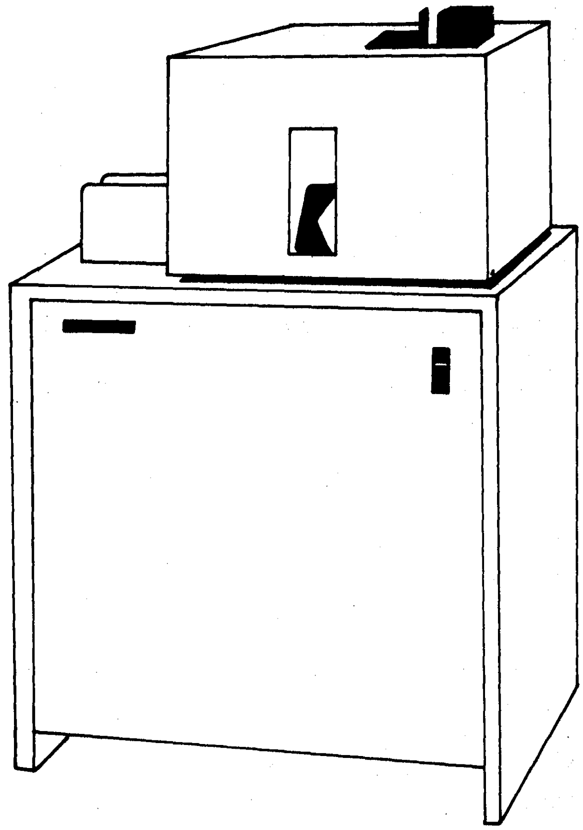


Figure 5-8. IBM 3521 Card Punch/3782 Card Attachment Unit, Model 1

BSC Transparent Operation

BSC transparent data from the host processor that is intended for punching must be transmitted one, two, or three full cards per block (80, 160, or 240 characters per block), with spaces (blanks) inserted wherever they are to appear in the card. On the 3776 using the 512-byte buffers, up to six full cards can be received in a block. IRS or other control characters within the data block will not be recognized as such in this mode, but will be punched as data.

SDLC Operation

For SDLC operation, refer to Chapter 7 or Chapter 8 "Outbound Data from Host Processor to 37770—Outbound Card Data".

3521 Special Features

Card Read Feature

This feature adds a read station for reading 80-column cards on the 3776-1, 2 and for punch checking on all models except the 3777-1.

During *punching*, data punched into the card is compared with the data that was intended for punching. If the data does not compare, the punch stops and an error is indicated to the operator. Data is also checked for invalid characters, or multipunches in rows 1 through 7. The punch-check can be disabled by specification in the punch card instruction or via the Punch Check command in the MLU in order to prevent an error indication when punching internally scored or prepunched cards.

Card read operation (available only on 3776-1,2) and data format are the same as described for the 3501 card reader. During *read* operation, data is also checked for invalid characters and for multipunches in rows 1 through 7. During card read operation, the last card of a file must be punched with /*EOF (five characters) to indicate end-of-file to the controller. The five characters must be punched into the first five columns of a *separate* card.

Card Print Feature

With this feature, the 3521 can print (interpret) cards as they are punched or read (except MLU mods). Printing is above the 12 row (top) of the card, column-for-column.

The EBCDIC 64-character set shown in Appendix B is provided on all machines. The characters are 0.062 inch wide by 0.079 inch high. Ink is supplied by an ink roll in contact with the type faces and is transferred directly from the type face to the card; no ribbon is used. The ASCII 64-character set is also available for use in the U.S. and Canada.

Katakana Card Print Feature

This feature allows the 3521 to print (interpret) the Katakana 127-character set on the card.

When this feature is installed, the 3521 speed is reduced to 25 cards per minute during punching, printing, or reading. The Katakana character set is shown in Appendix B.

3521 Operator's Panel

The following lights and keys are provided on the 3521 operator's panel.

Lights

Two lights on the operator's panel are used to indicate ready and check conditions of the 3521. Both lights being on indicates that the card punch is ready; and one light off indicates a check condition. Check conditions indicated by the lights are: card jam, empty hopper, and misfeed from the hopper. If the Card Read feature is installed, the lights also indicate a wrong punch (punch check), or multiple punches in rows 1 through 7 (invalid punch).

Keys

Three unlabeled keys (green, red, and blue) are used to control the 3521. The green (start) key causes a card to feed from the hopper and register at the punching station, if no error conditions exist, and places the card punch in a ready condition. The red (stop) key stops the card punch and drops the ready condition. The blue (nonprocess runout) key clears cards from the card feed and resets any error condition.

IBM 3411 Magnetic Tape Unit Model 1

One IBM 3411 Magnetic Tape Unit Model 1 can be attached to a 3776/3777 MLU terminal, to provide batch input and output data. The 3411 is a freestanding unit, cable-connected to the 3776 or 3777 controller.

The 3411 uses half-inch wide magnetic tape, with data recorded in nine tracks (eight data bits and one parity bit). Data can be recorded with a bit density of either 800 or 1600 bits per inch. A two-gap read/write head allows readback checking during write operations at which time tape first passes the write gap, then the read gap. The byte read is then checked against the byte that was written, ensuring that the tape was written properly. During reading, each byte is checked for parity.

Tapes written by or read by the 3411 may be labeled or unlabeled, as determined by the application, and under control of the user. Records written to or read from the tape may be fixed length or variable length, and may be blocked or unblocked, unspanned, under control of the user. Using labeled or unlabeled tapes, multiple data sets (files) may be contained on a single tape volume. Using labeled tapes, multivolume data sets (multiple tapes for a single data set) can be used.

Operations

The 3411 tape unit can be used in the following individual operations on the 3776/3777 MLU terminals depending on the availability of other attached I/O special features:

Online Operations	*Local or Offline Operations*
Tape Unit to Line	Card Reader to Tape Unit
Line to Tape Unit	Diskette 1 to Tape Unit Diskette 2 to Tape Unit
	Tape Unit to Card Punch
	Tape Unit to Diskette 1 Tape Unit to Diskette 2
	Tape Unit to Printer 1 or 2*

*3777-4

The 3411 tape unit can be used to buffer card medium or print medium data during a host output job.

To use the magnetic tape unit as a logical line printer or card punch, the operator executes an OUTPUT or HOSTOUT command to assign the tape unit to a particular medium/subaddress. During the subsequent host output operation, card medium or print medium data can be written on the tape unit. On an input operation, the tape unit can be used to transmit data created on another system.

Tape Records

The 3776/3777 MLU writes tape records in sizes ranging from 18 bytes to 255 bytes with a maximum block size of 4000 bytes.

The 3411 generates an inter-block gap (IBG) at the end of each block of records. On a subsequent read operation, the 3411 stops the read tape operation when it detects the absence of data bits in the IBG separating blocks of records on the tape. The interblock gap is also used to stop the "forward space block" and "backspace block" operations. Input record size is limited to 80 bytes because of host programming limitations.

Tape Files (Data Sets)

Each group of records, in groups of blocks, is identified by a data set name (8 character maximum) in the header label of a labeled tape or by its position as a file number counting from the beginning of an unlabeled tape. The 3411 writes a tape mark (TM) to identify the end of the data set or file followed by a second tape mark written at the end of an output operation. The tape mark is also used to stop the forward space file and backspace file operations.

Labeled Tape Contents

Labeled Tapes written by 3770 MLU consist of the following:

Single Dataset		*Multiple Datasets*	
One Volume	*Multiple Volumes*	*One Volume*	*Last Dataset on Multiple Volumes*
VOL1	VOL1	VOL1	VOL1
HDR1	HDR1	HDR1	HDR1
HDR2	HDR2	HDR2	HDR2
TM	TM	TM	TM
DATA	DATA	DATA	DATA
TM	TM	TM	TM
EOF1	EOV1	EOF1	EOF1
EOF2	EOV2	EOF2	EOF2
TM	TM	TM	TM
TM		HDR1	HDR1
		HDR2	HDR2
		TM	TM
		DATA	DATA
		TM	TM
		EOF1	EOV1
		EOF2	EOV2
		TM	TM
		TM	

For more information on the content of the labeled tapes, refer to Appendix E - "Data Format".

Unlabeled Tape Contents

Unlabeled Tapes written by 3770 MLU consist of the following (multiple volume not supported):

Single File	*Multiple Files*
DATA	DATA
TM	TM
TM	DATA
	TM
	TM

Unlabeled tapes read by 3770 MLU may start with a TM.

For more information on the content of the unlabeled tapes, refer to Appendix E - "Data Format".

Variable Length Records

Variable length records consist of a block descriptor word followed by one or more variable records. The variable records consist of a segment descriptor word followed by the actual data. The format is:

Block Descriptor Word		Segment Descriptor Word		Data	Segment Descriptor Word		Data
1 2 Length	3 4 X'0'	1 2 Length	3 4 X'0'		1 2	3 4	

Variable Length Record

Variable Length Block

Tape Usage Considerations

The tape may be used as either an input or an output device. Once a particular job begins to use the tape, it may not be used by any other job until the file or data set in use is closed.

When the use of a particular file or data set is complete, the user may specify the positioning of the tape. The user may specify *rewind* which will rewind the tape to the load point; the tape is ready and another operation may begin. For an unlabeled tape, the next operation may specify a specific file to be read or written. This will cause the tape to be forward spaced to the specified file. The user may also specify the current position. There is a possibility of overwriting existing data. For an input operation on a labeled tape, the correct data set will be located by name. For an output operation on a labeled tape, the new data set will begin after all existing data sets.

If the user specifies *rewind and unload,* the tape will be rewound and unloaded. Prior to any subsequent tape operations, the operator must reload a tape. Operation after loading a tape is as described above for rewind.

If the user specifies *leave* as the disposition, the tape will be positioned after the tape mark indicating the end of the file or data set. If the last operation was an output operation, two tape marks were written; in this case the tape will be positioned after the first tape mark and before the second tape mark. If the tape is unlabeled and on the next use of the tape the file number is not specified, the operation will begin from the current position. If this is an output operation, existing data may be overlaid. If the tape is labeled and the next operation is an output operation, the operation will begin from the current position and may overlay existing data. If the tape is labeled and the next operation is an input operation, the tape will be searched for the proper data set from the beginning of the tape.

Chapter 6. BSC Programming Considerations for the 3776 Models 1 and 2/3777 Model 1

The 3776-1/3776-2/3777-1 terminals conform to the rules for binary synchronous communications as described in the publication *General Information–Binary Synchronous Communications,* GA27-3004. This section provides specific information about use of certain data link and printer control characters, abort conditions, component selection procedures, and terminal identification.

Under normal MULTI-LEAVING operation of the 3777 Model 2, the information in this chapter does not apply. Refer to Chapter 3 for the 3777-2.

2770 Compatibility with the 3776-1/3776-2/3777-1

Those IBM programming systems identified as supporting the 2770 may also be used by the 3776-1/3776-2/3777-1 operating in BSC mode. Figure 6-1 is a comparison of features provided by the 2770 and by the 3770 terminals. Application programs written for communication with the 2770 can be used, with modification, for communication with the 3776-1/3776-2/3777-1 terminals. Modifications may be required because some features or functions provided by the 2770 are not present on the 3770 terminals, or operate in a different manner.

The 3776-1/3776-2/3777-1 must be defined to the using programming system as a 2770.

Some of the 2770 component selection characters (component addresses) are customer specifiable and field changeable. The 3770 component selection characters cannot be changed. See "Component Selection" in this chapter for the 3770 component selection programming considerations. See "Appendix B" for World Trade special characters.

3780 Compatibility with the 3776-1/3776-2/3777-1

Those IBM programming systems identified as supporting the 3780 may also be used by the 3776-1/3776-2/3777-1 operating in BSC mode. Figure 6-2 is a summary of features provided by the 3780 and 3776-1/3776-2/3777-1 terminals. Application programs written for communication with the 3780 can be used, with modification, for communication with the 3776-1/3776-2/3777-1. Modifications may be required because some features or functions provided by the 3780 are not present on the 3776-1/3776-2/3777-1 terminals, or operate in a different manner.

To be compatible with a 3780 using card input, a card reader or a diskette must be attached to the 3776-1/3776-2/3777-1. For the 3776-1 or 3776-2, the card reader may be a 3501, a 2502, or a 3521 with the Read Feature. For the 3777-1, the card reader is a 2502. For compatibility with a 3780 with an attached 3781 Card Punch, the 3776-1 or 3776-2 must have an attached 3521 Card Punch.

The 3776-1/3776-2/3777-1 must be identified to the using programming system as a 3780. The 3780 with the Component Selection feature provides the option for using either a DC2 or DC3 character to select the 3781 Card Punch. On the 3776-1 or 3776-2, the component selection character for selecting the card punch is a DC2 character, and cannot be changed. The DC3 character selects the Diskette Storage Device, if installed (refer to "Component Selection" in this chapter). Using MPLC, if a Select is received with no device specified, the printer will be selected. If no specific poll is received, a general poll is assumed.

2770 Feature	2770 Feature Availability*	3776-1/3776-2/3777-1 Feature Availability*	Notes
EBCDIC or ASCII	Optional	EBCDIC—Standard ASCII—Special	See Appendix G for ASCII
128/128 Char Alternating Buffer	Standard	Not Avail.	
256/256 Char Alternating Buffer	Special	Standard	The 3776-1/3776-2/3777-1 cannot exceed 256 characters with the EXTEND BUFFR switch off or 512 characters with the switch on.
512/512 Char Alternating Buffer	Special	Standard	
EBCDIC Transparency	Special	Standard	See "Programming Considerations—Receiver Abort" for limitations.
Extended Retry	Optional	Standard	
Multipoint	Special	Special	
Inquiry Mode	Special**	Special**	See "Inquiry Mode"
WACK Response	Standard	Standard	See "Control Characters—WACK" for usage.
Vertical Forms Control	Standard on 2213 Mod. 2	Standard	Maximum form length is 127 lines. See "Printer Control Characters" for operational differences.
Horizontal Format Control	Special	Standard	
Terminal ID	Standard	Standard	See "Terminal ID" for permissible characters.
Device Selection	Standard	Standard	See "Component Selection" in this chapter.
Expanded Print Line	Special		132 PP on 3776-1/3776-2/3777-1, no options.
Transmit/Receive Monitor Print	Special	Not Available	
Space Compression/Expansion	Special	Standard	
Synchronous Clock	Special	Not Available	
Auto Answer	Special	Standard	
Conversational Mode	Special	Not Avail.	3776-1/3776-2/3777-1 cannot operate in this mode.
Terminal-to-Terminal	Standard	Not Avail.	
Status Messages	Standard	Not Avail.	3776-1/3776-2/3777-1 cannot receive or transmit 2770 status messages.
Processor Interrupt	Standard	Standard	See "Control Characters—RVI".
Security ID	Special	Not Avail.	
On-Line Test	Standard	Standard	
Keyboard Correction	Special	Not Available	

* Optional—Provided at no additional charge, must be specified.
Special—Special feature available at additional charge.
Standard—Standard feature or capability of basic machine.
** Provided with Multipoint feature.

Figure 6-1. 2770 Feature Summary Compared to 3776-1/3776-2/3777-1

3780 Feature	3780 Feature* Availibility	3776-1/3776-2/ 3777-1 Feature* Availability	Notes
EBCDIC/ASCII	Optional	EBCDIC-STD ASCII-Special	See Appendix G.
512/512 Byte Buffer	Standard	Standard	256/256 Byte Buffer operator-selectable
Space Compression/Expansion	Standard	Standard	In BSC 512-byte mode, a maximum of 511 bytes are transmitted.
Vertical Forms Control	Standard	Standard	Maximum form length is 127 lines. See "Printer Control Characters".
Horizontal Format Control	Standard	Standard	
EBCDIC Transparency	Special	Standard	See "Programming Considerations–Receiver Abort" for limitations
Audible Alarm	Standard	Special	
Extended Retry	Optional	Standard	
Multipoint	Special	Special	
Inquiry Mode	Special**	Special**	See "Inquiry Mode"
Multiple 80-Column Card Records in Transparency	Special	Standard	
Switched Network Control	Special	Standard	Includes Auto Answer/Disconnect, Terminal ID. See "Terminal ID".
Keylock	Special	Special	
Synchronous Clock (Business Machine Clock)	Special	Not Avail.	
Conversational Mode	Standard	Not Avail.	3776-1/3776-2/3777-1 cannot operate in this mode.
Terminal-to-Terminal	Standard	Not Avail.	3776-1/3776-2/3777-1 cannot operate in this mode.
Additional Print Positions	Special	Not Avail.	132 print positions on 3776-1/3776-2/3777-1, no options.
Processor Interrupt	Standard	Standard	See "Control Characters-RVI".
Component Selection	Special	Standard	See "Component Selection".
On-Line Test	Standard	Standard	
WACK Response	Standard	Standard	
Load Buffer Prior to Initial Poll	Optional	Not Avail.	
1200 bps communication	Standard	Not Avail.	
9600 bps communication	Not Avail.	See Notes	Not available on 3776-1/3776-2 Standard feature on 3777-1. 3777-1 can operate at up to 19.2 kbps (20.4 kbps in World Trade).

*Optional — Provided at no additional charge, must be specified
Special — Special feature available at additional charge
Standard — Standard feature or capability of basic machine
**Provided with Multipoint feature

Figure 6-2. 3780 Feature Summary Compared to 3776-1/3776-2/3777-1

The 3780 terminal identification sequence consists of five characters when the 3780 transmits first after a connection has been established. The identification sequence for an initial line bid from a calling 3780 is as follows:

P S S	E P
A Y Y X X A B C	N A
D N N	Q D

Where: X can be any EBCDIC character from hex 'C0' through hex 'FF' (or ASCII character from hex '60' through hex '7F') and is transmitted twice. A, B, and C are three separate characters.

The 3776-1 or 3776-2 does not use the A, B, C characters, but uses only the X character transmitted twice, as described under "Terminal Identification."

BSC Data Link Control Characters

Figure 6-3 is a summary of the BSC control vocabulary. General usage of these characters is described in the *General Information* manual just mentioned. Specific use of certain of these control characters is described in the following paragraphs.

SOH (Start of Heading)

This character is not transmitted by a 3770 terminal except in a request for an online test from the host processor. SOH received as the first character of a block is treated as STX (Start of Text). An STX following an ITB is stripped from data received from the host processor.

ITB (End of Intermediate Transmission Block)

ITB is not transmitted by a 3770 terminal, but can be received. Operation is as described in the *General Information* manual.

WACK (Wait Before Transmit Positive Acknowledgment)

The WACK response is transmitted by a 3770 terminal for an indefinite period under the following conditions:

a. After receiving an MPLC selection and the control unit buffer is still busy with output from an earlier receive operation. This is always an immediate WACK.
b. A two-second timeout* occurs after receiving ETB or ETX, if the controller's buffer is not empty within that time.

WACK is also transmitted at two-second intervals for a period of three minutes if an operator-recoverable output device error occurs during a receive operation. This allows the operator three minutes to correct the error condition. If the operator has not corrected the error condition within three minutes, the 3770 terminal transmits EOT. Any ENQs received get a NAK response until the output device is ready.

The WACK response can also be received from the host processor and causes the 3770 terminal to reply with an ENQ.

*An immediate WACK option can be specified to eliminate the two-second timeout. This option must be specified by the user and jumpered in the machine by IBM. With this option, WACK is transmitted immediately.

Note: These characters are for communications control only. They are added to input data and deleted from output data.

Vocabulary Character	Character Name	Character Meaning		Character Structure	
		Control State	Message-Transfer State	EBCDIC	ASCII
*ENQ	Enquiry	Can you accept transmission (point-to-point)? Respond to your address (multipoint).	Between blocks: Please respond or repeat last response. Terminating a block: Discard this block and respond with NAK acknowledgment.	ENQ (X'2D')	ENQ (X'05')
*ACK 0	Even affirmative acknowledgment	I can accept transmission.	Even block received and validated.	DLE (X'1070')	DLE 0 (X'1030')
*ACK 1	Odd affirmative acknowledgment	None	Odd block received and validated.	DLE/ (X'1061')	DLE 1 (X'1031')
STX	Start of Text	Change to message-transfer state and start computing check value. (3770 treates SOH as STX, normally sends only STX.)	Clear check circuits and start computing new check value. 3770 treats SOH as STX, normally sends only STX.)	STX (X'02')	STX (X'02')
*NAK	Negative acknowledgment	I cannot accept transmission.	Block not validated, can accept retransmission.	NAK (X'3D')	NAK (X'15')
*TTD	Temporary Text Delay	Transmission will begin presently. Respond NAK and wait.	Transmission will continue presently. Respond NAK and wait.	STX ENQ (X'022D')	STX ENQ (X'0205')
*WACK	Wait Before Transmit	Enquire again later and delay transmission until an affirmative acknowledgment is received.	Enquire again later and delay further transmission until an affirmative acknowledgment is received. Block received and validated.	DLE, (X'106B')	DLE; (X'103B')
*ETB	End of Text Block	None	Check value follows, then turnaround and response. Another text block to follow.	ETB (X'26')	ETB (X'17')
*ETX	End of Text	None	Check value follows, then turnaround and response. This completes the text of a job but does not release the data link.	ETX (X'03')	ETX (X'03')
*RVI	Reverse Interrupt	None	Affirmative acknowledgment and signal that processor secondary station wants primary 3770 to relinquish the line.	DLE@ (X'107C')	DLE< (X'103C')
EOT	End of Transmission	Drop synchronism and return to control state.	Drop synchronism and return to control state. Not valid in text.	EOT (X'37')	EOT (X'04')
PAD	Leading Pad	Establish bit synchronism.	Establish bit synchronism.	Hex '55' (X'55')	Alternating Bits (01010101)
	Trailing Pad	Turnaround time.	Turnaround time.	All ones (X'FF')	All ones (X'FF')
SYN	Synchronous Idle	Establish or assure character synchronism, or time-fill. Discard character.	Establish or assure character synchronism, or time-fill. Discard character.	SYN (X'32')	SYN (X'16')

*Line turnaround.

Figure 6-3. BSC Control Vocabulary

RVI (Reverse Interrupt)

An RVI response to a selection sequence is transmitted by the terminal when it must transmit first. RVI is not transmitted in response to data except on the 3776-1/3776-2/3777-1 which respond with an RVI if the operator presses the ATTN key while receiving and the system card is jumpered for this feature.

When an RVI is received from the host processor in response to a data block, the terminal (1) transmits data contained in the buffer, (2) ends the last block with an ETX (ETB on the 3776-1/3776-2/3777-1 if not the true End of Text block) followed by an EOT, and (3) prepares to receive data from the host processor.

Note: After honoring an RVI, the terminal must enter receive mode (receive an ENQ or a multipoint selection with or without data) before it enters transmit mode to automatically restart transmitting.

TTD (Temporary Text Delay)

TTD is transmitted by a 3770 terminal if a buffer of data is not yet ready for transmission when a reply to the last block is received. If the buffer fill operation takes longer than approximately three minutes, the 3770 terminal aborts the operation and transmits EOT. The terminal will reply NAK to a TTD received from the host processor.

TTDs are also transmitted at two-second intervals for a period of three minutes if an operator-recoverable input device error occurs during a transmit operation. If the operator has not corrected the error condition within three minutes, the 3770 terminal aborts the operation and transmits EOT.

NAK (Negative Acknowledgment)

NAK indicates that the previous block was received in error and the receiver is ready to accept a retransmission of the erroneous block. When the terminal receives a NAK reply to a transmitted block, it retransmits the block. The same block may be transmitted up to 15 times in an attempt to obtain the proper reply. If a NAK response is received 16 times in succession, the terminal transmits EOT.

NAK is also the not-ready reply to a line bid or MPLC selection if the terminal is not ready to go on line (operator has not started an online job, or an Auto Interrupt cannot be accepted). NAK is also the reply to a TTD received from the host processor.

Abort Conditions

The 3776-1/3776-2/3777-1 terminals will abort the transmission or reception of data and send EOT under the following conditions.

Transmitter Abort

A 3770 terminal will abort transmission and send EOT anytime one of the following occurs while transmitting to the host processor:

- An EOT is received in reply to a data block, or in response to an ENQ (point-to-point or multipoint).*
- A DLE EOT (disconnect) is received (switched network) before the terminal transmits EOT to indicate the end of the job.*
- A 3770 terminal transmits 15 ENQs in succession and receives either no reply or invalid responses from the host processor.
- An unreadable diskette record is encountered.
- An operator-recoverable input device error occurs and the operator does not correct it within three minutes.

*An EOT will not be sent by the 3770, but the job will be aborted.

- The STOP JOB key is pressed before the normal end of the job.
- After 16 consecutive NAKs are received in reply to a transmitted data block.

Receiver Abort

A 3770 terminal will abort the job and send EOT if any of the following occur while receiving from the host processor (data in the receiver buffers may be destroyed during a receiver abort):

- If mixed non-transparent and transparent blocks are received between the first STX and ETX. An exception to this condition is when component selection is used preceding transparent data blocks. The component selection (DC) character must be contained in the first non-transparent block. Following blocks can be transparent, but cannot alternate between transparent and non-transparent thereafter. Transparent data can be directed to an attached card punch or diskette.
- A data block with good CRC (LRC) is received whcih exceeds the 256-byte buffer capacity or 512-byte buffer capacity.
- An EOT is received before the normal end of message (before ETX is received).*
- An unrecoverable error occurs before the message is complete.
- The operator stops the job before the normal end of the job.

*An EOT will not be sent by the 3770, but the job will be aborted.

Note: If an operator-recoverable output device error occurs and the operator does not correct it within three minutes (WACK responses are being sent to the host), the 3770 terminal sends an EOT but does not abort the job. Data remains in the buffers and subsequent point-to-point ENQs or multipoint selections are rejected with a NAK response until the operator intervenes.

For 3776-1/3776-2/3777-1, if a line-to-printer job is in progress and HOLD PRINT is on during operator error recovery, this abort may be prevented by pressing RESET before the three-minute timeout. RESET causes the three-minute timeout to restart.

3770 Transmission of Null Buffer to Host Processor

Under certain conditions (list follows), 3770 terminals send a null buffer (STX ETX with no data) to the host. Some of the RJE subsystems in the host do not specifically check for a null buffer from the 3770 defined as a 2770. When the RJE subsystem attempts to process the null buffer as an 80-byte data record, the results may be unpredictable depending on the content of the previous data record. *To reduce the consequences of a null buffer sent from a 3770, all RJE users should end each "job" sent from a 3770 with a "/*" sequence.* Should a null buffer follow immediately, it causes a JCL error to be returned, but does not affect the preceding job.

A null buffer is sent under the following conditions:

- During a diskette-to-line job when a data set contains null records
- After a diskette-to-line job of all active data sets
- After a card reader-to-line job when "/*EOF" would begin a new buffer

BSC Printer Control Characters

Format control characters are used to delineate lines of data received from the remote location for printing on the terminal.

Format control characters are entered into the buffer by certain keyboard keys and are transmitted within the data sent to the CP. When received, these control characters read into the controller's buffer. As the buffer reads out to the printer, these characters are recognized as control characters, removed from the print data, and used to control the output format of the printed data.

When outputting multiple overstrike characters to the 3776-1/3776-2 console line printer or the 3777-1/3203 line printer, no more than two characters may be printed in the same print position using backspace control. If more than one backspace is used to the same position with overprinting (to blot out a position, for example), only the first and last characters will print in that position. To print more than two characters in the same position (overstrikes), the CR (carriage return) or ESC M (space suppress) character must be used to return to the beginning of the line without indexing, and the desired characters overprinted. Each occurrence of a BS (backspace) character string causes that portion of a line to be printed. The following characters are recognized.

NL (New Line)

The EBCDIC NL character defines the end of a print line. During key entry, this character is stored into the buffer when the Return key is pressed.

On buffer readout to the printer, either during key entry or receiving from the line, the NL character initiates a print cycle. After data in the print buffer is printed, the forms advance one line space and the horizontal print position is moved to the left margin regardless of the previous print position. After printing and forms movement is complete, the print buffer is loaded with the next line of print data. If the current line position is at or below the bottom margin, the NL character causes the forms to advance to line 1 of the next form.

IRS (Interrecord Separator)

During keyboard entry, this character is stored in the buffer by the End Card function under control of the CODE key, and is used to delineate card data to be punched. During key entry, or when the IRS character is recognized during output of received data to the printer, it causes a new line function to occur as described under "NL (New Line)."

CR (Carriage Return)

On buffer readout of received data to the printer, the CR character initiates a print cycle and moves the horizontal print position to the left margin regardless of the current print position or a previous automatic NL function. The vertical print position is not moved.

VT (Vertical Tab)

During key entry, this character is stored into the buffer when the VERT TAB key is pressed.

During key entry, or on buffer readout of received data to the printer, the VT character initiates a print cycle. After printing is complete, the forms advance to the next predefined vertical tab stop. The horizontal print position is not moved. After printing and forms movement are complete, the next line of data is printed.

A maximum of 12 vertical tab stops can occur on a single form. If a VT character is contained in data to be printed below the highest VT set on a form, the forms will skip to the lowest tab setting on the next form. If no vertical tabs are set, a VT function is executed as a LF function.

FF (Forms Feed)

During key entry, this character is stored into the current buffer position when the FORM FEED key is pressed.

During key entry, or on buffer readout of received data to the printer, the FF character initiates a print cycle. After printing stops, the forms advance to line 1 of the next form. The horizontal print position is moved to the left margin.

HT (Horizontal Tab)

During data entry, this character stores in the buffer when the Tab key is pressed. The next character entered will print at the next print position at which a horizontal tab stop is set, and it stores into the next sequential buffer position. If the current horizontal print position is equal to or greater than the rightmost tab setting, the HT function is rejected as an error.

On buffer readout to the printer, the first character following the HT character will be loaded into the print-buffer location at which the next horizontal tab stop is set. If an HT function is executed when the horizontal print position is to the left of the left margin, the left margin setting is not treated as a horizontal tab stop and is ignored by the HT function. If the current horizontal print position is equal to or greater than the rightmost tab setting, the HT function is executed as a New Line function.

LF (Line Feed)

During keyboard data entry, the LF character is stored into the buffer when the INDEX key is pressed.

During key entry, or on buffer readout to the printer, the LF character initiates a print cycle. After printing is complete, the forms advance to the next print line. Printing on the next line begins in the next sequential print position. If an LF function is executed at or below the bottom margin, the forms advance to line 1 of the next form.

BS (Back Space)

During key entry, this character is stored into the current buffer position when the backspace key (←) is pressed.

During key entry, or on buffer readout of received data to the printer, the backspace character initiates a print cycle and moves the horizontal print position one space to the left if the current print position is greater than 1. The left margin setting is ignored. If the current print position is 1, the backspace function is not executed.

NUL (Null)

On buffer readout of received data to the printer, the NUL character is printed as a hyphen (-).

IGS (Space Expansion)

On buffer readout of received data to the printer, the IGS character begins a space expansion sequence. The low-order six bits of the byte following the IGS character is used as a binary count of the number of spaces (3 to 63). The high-order two bits of this count byte must be a binary 01. The number of spaces specified by the count byte are printed. In data directed to the 3521 Card Punch, IGS sequences cannot span two buffers.

BSC ESC (Escape) Sequences

In addition to the control characters just described, ESC sequences (an ESC character followed by another character) are used to provide multiple line spacing and additional skipping capability. This is functionally equivalent to multiple NL characters.

Figure 6-4 shows the ESC sequences used to control multiple spacing and skipping. ESC sequences can occur in data at any time within a line, but are not executed until a line feed occurs as a result of an EBCDIC NL or IRS character encountered to end the line. If more than one ESC sequence precedes a NL or IRS character, only the last ESC sequence preceding the NL or IRS is executed. The ESC sequences are not printed when they appear in the data stream to the printer from the buffer. If no ESC sequences are included in received data, single line spacing occurs as the result of a NL, or after a full line (132 characters) is printed. If an ESC sequence is included, the ESC sequence is executed instead of the NL function.

ASCII Code Sequence	EBCDIC Code Sequence	Carriage Operation After Printing
ESC Q	ESC/	Single Line Feed
ESC R	ESC S	Double Line Feed
ESC S	ESC T	Triple Line Feed
ESC A	ESC A	Skip to 1st VT Stop
ESC B	ESC B	Skip to 2nd VT Stop
ESC C	ESC C	Skip to 3rd VT Stop
ESC D	ESC D	Skip to 4th VT Stop
ESC E	ESC E	Skip to 5th VT Stop
ESC F	ESC F	Skip to 6th VT Stop
ESC G	ESC G	Skip to 7th VT Stop
ESC H	ESC H	Skip to 8th VT Stop
ESC I	ESC I	Skip to 9th VT Stop
ESC J	ESC J	Skip to 10th VT Stop
ESC K	ESC K	Skip to 11th VT Stop
ESC L	ESC L	Skip to 12th VT Stop
ESC M	ESC M	Space Suppress

Figure 6-4. BSC Escape Sequences

During the forms definition at the terminal, the operator must enter a number from 1 to 12 for each line at which a stop is desired. Escape sequences ESC A through ESC L received in data from the host processor are directly related to tab stops 1 through 12 set up by the operator, as indicated in Figure 6-4. Thus, ESC A causes a skip to tab stop 1, ESC B to tab stop 2, etc. Vertical tab (channel) stops need not be sequential from the top to the bottom of the form, and multiple tab stops can be specified for the same line position. A skip to an undefined tab stop will cause an overflow to the next form. For example, if tab stop 6 is not defined by the operator, an ESC G received will cause a skip to line 1 on the next form.

As previously stated, 2770 or 3780 application programs can be used, with modification, to support the 3770 terminals. If these programs are used, they may or may not require modification of ESC sequences sent to control skipping on the console printer. A 3770 terminal can accept only one skip to each tab stop (channel) (ESC A through ESC L) on a single form, or a total of 12 skips per form. A second skip to a particular tab stop on the same form will cause a skip to the selected VT tab stop on the next form. Therefore, 2770 or 3780 application programs must be modified to remove more than one skip to the same vertical tab stop on a form, if this condition exists. ESC sequences used to control single, double, and triple spacing and space suppression may need to be modified in certain cases. Vertical spacing occurs regardless of last print line or form length. ESC sequences not listed in Figure 6-4 nor described in these paragraphs will produce invalid results.

Horizontal Tab Format Message

The horizontal tab format message is defined by an ESC HT sequence, followed by a space character for each print position where a tab stop is not desired and by an HT character for each position where a tab stop is desired, starting at print position 1. A New Line (NL) character terminates the tab format message, but is not executed. A CR, NL, or FF character should be sent after the HT format message to return the horizontal print position to the left margin. All characters other than NL and ESC sequences will be considered as spaces. The tab format message should not contain more space and HT characters than the number of print positions (132) on the printer. If the tab format message contains less than 132 characters, the higher printer tab stop positions are reset. The left margin is set to 1, forms width is set to 132, and maximum print position is set to 132 when this sequence is received. The ESC HT sequence must be entirely contained in a single buffer.

The ESC HT formatting controls remain in effect for online or offline jobs until they are reset or the power is turned off.

Vertical Tab Format Message

The vertical tab format message is defined by an ESC VT sequence followed by a three-digit line number for the form length, a three-digit number for the last print line, and a three-digit number for each vertical tab stop from 1 through 12 sequentially.

An IRS code terminates the message. The form length and last print line must always be included. The message may be terminated after the last tab position is defined; it is not necessary to transmit all twelve tab stops. However, tab stop line numbers *must* be transmitted sequentially.

The last tab stop position defined should be less than or equal to the last print line. If the last tab stop value in a message is incomplete (1 or 2 characters), it will not be set. If the characters describing a line number are not numeric values, they are folded into numeric values. For example, an alphabetic A (X'C1') is interpreted as a numeric 1. Any additional characters in the vertical tab format message after the tab stop value 12 are ignored. The ESC VT sequence must be entirely contained in a single buffer.

For example:

```
E V                             I
S T 080 076 005 000 010 000 060 R
C                               S
```

This sequence defines an 80-line form with line 76 being the last valid print line. The first tab stop (or Channel 1) is line 5, the third tab stop is line 10, and the fifth tab stop is line 60. All other tab stops are reset. Tabs set below the last print line are functional (if the tab is set, a tab can be made to a line past the last print line).

When the ESC VT sequence is received, the maximum print line (MPL), forms length, and vertical tabs (VTs) are all set initially to their default values. If a partial forms definition or invalid parameters are received, the following are set:

- An invalid MPL causes the vertical forms control to remain set to the default values.
- An invalid forms length causes the form length to be set to the MPL received, and the vertical tabs to remain set at the default values.
- If only the MPL and the form length are received, the vertical tabs remain set at the default values.

A Form Feed (FF) character should precede this sequence. The maximum form length that can be specified in a vertical tab format message is 127 lines. The ESC VT formatting controls remain in effect for online or offline jobs until they are changed by another ESC VT sequence or by a stop job action, or are reset by a system reset or turning the power off.

Forms Alignment Considerations

When designing forms for the 3770 terminals, the first vertical tab must be set to the first printing line (line 1). When the operator aligns forms to start a job, the forms should be aligned vertically to the first printing line so that an FF or ESC A sequence advances the forms to the first printing line of the next form.

Line 1 (or the first printing line) is defined as the vertical print position at which the form is physically aligned when the forms definition process occurs.

Forms definition is established by:

- The host (ESC VT and ESC HT messages) or
- The operator (Start Job or Define Job procedures).

Note 1: The host should send a CR character following an ESC HT message to return the horizontal print position to the left margin (print position 1).

Figure 6-5 shows two forms design and alignment variations and their advantages and disadvantages.

BSC Component Selection

This section describes component selection as used by BSC. Component selection from the host processor allows the host processor to select the output device used by the terminal for output of a job.

Point-to-Point Networks

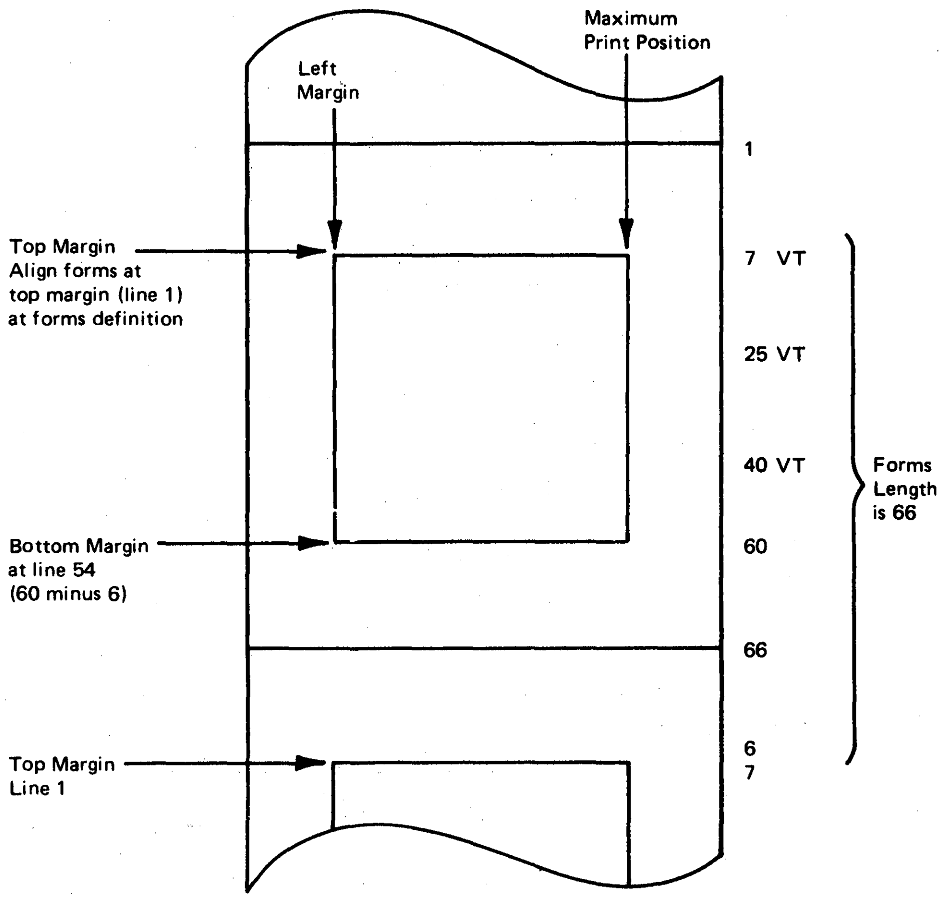
On a switched or leased point-to-point network, the component selection character is a valid selection character immediately following STX (and perferably by itself) in either the first block of received text or the block following an ETX block.

If the first character of received text is not a valid selection character, the character is handled as data and a default device is selected by the terminal. The normal default device for nontransparent data is the console printer, but this selection may be changed to the diskette on 3776-1/3776-2/3777-1 terminals. The normal default device for transparent data is the card punch.

If the component selection character is included in the first text block, it reads into the buffers in the same manner as a data character, but it is ignored on output from the buffer. Thus, only 255 data characters (or 511 with the EXTEND BUFFER switch on) can be accommodated in the first text block.

On a point-to-point network, selection can be made once for each message. The selection remains in effect until changed by a new selection following ETX or until EOT is received following ETX or until a receiver abort occurs. After an ETX block is received, and no valid component selection character is received in the next text block, the terminal continues to use the selection from the previous ETX block, rather than the normal default selection. After an ETB block is received, the terminal does not check the first data character of the next text block for a component selection character.

Method A



FF function moves the forms to line 1 of the next form.

ESC A sequence moves the forms to the first VT setting on the next form.

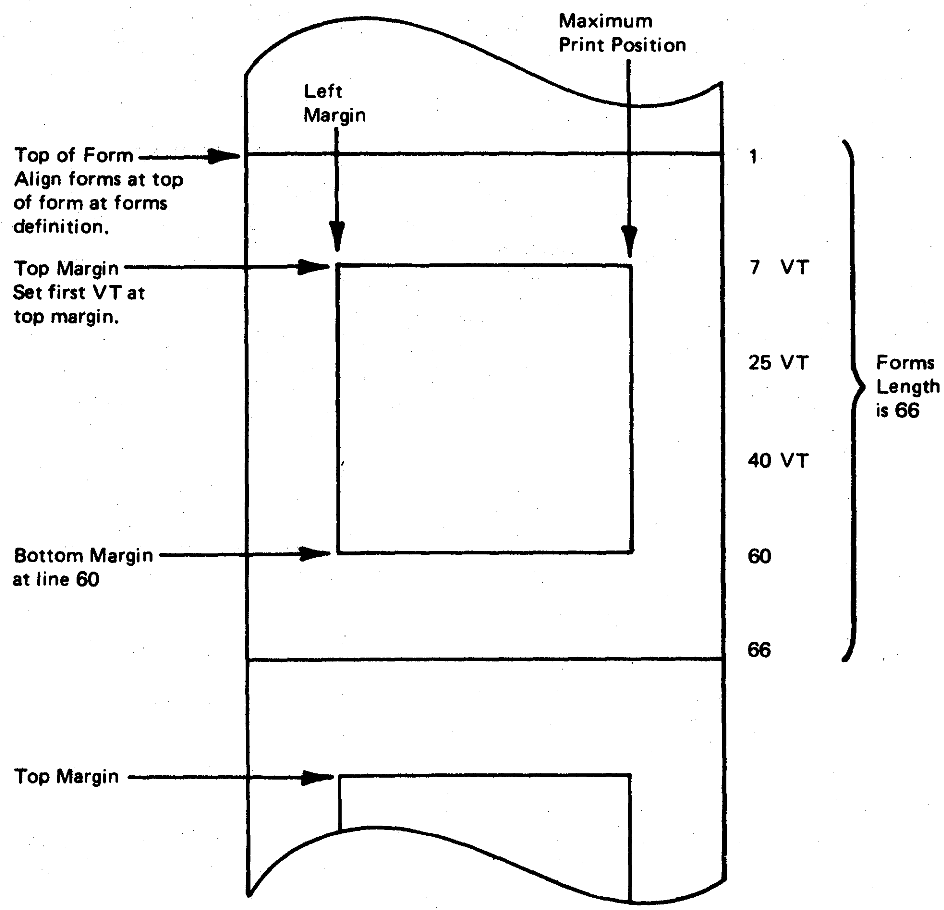
Note: If the first VT setting is equal to line 1, then a FF function moves the forms to the same vertical print position as an ESC A sequence.

Advantage: Compatible with 2770.

Disadvantage: Operator must know the top margin position in advance. Forms that are not pre-printed may be difficult to align after an end-of-forms condition.

Figure 6-5. Forms Alignment Considerations (Part 1 of 2)

Method B



FF function moves the forms to line 1 of the next form.

ESC A sequence moves the forms to the first VT setting of the next form.

Disadvantages:

1. An ESC A sequence must be executed to move the forms to the top margin of the next form (a FF function moves the forms to line 1 of the next form).
2. An ESC A sequence must be executed after forms definition to move the forms to the top margin.

Advantages:

1. Allows the host to set the top margin (TM) when the operator does not know what the TM setting should be (for example, on blank forms or for a special message to be printed above the normal top margin on preprinted forms).
2. Allows printing of special messages above the normal top margin.

Figure 6-5. Forms Alignment Considerations (Part 2 of 2)

Multipoint Networks

On a multipoint network, the component selection character is contained in the musti-point line control (MPLC) selection sequence, immediately following the terminal's address and preceding the ENQ.

Exception Conditions

If the selection character is absent, invalid, or a new selection is attempted while an old selection remains in effect, the selection is rejected with a NAK response. In the case of an absent selection on the 3776-1/3776-2/3777-1 terminal, the default device for transparent data is the card punch.

When a component selection character is received on a multipoint network and that device is either not present (system card not jumpered for device) or not available (device in offline use), a NAK response is transmitted. On a point-to-point network under the same conditions, an EOT is transmitted.

If the device is available but not ready, received data is accepted until the terminal's buffers are full and then WACK responses are transmitted in response to the received data until the device is made ready. The device light or NPR indicators and the Operator Attention Speaker (or Audible Alarm, if installed) alert the operator. If the device is available and ready an ACK 0 response is transmitted.

If the DISK switch is on, component selection except for the line printer is ignored, and received data will be written on the diskette if it is ready. The DISK switch will not override selection of the line printer.

Selection Characters

Component selection characters used are as follows:

DC1 (EBCDIC '11')–Selects Line Printer
DC2 (EBCDIC '12')–Selects Card Punch
DC3 (EBCDIC '13')–Selects Diskette

BSC transparent operation using component selection requires that the first block containing the component selection (DC) character be non-transparent in order to allow recognition of the DC character. The 3770 terminal can then change to transparent mode operation on the second block, but will not accept another non-transparent block until DLE ETX is received (see "Receiver Abort"). Transparent data can be sent to a card punch or diskette. Transparent data received with no component selection normally defaults to the card punch.

On multipoint machines only, input-device component selection characters (transmitted as part of the MPLC polling sequence) are as follows:

0 (EBCDIC 'F0')–Selects any input deivce that is ready
5 (EBCDIC 'F5')–Selects Keyboard
6 (EBCDIC 'F6')–Selects Card Reader
7 (EBCDIC 'F7')–Selects Diskette
Blank–Selects any input device that is ready on the 3776-1/3776-2/3777-1

Inquiry Mode

An additional function of the BSC Multipoint feature is "inquiry mode" operation. When inquiry mode is in effect at the 3770, and after the 3770 accepts a poll from the host processor, both buffers fill from the selected input device (see Note). The 3770 responds with EOT to this initial poll, and to all succeeding polls until both buffers have filled. After receiving a poll with the buffers full, the 3770 transmits two blocks as an incomplete message (the second block ends with ETB, a good response is received, and the 3770 sends EOT) and relinquishes the line. Two more blocks are automatically read (offline) from the input device. As before, a poll received before the buffers fill causes the 3770 to respond EOT. Once the 3770 begins inquiry mode operation, the initially selected input device remains selected until the 3770 sends the last block of the job (block ended with ETX).

Note: The host processor may use a device selection of 0 (see "Component Selection") to select whatever input device is specified by the 3770's job setup. If a specific device selection (5, 6, or 7) is received, and that device is not defined as the input device by the 3770 job setup, EOT is sent in response to the poll (the poll is rejected). Normal keyboard operation does not change (single-buffer transmission) when the 3770 is operating in inquiry mode.

If an MPLC selection sequence is received after inquiry mode operation is begun, the 3770 transmits RVI, and the host processor must poll the terminal to allow it to transmit the data.

Throughput at a 3770 transmitting in inquiry mode is degraded; however, this mode of operation allows interleaving of inquiry messages from other stations that require fast response. Thus, the host processor can continue receiving a batch message from the 3770 without appreciably degrading inquiry operations.

To operate in inquiry mode when the 3770 is a receiver and to eliminate delays on the line, the host processor should transmit only two blocks of data per transmission to the 3770. The 3770 need not be in inquiry mode when receiving. The 3770 should have the immediate WACK option installed to eliminate delays in the block-checking response back to the host processor. Any delays incurred during the transfer of data to the selected output device are incurred "offline". The selected output device will remain selected until the job is complete (host processor sends ETX, receives a positive response, and transmits EOT). If the host processor selects the 3770, and the 3770 has not yet transferred the first block of data to the output device, a WACK response to the selection is sent. When receiving data onto the Diskette, 'ignore ETX/EOT' may be specified for the job to prevent creating another data set each time ETX/EOT is received.

Terminal Identification (Switched Network)

Terminal identification can be used when operating on switched network to allow the host processor to identify the remote terminal. Each terminal on the network is assigned a single-character ID, which the terminal transmits twice (two contiguous characters) after the connection to the host processor is established. If the 3770 terminal transmits first, the ID is transmitted preceding the line-bid ENQ. If the host processor transmits first, the 3770 terminal transmits the ID characters immediately preceding the ACK 0 or NAK response.

The terminal ID desired for each terminal is specified by the customer and wired into the terminal by IBM. Characters that can be specified for terminal ID are the EBCDIC characters hex '40' through hex 'FF'. For multipoint operation, the multipoint address must be the same as the terminal identification address.

Remote Power Off

Remote Power Off is a standard feature for the 3777-1 and a specify feature for the 3776. The error log is automatically printed before the power off sequence completes. Using BSC, the host processor can cause the remote terminal to turn power off by transmitting the following non-transparent block:

S N	N E
T U P	U T
X L	L X

If this sequence is contained in the beginning of a block and followed by data, the data will be ignored. Card I/O device power is not turned off by this sequence.

Chapter 7. SNA/SDLC Programming Considerations for 3776 Models 1 and 2, 3777 Model 1

This chapter describes system generation and system programming considerations for System Network Architecture/Synchronous Data Link Control communications. The following information applies to the 3776-1/3776-2 and 3777-1. Refer to Chapter 8 for equivalent information on the MLU terminals.

Introduction to 3770 SNA

The 3770 Data Communication System communicates with the host processor using either Binary Synchronous Communication (BSC) or Systems Network Architecture (SNA). This chapter describes SNA as it is used by the 3770 Data Communication System.

For more information about SNA, refer to the *SNA General Information* manual listed in the preface of this publication and later in this chapter.

Components of the System

The basic components of the 3770 SNA network are:

- System/370 host processor
- VS operating system (OS/VS1, OS/VS2, or DOS/VS)
- Application Program(s)
- VTAM or TCAM
- 3704 or 3705 Communications Controller with Network Control Program/VS (NCP/VS)
- Synchronous Data Link Control (SDLC)
- 3770 Data Communication System

Figure 7-1 shows the components of a 3770 SNA network.

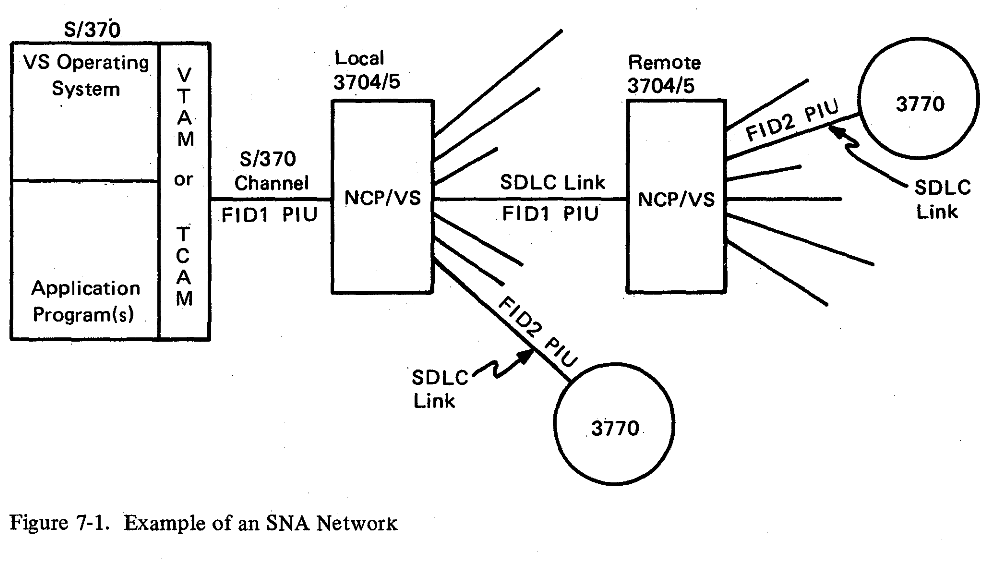


Figure 7-1. Example of an SNA Network

VTAM (Virtual Telecommunications Access Method)

VTAM directs the transmission of data between the host application programs and the 3770. VTAM 'controls' all of the network components, allocating their use to meet the needs of the application programs and the 3770 VTAM:

- Connects, disconnects, and controls access between the application program and the 3770.
- Controls data transfer between the application programs and the 3770.
- Allocates the 3770 and other terminals in the network for use by the application programs.

TCAM (Telecommunications Access Method)

When queued control is required, application programs can use TCAM (Telecommunications Access Method) with or without VTAM. TCAM provides general control over transaction activity; for example, data can be directed to an inactive 3770 and held in queue until the 3770 is activated.

3704/3705 Communications Controllers

In the 3770 SNA environment, the access method allocates much of the network management responsibility to the 3704/3705 Communications Controller. In addition to the locally attached communications controller, the network may also have remote communications controllers (see Figure 7-1).

The control program that operates in the 3704/3705 Communications Controller is the Network Control Program/VS (NCP/VS). The NCP/VS routes data through the network and furnishes such communications management services as: line control, insertion and deletion of line control information, dynamic buffering of data, and recovery from message errors.

Synchronous Data Link Control (SDLC)

SDLC is the standard line control discipline for SNA. It is designed for efficient control between communicating elements of the network. One transmission can carry data as well as confirmation of earlier transmissions. SDLC features inherent data transparency, therefore, it can convey any 8-bit character code, as well as non-coded information, without restrictions. SDLC accommodates both duplex and half-duplex operation.

3770 SNA Characteristics

Before the access method can communicate with a terminal, it must know the terminal's SNA characteristics. The SNA characteristics of the 3770 are:

- Physical Unit Type 2
- Logical Unit Type 1
- Function Management Profile 3
- Transmission Services Profile 3
- FM Header Subset

Subset Type:	*Used By:*	*With FM Header Type:*
1	All 3770/3770P	1
1	3776-3/3776-4/3777-1/3777-3/3777-4	1 and 3
2	All 3770/3770P	1
3	3770 Programmables	1 and 2

From these characteristics (specified at the access method generation), the access method determines the format of the transmission record and the type of control information required by the terminal.

3770 SNA Communications

Before the 3770 and the host application program can begin communications, certain protocol requirements must be met:

1. An SSCP-PU session must be established between the access method and NCP physical services. The access method does this by issuing an Activate Physical network command to the NCP.
2. Data flow must be enabled between the access method and the NCP. The access method does this with the Start Data Traffic network command.
3. The modem for the SDLC link between the communications controller and the 3770 must be activated. The access method does this by issuing an Activate Link command to the NCP.
4. A physical connection must be made between the communications controller and the 3770. The access method does this by issuing a Contact command to the NCP which then polls the 3770. After a connection is made, the NCP sends a Contacted command to the access method.
5. An SSCP-PU session must be established between the access method and the 3770 physical unit. The access method does this with the Activate Physical network command.
6. An SSCP-LU session must be established between the access method and the 3770 logical unit. The access method does this by issuing an Activate Logical network command.
7. An APPL-LU session must be established between the host application program and the 3770 logical unit. After the 3770 is put into communicate mode, this can be initiated two ways:
   - An active application program can issue an OPNDST macro to the access method. This causes the access method to issue a Bind command to the 3770 establishing the APPL-LU session. The NCP LU macro that describes the logical unit must specify PACING= (1,1).
   - The 3770 terminal operator can send a LOGON request to the access method requesting a session with a particular application program. The access method then activates the requested application program which initiates the APPL-LU session as described above.
8. Data flow must be enabled between the host application and the 3770. The access method does this with the Start Data Traffic network command. Once data flow is enabled, data request units can flow between the application program and the 3770.

SNA communications can be terminated in the following manner:

1. The APPL-LU session must be terminated. This can be done two ways:
   - The application program can issue a CLSDST macro to the access method. This causes the access method to issue a Clear network command to the 3770 to purge any outstanding requests or responses. The access method then issues the Unbind command to terminate the session.
   - The 3770 terminal operator can request that the session be terminated by sending a LOGOFF request unit to the access method. The access method then notifies the application program which initiates the session termination as described above.
2. The access method terminates the SSCP-LU session by issuing a Deactivate Logical command to the 3770.
3. The access method terminates the SSCP-PU session with the 3770 by issuing the Deactivate Physical command to the 3770. The access method can power-down the 3770 with a certain bit setting in the Deactivate Physical request unit.
4. The access method deactivates the modem for the link by issuing a Deactivate Link network command.
5. The access method terminates the SSCP-PU session with the NCP by issuing a Deactivate Physical network command to the NCP.

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Figures 7-2 and 7-3 are examples of establishing and terminating SNA communications with the 3770. Refer to Figure 7-4 for the SNA network commands that apply to the 3770.

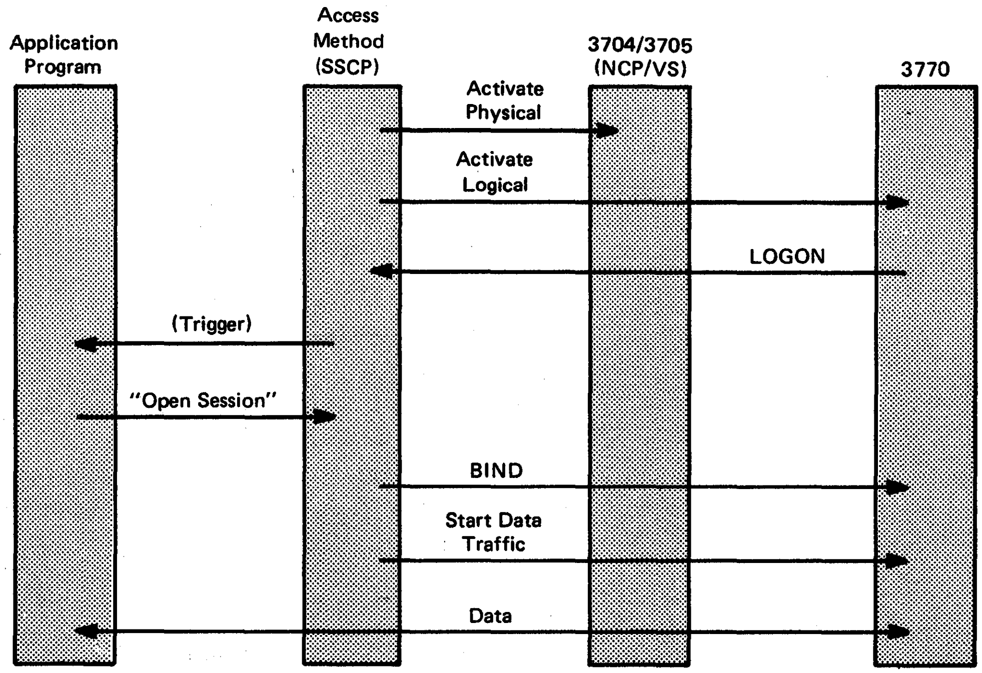


Figure 7-2. Example of Establishing SNA Communications

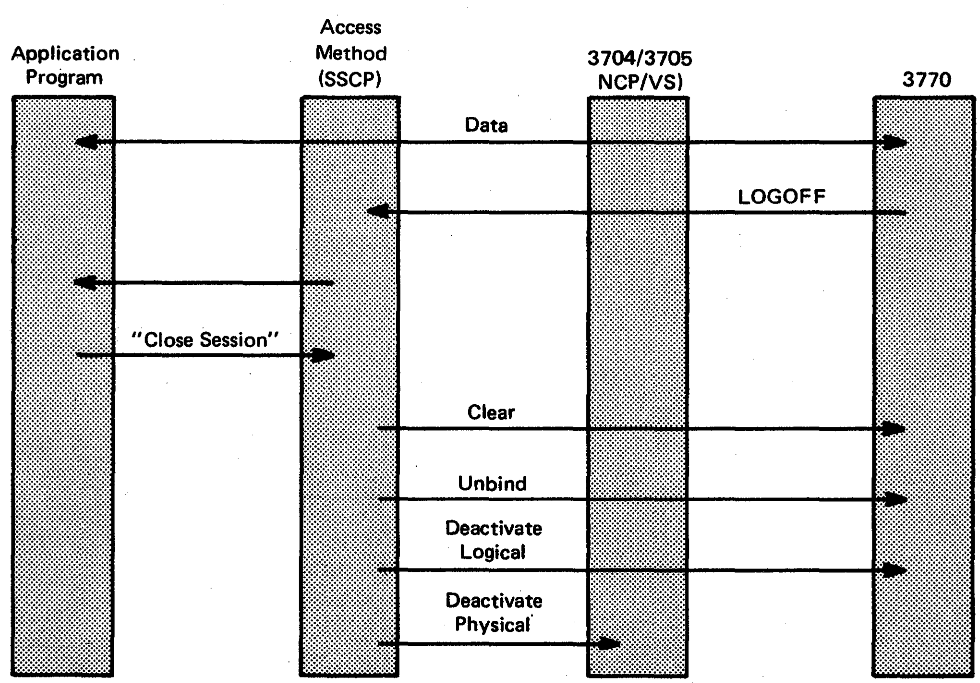


Figure 7-3. Example of Terminating SNA Communications

Command	Origin/Dest.	Function	Prerequisite	Request Unit (RU) Contents
Activate Link	AM/NCP	Activates the modem associated with the specified SDLC link.	Session between AM and NCP physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Physical Configuration Services. Byte 2 = X'0A' - Request code. Bytes 3 - 4 = Network address of the link.
Activate Logical	AM/3770	Establishes a session between AM and the 3770 logical unit (SSCP-LU session).	Session between AM and 3770 physical unit (SSCP-PU session).	Byte 0 = X'0D' - Request code. Byte 1 = X'01' - Activation type: cold. Byte 2 = X'01' - DFC level.
Activate Physical	AM/NCP or AM/3770	Establishes a session between AM and the NCP or 3770 physical unit (SSCP-PU session).	No SSCP-PU session.	Byte 0 = X'11' - Request code. Byte 1 = X'01' - Activation type: cold. Byte 2 = X'01' - DFC level.
Bid	AM/3770	Sent by the AM application program to request permission from the 3770 to start a bracket.	Session between application and 3770 logical unit (APPL-LU session—between-bracket [BETB] state).	Byte 0 = X'C8' - Request code.
Bind	AM/3770	Establishes a session between a host application program and the 3770 logical unit (APPL-LU session).	Session between AM and the 3770 logical unit (SSCP-LU session)	Byte 0 = X'31' - Request code. Byte 1 = X'01' - Activation type: cold. Byte 2 = X'03' - FM profile for 3770. Byte 3 = X'03' - TS profile for 3770. Byte 4 - FM data protocol for host application: Bit 1 - Request mode: B'0' - Immediate. Bits 2 - 3 - Chain response: B'01' - Exception response. B'10' - Definite response. B'11' - Exception or Definite response. Byte 5 - FM data protocol for 3770: Bit 0 - Chaining use: B'1' - Multiple RU chains allowed. Bit 1 - Request mode: B'0' - Immediate. Bits 2 - 3 - Response protocol: B'01' - Exception response. B'10' - Definite response. B'11' - Exception or Definite response (3770 defaults to Definite). Bit 6 - Compression: B '1' - Compression may be used. Bit 7 - Send end-bracket (EB) indicator: B'0' - 3770 will not send EB. B'1' - 3770 may send EB. Byte 6 - Common host - 3770 protocol: Bit 1 - FM header usage: B'1' - FM headers allowed. Bit 2 - Brackets: B'1' - Brackets will be used. Bit 3 - Bracket termination rule: B'1' - Bracket termination is controlled by the type of response requested by the CPU Bit 4 - Alternate code: B'1' - ASCII. B'0' - EBCDIC. Byte 7 - Common host - 3770 protocol: Bits 0 - 1 - FM transaction mode: B'01' - Half-duplex contention. B'10' - Half-duplex flip-flop.

Figure 7-4. SNA Network Commands (Part 1 of 5)

Command	Origin/Dest.	Function	Prerequisite	Request Unit (RU) Contents
Bind (Cont.)	AM/3770	Establishes a session between a host application program and the 3770 logical unit (APPL-LU session). 1. Bytes 12 and 13 are not checked by 3770 terminals. 2. Bytes 17 through the end of the Bind RU are not checked by 3770 terminals with a single logical unit. 3. A header and data combination may occur only when the data set (or destination) selection begins (BDS) and ends (EDS) within the same header and chain. This is called an ODS (only-data-set) header and uses the Type 1 FM header.	Session between AM and the 3770 logical unit (SSCP-LU session)	Byte 7 (Continued) Bit 2 - Recovery responsibility: B'0' - Host is responsible. Bit 3 - Brackets first speaker: B'0' - 3770 is first speaker. Bit 6 - Related chains: B'0' - No related chains. Bit 7 - Contention resolution: B'0' - 3770 speaks first in Data Traffic Active state. Byte 8 - Inbound Pacing: Bits 2-7 - Inbound pacing value Byte 9 - Outbound Pacing: Bits 2-7 - Receive pacing count: B'000000' or B'000001' - for non-programmable 3770 models Byte 10 - Secondary Logical Unit (SLU) Inbound RU Size: Bits 0-3 = X'0' or $\geq$ X'8' } if 3770 is in 256-byte mode $\geq$X'8' if 3770 is in 512-byte mode Bits 4-7 = X'0' if Bits 0-3 = X'0' $\geq$X'5' if Bits 0-3$\geq$X'8' and 3770 is in 256-byte mode $\geq$ X'6' if Bits 0-3$\geq$X'8' and 3770 is in 512-byte mode Byte 11 - Primary Logical Unit (PLU) Outbound RU Size: Bits 0-3 = X'0' or X'8' } if 3770 is in 256-byte mode X'8' if 3770 is in 512-byte mode Bits 4-7 = X'0' if Bits 0-3 = X'0' $\leq$X'5' if Bits 0-3 = X'8' and 3770 is in 256-byte mode $\leq$X'6' if Bits 0-3 = X'8' and 3770 is in 512-byte mode Byte 14 - Logical Unit (LU) Profile present: X'00' - None X'01' - LU Profile Byte 15 - FM Header Subset and Data Stream Profile Bits 0-3 - FM Header Subset: X'0' - Default X'1' - Header and Data combinations are limited (see note 3). X'2' - Header and Data combinations are permitted in the same chain. Bits 4-7 - Data Stream Profile: X'0' - SCS Basic Controls Byte 16 - Logical Unit (LU) Profile: Bit 0 = B'0' - Interrupt level Bit 1 - Compacted data B'0' - Compacted data not allowed B'1' - Compacted data allowed Bits 2-7 - Reserved Byte 17 - (See note 2)

Figure 7-4. SNA Network Commands (Part 2 of 5)

Command	Origin/Dest.	Function	Prerequisite	Request Unit (RU) Contents
Cancel	AM/3770 and 3770/AM	Indicates that an error has occurred in the current request unit chain. Preceding request units in the chain should be discarded. The next request unit sent should be either an only-in-chain request unit or first-in-chain request unit.	Data flow enabled.	Byte 0 = X'83' - Request code.
Chase	AM/3770	Ensures that the 3770 has received and responded to all outstanding requests. The 3770 processes all remaining requests in its buffers, then responds to the Chase.	Data flow enabled.	Byte 0 = X'84' - Request code.
Clear	AM/3770	Purges all outstanding requests and responses relating to the APPL-LU session. Clear is normally used after a catastrophic error as the first step in the data traffic recovery sequence or prior to an unconditional Unbind.	Data flow enabled.	Byte 0 = X'A1' - Request code.
Contact	AM/NCP	Causes the NCP to start a contact poll to the 3770. When the connection is made, the NCP returns a Contacted response to AM.	Session between AM and the 3770 physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'01' - Request code. Bytes 3-4 - Network address of the 3770.
Contacted	NCP/AM	Informs AM that the NCP received a response to a contact poll, or an error occurred during a contact poll.	Session between AM and the 3770 physical unit (SSCP-PU session). Contact must be active.	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'80' - Request code. Bytes 3 - 4 - Network address of the 3770. Byte 5 - Status: X'01' - Loaded. X'02' - Load required. X'03' - Error on contact.
Data	AM/3770 and 3770/AM	Transfers data between the application program and the 3770. User specified 3770 control information may precede the data.	Data flow enabled.	Optional 3770 control information and/or data. RH byte 0 bits 1, 2 = B'00' identify the RU contents as data.
Deactivate Link	AM/NCP	Deactivates the modem associated with the specified SDLC link.	Every resource on the link must be in the 'discontacted state': • A Contact was never issued to the resource. • A Discontact was issued to the resource. • An unrecoverable physical error occurred at the resource or on the link.	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'0B' - Request code. Bytes 3 - 4 - Network address of the link.
Deactivate Logical	AM/NCP	Terminates the session Between AM and the 3770 logical unit.	SSCP-LU session.	Byte 0 = X'0E' - Request code.

Figure 7-4. SNA Network Commands (Part 3 of 5)

Command	Origin/Dest.	Function	Prerequisite	Request Unit (RU) Contents
Deactivate Physical	AM/NCP or AM/3770	Terminates the session between AM and the 3770 or NCP physical unit (SSCP-PU). Optionally powers-down the 3770.	SSCP-PU session.	Byte 0 = X'12' - Request code. Byte 1 - Type: X'01' - Final use; power-down the 3770. X'02' - Not final use.
Dial	AM/NCP	Causes the NCP to initiate an outbound call on an SDLC link. If autodial is specified, the NCP performs the dial operation. If manual dial is specified, the NCP enables the link and the operator performs the dial.	The modem must be active.	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'0E' - Request code. Bytes 3-4 - Network address of the link. Byte 5 - SDLC addressing character for the 3770. Byte 6 - Type: Bit 0 = 1 - Secondary station. Bit 1 - Type of dial: B'0' - Autodial. B'1' - Manual dial. Byte 7 - Dial retry limit. Byte 8 - Number of dial digits. Bytes 9-n - Dial digits.
Discontact	AM/NCP	Causes the NCP to stop polling the 3770.	The link to the 3770 must not be active.	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'02' - Request code. Bytes 3-4 - Network address of the 3770.
Entering Auto Network Shutdown	NCP/AM	Notifies AM that the NCP is entering auto network shut-down. The NCP sends the 3770 'path error' responses to requests directed to the host.	N/A	Byte 0-1 - Reason for ANS: X'0601' - ANS initiated by 3704/3705 operator. X'0602' - ANS entered because of channel timeout.
Entering Slowdown	NCP/AM	Informs AM that the normal flow of data through the NCP is impeded because of limited available buffers.	Session between AM and the NCP physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = XX'02' - Configuration services. Byte 2 = X'02' - Request code. Bytes 3-4 - Network address of NCP physical services.
Execute Test	AM/NCP	Causes the NCP to execute an online line test (OLLT) for an SDLC link.	Session between AM and the NCP physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = X'03' - Maintenance services. Byte 2 = X'01' - Request code. Bytes 3-n - Test data.
Exiting Slowdown	NCP/AM	Informs AM that the NCP buffer limitation has been lifted and normal data flow may resume.	Session between AM and NCP physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'15' - Request code. Bytes 3-4 - Network address of NCP physical services.
Inoperative	NCP/AM	Informs AM that contact between the NCP and the 3770 has been lost. The Inoperative is sent only when an established contact is lost; not for failure to make contact.	SSCP-PU session and in 'contacted' state.	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'81' - Request Code. Bytes 3-4 - Network address of the failing resource or link. Byte 5 - Cause: X'01' - Resource failed. X'02' - Link failed.
Logical Unit Status (LUSTAT)	3770/AM	Allows the 3770 to inform AM when the problem has been resolved.	Data flow enabled.	Byte 0 = X'04' - Request code. Bytes 1-2 - Status: X'081C' - Component failure; permanent error.

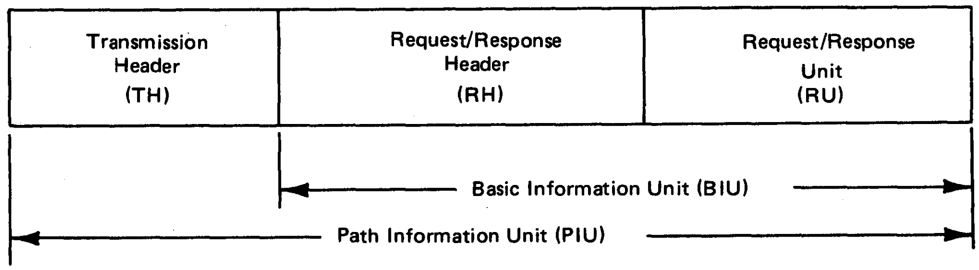
Figure 7-4. SNA Network Commands (Part 4 of 5)

Command	Origin/Dest.	Function	Prerequisite	Request Unit (RU) Contents
Off Hook	NCP/AM	Informs AM that a physical connection has been established between the NCP and the 3770.	Session between AM and the NCP physical unit (SSCP-PU session). Physical connection between NCP and the 3770.	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'84' - Request code. Bytes 3-4 - Network address of the link. Bytes 5-10 - Station ID.
Record Maintenance Statistics	NCP/AM	Informs AM of error statistics when an unrecoverable error occurs on the link.	Session between AM and the NCP physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = X'03' - Maintenance services. Byte 2 = X'81' - Request code. Bytes 3-4 - Network address of the failing link or 3770 terminal. Bytes 5-n - Error statistics (refer to the 3704/3705 Program Reference Handbook for MDR record formats).
Record Test Data	NCP/AM	Informs AM of the current status of an online line test (OLLT).	Session between AM and NCP physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = X'03' - Maintenance services. Byte 2 = X'82' - Request code. Bytes 3-4 - Network address of the SDLC link being tested. Bytes 5-n - Test data.
Shutdown (SHUTD)	AM/3770	Requests that the 3770 stop sending data and to prepare for session termination.	Data flow enabled.	Byte 0 = X'C0' - Request code.
Shutdown Complete (SHUTC)	3770/AM	Informs AM that the 3770 is in the quiesce state.	Data flow enabled.	Byte 0 = X'C1' - Request code.
Request Shutdown (RSHUTD)	3770/AM	Informs the host that the 3770 wants to stop processing and end the SSCP-LU session. The 3770 remains in communicate mode until it receives a Clear and Unbind from the host.	Data flow enabled.	Byte 0 = X'C2' - Request code.
Signal	3770/AM or AM/3770	Sends an expedited signal to the host regardless of the normal flow.	Data flow enabled.	Byte 0 = X'C9' - Request code. Bytes 1-4 - Signal code. (X'0001 0000' - 3770 to Access Method)
Start Data Traffic (SDT)	AM/3770	Places the 3770 in the 'data flow enabled' state.	Session between the application program and the 3770 logical unit.	Byte 0 = X'A0' - Request code.
Unbind	AM/3770	Terminates the session between the host application program and the 3770 logical unit (APPL-LU).	APPL-LU session.	Byte 0 = X'32' - Request code. Byte 1 = X'01' - Unbind type.

Figure 7-4. SNA Network Commands (Part 5 of 5)

SNA Transmission Blocks

The basic unit of information in the SNA network is the Path Information Unit (PIU). A PIU may request a data communication operation, transfer data, or indicate the result of a data communication operation. The general format of the PIU is shown below.



Request/Response Unit (RU): The basic unit of information in the data communication network. It may contain commands that control the flow of data through the network, responses to commands, acknowledgement of data, and optional data.

Request/Response Header (RH): Contains fields that identify the RU and control the flow of data through the network.

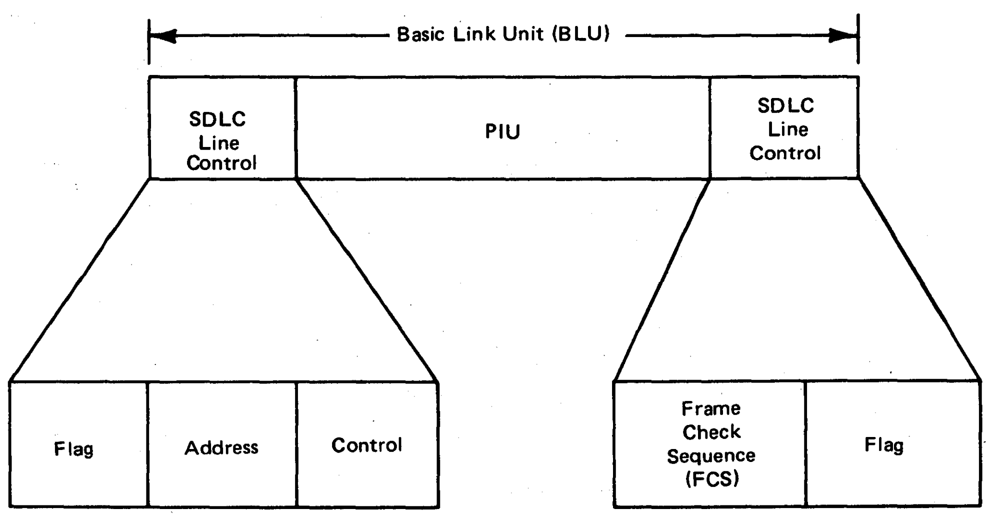
Basic Information Unit (BIU): An RU with its associated RH.

Transmission Header (TH): Used to route the PIU through the network to its destination.

Path Information Unit (PIU): A BIU with its associated TH.

In some SNA networks, multiple PIUs may be transmitted over an SDLC link in a single transmission block. These multiple PIUs are referred to as a Basic Transmission Unit (BTU). Since the 3770 allows only one PIU per transmission, the PIU and BTU are the same.

When the PIU is transmitted over an SDLC link, it must have SDLC link control information appended to it. The PIU with the SDLC line control information is called a Basic Link Unit (BLU).



Flag: 8-bit sequence (01111110) at the beginning and end of the BLU that serves as a delimiter. For contiguous BLUs, the ending flag of one BLU may be the beginning flag on the next.

Address: A one-byte station address. An address of all zeros is a null address that is used for testing.

Control: A one-byte field that controls and identifies the BLU.

Frame Check Sequence (FCS): A two-byte check character that is derived by the accumulation of all of the bits between the starting and ending flags.

For more information about SDLC line control, refer to the *IBM SDLC General Information* manual.

PIU Formats

The PIU in the 3770 SNA network can be in one of two formats depending on its origination and destination:

Format Identification One (FID1): Used for transmission between the host and the communications controller; also used for transmission between the local communications controller and a remote communications controller.

Format Identification Two (FID2): Used for transmission between the communications controller and the 3770.

The NCP converts the FID1 PIU to a FID2 PIU on requests that are directed to the 3770, and converts the FID2 PIU to a FID1 PIU on requests that are directed to the host.

Figure 7-5 shows the FID1 and FID2 PIU formats.

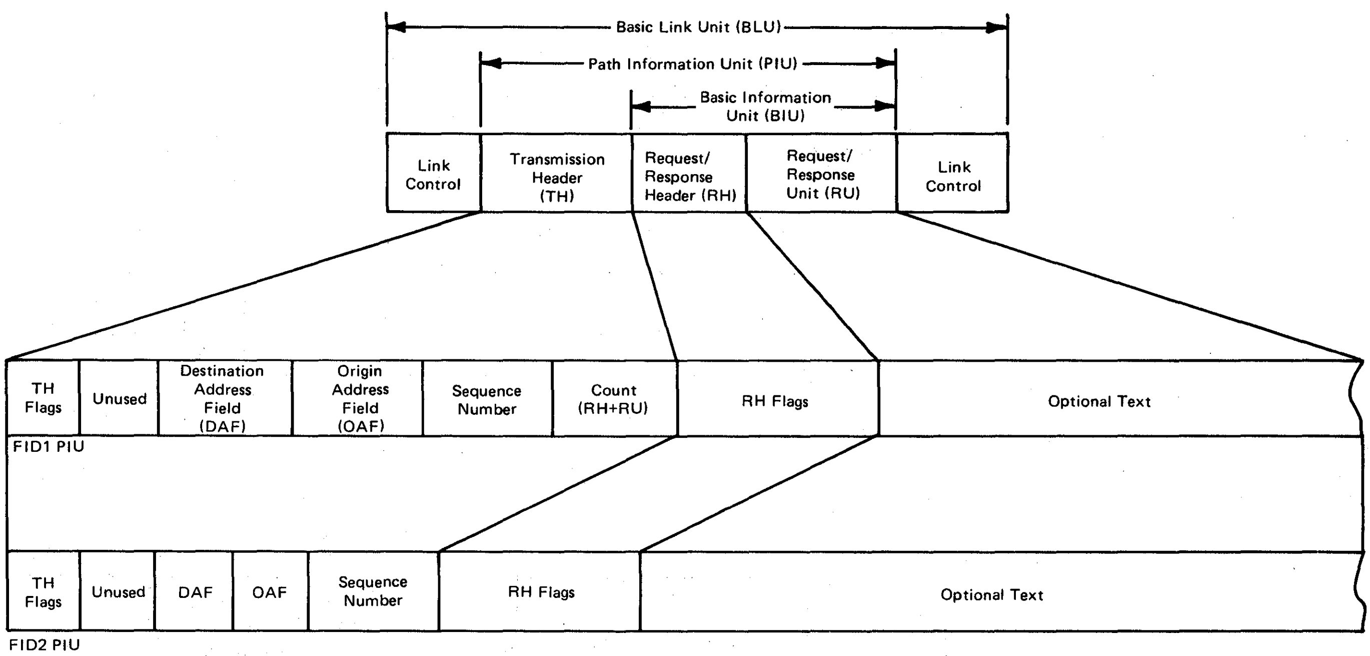


Figure 7-5. PIU Formats in the 3770 SNA Network

Data Chaining

In some cases it is desirable to send or receive a group of related requests through the network as a single entity. In an SNA network, this is done by 'data chaining'. A data chain begins with a request that is identified as *beginning-of-chain.* This first request unit of the chain may be followed by one or more *middle-of-chain* requests and the chain ends with an *end-of-chain* request. A chain can consist of only one request unit. In this case the request is called an *only-one (RU)-in-chain* request. The different request units of the chain are identified by flags in the request header (RH):

RH Byte 0, Bits 6 and 7

B'10' - Beginning-of-Chain (BOC)
B'01' - End-of-Chain (EOC)
B'00' - Middle-of-Chain (MOC)
B'11' - Only-one-in-Chain (OC)

The following rules apply to 3770 data chaining:

- If the 3770 receives a Cancel while receiving a chain of requests, it discards all previously received requests of the chain.
- If the 3770 sends a negative response to a request in a chain, it purges all further requests until it encounters an end-of-chain request or Cancel.

3770 SNA Bracket Protocol

Figure 7-6 shows examples of bracket protocol. SNA bracket protocol is used by the 3770 to resolve contention between the host application program and the 3770. Brackets are used to prevent a series of requests or chains from being interrupted. This series of requests or chains is referred to as a 'conversation'.

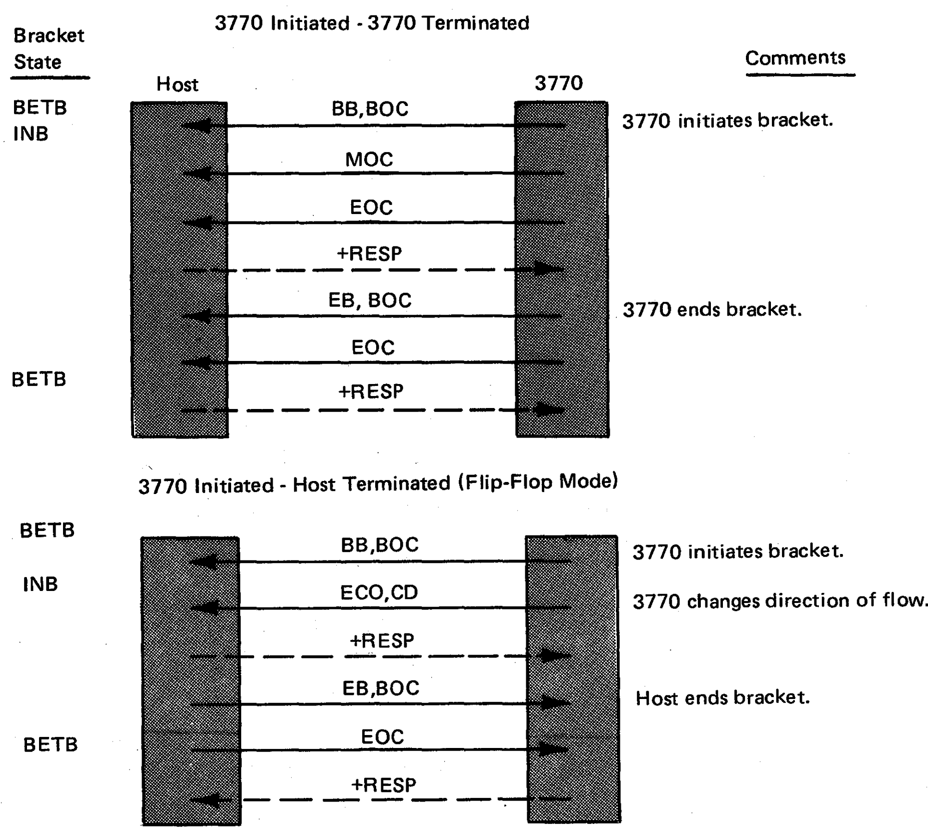
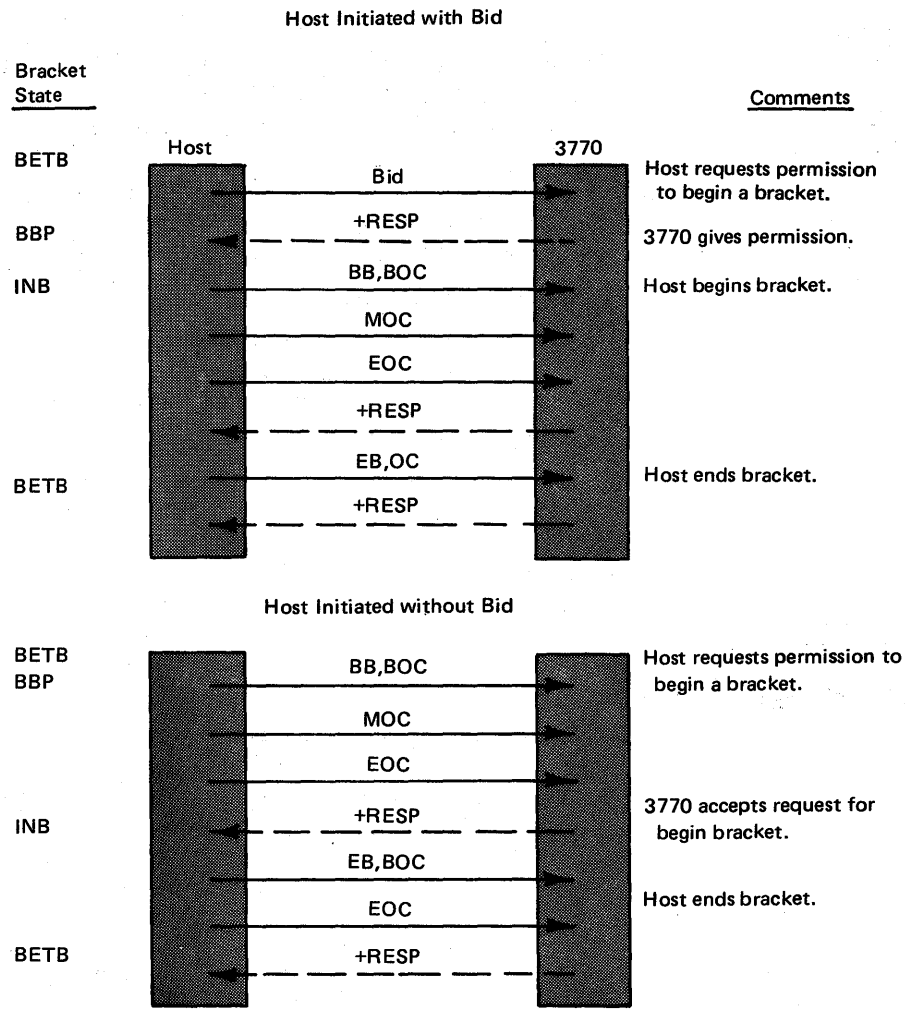


Figure 7-6. Examples of Bracket Protocol (1 of 2)



BB	–	Begin bracket
EB	–	End bracket
BOC	–	Beginning of chain
MOC	–	Middle of chain
EOC	–	End of chain
OC	–	Only of chain.
BETB	–	Between brackets
INB	–	In brackets
BBP	–	Begin bracket pending
RESP	–	Response

Figure 7-6. Examples of Bracket Protocol (2 of 2)

A conversation begins and ends with brackets. The brackets are identified by flags in the request header (RH):

RH Byte 2, Bits 0 and 1

B'10' - *Begin Bracket (BB)* - Identifies the first request unit of a conversation.

B'01' - *End Bracket (EB)* - Identifies the last request of a conversation or the first request in the last chain of a conversation.

A request unit may be both a begin bracket and end bracket. This indicates that it is the only request unit or chain in the conversation.

The 3770 manages bracket communications and is always the 'first speaker'. The first speaker either begins a conversation with a begin bracket or gives permission to the application program to begin a bracket. The host application program requests permission to begin a bracket by sending a Bid request to the 3770. The 3770 gives permission to the host application program by returning a positive response to the Bid. The application program then begins the conversation with a begin bracket request.

The host application program can also request permission to begin a bracket by sending a begin bracket request to the 3770. If the 3770 accepts the begin bracket, it returns a positive response. Otherwise, it returns a negative response to the host application program and the begin bracket request is discarded.

In order to manage bracket protocol, the 3770 maintains three bracket states:

- *Between Brackets (BETB)* - No conversation is taking place. A begin bracket request or Bid may be accepted.
- *Begin Bracket Pending (BBP)* - The 3770 has given permission to the application program to begin a bracket. The BBP state is entered from the BETB state when the 3770 sends a positive response to a Bid. The BBP state exits to the INB state when the begin bracket request is received.
- *In Brackets (INB)* - A conversation is taking place. The INB state is entered from the BETB state when a begin bracket request is initiated by the 3770 or accepted by the 3770. The INB state exits to the BETB state when the 3770 sends an end bracket request or receives an end bracket request and end of chain.

Figure 7-7 shows 3770 bracket management decisions on accepting or rejecting bracket requests.

		Bracket State		
		BETB	INB	BBP
REQUEST UNIT	Not Begin Bracket Not End Bracket	Reject	Accept	Reject
	Begin Bracket Not End Bracket	Accept	Reject	Accept
	Not Begin Bracket End Bracket	Reject	Accept	Reject
	Begin Bracket End bracket	Accept	Reject	Accept
	Bid	Accept	Reject	Reject

Figure 7-7. Bracket Request Accept/Reject Table

Transaction Modes

The 3776/3777 SLU terminals operate only in flip-flop mode.

The 3770 and host go into contention only between brackets. Flow within the brackets can change direction (flip-flop) at the end of any chain by setting the change direction indicator in the RH (RH byte 2, bit 2).

Installing an IBM 3770/SNA System

This section is a guide for those who install the IBM 3770 Data Communication System. It describes the steps required to install the 3770 system in an SNA/SDLC telecommunications network using; (1) an IBM 3704 or 3705 Communications Controller with Network Control Program/Virtual Storage (NCP/VS) or Advanced Communications Controller with Network Control Program/Virtual Storage (ACF/NCP/VS), and (2) an IBM System/370-VS with the Virtual Telecommunications Access Method (VTAM) or ACF/VTAM or the Telecommunications Access Method (TCAM) or ACF/TCAM. Refer to Figure 7-8. This section highlights the aspects of the installation process that are unique to the 3770 system and directs the reader to other IBM publications that provide more information. The intent of this section is that it be used as a guide to the NCP, VTAM, TCAM, and other publications; not as a substitute for them.

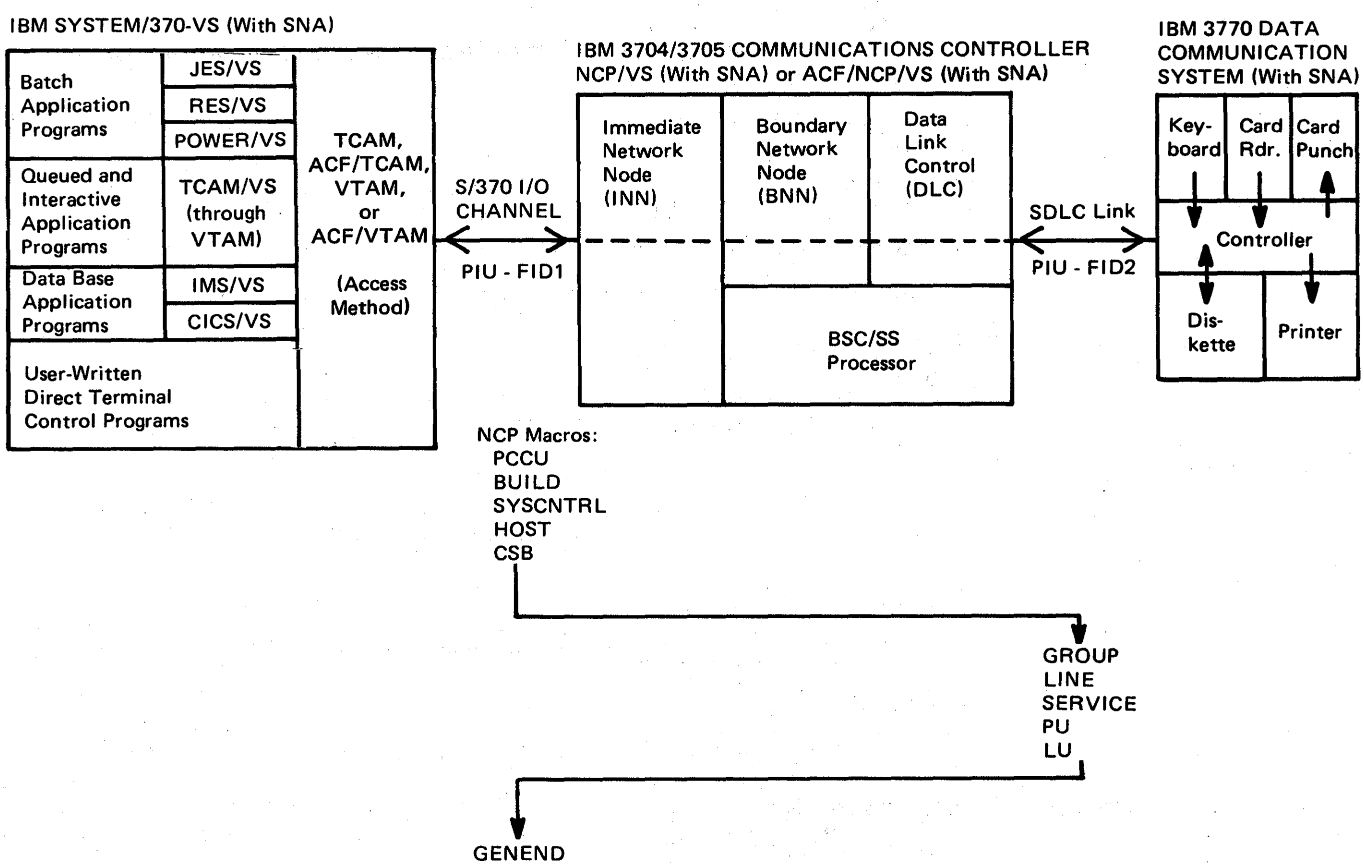


Figure 7-8. IBM 3770 Communication Terminal in an SNA/SDLC Network

Related Publications

Other manuals of a more general nature are listed in "Related Publications" in the front of this manual. This section uses short titles from the following list to refer to other IBM publications that contain information necessary for the installation process or contain references to other IBM publications where that information may be found. For example, the *VTAM Concepts and Planning Manual* contains references to the appropriate manuals for installing VTAM, writing VTAM application programs, and operating VTAM.

Introduction and General Information Manuals

ACF Introduction

Introduction to Advanced Communications Function, GC30-3033

ACF General Information

Advanced Communications Function for VTAM General Information, GC38-0254
Advanced Communications Function for TCAM General Information, GC30-2050
ACF/TCAM - NCP Bibliography and Master Index, SC30-3141

CICS General Information

Customer Information Control System (CICS/VS) General Information Manual, GH20-1280

IMS General Information

Information Management System Virtual Storage (IMS/VS) General Information Manual, GH20-1260

SDLC General Information

IBM Synchronous Data Link Control General Information, GA27-3093

SNA General Information

IBM Systems Network Architecture General Information, GA27-3102

SNA Introduction

IBM Systems Network Architecture Introduction, GA27-3116
IBM 3770 SNA Installation Guide, GC30-3064

ACF/TCAM Introduction

ACF/TCAM Version 2, General Information: Introduction, GC30-3057

VTAM Introduction

Introduction to VTAM (Virtual Telecommunications Access Method, GC27-6987

3704/3705 Introduction

Introduction to the IBM 3704 and 3705 Communications Controllers, GA27-3051

Concepts, Facilities, and Planning Manuals

TCAM Concepts and Facilities

ACF/TCAM Version 2, General Information: Functional Description, GC30-3131

VTAM Concepts and Planning

VTAM Concepts and Planning, DOS/VS, OS/VS1, OS/VS2, GC27-6998

Program Generation and Installation Manuals

Information Management System

IMS MFS User's Guide, SH20-9053

NCP and ACF/NCP/VS Generation and Utilities

IBM 3704 and 3705 Control Program Generation and Utilities Guide and Reference Manual, GC30-3008
IBM 3705 Advanced Communications Function for Network Control Program/VS Generation and Utilities Reference Manual, SC30-3116
NCP Generation and Utilities Manual, GC30-3004
ACF/NCP/VS Installation, SC30-3142
ACF/NCP/VS Utilities, SC30-3143

TCAM Programmer's Guide

Refer to *ACF/TCAM Functional Description,* GC30-3131, for the appropriate programming publications for your operating system.

- *ACF/TCAM, Version 2 Application Programming,* SC30-3135
- *ACF/TCAM, Version 2 Installation: Guide,* SC30-3132
- *ACF/TCAM, Version 2 Installation: Reference,* SC30-3133

VTAM System Programmer's Guide

Refer to *VTAM Concepts and Planning,* GC27-6998, for the appropriate programming publications for your operating system.

- *DOS/VS VTAM System Programmer's Guide,* GC27-6957
- *OS/VS1 VTAM System Programmer's Guide,* GC27-6996
- *OS/VS2 SVS VTAM System Programmer's Guide,* GC27-0049
- *OS/VS2 MVS System Programming Library,* GC28-0688
- *ACF/VTAM System Programming Guide,* SC38-0268 *(DOS/VS Rel 1)*
- *ACF/VTAM System Programming Guide,* SC38-0258 *(OS/VS Rel 1)*
- *ACF/VTAM Installation,* SC27-0464 *(DOS/VSE Rel 2)*
- *ACF/VTAM Installation,* SC27-0468 *(OS/VS Rel 2)*
- *ACF/VTAM Installation,* SC27-0439 *(DOS)*

Program Reference Manuals

CICS Reference Manuals

CICS Application Programmer's Reference Manual, SH20-9003
CICS System Programmer's Reference Manual, SH20-9004

IMS Reference Manuals

IMS Application Programmer's Reference Manual, SH20-9026
IMS System Programmer's Reference Manual, SH20-9027

Program Reference Handbook

IBM 3704 and 3705 Program Reference Handbook, GY30-3012

ACF/TCAM Reference Manual

ACF/TCAM Program Reference Summary, LY30-3042

VTAM Macro Language Manuals

VTAM Macro Language Guide, GC27-6994
VTAM Macro Language Reference, GC27-6995

Operator's Manuals

ACF/TCAM Operation

ACF/VTAM, Version 2 Operation, SC30-3136

VTAM Network Operating Procedures

Operator's Library: VTAM Network Operating Procedures, GC27-6997

Control Panel Guides

Guide to Using the IBM 3704 Communications Controller Control Panel, GA27-3086
Guide to Using the IBM 3705 Communications Controller Control Panel, GA27-3087

Writing NCP Generation Macro Instructions

The NCP macro instructions are used in two ways. First, they are used to generate the NCP load modules. Then, they are used by VTAM to get information about the network.

Most of the parameters specified in the NCP generation macro instructions are used only for generating the network control program. However, some parameters are used both in generating the NCP and again in defining the NCP network to the access method. The jointly used parameters and the access method-only parameters are made available to VTAM when the NCP generation deck is filed during the network definition process. The *NCP Generation and Utilities* manual lists the access method-only macros and operands, and indicates where they must appear in the NCP source deck used for the access method initialization. The *VTAM or TCAM System Programmer's Guide* explains how to use the access method-only NCP macros and operands. Placing the access method-only macros in the deck before generating the NCP load module is recommended, because the syntax of the macros is checked. Adding them to the deck after generating the program can introduce errors (such as misspelled operands or misplaced cards).

There are several critical NCP coding requirements imposed by the access method and the 3770 system.

System and Configuration Definition Macro Instructions

PCCU Macro (VTAM only)
BUILD Macro
SYSCNTRL Macro
HOST Macro
CSB Macro
LUPOOL (switched networks only)

The list of NCP macro instructions to be written is taken from the *System* and *Configuration Definition* lists in the *NCP Generation Macro Instructions* section of the *NCP Generation and Utilities* manual. The list is included here for reference only, with one exception. When writing the NEWNAME parameter in the BUILD macro, note that the name must be the same as the file name of the generated NCP phase (DOS/VS or the member name of the NCP (OS/VS).

Additional NCP/3770 Definition Considerations

The person who writes the NCP macro instructions should know the answers to the following questions or code the operands as indicated.

GROUP Macro Instruction

Parameter	**NCP Operand**
Type of line	DIAL=YES or NO
Type of line control	LNCTL=SDLC
Type of pacing	*VPACING=3,1

LINE Macro Instruction

Parameter	**NCP Operand**
Line speed	SPEED=1200, 2400, 4800, 9600, or 19200
Type of station	PUTYPE=2
Half-duplex or duplex facility	DUPLEX=FULL or HALF

PU Macro Instruction

Parameter	**NCP Operand**
Type of station	PUTYPE=2
Segment Size	MAXDATA=265 for 256-byte buffer =521 for 512-byte buffer
Number of PIUs outstanding	MAXOUT=1
Service order table limit	PASSLIM=1

LU Macro Instruction (for nonswitched links only)**

Parameter	**NCP Operand**
Pacing the logical unit	**PACING=1,1

*For the 3770 terminals, VPACING could initially be set at 2 values greater than PACING. If PACING = 1,1; then VPACING = 3,1.
**For switched links, PACING is defined in VTAM rather than in NCP.

Generating the NCP Load Module

Generating the NCP module is a multistage process. It involves assembling the NCP macros, assembling NCP assembler code (derived from the macro assembly or directly coded by you), and link-editing the assembled code (along with IBM-supplied object modules that will be needed as indicated by the options selected in the NCP macro instructions).

Save the intermediate output of the generation process—the NCP load module and resource resolution tables—in case you wish to do partial NCP generations later. Refer to the *NCP Generation and Utilities* manual for more details.

DOS/VS only:

DOS/VS users must put generated NCP load module and initial test routines on NCP libraries with the CSERV utility.

Filing NCP Instructions for Use by VTAM

As part of the VTAM definition procedure, you must file the macro instructions you have written for each NCP. (See the *VTAM System Programmer's Guide* and *VTAM Network Operating Procedures.*) VTAM uses the NCP macro instructions to build its resource definition tables, which describe the components of the network. VTAM uses these tables to communicate with the network components.

Coding and Filing the VTAM Definition Statements

After you have generated your NCP load module, put the macro instructions in the VTAM definition file to provide a definition of the NCP and its network to VTAM.

Coding, Assembling, and Installing Application Programs that Use VTAM

The symbolic names that you use in your VTAM application programs to communicate with specific 3770 physical and logical units must match the NCP macro instruction labels for PU and LU macros. However, you do not have to know the symbolic names when you code your application program. If you write a LOGON exit-routine, VTAM will provide the program with the symbolic name of each 3770 logical unit when the 3770 logical unit requests connection. See the *VTAM Macro Language* manuals for details.

Activating and Loading the NCPs

When you start VTAM, VTAM will activate and load the NCPs named in the configuration list that you specified in the VTAM start parameter, CONFIG=.

NCPs that VTAM does not load (because you did not name them in a configuration list) can be loaded after you have started VTAM by using VTAM's VARY NET command.

Activating 3770 VTAM Operator Commands

Before VTAM can transmit to a 3770, both the 3770 physical unit (PU) and its logical unit (LU) must be active. There are two ways to activate physical and logical units with VTAM:

1. Specify ISTATUS=ACTIVE in the NCP macro instructions that describe 3770 logical units, to indicate that each is to be automatically activated when the NCP is activated.

   or

2. Activate each 3770 physical unit and logical unit individually by issuing VTAM's VARY NET command.

Operational Considerations

Transmission Headers

All 3770 terminals support "FID2" transmission and request/response headers (TH and RH). The headers consist of the nine bytes as shown in the Data Area Layouts section of the *IBM 3704 and 3705 Program Reference Handbook,* GY30-3012.

Sense Data–Inbound Error Response

The 3770 will set the ERR bit on inbound responses to identify an error response. Sense data will accompany the error response. The sense data consists of four bytes as follows:

Major Code (SBO)	*Modifiers (SBI)*
Path Error (X'80')	X'04' - Unrecognized DAF
	X'07' - Segmenting Error
	X'09' - LU not active
Request Header Error (X'40')	None
State Error (X'20')	X'01' - Sequence Number
	X'02' - Chaining
	X'05' - Data Traffic Reset
Request Error (X'10')	X'02' - RU Length Error
	X'03' - Function Not Supported
	X'05' - Parameter Error
	X'07' - Category Not Supported
	X'08' - Invalid FM Header
Request Reject (X'08')	X'02' - Intervention Required
	X'05' - Session Limit Exceeded
	X'0A' - Permission Rejected
	X'0B' - Bracket Race Error
	X'11' - Break
	X'12' - Insufficient resource
	X'13' - Bracket Bid Reject - No RTR Forthcoming
	X'1B' - Receiver in Transmit Mode
	X'1C' - Request Not Executable
	X'21' - Invalid Session Parameters
	X'25' - Component Not Available

3770 Considerations for the Bind Command

The following Bind command parameters must be specified when the host issues a Bind command to a 3770 terminal.

Function Management (FM) Profile

The function management profile for the 3770 must be defined as FM Profile 3 or the 3770 rejects the Bind command.

Transmission Services (TS) Profile

The transmission services profile for the 3770 must be defined as TS Profile 3 or the 3770 rejects the Bind command.

Primary (Host) Protocol

The primary (host) request mode selection must specify immediate request mode. The primary (host) chain response protocol must not specify "no response" or the 3770 rejects the Bind command.

Secondary (3770) Protocols

The following protocols on chains and brackets must be specified when the host issues a Bind command.

Chaining: The secondary (3770) chaining selection must specify that multiple request unit chains may be used.

Request Mode: The secondary (3770) request mode selection must specify immediate request mode.

Chaining Response: Three types of responses may be selected for chaining in the BIND command:

1. Exception response: If the Bind command to the 3770 specified exception response, the 3770 asks only for exception responses to request units sent to the host.
2. Definite response: If the Bind command to the 3770 specifies definite response, the 3770 requests a definite response only on the end-of-chain (EOC) request unit. For all other request units sent to the host, the 3770 requests only the exception response.
3. Both exception and definite responses: If both responses are specified in the Bind command, the 3770 assumes (defaults to) the definite response protocol.

End Bracket (EB): If the Bind command permits the 3770 to send the end-of-bracket indicator, the 3770 sends EB only if the 3770 initiated the bracket. The 3770 does not terminate a host-initiated bracket.

If the Bind command does not permit the 3770 to send the end-of-bracket indicator, the 3770 does not terminate any brackets regardless of which logical unit (host or 3770) initiated the bracket.

Common Protocols

The following protocols common to both logical units (host and 3770) must be observed when the host issues a Bind command.

Batch or Interactive - FM Header Usage: If FM headers are allowed on request units, the 3770 assumes the batch mode of operation which can include all I/O devices attached.

If the Bind command does not allow FM headers, the 3770 assumes an interactive mode of operation which can include only the keyboard and the console printer.

Bracket Protocol: The 3770 logical unit requires that bracket protocol be specified in all Bind commands and that bracket termination rule one (1) be used as follows:

- If a definite response is requested by the sender, the bracket is not terminated until the sender receives a positive response.
- If an exception response is requested, the bracket is terminated unconditionally when the receiver processes the chain with the end-of-bracket (EB) request unit.
- If Begin Bracket (BB) and End Bracket (EB) indicators are both on in the same chain, the bracket is unconditionally terminated regardless of the type of request.

Data Transmission Code: If the alternate code is specified in the Bind command, the 3770 assumes ASCII is used for data transmission.

If the alternate code is not specified, the 3770 assumes EBCDIC is used for data transmission.

Function Management Transaction Mode: If the Bind command permits FM headers to be used (batch session), the 3770 must run in half-duplex, flip-flop mode.

Recovery Responsibility: The 3770 requires the Bind command to specify that the primary logical unit (the host application program) be responsible for error recovery.

First Speaker in Brackets: The 3770 requires that the Bind command specify the secondary logical unit (the 3770) as the first speaker for bracket protocol. To resolve a contention situation when the host and the 3770 simultaneously issue a begin bracket (BB) request unit, the host must accept the 3770 BB request. The 3770 may reject a BB request unit from the host.

Responses

A response convention is used to assure the sender that the request unit was received and is acceptable to the receiver. The two types of convention that the 3770 supports are as follows:

1. Exception or error response. The request unit chain only requires a response if the request is in error or unacceptable.
2. Definite response. The request unit chain requires a response, either positive or negative.

Definite Response (DR 1/2)

This response indicates that a request unit has been received by the user. When sent without an error indicator, DR 1/2 indicates that the request unit was received successfully and acted upon.

Exception Response (EX)

This response is always sent in combination with a DR 1/2 response and indicates that the request unit has not been received successfully or could not be acted upon. A DR 1/2 response will not be sent until the operation being performed (print, punch, etc.) has emptied the buffer. This response is always accompanied by four bytes of sense information. The first two bytes are defined by the network and the last two bytes are set to zeroes by the 3770. All four bytes are supplied by the logical unit when sending an error response.

The access method application program may request that the 3770 send two types of responses for request units received from the access method application program, that is:

Exception response (DR 1/2, EX) only, which is negative only;
Definite response (DR 1/2, NEX), which is positive.

Only exception responses are required for the request units in the chain, except for the last request unit. The last request unit in the chain may require a definite response.

Interactive Operator Interface

ID Reader

The ID Reader may be activated by the 3770 operator via a code key function. A code will be displayed in the NPR to notify the operator that the ID Reader has been activated. Up to 213 characters may be entered into the buffer before inserting the badge in the reader. When the badge is read, the buffer is automatically transmitted to the host processor. Printing of the ID Reader data will be inhibited.

Note: A Longitudinal Redundancy Check (LRC) will be performed, but the LRC characters will not be transmitted.

Secure Data

The code functions Inhibit Print (INP) and Enable Print (ENP) are supported by 3770 to allow the host to control entry of secure data at the terminal. Upon receipt of INP, the print-inhibit state is entered. While in the print-inhibit state, if the keyboard is used as the input device, the Print Inhibit light will be turned on and any data entered via the keyboard will not be printed. Data received from the host during print-inhibit state will be printed, and the Print Inhibit light will be turned off. This will not affect the print-inhibit state in the terminal.

When ENP is received, print-inhibit state will be reset.

The ATTN key may be used during print-inhibit state to transmit SIGNAL. The function associated with this request is application dependent.

Function Management Header

The 3776 Model 1 & 2 and the 3777 Model 1 use type 1 function management (FM) headers. The 3777 Model 1, in addition to using the type 1 FM header (transmit and receive), accepts the type 3 FM header from the host provided that the header contains data decompaction information.

The basic type 1 FM header is a six-byte control field that occurs at the beginning of a request unit. The presence of the FM header is indicated in the request header via the Formatted Indicator bit. The header may occur only on beginning-of-chain (BOC) or only-one-(RU)-in-chain (OC) request units. For the 3770, the functions provided by the FM header are:

- Component selection
- Data set delimiting
- String Control Byte (SCB) definition

Each inbound data set originating from the card reader or the diskette will be framed by FM headers. When the device from which the data originated is the keyboard, no FM headers are present. All outbound data sets should be framed by FM headers. If the 3770 receives a data set without an FM header (i.e., the Formatted Indicator in the request header is off), the console printer is selected.

FM Header Type 1

The format of the FM header (Type 1) is as follows:

Byte	*Bits*	*Meaning*
0	0-7	X'06' - Length of header
1	0-7	X'01' - Type = 1
2	0-3	Input/Output, Media Selection (Bit 0 must be 0 for 3770) Output X'0' - Console printer X'1' - Exchange Diskette (Host to 3770 Only) X'2' - Card punch X'3' - Line printer X'4' - Nonexchange Diskette, User Data Set Inbound/Outbound, 3770P Only X'5' - Print Data Set X'6' - Transaction Data Set (3770-to-Host) X'7' - Reserved Input X'0' - Console (keyboard) X'1' - Diskette X'2' - Card reader
	4-7	Device address X'0' - Console printer or line printer, card reader or punch, or diskette 1 X'1' - Diskette 2
3	0-7	Reserved
4	0-2	Destination Selection: B'000' - Resume (RDS) B'001' - End (EDS) B'010' - Begin (BDS) B'011' - Begin & End (only - ODS) B'100' - Suspend (SDS) B'101' - Abort (ADS) B'110' - Continue (inbound support only) (CDS) B'111' - Reserved
	3	DST - Data Set Transmission (medium = exchange) B'0' - Transmission Exchange Format (T–type disk data set required). B'1' - Basic Exchange Format
	4	Reserved
	5	CMI B'0' Not compressed data B'1' Compressed data
	6	CPI B'0' Not compacted data B'1' Compacted data (Host to 3777-1 Only)*
	7	Reserved
5	0-7	ERCL 0-255 for card medium (0 defaults to 80) and exchange medium (if DST = 0), or 1-128 for exchange medium (if DST=1).

*On the 3777-1, compacted data cannot be directed to the diskette. If CPI=1 and output device is the diskette, the header is rejected (even if DISK switch is on).

Note: Inbound Data from 3770 - Inbound FM headers will contain the device selection indicators for the device from which the data originated.

Outbound Data to 3770 - If the 3770 DISK switch is on, all valid selections except the console will be overridden unless the machine is jumpered for ASCII and the Bind is for EBCDIC. In this case the DISK switch is ignored. The only valid devices are console printer, diskette, and punch. If the DISK switch is not on and the device select field specifies a valid device that is not attached to the 3770, an exception response (Component Not Available) will be sent. If the device select field specifies a device that is invalid for the 3770, the 3770 will send an exception response indicating an invalid FM header.

FM Header Type 3

The format of the FM header (Type 3) is as follows:

Byte	*Value*	*Meaning*
*0	L	Length of header
1	X'03'	Type = 3
2	X'02'	Contents = decompaction table
*3	M	Number of master characters - X'03' → X'10'
*4	L-1	Master characters followed by any nonmaster characters

*See table below for values of variables.

The type 3 FM header is accepted only by the 3777-1 and only if the FM header contains data decompaction information.

The number of characters in the decompaction table depends on the number of master characters. The hex values for the variables in the Type 3 FM header are given in the table below.

Number of Master Characters M		*Length of Header L*
Decimal	*Hex*	*Hex*
16	10	14
15	0F	23
14	0E	40
13	0D	5C
12	0C	74
11	0B	8C
10	0A	A0
9	09	B4
8	08	C4
7	07	D3
6	06	E0
5	05	EB
4	04	F4
3	03	FB

The master and non-master characters are defined beginning at byte 4 and ending at byte (L-1).

Inbound Data from 3770 to Host Processor

This section discusses the format and contents of the request units sent from the various terminal sources to the host processor.

Inbound Card Data

The 3770 will send card data to the host processor as follows:

Nontransparent Cards:

- TRN and IGS codes are not allowed in data*
- Trailing Blanks are truncated
- IRS code is appended to the resultant card image to denote end of record
- RU size can vary from 0 to 512 bytes
- 3770 will not span card records across RU boundaries

***Note:** The 3770 does not check for TRN and IGS codes in card data. If these codes exist in card data, use the transparent mode of data transmission to ensure proper processing at the host processor.

Transparent Cards:

- Trailing blanks are truncated
- TRN code followed by a one-byte binary count (0-80) precedes the truncated card image
- IRS code is appended to the resultant card image
- RU size can vary from 0 to 512 bytes
- 3770 will not span card records across RU boundaries

The card RUs are sent from the beginning of a card deck to the EOF as one data set and one bracket. The user can delimit jobs or transactions within the bracket by inserting an "end-of-chain" card(s) in the deck. Columns 1-6 of the card should contain /*EOC blank (all other columns are ignored). When the 3770 reads this card, the reader will stop and that RU will be sent as the end of chain. Reading will resume after the positive response to the chain has been received. The next RU from the reader will be a beginning of chain. If the 3770 is bound in a session requesting exception response chains, the reader will not stop when a /*EOC is read.

Note: The 3770 will not recognize the /*EOC card in transparent decks.

The 2502 has a switch to control the end-of-file condition when the hopper empties. The 3501 and 3521 use the /*EOF card to detect the EOF condition. The /*EOF will not be included in the data stream.

Inbound Disk Data

Concatenated Data Sets (SNA Only)

If this option is specified (CODE/C) for a 'transmit all active data sets' job, consecutive data sets that have the same medium and subaddress will be concatenated using the CDS (Continue Destination Select) FM Header type 1.

If a data set with a different medium or subaddress is encountered, an EDS header followed by a BDS header will be sent to the host.

Before using this option, verify that the host application program can receive concatenated data sets.

Example of Concatenation:

Assumptions:

- 'Transmit all active data sets' job executed at the terminal
- Host application program can receive CDS FM Headers

Data Set #1 - Card Medium, Subaddress (X'20' in bytes 80 and 81 of data set label)	BDS Header
Data Set #2 - Card Medium, Subaddress 0	CDS Header
Data Set #3 - Card Medium, Subaddress 0	CDS Header
	EDS Header
Data Set #4 - Console Medium, Subaddress 0	BDS Header

Transmission Data Sets

The RU structure and content of data originating from the diskette is identical to the format and content of the original source of input, and the media field in the FM header will identify the original source of the input. If the data originated from the card reader, the format will be as described for cards. One or more data sets will be sent as a bracket, and chains within the data set(s) will be sent if the /*EOC was used in the card to disk operation.

If an IUS character is detected, it will be stripped from the data stream before transmission and the RU will carry EOC. The RU size can vary from 0 to 512 bytes depending upon the data set block length.

Basic Exchange Data Sets

The FM Header media field will identify the source of the input as diskette, and the entire data set will be transmitted as a single chain. The 3770 will read one sector at a time from the diskette and transmit one sector per RU. If the block length is less than or equal to 80 bytes, the media will indicate the card reader as the source. This also applies to the Record Compress mode 3776-1/3776-2/3777-1 of operation where multiple sectors are contained in one RU.

Inbound Keyboard Data

The inbound keyboard data will be SNA character string as described later in this chapter. Pressing the EOM key forces an end bracket as well as an end-of-chain condition.

Outbound Data from Host Processor to 3770

This section discusses the format and content of the request units sent from the host processor to the various terminal destinations.

Outbound Card Data

The format and content of the RUs for the punch should be identical to the inbound card formats except that data compression is allowed. The 3770 will not support punch records spanned across RU boundaries.

When the 3770 receives transparent data, it will not examine the characters to be punched; so all 256 codes can be punched.

Outbound Diskette Data

Each data set identified by the data set delimiting indicators in the FM header will create a new data set on the diskette. On a 3770 with only one line-to-diskette data set, if the FM header is not compatible with the existing data set, the 3770 sends an exception response (Component Not Available). The data set will be closed when an FM header with End Data Set on is received. The contents of the RUs should be formatted as they would for the final destination device.

When a data set to be written on diskette is received, the 3770 will write either a basic exchange data set or a "transmission" data set. The type of data set is determined by an indicator in the FM Header.

When writing a basic exchange data set, the 3770 uses the record length specified in the FM header to deblock the records in the RU. If the RU contains an uneven multiple of the specified record length, the record is padded with NULs to force an even multiple. One record per 128-byte sector is written to diskette. If the record length is less than 128, the 3770 pads with nulls. A basic exchange data set may contain multiple chains, but the extent of the chains is lost once the data is written to diskette. Basic exchange data sets containing compressed data are not supported.

If Basic Exchange is not specified in the FM header, the 3770 will create a "Transmission" data set. Two (four, if in 512-byte mode) 128-byte sectors will be written per RU. If the RU contains fewer than 256 (512) bytes of data, the 3770 pads with nulls. The extent of each chain is maintained by inserting an IUS in the buffer before writing to the diskette. Compressed data is allowed in "transmission" data sets. Basic exchange and "transmission" data sets cannot be mixed on the same diskette.

Outbound Printer Data

The 3770 console printer uses SNA character string (SCS) and data compression. The SCS for the console printer is described later in this chapter.

The 3770 will accept print records spanned across RU boundaries, but records may not be spanned across chains. SCBs may be used for data compression. The channel settings may be specified with the Set Vertical Format (SVF) sequence or set locally by the 3770 operator.

SNA Format Controls

The following summarizes the characters from the SNA standard character string (SCS) used by the 3770 keyboard/console printer for format control.

Set Horizontal Format (SHF)

EBCDIC = 2BC1

This function sets horizontal formatting controls including maximum print position, left margin, right margin, and horizontal tab stops. A one-byte count follows the SHF code and is a binary byte count of the parameters that follow the SHF code (including the count parameter itself). The first three parameters following the count define the maximum print position (MPP), the left margin (LM), and the right margin (RM), respectively. Tab-stop column values start in the fifth parameter position following the SHF code. The SHF count code itself sets all horizontal formatting controls to their default values. If specific parameters are not present in the SHF sequence or have a value of zero, the values for those format controls remain equal to their default values. The following sequences (and only these) are valid:

SHF count				
SHF count	MPP			
SHF count	MPP	LM		
SHF count	MPP	LM	RM	
SHF count	MPP	LM	RM	T1 ... Tn

The first data printed after the SHF sequence uses the new horizontal forms control.

The SHF sequence will not be generated for inclusion in the 3770-to-host processor data stream.

Maximum Print Position Parameter (MPP)

This one-byte binary number specifies the maximum print position value to be used in place of the physical device maximum. The value assigned to maximum print position is as follows:

- If the value specified is greater than zero and less than or equal to 132 (device maximum print position for the serial printer and the line printer), then the maximum print position is set to the specified value.
- If the value specified is zero, then the maximum print position is set to 132 (default value for the serial printer and the line printer).
- If the maximum print position parameter is not specified, the maximum print position is set to 132 (default value for the serial printer and the line printer).
- If the specified value is greater than 132 (physical device maximum), an error response (with sense data included) is sent and processing of the request unit (RU) is terminated. All horizontal format controls will remain equal to their default values following the error detection.

Use of the maximum print position parameter is as follows:

Output Data to 3770: If an attempt is made to print a graphic character in maximum print position + 1, (MPP + 1) a new line function (CR + line feed) is performed automatically and the character printed at the print position defined by the left margin. If an attempt is made to perform a control function (VT, horizontal tab, IRS, ...) at MPP + 1, the results depend on the function attempted and are detailed in the descriptions for each function.

Left Margin Parameter (LM)

The left margin parameter value replaces column one as the left-most print position. Valid left margin values are less than or equal to the value of the maximum print position. The default value for the left margin parameter is column one. The left margin position value is stored as the first tab. Therefore, if a backspace is done to the left of the left margin position, a tab causes the print position to move to the left margin. The value assigned to the left margin is as follows:

- If the specified value is greater than zero and less than or equal to the maximum print position, then the left margin is set to the specified value.
- If the value specified is zero, then the left margin is set to column one.
- If the left margin parameter is not present, the left margin is set to column one.
- If the specified value is greater than the value of the maximum print position, an error response is generated. The processing of the request unit containing the error is terminated immediately, and all horizontal formats except maximum print position retain their default values.

Use of the left margin parameter is as follows:

Output Data to 3770: The left margin parameter defines the normal left-most boundary for printed output and is the resultant print position following a new line or carriage return function.

Right Margin Parameter (RM)

The right margin parameter is used to assist the operator when formatting a keyboard generated data stream. The right margin default value is the maximum print position. The value assigned to the right margin is as follows:

- If the specified value is greater than the value of the left margin and less than or equal to the value of the maximum print position, then the right margin is set to the specified value.
- If the specified value of the right margin is zero, the right margin is set to the maximum print position.
- If the RM parameter is not specified, the right margin is set to the maximum print position.
- If the specified value of the right margin is greater than the value of the maximum print position, or less than or equal to the left margin an error response is generated. The processing of the request unit containing the error is terminated immediately. All horizontal formats except the maximum print position and left margin remain equal to their default values following the error detection.

Use of this parameter is as follows:

Output Data to 3770: Ignored.

Tab Stop Parameters (T1...Tn)

The horizontal tab stop parameters set column values for use with the horizontal tab function and consist of a series of binary bytes. Valid tab stop column values are equal to or greater than the left margin (LM) and equal to or less than the maximum print position (MPP) parameter. If no tab stops are specified, the default is a tab stop at each column. The maximum number of stops that can be set is equal to the number of print positions for the physical device (132). More than 132 tab stops may be specified as long as they are valid (duplicate values can, therefore, exist). An error response is generated to the request unit (RU) if tab stop column values are specified that are outside the valid range. The processing of the RU containing the error is to be terminated immediately. The horizontal formats: maximum print position, left margin, and right margin remain as specified following the error detection, but the tab stops are in an undetermined state. There is no check to determine if equal tab stop values have been specified. The first unique tab stop value sets the stop and all subsequent identical values are effectively no-ops. The tab stop parameters do not have to be in any ordered sequence.

Set Vertical Format (SVF)

EBCDIC = 2BC2

This function sets vertical formatting controls including maximum print line, top margin, bottom margin, and vertical tab (T1...Tn) stops. A one-byte count follows the set vertical format code and is a binary count of the parameters that follow the SVF code (including the count parameter itself). The SVF count code itself sets all vertical formatting controls to their default values. The first three values following the count define the maximum print line, top margin, and bottom margin in that order. A zero value for any of these parameters is a no-op and results in the function retaining its default value. Vertical tab stop values start in the fifth parameter position following the SVF code. Parameters of SVF are one binary byte each. The following sequences (and only these) are valid:

SVF count				
SVF count	MPL			
SVF count	MPL	TM	BM	
SVF count	MPL	TM	BM	T1 . . . Tn

Because it is possible for the current line number to be outside the bounds specified in the set vertical format sequence after the new vertical formats are established, the current line number is reset to the top margin when the SVF code is detected prior to decoding the sequence. Printer forms should therefore be positioned at the top margin. The SVF sequence does not result in any forms movement.

The set vertical format sequence is not generated for inclusion in the 3770-to-host processor data stream.

Maximum Print Line (MPL)

This one-byte binary value specifies the last usable line of a page (form). Valid values are from 1 to 127.

The maximum print line value is used to calculate the number of line feeds to perform when a form feed (FF) function is requested.

The default value of the maximum print line is one.

Top Margin (TM)

This one-byte binary value specifies the top margin of the page. It is assumed that the forms are positioned at the top margin when the set vertical format sequence is received and any subsequent forms feed function causes a skip to the top margin of the next page. The default value for the top margin is line 1. The top margin value is stored in channel one. Thus, a skip to channel one causes the forms to move to the top margin position.

Bottom Margin (BM)

This one-byte binary value specifies the line value following which an automatic skip to the top margin of the next page takes place. Whenever a line positioning function occurs which would cause the current line value to exceed the bottom margin, the skip function is executed. Valid bottom margin values are less than or equal to the maximum print line. If an invalid bottom margin value is detected, an error response is generated and processing of the request unit is terminated immediately. The vertical format parameter for maximum print line remains as specified, but the bottom margin and tab stops retain their default values.

Tab Stop Parameters (T1...Tn)

The vertical tab stop parameters set line number values for use with the vertical tab (VT) function or the select (SEL) function. Valid tab stop line values are between the top margin and the bottom margin (X'00' is also valid). The maximum number of stops that can be set is 11. If the number of tab stops exceeds 11, then only the first 11 are set and the remainder are ignored with no error indicated.

Horizontal Tab (HT)

EBCDIC = 05

This function moves the print position from its current position to the column value specified by the next higher tab stop setting. If a tab stop is set in the current print position, that stop is ignored.

Output Data to 3770: If the current print position column value is equal to or greater than the highest tab stop setting (or if no stops have been set), the horizontal tab function executes the equivalent of a space function.

If the horizontal tab is specified at the maximum print position + 1, the following occurs:

a. If the current line number equals the bottom margin and the bottom margin is not equal to the maximum print line then the print position is moved to the left margin plus one on the top margin of the next page.
b. If the current line number equals the maximum print line, then the print position is moved to the left margin plus one on the top margin of the next page.
c. If neither the (a) nor the (b) condition exists, then the print position is moved to the left margin plus one on the next line.

Vertical Tab (VT)

EBCDIC = 0B

This function moves the print position vertically from its current line number to the line value specified by the next higher vertical tab stop setting. If a vertical tab stop function is set for the current line number, that stop is ignored.

Output Data to 3770: If no vertical tab stops have been set or if the current line number is equal to or greater than the highest tab stop value, the vertical tab function executes the equivalent of a line feed with the following resultant movement:

a. If the current line number equals the bottom margin and the bottom margin is not equal to the maximum print line then the print position is moved to the top margin of the next page.
b. If the current line number equals the maximum print line, then the print position is moved to the top margin of the next page.
c. If neither the (a) nor the (b) condition exists then the print position is moved to the next line.

There is no special consideration if the vertical tab is specified at print position MPP + 1.

Line Feed (LF)

EBCDIC = 25

This function moves the print position vertically from its current position to the next line.

Output Data to 3770: If the current line number equals the bottom margin or the maximum print line, the following can occur:

a. If the current line number equals the bottom margin and the bottom margin is not equal to the maximum print line then the print position is moved to the top margin of the next page.
b. If the current line number equals the maximum print line, then the print position is moved to the top margin of the next page.
c. If neither the (a) nor the (b) condition exists then the print position is moved to the next line.

There is no special consideration if the line feed is specified at print position MPP + 1.

Form Feed (FF)

EBCDIC = 0C

This function moves the print position to the top margin line and the left margin print position of the next page.

Output Data to 3770: If default forms control has been specified (maximum print line = 1), the form feed function executes the equivalent of a NL function. Since the bottom margin must equal 1 if maximum print line = 1, the new line function moves the print position to the left margin of the next line. There is no special consideration if the current position equals MPP + 1.

Record Separator (IRS)

EBCDIC = 1E

This control code performs the function of terminating a line of print, a transparent data stream, or a secure data string. The following is a description of its use in terminating a line of print.

Output Data to 3770: The record separator (IRS) function code forces a carriage return (CR) and line feed (LF) function as follows:

a. If the current line number equals the bottom margin value and the bottom margin value is not equal to the maximum print line value then the print position is moved to the left margin print position and the top margin line of the next form.
b. If the current line number equals the maximum print line value, then the print position is moved to the left margin print position and the top margin line of the next form.
c. If neither the (a) nor the (b) condition exists, then the print position is moved to the left margin on the next line.

There is no special consideration if the IRS code is specified at print position MPP + 1.

New Line (NL)

EBCDIC = 15

Output Data to 3770: The new line function code forces a carriage return (CR) and line feed (LF) function as follows:

a. If the current line number equals the bottom margin value and the bottom margin value is not equal to the maximum print line value, then the print position is moved to the left margin print position and the top margin line of the next form.
b. If the current line number equals the maximum print line value, then the print position is moved to the left margin print position and the top margin line of the next form.
c. If neither the (a) nor the (b) condition exists then the print position is moved to the left margin on the next line.

Note: If data being printed contains compression/expansion characters and if the expansion moves the print position beyond the maximum print position, an automatic carriage return and line feed occurs.

Carriage Return (CR)

EBCDIC = 0D

Output Data to 3770: This function moves the print position from the current position to the left margin. If the current position equals the left margin, the function is effectively a no-op. There is no special consideration if the carriage return function code is specified at print position MPP + 1.

Backspace (BS)

EBCDIC = 16

Output Data to 3770: This function moves the current print position one column position to the left. If the current print position equals the left margin, the backspace is performed. If the current print position equals column one, the backspace function will be a no-op. There is no special consideration if the backspace function code is specified at print position MPP + 1.

Inhibit Print (INP)

EBCDIC = 24

Output Data to 3770: This function disables the printing of keyboard-entered data and causes the PRINT INHIBIT light to be on when a keyboard operation is in progress.

Enable Print (ENP)

EBCDIC = 14

Output Data to 3770: This function restores the printing of keyboard-entered data.

Secure String Reader (SSR)

EBCDIC = 0450

Output Data to 3770: SSR is not in the host processor-to-3770 data stream.

Select (SEL)

EBCDIC = 04

The SEL function is used for vertical forms control as defined by SVF or as set locally by the operator. The SEL function is followed by a one-byte parameter which specifies the channel number:

Channel	*Select Parameter*
1...9	X'81' ... X'89'
10...12	X'7A' ... X'7C'

The SEL function moves the print position vertically from its current line number to the line value specified by the channel number setting. If the channel number setting is less than or equal to the current line number, forms movement will be to that line number on the next form. If the channel number setting does not contain a line value, the SEL function executes the equivalent of a line feed (LF). An invalid selection sequence results in an error condition.

Output Data to 3770: If SEL is detected in the host processor-to-3770 data stream and the select parameter is valid, the 3770 executes the forms control function. If an invalid select parameter is received, the 3770 sends an error response and immediately terminates processing of the request unit.

Transparent (TRN)

EBCDIC = 35

This control code is used to denote the start of a transparent data stream. It is followed by a one-byte binary count that indicates the number of bytes of transparent data. The transparent data stream is terminated by an IRS (record separator) character.

Undefined Graphics

If an undefined graphic (X'40'-X'FF') or an undefined SCS control code (beginning with a binary '00') is received, the 3770 prints a "-".

SCS Error Summary

Parameter Error: Sense = X'10050000'

MPP > 132
LM > MPP
RM ≤ LM
TAB > MPP
TAB < LM
BM > MPL
TAB > BM
SEL - Invalid parameter
SHF Count = 0
SVF Count = 0

SDLC Considerations

Details of the SDLC link level control are included in *IBM Synchronous Data Link Control General Information*, GA27-3093.

Terminal ID

The ID information from the 3770 terminal for the SDLC XID command consists of six bytes. Part of this ID is supplied with the terminal when it is shipped; the rest is supplied by the user, in hexadecimal notation, to the IBM maintenance person installing the terminal. The format follows:

Byte	1	2	3	4	5	6
Value	02	00	0M	M0	0J	SS

- Bytes 5–6 (0J SS): ID Number (IDNUM—20 bits) where:
  - SS = SDLC address—values supplied by user and jumpered by installer in TID Byte 1, Bits 0-7, on system card.
  - J = Jumper bits—values supplied by user and jumpered by installer in TID Byte 2, Bits 0-3, on system card.
  - X'00'—supplied with terminal
- Bytes 3–4 (0M M0): Block Number (IDBLK—12 bits)—supplied with terminal, where:
  - MM = X'13' for 3776-1/3776-2/3777-1
  - X'0'—supplied with terminal
- Byte 2 (00): Reserved (8 bits)—supplied with terminal
- Byte 1 (02): Functional Level (8 bits)—supplied with terminal

For example, assume a 3776 terminal with J = X'B' and SS = X'C1'. The terminal ID bytes from the 3776 would be sent to the CPU as:

Byte	1	2	3	4	5	6
Hex	02	00	01	30	0B	C1

Outstanding Frames

The 3770 support in NCP should be generated so that only one request/response unit is outstanding before link level acknowledgement is required.

Fan Out and SNBU

The 3770 terminals use fan-out modems on a multipoint basis only.

Remote Power Down

If the 3777 receives a DACTPU command from the access method with the FINAL bit on, the 3777 powers down following the NSA response to SDRM. The FINAL parameter is set through a host application write to operator (WTO) command that requests the system operator to perform a vary off with power down. Remote Power Down is standard on the 3777 and available as a feature on the 3776.

Chapter 8. SNA/SDLC Programming Considerations for 3776 Models 3 and 4, 3777 Models 3 and 4

This chapter describes system generation information and system programming considerations for System Network Architecture/Synchronous Data Link Control communications. The following information applies to the 3776-3/3776-4/3777-3/3777-4.

Installing an 3776/3777 MLU Terminal in an SNA System

This section is a guide for those who install the 3776 Models 3 and 4/3777 Models 3 and 4 Terminal. It describes the parameters required to install the 3776/3777 MLU models in an SNA/SDLC telecommunications network using; (1) an IBM 3704 or 3705 Communications Controller with Network Control Program/Virtual Storage (NCP/VS or ACF/NCP/VS), and (2) an IBM System/370-VS with the Virtual Telecommunications Access Method (VTAM or ACF/VTAM). (Refer to Figure 8-1.)

This section highlights the aspects of the installation process that are unique to the 3776/3777 and directs the reader to other IBM publications that provide more information. The intent of this section is that it be used as guide to the NCP, ACF/NCP/VS, VTAM, ACF/VTAM and other publications; not as a substitute for them.

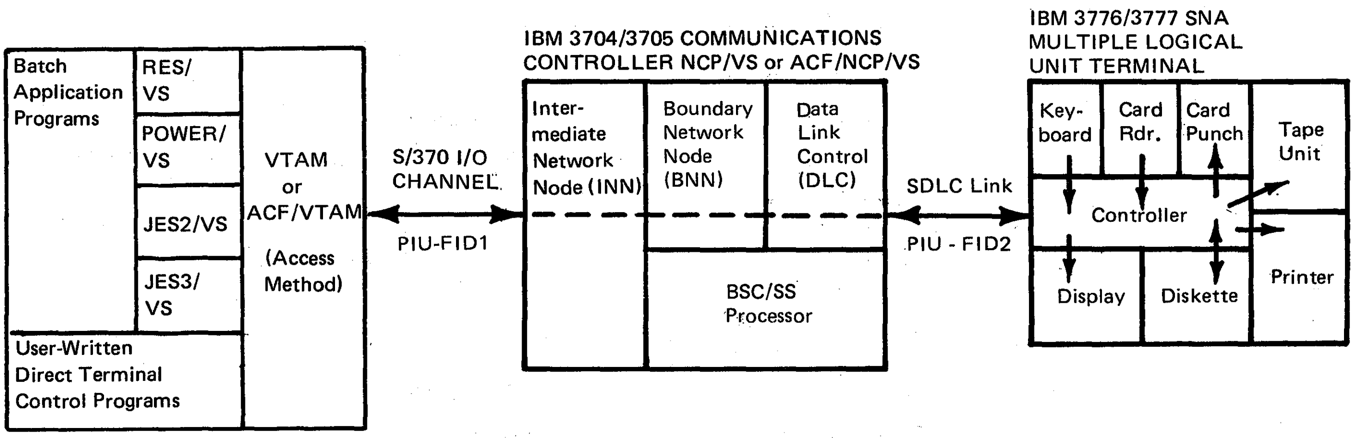


Figure 8-1. IBM 3776/3777 MLU Terminal in an SNA Network

Related Publications

When installing a 3776/3777 MLU terminal on an SNA network, refer to "Related Publications" in Chapter 7. Other manuals of a more general nature are listed at the front of this manual.

NCP Generation Macro Instructions

The NCP macro instructions are used in two ways. First, they are used to generate the NCP load modules. Then, they are used by VTAM or ACF/VTAM to obtain information about the network.

Most of the parameters specified in the NCP or ACF/NCP/VS generation macro instructions are used only for generating the network control program. However, some parameters are used both in generating the NCP or ACF/NCP/VS and again in defining the NCP or ACF/NCP/VS network to VTAM or ACF/VTAM.

The *NCP Generation and Utilities* manual lists the VTAM-only macros and operands, and indicates where they must appear in the NCP source deck used for VTAM initialization. The *VTAM System Programmer's Guide* explains how to use the VTAM-only NCP macros and operands.

NCP System and Configuration Definition Macro Instructions

PCCU Macro (VTAM only)
BUILD Macro
SYSCNTRL Macro
HOST Macro
CSB Macro
LUPOOL (for switched lines only)

The list of NCP macro instructions to be written should be taken from the *System* and *Configuration Definition* lists in the *NCP Generation Macro Instructions* section of the *NCP Generation and Utilities* manual.

NCP Line and Terminal Definition Macro Instructions

The person who writes the NCP macro instructions should know the choices to make to code the following parameters for the system being installed.

GROUP Macro Instruction

Parameter	**NCP Operand**
Type of line	DIAL = YES or NO
Type of line control	LNCTL = SDLC
Type of pacing	VPACING = y,1

LINE Macro Instruction

Parameter	**NCP Operand**
Line speed	SPEED = 2400, 4800, 7200, 9600, or 19200
Type of station	PUTYPE = 2
Half-duplex or duplex facility	DUPLEX = FULL or HALF
3705 line address	ADDRESS = xxx or (xxx,yyy)

PU Macro Instruction

Parameter	**NCP Operand**
Type of station	PUTYPE = 2
Segment size	MAXDATA = 265 for 256-byte buffer 521 for 512-byte buffer
Number of PIUs outstanding	MAXOUT = 7
Service order table limit	PASSLIM = 3

LU Macro Instruction (for switched lines the LU is defined in VTAM)

Parameter	**NCP Operand**
Pacing the logical unit	PACING = x,1 x = maximum of 8 for 256 byte RU x = maximum of 4 for 512 RU

NCP VPACING and PACING Parameters

VPACING controls the rate of data transfer from the CPU to the 3705 communications controller for a specific session. PACING controls the rate of data transfer from the 3705 to the terminal. By keeping VPACING larger than PACING, NCP will usually have an RU to send whenever a pacing request is received from the terminal. For example, a session with a PACING value of 2,1 could have a VPACING value of 4,1.

In NCP 5, the pacing value specified in the BIND command cannot override the value specified in the NCP generation and therefore the BIND value should match the NCP value.

In ACF/NCP, the BIND value can override the NCP definition. Therefore, the value chosen for VPACING should be greater than the value used in the BIND command.

Inbound pacing is supported only in ACF/VTAM and is specified in the BIND command.

If using NCP 5, inbound pacing must not be specified (BIND RU byte 8 must be X'00'). The user can, via a TIP specification, limit the number of RUs the 3776/3777 sends before requesting a definite response. This may be used to control the amount of data flowing in each direction. For example, assuming data is available at both the terminal and the host, specifying a higher **outbound** pacing value than inbound for the respective sessions assures that more outbound than inbound data flows on the communication line.

DUPLEX Parameter

The line macro parameter DUPLEX=FULL or HALF refers only to the communication facility and the modem interface to that facility. When more than one terminal is connected to the same line, it is possible for NCP to send to one terminal at the same time it is receiving from the other terminal. This requires the DUPLEX=FULL communication facility and two address ports on the 3705. Both addresses are specified in the ADDRESS parameter.

MAXDATA Parameter

MAXDATA=521 specifies the maximum size PIU that can be sent to the terminal. The RU size actually used is controlled by the size specified in the BIND command for each session (plus header data).

MAXOUT Parameter

MAXOUT is an indication of terminal buffer space and is used to reduce the number of line turnarounds during transmission. MAXOUT must be equal or greater than any PACING value if that pacing is to be effective.

OS/VS1 RES Generation with the 3776/3777 MLU

The following operands must be coded for the 3770 MLU operation with OS/VS1 RES (Remote Entry Services). These and other operands that are necessary or optional to the proper generation and operation are described in *OS/VS1 RES System Programmer's Guide*, GC28-6878.

RTAM Generation

The following RTAM (remote terminal access method) generation macro instructions must be coded. Following the macros is a discussion of some of the parameter choices.

TERMINAL Macro	
TDESCR=(w,t,d,f)	
w=3	For 132-character printer width
t=8	For SNA Workstation
d=5	SNA character string
f=3	Console support and transparency
RDRS=rd	
RDRS=n	Maximum is 9 (Inbound Card Medium) (1 is the default value)
PTRS=pr	
PTRS=n	Maximum is 9 (Outbound Print Medium) (1 is the default value)
PCHS=pu	
PCHS=n	Maximum is 1 (Outbound Card Medium) (1 is the default value)
VBUF=	Number of buffers minus 2; controls output chain size. •
BUFXSIZ=512	Permits 512 byte RU and allows Bind command to specify 256
NODE=	List of LU names that can be logged on as this workstation
SESSLIM=6	Can be larger for device pooling operating mode
RTAM Macro	
PORTS=x	Number of SNA workstations
SNACOMP=YES	SNA Compression support
CPACT=YES	SNA Compaction support
CPACTDF=	Default Compaction table
APPLID=RTAM	Application name

Programming Considerations for VS1 RES/RTAM

The first session logged on is always used for console traffic although input on any session is accepted. The medium bits in the bind, (print outbound, card outbound and card input) do not have to be the same across all logged on sessions. This allows a dedicated print session with a higher pacing value, such as 2,1 or 3,1.

RU size is controlled by three parameters. By defining MAXDATA=521 (512-byte RU+header data) and BUFXSIZ=512, the RU size actually used can be controlled by the BIND command. RES uses the smaller value of the BUFSIZ parameter and RU size in the BIND command.

Chain size is controlled by use of the VBUF parameter. A small chain size can adversely affect performance. VBUF specifies the number of buffers reserved for each session and saves two of those for input buffers. An example VBUF=8 means outbound chains will have 6 RUs per chain. The amount of data per chain depends on compression, compaction, and RU size. Because only 2 buffers are reserved for input from the terminal, VTAM may have to use its pageable buffers to hold data while RES is emptying its own buffers. If VTAM runs out of buffers, the session is aborted with a CLEAR command. Look at BUFFACT= on the VTAM APPL macro and BUFLIM= on the NCP LU macro if problems occur. Inbound pacing is a feature of ACF/VTAM only.

The MODIFY command allows dynamic control over the use of transparency, compression, and compaction. Console and transparency will normally be supported in the RTAM generation TERMINAL macro with compression and compaction supported in the BIND command.

Concatenation Restriction

The user should consult the current level of RES documentation for continue destination selection (CDS) FM Header support.

DOS/VS POWER/VS Generation with the 3776/3777 MLU

The following parameters must be coded to generate POWER support for the 3776/3777 MLU terminal. These and other parameters that are necessary or optional to the proper generation and operation are described in *DOS/VS POWER/VS Installation Guide and Reference*, GC33-6048 for Release 34.

Generating POWER/VS

The following POWER parameters must be coded for 3776/3777 MLU support.

POWER Macro	
SNA=(X,,POWER)	X=number of concurrent LUs POWER is default applied
PRMT Macro	
REMOTE=XXX	XXX is remote=ID
TYPE=LUT1	SNA terminal support
CONSOLE=YES	
SESSLIM=6	
COMPACT=	Default compaction table name

Programming Considerations for DOS/VS POWER/VS

POWER/VS allows the user control over which media are supported on which sessions and thus control over pacing values. A printer-only session with a pacing value higher than other sessions for other media should help performance. POWER supports 256 byte RUs only, and compression/compaction is supported only for an outbound print medium.

Concatenation Restriction

The 3776/3777 MLU terminals have the capability to concatenate input data from several sources. If the data set record lengths are not the same from the several input sources, the 3776/3777 MLU can send a "Continue Destination Selection" (CDS) FM header between the data sets with unequal record lengths. *However, for POWER/VS, concatenation of input data sets of unequal record length is invalid.*

Card Medium Restriction

For inbound card medium data sets, with a record length of ≤ 80 bytes the 3776/3777 MLU sends a default record length value of X'00' in byte 5 of the FM header. *For POWER/VS, an inbound card medium record length greater than 80 is invalid.*

Exchange Medium

Beginning with DOS/VS Release 35, POWER/VS will support exchange medium on the inbound flow only. Record length is restricted to 1-128 bytes.

OS/VS2 JES2 Generation with the 3776/3777 MLU

The following parameters must be coded to generate 3776/3777 MLU support for operation with OS/VS2 JES2 or the Network Job Entry Facility for JES2 Program Product. These and other parameters that are necessary or optional to the proper generation and operation are described in *OS/VS2 MVS System Programming Library: JES2*, GC23-0002 with Supplement GC23-0053, for Release 4.1 of JES2. If you have installed the Network Job Entry Facility for JES2, Program Product 5740-XR8, the information is contained in System Program Library: Network Job Entry Facility for JES2 SC23-0003. Support of the MLU function starts with the Release 2 level of this Program Product. Both JES2 and Network Job Entry Facility for JES2 run with OS/VS2 MVS Release 3.7.

JES2 Initialization

The following JES2 initialization parameters must be coded.

RMTnnn (Remote Terminal)	
terminal type=LUTYPE1	Specifies an SNA terminal.
CONSOLE	Specifies the presence of the Console Display
BUFSIZE=nnn	256 or 512
SETUPHDR/SETUPMSG	SETUPMSG means a console message is sent to the operator requesting set up. (SETUPHDR is not supported by 3770 MLU)
COMP/NOCOMP	Compression/No Compression
CMPCT/NOCMPCT	Compaction/No Compaction
NUMPR=n	Outbound print medium, 1-6, default=1
NUMPU=n	Outbound card medium, 0-7, default=0
NUMRD=n	Inbound card medium, 0-7, default=1
WAITIME=1	Minimum wait, 1-30 seconds, default=1
Rn.PR1 (Remote printer)	n=1-255
FCBLOAD	FCB (forms control buffer) support is provided
COMPACT=	Default compaction table name
CLASS=	Output class(es)
PRWIDTH=132	For 132 character printer
FORMS=cccc	This should match the default value in the Terminal Initialization Procedure
UCS=cccc	This should match the default value in the Terminal Initialization Procedure
CKPTLNS=nnnnn	Specifies the number of lines (1-32767) printed per logical page. Default: 100
CKPTPGS=nnnnn	Specifies the number of logical pages (1-32767) printed before a checkpoint. Default: 1
Rn.RD (Remote reader)	n=1-255
Rn.PU (Remote punch)	n=1-255
CKPTLNS=nnnnn	Specifies the number of cards (1-32767) punched per logical page. Default: 100
CKPTPGS=nnnnn	Specifies the number of logical pages (1-32767) punched before a checkpoint. Default: 1
COMPACT=	Default compaction table name.

Programming Considerations for OS/VS2 JES2

JES2 has chain size parameters (CHAINSIZ= on the Rnnn.PRm and Rnnn.PUm initialization parameters) that allow complete data sets to be sent as a single chain. This function improves performance.

JES2 ignores most of the BIND parameters that are specified in the mode table and builds its own BIND command based on the JES2 initialization parameters. About the only bit for the user to define in the logmode table is the alternate code option. The same BIND command parameters are then enforced on all sessions of a workstation because there is no way to control which session is used for a given medium. That is, BUFSIZE= determines if all sessions are to operate in 256- or 512-byte mode, and whether compression/compaction is used.

RU size is determined by BUFSIZE= on the RMT nnn initialization parameter. The default for MAXSESS is the number of lines. This value needs to be the sum of all logical units on all terminal definitions.

With a dedicated console on the MLU 3770 terminal, the CONSOLE parameter should be specified on the RMT nnn initialization parameter so messages are not held until JES2 writers are idle.

OS/VS2 JES3 Generation with 3776/3777/MLU

The following parameters must be coded as shown to generate 3776/3777 /MLU support for operation with OS/VS2 JES3.

These and other parameters that are necessary or optional to the proper generation and operation are described in *OS/VS2 MVS System Programming Library: JES3.*

JES3 Initialization

The following JES3 initialization parameters must be coded:

RJPWS	
N=terminal name	Must be 5 characters
CONSOLE	
JNAME=consname	Consists of terminal name of RJPWS statement
TYPE =RJP	Indicates RJP console name
DEST =NONE	Indicates destination code not correlated to any message class

The following JES3 initialization parameters may be coded.

RJPWS	
RD=n/1	Number of inbound card devices
PR=n/1	Number of outbound print devices
PU=n/0	Number of outbound card devices
C=*R*/S	R=console not equal print S=console equal print
COMPACT=	Default compaction table
AUTO=	(Y, luname, modetabentry) Specifies luname, and mode table entry to be used if simulated logon is used
LU=	Specifies valid LUs permitted to logon at this workstation

Logon to JES3

To logon to JES3 SNA RJP, the following command must be used: LOGON APPLID (applicationname) MODE (modetabentry) DATA (wsname,password)

application name - as defined to VTAM on APPL statement and JES3 on COMMDEFN statement
modetabentry - one that has been defined to VTAM
wsname, password - as defined for this work station to JES3

Programming Considerations for OS/VS2 JES3

Specifying chain size on a data set basis can improve performance and checkpointing on data outbound to the 3770. The default is a data set that will be sent as a chain (best performance) with checkpointing defaulting to the definition on the DEVICE statement. The data set can be sent as multiple chains with checkpointing occurring at end of chain. There the chain size as specified for the data set will be the number of logical records or the number of pages (skip to channel one). The specification of the CHNSZ parameters can be for a SYSOUT class (on SYSOUT initialization statement) or for a particular data set of a job (on //*FORMAT job statement).

JES3 ignores all bind parameters except as follows:

FM profile, TS profile; compression, compaction, alternate code indicator, PDIR, span cards, LU profile card media supported, and RU size.

Programming Considerations for RJE Throughput

If the terminal printer has priority, then the session used by the printer should have a relatively-higher pacing value. VS1 RES and DOS/VS POWER can control the medium by session.

The MLU terminal has a fixed number of receive buffers and therefore the pacing values, RU sizes, and number of active sessions are important. Use only the number of sessions needed. Most users will have 3 or 4 sessions consisting of console, input, and one or two output sessions. Each receive buffer holds a 256-byte RU with two buffers internally linked together for sessions with 512-byte RUs.

When a session is running by itself, and turnaround delay is small, about the same throughput is achieved for a 512-byte RU size with PACING=(1,1)* as for a 256-byte RU size with PACING=(2,1)*.

In general, when the media can be controlled on a session basis (DOS and VS1) and output is favored, the medium associated locally with a high speed output device i.e. 3262, 3203, or 3411 should have the largest RU size and pacing value. The session(s) using the card medium normally associated locally with low speed output, i.e. 3521 card punch, should be restricted to 256 byte RUs and PACING=(1,1)*. Start with midrange pacing values and modify as needed. For JES2 and JES3, pacing and RU size parameters will not vary greatly between sessions. For example, if an output job to be punched has a pacing value that is too high, internal resources of the terminal could be tied up while waiting for many RUs to be punched before the buffers containing the RU data are returned to the receive buffer pool in the 3770 MLU.

High pacing rates and high spool use in VTAM (VTAM buffer size definitions) can slow down the RFE component.

*PACING (n,m) refers to a group of "n" RUs where the pacing bit in RH1 is set on the "mth" RU of the set. For inbound pacing, the 3770 MLU assumes m=1; n=byte 8 of the session BIND. For outbound pacing, "m" is an NCP generation parameter and should be set to "1" for 3770 MLU; n=byte 9 of the session BIND.

Pacing and Line Buffering

The following information for the 3776/3777 MLU terminals complements the previous pacing and buffering information in this chapter for the host system control programs and for RJE subsystems described earlier.

Link Level Pacing - Modulus 8

The 3776/3777 MLU when responding to poll with "Receive Ready", is capable of receiving up to seven 512-byte buffers with associated TH/RH fields. These information frames (I-frames) may be destined for any of the established sessions. Once data has been received, the terminal will respond with "Receive Not Ready" until it again has at least two 272-byte buffers available to receive more data. In general, enough buffers should be available to handle the outstanding session pacing values at any given time.

Session Pacing

The 3776/3777 MLU uses both inbound and outbound pacing as defined in the pacing bytes RU-8 and RU-9 respectively of the BIND command.

Inbound Pacing: The 3776/3777 MLU sets the pacing bit in RH-1 on the first of N inbound requests on the normal flow of each LU-LU session (e.g. M = 1). If after sending N requests, a pacing response has not been received, that session ceases transmission until pacing is received. If byte RU-8 of the BIND is '00', the pacing bit in RH-1 is never set and the 3776/3777 MLU never delays inbound requests to await pacing. (Inbound pacing is possible only with ACF/NCP.)

When inbound pacing is not supported, the number of RUs per chain can be controlled through the TIP definition. This can prevent overruns in the host. Control of the number of RUs per chain, or inbound pacing along with outbound pacing, can be used to control the percentage of inbound data relative to outbound data.

Outbound Pacing: The 3776/3777 MLU allows the outbound pacing field, BIND byte RU-9 bits 2-7, to be set with a value from X'01' to X'07' (X'03' if 512-byte outbound RUs, i.e. RU11 = X'86'). This is based upon the link capability to handle up to seven I-frames. Using the outbound pacing field in the BIND command, the application program in the host apportions its outbound traffic so as to not "tie-up" a high speed output device such as the printer, by having too may buffers allocated to a session carrying data to a slow device, such as the card punch. It is then, up to the user to optimize the outbound pacing value for each session. See "Line Buffering" below for guidelines.

Line Buffering

The 3776/3777 MLU has seventeen 272-byte line receive buffers. One buffer is reserved for expedited flow messages, leaving 16 for normal flow. Expedited flow messages are processed immediately and their buffer is returned to the pool.

The number (N) of buffers used for a session is defined by the pacing value in the session bind (BIND RU byte 9). When a session using 256-byte RUs is bound, 2N-1 buffers are allocated to the session. For 512-byte RUs, 2 (2N-1) buffers are allocated. Thus, the value of N along with the RU size determine the number of sessions that can be active at one time. The following tables illustrate this relationship:

256-Byte RUs - All Sessions With Same Pacing Value

Pacing Value (N)	Number of Active Sessions Allowed	Buffers Allocated per Session	Total Buffers Allocated
1	6	1	6
2	5	3	15
3	3	5	15
4	2	7	14
5	1	9	9
6	1	11	11
7	1	13	13
512-Byte RUs - All Sessions With Same Pacing Value			
1	6	2	12
2	2	6	12
3	1	10	10

The following examples show how varying the pacing value between sessions affects buffer allocation:

1. 4 sessions (256) with pacing (2,1) = 12 buffers allocated
   1 session (256) with pacing (1,1) = 1 buffer allocated
   Total 13 buffers allocated
2. 3 sessions (512) with pacing (1,1) = 6 buffers allocated
   1 session (512) with pacing (2,1) = 6 buffers allocated
   Total 12 buffers allocated
3. 1 session (512) with pacing (2,1) = 6 buffers allocated
   1 session (256) with pacing (3,1) = 5 buffers allocated
   4 sessions (256) with pacing (1,1) = 4 buffers allocated
   Total 15 buffers allocated
4. 4 sessions (256) with pacing (1,1) = 4 buffers allocated
   1 session (256) with pacing (3,1) = 5 buffers allocated
   1 session (256) with pacing (4,1) = 7 buffers allocated
   Total 16 buffers allocated

The paragraphs below describe in detail how buffer allocation is controlled.

The terminal controls the number of sessions that can be bound at any one time by maintaining a summary counter of the number of buffers specified in the session BINDs accepted. BIND RU byte 9 is the value (N) that specifies the number of data buffers the host may send on the session before waiting for a pacing response from that session. To prevent a session from being locked out by any other session, 2N-1 buffers must be allocated to the session. For sessions specifying 512-byte RUs (BIND RU byte 11 = X'86'), the quantity 2N-1 is doubled. The sum of these quantities is not allowed to exceed 16. Any BIND that would cause this sum to be exceeded is rejected with a sense code of '08120000' (indicating a lack of 3770 MLU resources).

The summary counter is incremented and decremented only when sessions are bound and unbound respectively.

Once a session is bound, the terminal allocated xN buffers to the session count (C_s): where x = 1 if in 256-byte RU mode or = 2 if in 512-byte RU mode.

Concurrently, the terminal decrements a "currently available" count. The currently available count varies as buffers are processed on all sessions and when an isolated pacing response (IPR) is sent on any session.

The currently available count (A) is set initially at 16. When a session is bound, the count is decremented by xN. The count is incremented by x for each RU processed; C_s is decremented by x for each RU processed. When processing of a buffer begins, the pacing bit is checked. If set, the value of xN is compared to the current value of A. If xN is $\leq$ A, then an IPR is sent for that session; C_s is incremented by xN and A is decremented by xN.

If xN > A, the session is placed on the pacing queue; each time A is incremented, the queue is checked. When A is $\geq$ xN for the top session on the queue, an IPR is sent and the values C_s and A are adjusted as described above.

If the pacing indicator is detected and C_s is currently greater than xN for that session, then C_s is reset to xN and A is incremented by the difference. This situation can occur when operating with NCP 5. This built-in correction algorithm guarantees that C_s never exceeds 2xN.

Medium/Subaddress Considerations

The host RJE subsystem generates a medium/subaddress for outbound data to be sent to the 3776/3777 MLU terminals. A particular medium/subaddress value is specified for each output task and sent to the terminal in the Medium byte (2) of the Type 1 FM header. At the terminal, the operator uses the OUTPUT or HOSTOUT command to assign a specific output device to the medium/subaddress. The assigned device receives the data accompanying the FM header. The following table shows some examples of medium/subaddress assignments at the host and at the terminal.

RJE Task				*Subaddress*	*Terminal Device*
POWER	*RES*	*JES2*	*JES3*		
LST1	PR1	RnPR1	JNAMEPR1	0	Line Printer
LST2	PR2	RnPR2	JNAMEPR2	1	Diskette 1 ("spool" print data)
PUN1	PU1	RnPU1	JNAMEPU1	0	Card Punch
PUN2	PU2	RnPU2	JNAMEPU2	1	Diskette 2 ("spool" punch data)

JNAME=5 character JES3 workstation name

System Generation Consideration for Terminal Initialization

The Terminal Initialization Procedure command (TIP) allows specification of defaults to take effect at power on. The TIP definition can specify:

- Initialization data for the communication adapter (these values must match the values in the NCP generation for the terminal). See Chapter 4.
- Predefined procedures to be executed.
- The response timeout interval (1-99 minutes) for intervention required situations.
- The maximum number of RUs per chain (useful to prevent overrunning the NCP when inbound pacing is not supported and to control the percentage of inbound data relative to outbound data on the communication line).
- Whether or not the 2502 is a "Hot" reader.
- Whether or not multiple SIGNAL interrupt is desired.
- Whether or not full SNA spool monitoring is desired (if selected, spool monitoring causes a spool message to display when an input or output job begins and ends).

3770 SNA Characteristics

Before the access method can communicate with a terminal, it must know the terminal's SNA characteristics. The SNA characteristics of the 3770 are:

- Physical Unit Type 2
- Logical Unit Type 1
- Function Management Profile 3
- Transmission Services Profile 3
- FM Header Subset

Subset Type:	*Used By:*	*With FM Header Type:*
1	All 3770	1
1	3776-3/3776-4/3777-1/3777-3/3777-4	1 and 3
2	All 3770	1

From these characteristics (specified at the access method generation), the access method determines the format of the transmission record and the type of control information required by the terminal.

3770 SNA Communications

Before the 3770 and the host application program can begin communications, certain protocol requirements must be met:

1. An SSCP-PU session must be established between the access method and NCP physical services. The access method does this by issuing an Activate Physical network command to the NCP.
2. Data flow must be enabled between the access method and the NCP. The access method does this with the Start Data Traffic network command.
3. The modem for the SDLC link between the communications controller and the 3770 must be activated. The access method does this by issuing an Activate Link command to the NCP.
4. A physical connection must be made between the communications controller and the 3770. The access method does this by issuing a Contact command to the NCP which then polls the 3770. After a connection is made, the NCP sends a Contacted command to the access method.
5. An SSCP-PU session must be established between the access method and the 3770 physical unit. The access method does this with the Activate Physical network command.
6. An SSCP-LU session must be established between the access method and the 3770 logical unit(s). The access method does this by issuing an Activate Logical network command.
7. An APPL-LU session(s) must be established between the host application program and the 3770 logical unit(s). After the 3770 is put into communicate mode, this can be initiated two ways:
   - An active application program can issue an OPNDST macro to the access method. This causes the access method to issue a Bind command to the 3770 establishing the APPL-LU session.
   - The 3770 terminal operator can send a LOGON request to the access method requesting a session with a particular application program. The access method then activates the requested application program which initiates the APPL-LU session as described above.
8. Data flow must be enabled between the host application and the 3770. The access method does this with the Start Data Traffic network command. Once data flow is enabled, data request units can flow between the application program and the 3770.

SNA communications can be terminated in the following manner:

1. The APPL-LU session(s) must be terminated. This can be done four ways:
   - The application program can issue a CLSDST macro to the access method. This causes the access method to issue a Clear network command to the 3770 to purge any outstanding requests or responses. The access method then issues the Unbind command to terminate the session.
   - The 3770 terminal operator can request that the session be terminated by sending a LOGOFF request unit to the access method. The access method then notifies the application program which initiates the session termination as described above.
   - If the operator enters an ENABLE command while communications on any session are active, the communications adapter is reset, NCP is notified, and all sessions go inactive.
   - The terminal operator may request session shutdown by entering the RSHUTD command.
2. The access method terminates the SSCP-LU session by issuing a Deactivate Logical command to the 3770.
3. The access method terminates the SSCP-PU session with the 3770 by issuing the Deactivate Physical command to the 3770.
4. The access method deactivates the modem from the link by issuing a Deactivate Link network command.
5. The access method terminates the SSCP-PU session with the NCP by issuing Deactivate Physical network command to the NCP.

Figures 8-2 and 8-3 are examples of establishing and terminating SNA communications with the 3770.

SNA commands that apply are described later in this chapter.

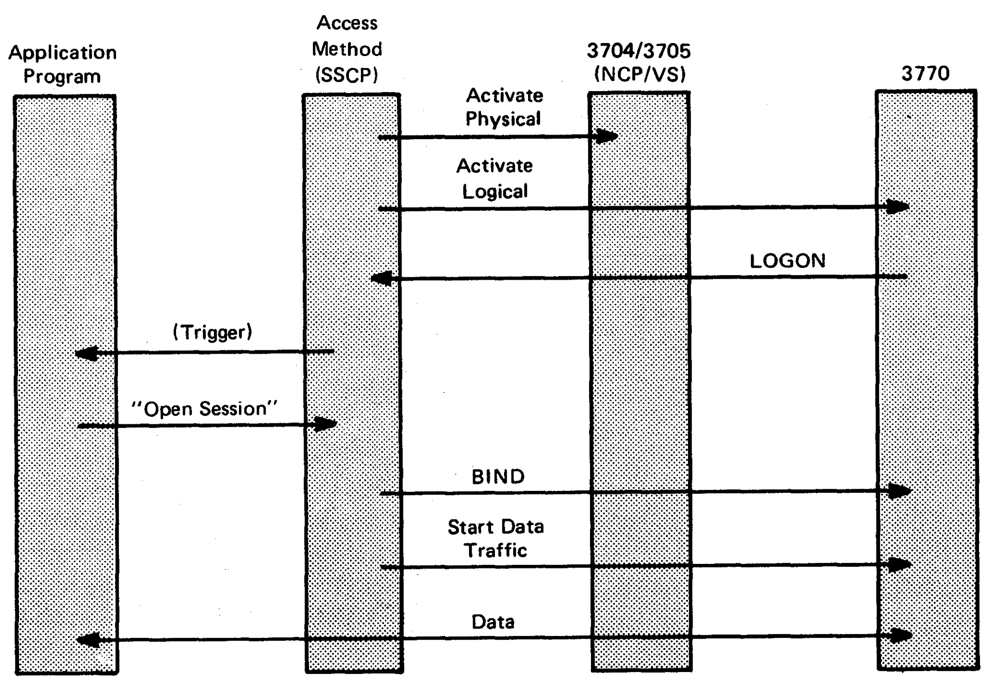


Figure 8-2. Example of Establishing SNA Communications

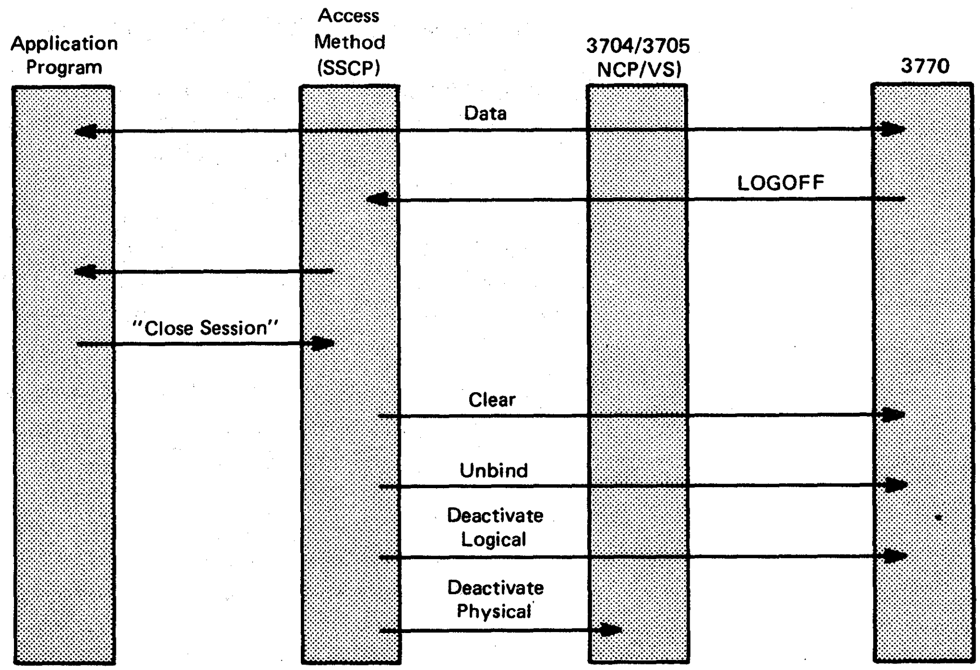
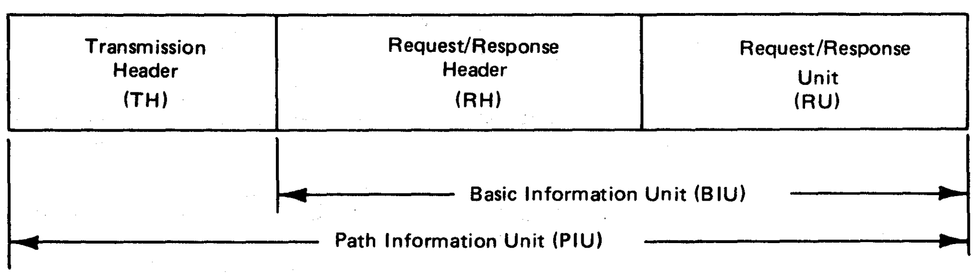


Figure 8-3. Example of Terminating SNA Communications

SNA Transmission Blocks

The basic unit of information in the SNA network is the Path Information Unit (PIU). A PIU may request a data communication operation, transfer data, or indicate the result of a data communication operation. The general format of the PIU is shown below.



Request/Response Unit (RU): The basic unit of information in the data communication network. It may contain commands that control the flow of data through the network, responses to commands, acknowledgement of data, and optional data.

Request/Response Header (RH): Contains fields that identify the RU and control the flow of data through the network.

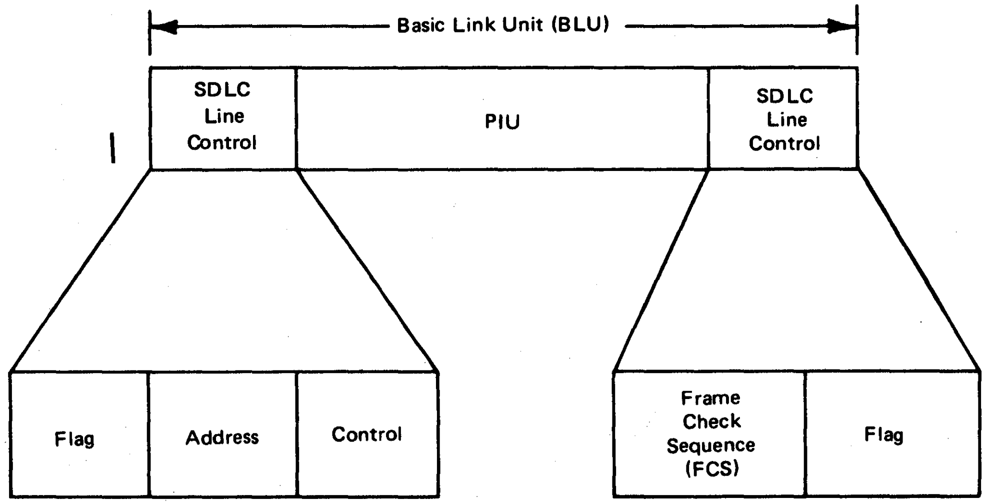
Basic Information Unit (BIU): An RU with its associated RH.

Transmission Header (TH): Used to route the PIU through the network to its destination.

Path Information Unit (PIU): A BIU with its associated TH.

In some SNA networks, multiple PIUs may be transmitted over an SDLC link in a single transmission block. These multiple PIUs are referred to as a Basic Transmission Unit (BTU). Since the 3770 allows only one PIU per transmission, the PIU and BTU are the same.

When the PIU is transmitted over an SDLC link, it must have SDLC link control information appended to it. The PIU with the SDLC line control information is called a Basic Link Unit (BLU).



Flag: 8-bit sequence (01111110) at the beginning and end of the BLU that serves as a delimiter. For contiguous BLUs, the ending flag of one BLU may be the beginning flag on the next.

Address: A one-byte station address. An address of all zeros is a null address that is used for testing.

Control: A one-byte field that controls and identifies the BLU.

Frame Check Sequence (FCS): A two-byte check character that is derived by the accumulation of all of the bits between the starting and ending flags.

For more information about SDLC line control, refer to the *IBM SDLC General Information* manual.

PIU Formats

The PIU in the 3770 SNA network can be in one of two formats depending on its origination and destination:

Format Identification One (FID1): Used for transmission between the host and the communications controller; also used for transmission between the local communications controller and a remote communications controller.

Format Identification Two (FID2): Used for transmission between the communications controller and the 3770.

The NCP converts the FID1 PIU to a FID2 PIU on requests that are directed to the 3770, and converts the FID2 PIU to a FID1 PIU on requests that are directed to the host.

Figure 8-4 shows the FID1 and FID2 PIU formats.

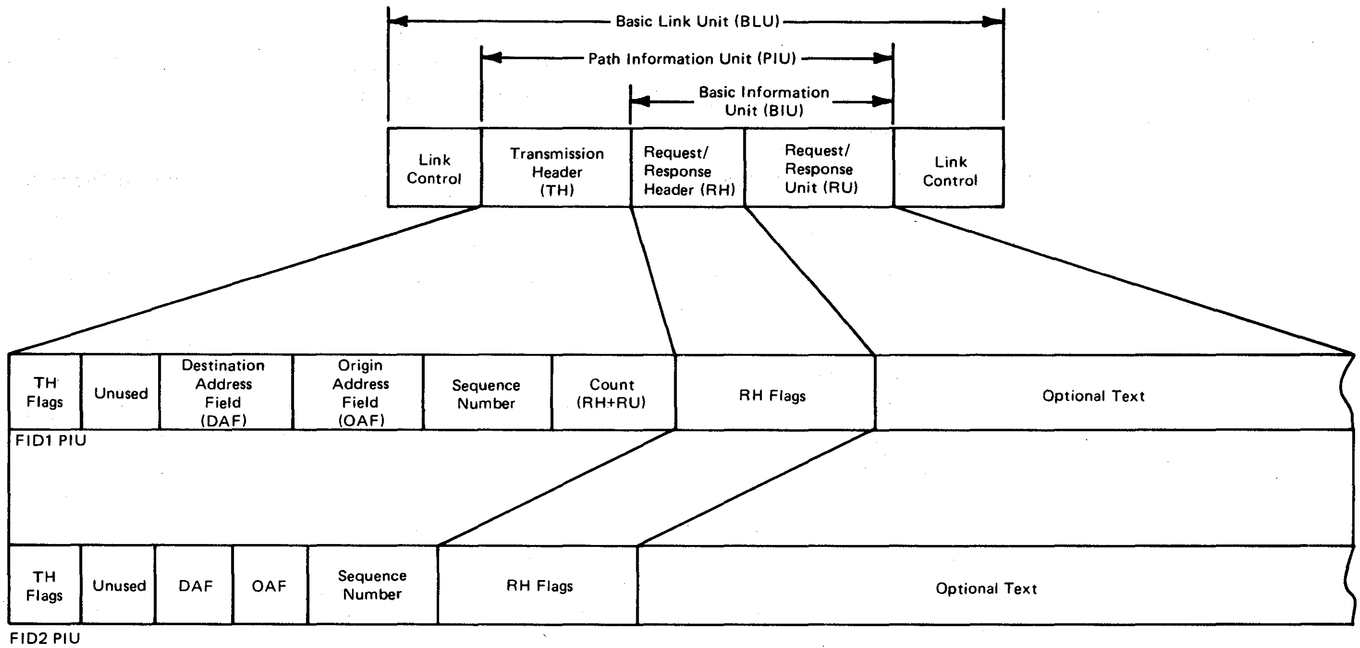


Figure 8-4. PIU Formats in the 3770 SNA Network

Data Chaining

In some cases it is desirable to send or receive a group of related requests through the network as a single entity. In an SNA network, this is done by 'data chaining'. A data chain begins with a request that is identified as *beginning-of-chain.* This first request unit of the chain may be followed by one or more *middle-of-chain* requests and the chain ends with an *end-of-chain* request. A chain can consist of only one request unit. In this case the request is called an *only-one (RU)-in-chain* request. The different request units of the chain are identified by flags in the request header (RH):

RH Byte 0, Bits 6 and 7

B'10' - Beginning-of-Chain (BOC)
B'01' - End-of-Chain (EOC)
B'00' - Middle-of-Chain (MOC)
B'11' - Only-one-in-Chain (OC)

The following rules apply to 3770 data chaining:

- If the 3770 receives a Cancel while receiving a chain of requests, it discards all previously received requests of the chain.
- If the 3770 sends a negative response to a request in a chain, it purges all further requests until it encounters an end-of-chain request or Cancel.

Inbound chains are limited to the number of RUs specified in the TIP (see Chapter 4). If a maximum is not specified in the TIP, no limit is enforced.

3770 SNA Bracket Protocol

Figure 8-5 shows examples of bracket protocol. SNA bracket protocol is used by the 3770 to resolve contention between the host application program and the 3770. Brackets are used to prevent a series of requests or chains from being interrupted. This series of requests or chains is referred to as a 'conversation'.

A conversation begins and ends with brackets. The brackets are identified by flags in the request header (RH):

RH Byte 2, Bits 0 and 1

B'10' - *Begin Bracket (BB)* - Identifies the first request unit of a conversation.
B'01' - *End Bracket (EB)* - Identifies the last request of a conversation or the first request in the last chain of a conversation.

A request unit may be both a begin bracket and end bracket. This indicates that it is the only request unit or chain in the conversation.

The 3770 manages bracket communications and is always the 'first speaker'. The first speaker either begins a conversation with a begin bracket or gives permission to the application program to begin a bracket. The host application program requests permission to begin a bracket by sending a Bid request to the 3770. The 3770 gives permission to the host application program by returning a positive response to the Bid. The application program then begins the conversation with a begin bracket request.

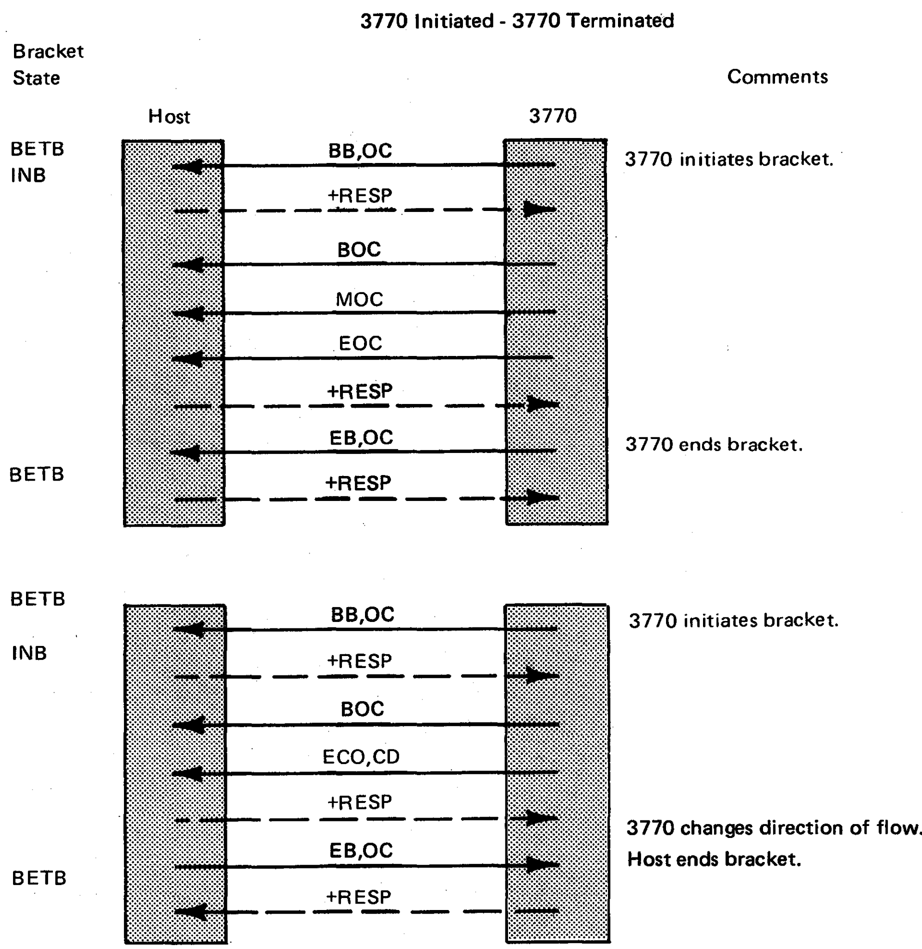
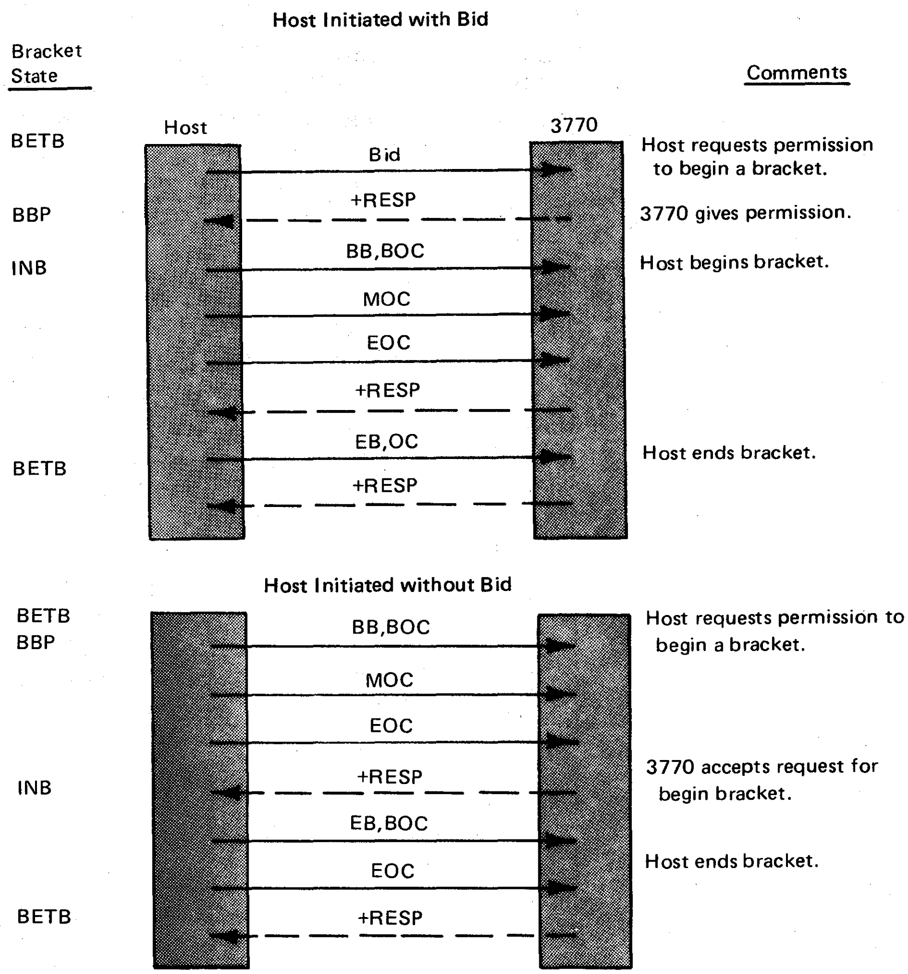


Figure 8-5. Examples of Bracket Protocol (1 of 2)



BB	–	Begin bracket
EB	–	End bracket
BOC	–	Beginning of chain
MOC	–	Middle of chain
EOC	–	End of chain
OC	–	Only of chain.
BETB	–	Between brackets
INB	–	In brackets
BBP	–	Begin bracket pending
RESP	–	Response

Figure 8-5. Examples of Bracket Protocol (2 of 2)

The host application program can also request permission to begin a bracket by sending a begin bracket request to the 3770. If the 3770 accepts the begin bracket, it returns a positive response. Otherwise, it returns a negative response to the host application program and the begin bracket request is discarded.

In order to manage bracket protocol, the 3770 maintains three bracket states:

- *Between Brackets (BETB)* - No conversation is taking place. A begin bracket request or Bid may be accepted.
- *Begin Bracket Pending (BBP)* - The 3770 has given permission to the application program to begin a bracket. The BBP state is entered from the BETB state when the 3770 sends a positive response to a Bid. The BBP state exits to the INB state when the begin bracket request is received.

- *In Brackets (INB)* - A conversation is taking place. The INB state is entered from the BETB state when a begin bracket request is initiated by the 3770 or accepted by the 3770. The INB state exits to the BETB state when the 3770 sends an end bracket request or receives an end bracket request and end of chain.

Figure 8-6 shows 3770 bracket management decisions on accepting or rejecting bracket requests.

		Bracket State		
		BETB	INB	BBP
REQUEST UNIT	Not Begin Bracket Not End Bracket	Reject	Accept	Reject
	Begin Bracket Not End Bracket	Accept	Reject	Accept
	Not Begin Bracket End Bracket	Reject	Accept	Reject
	Begin Bracket End bracket	Accept	Reject	Accept
	Bid	Accept	Reject	Reject

Figure 8-6. Bracket Request Accept/Reject Table

SNA Transaction Modes

The 3770 RJE terminals operate only in half duplex flip-flop mode.

The 3770 and host go into contention only between brackets. Flow within the brackets can change direction (flip-flop) at the end of any chain by setting the change direction indicator in the RH (RH byte 2, bit 2).

Transmission Headers

All 3770 terminals support "FID2" transmission and request/response headers (TH and RH). The headers consist of the nine bytes as shown in the Data Area Layouts section of the *IBM 3704 and 3705 Program Reference Handbook*, GY30-3012.

3770 Considerations for the Bind Command

The Bind command parameters described later in this chapter must be specified when the host issues a Bind command to a 3770 terminal.

Function Management (FM) Profile

The function management profile for the 3770 must be defined as FM Profile 3 or the 3770 rejects the Bind command.

Transmission Services (TS) Profile

The transmission services profile for the 3770 must be defined as TS Profile 3 or the 3770 rejects the Bind command.

Primary (Host) Protocol

The primary (host) request mode selection must specify immediate request mode. The primary (host) chain response protocol must not specify "no response" or the 3770 rejects the Bind command.

Secondary (3770) Protocols

The following protocols on chains and brackets must be specified when the host issues a Bind command.

Chaining: The secondary (3770) chaining selection must specify that multiple request unit chains may be used.

Request Mode: The secondary (3770) request mode selection must specify immediate request mode.

Chaining Response: Three types of responses may be selected for chaining in the BIND command:

1. Exception response: If the Bind command to the 3770 specified exception response, the 3770 asks only for exception responses to request units sent to the host.
2. Definite response: If the Bind command to the 3770 specifies definite response, the 3770 requests a definite response only on the end-of-chain (EOC) request unit. For all other request units sent to the host, the 3770 requests only the exception response.
3. Both exception and definite responses: If both responses are specified in the Bind command, the 3770 assumes (defaults to) the definite response protocol.

End Bracket (EB): If the Bind command permits the 3770 to send the end-of-bracket indicator, the 3770 sends EB only if the 3770 initiated the bracket. The 3770 does not terminate a host-initiated bracket.

If the Bind command does not permit the 3770 to send the end-of-bracket indicator, the 3770 does not terminate any brackets regardless of which logical unit (host or 3770) initiated the bracket.

Common Protocols

The following protocols common to both logical units (host and 3770) must be observed when the host issues a Bind command.

Batch or Interactive - FM Header Usage: If FM headers are allowed on request units, the 3770 assumes the batch mode of operation which can include all I/O devices attached.

If the Bind command does not allow FM headers, the 3770 session can include only the keyboard and the console display.

Bracket Protocol: The 3770 logical unit requires that bracket protocol be specified in all Bind commands and that bracket termination rule one (1) be used as follows:

- If a definite response is requested by the sender, the bracket is not terminated until the sender receives a positive response.
- If an exception response is requested, the bracket is terminated unconditionally when the receiver processes the chain with the end-of-bracket (EB) request unit.
- If Begin Bracket (BB) and End Bracket (EB) indicators are both on in the same chain, the bracket is unconditionally terminated regardless of the type of request.

Data Transmission Code: If the alternate code is specified in the Bind command, the 3770 assumes ASCII is used for data transmission.

If the alternate code is not specified, the 3770 assumes EBCDIC is used for data transmission.

Function Management Transaction Mode: If the Bind command permits FM headers to be used (batch session), the 3770 must run in half-duplex, flip-flop mode.

Recovery Responsibility: The 3770 requires the Bind command to specify that the primary logical unit (the host application program) be responsible for error recovery.

First Speaker in Brackets: The 3770 requires that the Bind command specify the secondary logical unit (the 3770) as the first speaker for bracket protocol. To resolve a contention situation when the host and the 3770 simultaneously issue a begin bracket (BB) request unit, the host must accept the 3770 BB request. The 3770 may reject a BB request unit from the host.

Responses

A response convention is used to assure the sender that the request unit was received and is acceptable to the receiver. The two types of convention that the 3770 supports are as follows:

1. Exception or error response. The request unit chain only requires a response if the request is in error or unacceptable.
2. Definite response. The request unit chain requires a response, either positive or negative.

Definite Response (DR 1/2)

This response indicates that a request unit has been received by the user. When sent without an error indicator, DR 1/2 indicates that the request unit was received successfully and acted upon.

Exception Response (EX)

This response is always sent in combination with a DR 1/2 response and indicates that the request unit has not been received successfully or could not be acted upon. A DR 1/2 response will not be sent until the operation being performed (print, punch, etc.) has emptied the buffer. This response is always accompanied by four bytes of sense information. The first two bytes are defined by the network and the last two bytes are set to zeroes by the 3770. All four bytes are supplied by the logical unit when sending an error response.

The access method application program may request that the 3770 send two types of responses for request units received from the access method application program, that is:

Exception response (DR 1/2, EX) only, which is negative only;
Definite response (DR 1/2, NEX), which is positive or negative as appropriate.

Only exception responses are required for the request units in the chain, except for the last request unit. The last request unit in the chain may require a definite response.

Session Control Commands

Session Control (SC) requests are sent from the host to establish and maintain a session with the 3776/3777 MLU. SC commands are identified through the setting of the RH Category bits (RH-0, bits 1 & 2) to B'11'. The individual commands are identified by the first byte of the RU as follows:

Command	*RU-0*	*Support*	*Flow*
Activate Physical	X'11'	Outbound	Expedited
Deactivate Physical	X'12'	Outbound	Expedited
Activate Logical	X'0D'	Outbound	Expedited
Deactivate Logical	X'0E'	Outbound	Expedited
Bind	X'31'	Outbound	Expedited
Unbind	X'32'	Outbound	Expedited
Clear	X'A1'	Outbound	Expedited
Start Data Traffic	X'A0'	Outbound	Expedited
CRYPTO Verification	X'C0'	Outbound	Expedited

If a SC request is received that does not have an RU byte, an "RU Length Error" response will be returned.

ACTPU and DACTPU are the only SC functions that apply to the 3776/3777 MLU physical unit and they must have a Destination Address Field (DAF) equal to X'00'. All other SC functions relate to a specific logical unit and must have the DAF set appropriately, that is: X'01' through X'06'. If a DAF other than X'00' through X'06' is received, an "Unrecognized DAF response is returned." If a DAF is received for a valid inactive session, other than on ACTLU, an "LU Not Active" response is returned.

In the following descriptions it is assumed that the previous checks have been made to identify a valid SC command. The 3776/3777 MLU assumes that all SC requests are sent as defined by architecture and does not check for valid/invalid parameters except as noted on the BIND command. Figure 8-7 summarizes the commands.

Activate Physical Unit (ACTPU)

ACTPU (COLD) is sent by the SSCP to activate the 3776/3777 MLU physical unit. The terminal assumes the ACTPU state, resets all other states, and returns a positive response (COLD). Until physically activated, the 3776/3777 MLU rejects all requests received (8008). If ACTPU (ERP) is received and the PU is already active, a positive response (ERP) is returned; this is transparent to all sessions in the 3776/3777 MLU. If the physical unit is not active, the ACTPU (ERP) has the same effect as an ACTPU (COLD) and a positive response (COLD) is returned.

Deactivate Physical Unit (DACTPU)

DACTPU is sent by the SSCP to the 3776/3777 MLU to deactivate the physical unit. If the physical unit is active, the 3776/3777 MLU returns a positive response.

If "Final Use" is specified (RU byte 1=X'01'), the 3776/3777 MLU will, following receipt of a link level "disconnect" command, post a message "FINAL USE RECEIVED." If in unattended mode, a power off sequence is started that prevents further local operations from being started and after any local jobs complete the MLU will power off. (The 3776 must have the Remote Power Down feature.)

Activate Logical Unit (ACTLU)

ACTLU is sent by the SSCP to activate each 3776/3777 MLU logical unit. The 3776/3777 MLU responds with a definite response (COLD) to each ACTLU if the physical unit has been activated and if the DAF is valid (X'01' to X'06') as defined earlier. If ACTLU (ERP) is received and the LU is already active, a positive response (ERP) is returned; this will be transparent to the current session operation. If the logical unit is not active, the ACTLU (ERP) has the same effect as an ACTLU (COLD) and a positive response (COLD) is returned. All requests and responses to the LU are rejected until the LU has been activated (8009).

Deactivate Logical Unit (DACTLU)

DACTLU is sent by the SSCP to deactivate a specific logical unit. The 3776/3777 MLU responds with a definite response to DACTLU unless the LU or PU had not been activated. In this case the appropriate negative response is returned.

Bind Session (BIND)

BIND is sent by the primary LU (in the host processor) to the 3776/3777 MLU to establish a session between it and one of the LUs within the 3776/3777 MLU. It is sent as a result of the host-initiated logon request or as an unsolicited (remote logon) request to start a session.

The 3776/3777 MLU will accept up to six BIND commands so long as each is directed to a specific DAF, X'01' to X'06'. Each BIND may have its own unique fields so long as the basic requirements defined in Figure 8-7 are met; e.g. one BIND may support compression inbound and another not, or one may have an outbound pacing value of X'02' and another a value of X'04', etc. The current BIND parameters for each session, except the CRYPTO field, may be displayed by the operator via the DISPLAY command (see "Terminal Operator Commands" in Chapter 4).

Note: Upon receipt of a valid BIND command, the CPM sequence numbers for that session are set to zero.

No BIND will be rejected based upon the inbound medium byte (RU25). However, for inbound transmission, the 3776/3777 MLU selects an available session that was "bound" to allow the data stream medium defined by the operator as the input device. If all potentially acceptable sessions are unavailable, a SIGNAL command is sent on one of these sessions (in use for outbound data) and when a "Change Direction" response (CD) is sent back, the data stream is transmitted. If no acceptable sessions are Bound, the HOSTIN operation is aborted, and the operator is informed. If a valid session is busy with an inbound job, the new HOSTIN job is queued to follow.

Unbind Session (UNBIND)

UNBIND is sent by the primary LU in the host to a specific Secondary LU in the 3776/3777 to go out of session with that LU.

Clear (CLEAR)

CLEAR is sent by the host LU to purge all requests and responses related to the active session. CLEAR is normally used after a catastrophic error as the first step in the data traffic recovery sequence or prior to an unconditional UNBIND. The 3776/3777 MLU resets its sequence numbers to 0, reset data traffic active state, purges all outstanding requests and responses on this session, and then send a positive response to the CLEAR.

Command	Origin/Dest.	Function	Prerequisite	Request Unit (RU) Contents
Activate Link	AM/NCP	Activates the modem associated with the specified SDLC link.	Session between AM and NCP physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Physical Configuration Services. Byte 2 = X'0A' - Request code. Bytes 3 - 4 = Network address of the link.
Activate Logical	AM/3770	Establishes a session between AM and the 3770 logical unit	Session between AM and 3770 physical unit (SSCP-PU session).	Byte 0 = X'0D' - Request code. Byte 1 = X'01' - Activation type, cold. Byte 2 = X'01' - DFC level.
Activate Physical	AM/NCP or AM/3770	Establishes a session between AM and the NCP or 3770 physical unit (SSCP-PU session).	No SSCP-PU session.	Byte 0 = X'11' - Request code. Byte 1 = X'01' - Activation type cold. Byte 2 - X'01' - DFC level.
Bid	AM/3770	Sent by the AM application program to request permission from the 3770 to start a bracket.	Session between application and 3770 logical unit (APPL-LU session—between-bracket [BETB] state).	Byte 0 = X'C8' - Request code
Bind	AM/3770	Establishes a session between a host application program and the 3770 logical unit (APPL-LU session).	Session between AM and the 3770 logical unit (SSCP-LU session)	Byte 0 = X'31' - Request code. Byte 1 - X'01' - Activation type cold Byte 2 Byte 3 = X'03' - TS profile for 3770. Byte 4 - FM data protocol for host application: Bit 1 - Request mode B'0' - Immediate Bits 2 - 3 - Chain response. B'01' - Exception response. B'10' - Definite response. B'11' - Exception or Definite response. Byte 5 - FM data protocol for 3770: Bit 0 - Chaining use. B'1' - Multiple RU chains allowed. Bit 1 - Request mode. B'0' - Immediate Bits 2 - 3 - Response protocol. B'01' - Exception response. B'10' - Definite response. B'11' - Exception or Definite response (3770 defaults to Definite). Bit 6 - Compression B'1' - Inbound data will be compressed. Reset internally if Alternate Code is specified. Bit 7 - Send end-bracket (EB) indicator: B'0' - 3770 will not send EB. B'1' - 3770 may send EB (RU-5, Exception response mode not allowed). Byte 6 - Common host - 3770 protocol: Bit 1 - FM header usage: B'1' - FM headers allowed. Bit 2 - Brackets: B'1' - Brackets will be used. Bit 3 - Bracket termination rule: B'1' - Bracket termination is controlled by the type of response requested by the CPU. Bit 4 - Alternate code: B'1' - ASCII. B'0' - EBCDIC.

Figure 8-7. SNA Network Commands (Part 1 of 6)

Command	Origin/Dest.	Function	Prerequisite	Request Unit (RU) Contents
Bind (Cont.)	AM/3770	Establishes a session between a host application program and the 3770 logical unit (APPL-LU session).	Session between AM and the 3770 logical unit (SSCP-LU session).	**Byte 7 - Common host - 3770 protocol:** **Bits 0 - 1 - FM transaction mode:** **B'10' - Half-duplex flip-flop.** Bit 2 - Recovery responsibility: B'0' - Host is responsible Bit 3 - Brackets first speaker: B'0' - 3770 is first speaker. Bit 7 - Contention resolution: B'0' - 3770 speaks first in Data Traffic Active state Byte 8 - Inbound Pacing: Bits 2 - 7 - Inbound pacing value Byte 9 - Outbound Pacing: Bits 2 - 7 - Receive pacing count: Must be X'1' to X'7'. Byte 10 - Secondary Logical Unit (3770) Inbound RU Size: Bits 0-3 = X'0' or ≥X'8' Bits 4-7 = X'0' if Bits 0-3 = X'0' ≥X'5' if Bits 0-3≥X'8' and 3770 is in 256-byte mode ≥X'6' if Bits 0-3≥X'8' and 3770 is in 512-byte mode Byte 11 - Primary Logical Unit (Host) Outbound RU Size: Bits 0-3 = X'0' or X'8' Bits 4-7 = X'0' if Bits 0-3 = X'0' ≤X'5' if Bits 0-3 = X'8' and 3770 is in 256-byte mode ≤X'6' if Bits 0-3 = X'8' and 3770 is in 512-byte mode **(See Note 1.)** Byte 14 - Logical Unit (LU) Profile present: X'01' - LU Profile Type 1 Byte 15 - FM Header Subset and Data Stream Profile: Bits 0-3 - FM Header Subset: X'0' - Default X'1' - Header and Data combinations are limited (see note 2.) X'2' - Header and Data combinations are permitted in the same chain. Bits 4-7 - Data Stream Profile: X'0' - SCS Basic Controls X'1' - SCS basic controls, and card data may span RU's (3776/3777 MLU will span card data inbound). Byte 16 - Logical Unit (LU) Profile: Bit 0 = B'0' - Interrupt level Bit 1 - Compacted data B'0' - Compacted data not allowed B'1' - Compacted data allowed

Notes:

1. Bytes 12 and 13 are not checked by 3770 terminals.
2. A header and data combination may occur only when the data set (or destination) selection begins (BDS) and ends (EDS) within the same header and chain. This is called an ODS (only-data-set) header **and uses the Type 1 FM header.**

Figure 8-7. SNA Network Commands (Part 2 of 6)

Command	Origin/Dest.	Function	Prerequisite	Request Unit (RU) Contents
Bind (Cont.)	AM/3770	Establishes a session between a host application program and the 3770 logical unit (APPL-LU session). **Note:** 1. Byte 27, Bit 2 will be reset internally after a CRV is received and processed.	Session between AM and the 3770 logical unit (SSCP-LU session).	Bytes 17-20 are not checked Byte 20 - Medium flag, host to terminal, terminal receive capability: Included for user reference only. Bit 0 - Document format B'0' - May not be sent B'1' - May be sent Bit 1 - Card format B'0' - May not be sent B'1' - May be sent Bit 2 - Exchange medium format B'0' - May not be sent B'1' - May be sent Bit 3 - Disk data management format Bit 4 - Extended card format Bit 6 - Secondary send CD every EDS Bytes 21-24 are not checked Byte 25 - Medium flag, terminal to host, host receive capability Bit 0 - Document format B'0' - terminal will not send document format Bit 1 - Card format B'0' - May not be sent B'1' - May be sent Bit 2 - Exchange format B'0' - May not be sent B'1' - May be sent Bit 3 - Disk data management format (not supported) Bit 4 - Extended card format (not supported) Bit 5 - Extended document format Byte 26 Bits 0-1, must be B'00' Bits 2-3, CRYPTO session level B'00' - No CRYPTO session B'01' - Session level CRYPTO B'11' - Mandatory CRYPTO Bits 4-7, CRYPTO field length X'0' - No CRYPTO field X'9' - CRYPTO field length (parameter byte 27 + 8 byte key) For length non-zero Byte 27 Bits 0-1, CRYPTO key mode B'00' - Session key (KS) enciphered under LU key (KLU) Bit 2, Bits 5-7, CRYPTO cipher method X'0' - Block chain cipher, DES algorithm Bytes 28-35, session key enciphered under LU key (KLU)
Crypto Verification	AM/3770	Verifies Session Key	Session between AM and the 3770 logical unit (SSCP-LU session)	Byte 0 = 'C0' Bytes 1-8 = partially inverted seed enciphered under session key.

Figure 8-7. SNA Network Commands (Part 3 of 6)

Command	Origin/Dest.	Function	Prerequisite	Request Unit (RU) Contents
Cancel	AM/3770 and 3770/AM	Indicates that an error has occurred in the current request unit chain. Preceding request units in the chain should be discarded. The next request unit sent should be either an only-in-chain request unit or first-in-chain request unit.	Data flow enabled.	Byte 0 = X'83' - Request code.
Chase	AM/3770	Ensures that the 3770 has received and responded to all outstanding requests. The 3770 processes all remaining requests in its buffers, then responds to the Chase.	Data flow enabled.	Byte 0 = X'84' - Request code.
Clear	AM/3770	Purges all outstanding requests and responses relating to the APPL-LU session. Clear is normally used after a catastrophic error as the first step in the data traffic recovery sequence or prior to an unconditional Unbind.	Data flow enabled.	Byte 0 = X'A1' - Request code.
Contact	AM/NCP	Causes the NCP to start a contact poll to the 3770. When the connection is made, the NCP returns a Contacted response to AM.	Session between AM and the 3770 physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'01' - Request code. Bytes 3-4 - Network address of the 3770.
Contacted	NCP/AM	Informs AM that the NCP received a response to a contact poll, or an error occurred during a contact poll.	Session between AM and the 3770 physical unit (SSCP-PU session). Contact must be active.	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'80' - Request code. Bytes 3 - 4 - Network address of the 3770. Byte 5 - Status: X'01' - Loaded. X'02' - Load required. X'03' - Error on contact.
Data	AM/3770 and 3770/AM	Transfers data between the application program and the 3770. User specified 3770 control information may precede the data.	Data flow enabled.	Optional 3770 control information and/or data. RH byte 0 bits 1, 2 = B'00' identify the RU contents as data.
Deactivate Link	AM/NCP	Deactivates the modem associated with the specified SDLC link.	Every resource on the link must be in the 'discontacted state': • A Contact was never issued to the resource. • A Discontact was issued to the resource. • An unrecoverable physical error occurred at the resource or on the link.	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'0B' - Request code. Bytes 3 - 4 - Network address of the link.
Deactivate Logical	AM/NCP	Terminates the session Between AM and the 3770 logical unit.	SSCP-LU session.	Byte 0 = X'0E' - Request code.

Figure 8-7. SNA Network Commands (Part 4 of 6)

Command	Origin/Dest.	Function	Prerequisite	Request Unit (RU) Contents
Deactivate Physical	AM/NCP or AM/3770	Terminates the session between AM and the 3770 or NCP physical unit (SSCP-PU). Optionally powers-down the 3770.	SSCP-PU session.	Byte 0 = X'12' - Request code. Byte 1 - Type: X'01' - Final use; power-down the 3770. X'02' - Not final use.
Dial	AM/NCP	Causes the NCP to initiate an outbound call on an SDLC link. If autodial is specified, the NCP performs the dial operation. If manual dial is specified, the NCP enables the link and the operator performs the dial.	The modem must be active.	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'0E' - Request code. Bytes 3-4 - Network address of the link. Byte 5 - SDLC addressing character for the 3770. Byte 6 - Type: Bit 0 = 1 - Secondary station. Bit 1 - Type of dial: B'0' - Autodial. B'1' - Manual dial. Byte 7 - Dial retry limit. Byte 8 - Number of dial digits. Bytes 9-n - Dial digits.
Discontact	AM/NCP	Causes the NCP to stop polling the 3770.	The link to the 3770 must not be active.	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'02' - Request code. Bytes 3-4 - Network address of the 3770.
Entering Auto Network Shutdown	NCP/AM	Notifies AM that the NCP is entering auto network shutdown. The NCP sends the 3770 'path error' responses to requests directed to the host.	N/A	Byte 0-1 - Reason for ANS: X'0601' - ANS initiated by 3704/3705 operator. X'0602' - ANS entered because of channel timeout.
Entering Slowdown	NCP/AM	Informs AM that the normal flow of data through the NCP is impeded because of limited available buffers.	Session between AM and the NCP physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = XX'02' - Configuration services. Byte 2 = X'02' - Request code. Bytes 3-4 - Network address of NCP physical services.
Execute Test	AM/NCP	Causes the NCP to execute an online line test (OLLT) for an SDLC link.	Session between AM and the NCP physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = X'03' - Maintenance services. Byte 2 = X'01' - Request code. Bytes 3-n - Test data.
Exiting Slowdown	NCP/AM	Informs AM that the NCP buffer limitation has been lifted and normal data flow may resume.	Session between AM and NCP physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'15' - Request code. Bytes 3-4 - Network address of NCP physical services.
Inoperative	NCP/AM	Informs AM that contact between the NCP and the 3770 has been lost. The Inoperative is sent only when an established contact is lost; not for failure to make contact.	SSCP-PU session and in 'contacted' state.	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'81' - Request Code. Bytes 3-4 - Network address of the failing resource or link. Byte 5 - Cause: X'01' - Resource failed. X'02' - Link failed.
Logical Unit Status (LUSTAT)	3770/AM	Allows the 3770 to inform AM when the problem has been resolved.	Data flow enabled.	Byte 0 = X'04' - Request code. Bytes 1-2 - Status: X'081C' - Component failure; permanent error.

Figure 8-7. SNA Network Commands (Part 5 of 6)

Command	Origin/Dest.	Function	Prerequisite	Request Unit (RU) Contents
Off Hook	NCP/AM	Informs AM that a physical connection has been established between the NCP and the 3770.	Session between AM and the NCP physical unit (SSCP-PU session). Physical connection between NCP and the 3770.	Byte 0 = X'01' - Network services. Byte 1 = X'02' - Configuration services. Byte 2 = X'84' - Request code. Bytes 3-4 - Network address of the link. Bytes 5-10 - Station ID.
Record Maintenance Statistics	NCP/AM	Informs AM of error statistics when an unrecoverable error occurs on the link.	Session between AM and the NCP physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = X'03' - Maintenance services. Byte 2 = X'81' - Request code. Bytes 3-4 - Network address of the failing link or 3770 terminal. Bytes 5-n - Error statistics (refer to the 3704/3705 Program Reference Handbook for MDR record formats).
Record Test Data	NCP/AM	Informs AM of the current status of an online line test (OLLT).	Session between AM and NCP physical unit (SSCP-PU session).	Byte 0 = X'01' - Network services. Byte 1 = X'03' - Maintenance services. Byte 2 = X'82' - Request code. Bytes 3-4 - Network address of the SDLC link being tested. Bytes 5-n - Test data.
Shutdown (SHUTD)	AM/3770	Requests that the 3770 stop sending data and to prepare for session termination.	Data flow enabled.	Byte 0 = X'C0' - Request code.
Shutdown Complete (SHUTC)	3770/AM	Informs AM that the 3770 is in the quiesce state.	Data flow enabled.	Byte 0 = X'C1' - Request code.
Request Shutdown (RSHUTD)	3770/AM	Informs the host that the 3770 wants to stop processing and end the SSCP-LU session. The 3770 remains in communicate mode until it receives a Clear and Unbind from the host.	Data flow enabled.	Byte 0 = X'C2' - Request code.
Signal	3770/AM or AM/3770	Sends an expedited signal to the host regardless of the normal flow.	Data flow enabled.	Byte 0 = X'C9' - Request code. Bytes 1-4 - Signal code. (X'0001 0000' - 3770 to Access Method)
Start Data Traffic (SDT)	AM/3770	Places the 3770 in the 'data flow enabled' state.	Session between the application program and the 3770 logical unit.	Byte 0 = X'A0' - Request code.
Unbind	AM/3770	Terminates the session between the host application program and the 3770 logical unit (APPL-LU).	APPL-LU session.	Byte 0 = X'32' - Request code. Byte 1 = X'01' - Unbind type.

Figure 8-7. SNA Network Commands (Part 6 of 6)

Start Data Traffic (SDT)

SDT is sent by the host LU to complete a data traffic recovery (following a CLEAR) or initialization (following a BIND) sequence with a specific LU. No Data Flow Control (DFC) or FM data traffic, either inbound or outbound, may flow until SDT is received for the specified session. Any FM or Data Flow Control data received for a session prior to receipt of SDT is rejected with sense X'2005', "Data Traffic Reset".

CRYPTO Verification (CRV)

CRV is sent from the host to a specific LU in the 3776/3777 (not 3777-4) MLU after a BIND to verify that both the host and the terminal are using the same session key and that both know how to use it.

Data Flow Control Commands

Data Flow Control (DFC) requests are passed between the host application and the 3776/3777 MLU to provide controls over session data flow that are in addition to RH controls and established protocols. DFC functions are identified through the setting of the RH Category bits (RH-0, bits 1 & 2) to B'10'. The individual commands are identified by the first byte of the RU as follows:

Commands	*RU-0*	*Support*	*Flow*
CANCEL	X'83'	Inbound & Outbound	Normal
BID	X'C8'	Outbound	Normal
CHASE	X'84'	Outbound	Normal
SIGNAL	X'C9'	Inbound & Outbound	Expedited
SHUTD	X'C0'	Outbound	Expedited
SHUTC	X'C1'	Inbound	Expedited
RSHUTD	X'C2'	Inbound	Expedited
LUSTAT	X'04'	Inbound	Normal

The 3776/3777 MLU reacts to the TH/RH parameters as defined for DFC requests received. All bytes beyond RU-0 are ignored. For inbound requests, subsequent sections define the TH/RH/RU fields that will be sent.

If a DFC request is received that does not have an RU byte, the following response is sent:

TH/RH = -RESP
Sense = X'10020000' (RU Length Error)

If a DFC request is received that is not supported (not listed as outbound above), the following response is sent:

TH/RH = -RESP
Sense = X'10030000' (Function Not Supported)
RU-4 = First byte of Request RU

If a synchronous DFC request is received that is out of sequence, the following response is sent:

TH/RH = -RESP
Sense = X'2001000' (Sequence Number Error)
RU-4 = First byte of Request RU

All parameters on responses to inbound DFC requests are ignored.

CANCEL (Outbound)

CANCEL is sent by the host LU to terminate a partially transmitted chain of FM Data Requests. CANCEL is normally sent when the 3776/3777 MLU sends an error response to a chain element. CANCEL forces the 3776/3777 MLU out of "purging chain" state.

CANCEL (Inbound)

CANCEL is sent to cancel a partially transmitted chain in the network when either an FM Data error response is received, or the operator aborts the inbound job (see "Terminal Operator Commands" in Chapter 4), or the source device encounters a hard error.

BID

BID is sent by the host LU to request permission from the 3776/3777 MLU to start a bracket. If the 3776/3777 MLU is between brackets at the time, a positive response is sent and the session goes to "pending begin bracket" state. Otherwise, the BID is rejected.

CHASE

CHASE is sent by the host LU, normally when running in "exception response" mode, to determine when the 3776/3777 MLU has finished processing all the previously sent RUs. The 3776/3777 MLU completes processing of data received for this session and then responds to CHASE.

SIGNAL (Outbound)

SIGNAL is sent by the host LU to request a break in the inbound data flow to allow it to send. Upon receipt of SIGNAL, a definite response is sent immediately, and a "Change Direction" response is sent as soon as possible to indicate the 3776/3777 MLU is going to receive mode.

SIGNAL (Inbound)

SIGNAL is sent by the 3776/3777 MLU to interrupt the host LU outbound data flow in the following situations:

1. The operator enters an APPL REQ message and there are no available sessions. The established Sessions are checked in the order "n" thru "n+5" where "n" is the first session bound (wraps from X'06' to X'01'). This algorithm attempts to send all console data on the initial session, but if the initial session is busy, a subsequent session will be used.
2. The operator initiates a HOSTIN function and there is no session available supporting the specified medium. The 3776/3777 MLU scans the acceptable sessions busy with outbound data flow in the order "n+1" thru "n" where "n" is the first session bound (wraps from X'06' to X'01'). This algorithm attempts to keep the initial session free for console data flow.

Note: Signal will be sent twice if Mult Signal Interrupt is specified in the TIP or by the Status command.

SHUTDOWN (SHUTD)

SHUTD is sent by the host LU as a preliminary step to an orderly session shutdown. The 3776/3777 MLU will send a positive response immediately to SHUTD and subsequently send SHUTC to signal that the 3776/3777 MLU has entered quiesce state.

SHUTDOWN COMPLETE (SHUTC)

SHUTC is sent by the 3776/3777 MLU following receipt of SHUTD as soon as "between brackets" state is entered. No inbound FM Data will flow on a session that has quiesced.

Request Shutdown (RSHUTD)

RSHUTD is sent by the 3776/3777 MLU as a preliminary step to an orderly session shutdown; it is a request for a CLEAR, UNBIND command sequence from the host. RSHUTD is initiated by the operator (see "Terminal Operator Commands" in Chapter 4) where the desired session, X'01'–X'06', must be specified. Once initiated, the RSHUTD request is sent immediately, assuming the required buffer is available. The host may still send data to the session before CLEAR, UNBIND is sent. The user is cautioned to understand exactly what action the particular host RJE subsystem being used will take upon receipt of RSHUTD.

Logical Unit Status (LUSTAT)

LUSTAT is used by the 3776/3777 MLU to send device status information to the host LU. It is used following an intervention required response to indicate the device is again ready. If the host LU ends the use of the medium/subaddress (via an End or Abort Destination Selection FM Header) requiring intervention, LUSTAT is not sent.

If the intervention required response is sent to the request carrying "Begin Destination Selection" (BDS), LUSTAT is sent either:

1. When the device becomes ready or
2. Upon receipt of another 'BDS' (new medium/subaddress is not compared with previous) to this session having LUSTAT "outstanding".

LUSTAT is also sent if the session is in transmit mode, using the Cryptographic feature, and if hardware errors are encountered.

Sense Data (Inbound Error Responses)

The 3776/3777 MLU utilizes the following bit settings for sense data on inbound error responses:

Major Code (SBO)	*Modifier (SB1)*
Path Error - X'80'	X'04' Unrecognized DAF X'05' No Session X'07' Segmenting Error X'08' PU Not Active X'09' LU Not Active
State Error - X'20'	X'01' Sequence Error X'02' Chaining X'05' Data Traffic State Reset X'09' CRYPTO State Error
Request Error - X'10'	X'01' RU Data Error X'02' RU Length Error X'03' Function Not Supported X'05' Parameter Error X'07' Category Not Supported X'08' Invalid FM Header
Request Reject - X'08'	X'02' Intervention Required X'0B' Bracket Race X'0C' Procedure Not Supported X'12' Insufficient Resources X'13' Bid Reject - No RTR X'15' Function Active X'1B' Receiver in Xmit Mode X'1C' Function Not Executable X'21' Invalid Session Parameters X'25' Component Not Available X'48' CRYPTO Component Failure

The 3776/3777 MLU will not set the user data sense bytes (SB2 and SB3) to anything other than X'0000'.

Path Error - Major Code = X'80'

Modifier (Byte 1)	*Description*
X'04'	Unrecognized DAF - Returned if the Destination Address Field (DAF) received is something other than X'0' (PU) or X'01' - X'06' (LUs).
X'05'	No session - Returned if Origin Address Field (OAF) on a received request is different than the OAF on the BIND command for that session.
X'07'	Segmenting Error - Returned if the MPF field in TH-0 is set to B'10' on the request received (settings of B'00' or B'01' are ignored).
X'08'	PU Not Active - Returned on any request, except ACTPU, if the physical unit (X'00') has not been activated.
X'09'	LU Not Active - Returned on any request, except ACTLU, destined for a session (X'01'-X'06') that has not been activated via an ACTLU (DACTLU for inactive session gets a positive response).

State Error - Major Code = X'20'

Modifier (Byte 1)	*Description*
X'01'	Sequence Error - Returned if a received normal flow requests Sequence Number Field (SNF) does not compare with the Sync Counter maintained by each session.
X'02'	Chaining Error - Returned if a "begin chain" (BC) FM data request is received while the session is currently "processing a chain", or if something other than a BCI request is received when *not* "processing a chain".
X'05'	Data Traffic State Reset - Returned if any Data Flow Control (DFC) or FM data request is received for a session prior to receipt of START DATA TRAFFIC or after Data Traffic Active has been reset, e.g. CLEAR received.
X'09'	CRYPTO State Error - Returned if encrypted data is received before the Cryptographic Verification (CRV) command has been successfully processed for this Cryptographic session.

Request Error - Major Code = X'10'

Modifier (Byte 1)	*Description*
X'01'	RU Data Error - Returned if an RU containing compacted data is received prior to receipt of a valid Type 3 FM Header containing a compaction table.
X'02'	RU Length Error - Returned for the following conditions: 1. Session Control or Data Flow Control request with no RU field received. 2. RU field received > 256 or > 512 on session bound for maximum outbound RU size of 256 (RU-11 $\leq$ X'85') or 512 (RU-11 $\leq$ X'86') respectively.
X'03'	Function Not Supported - Returned if a Session Control or Data Flow Control request is received other than those specified as having outbound support by the 3776/3777 MLU. Also sent if a BIND is received specifying CRYPTO and the CRYPTO adapter has not been installed. Also sent in response to an NS request (REQMS) if RU0-RU4 is $\neq$ X'4103040000'.

Modifier (Byte 1)	*Description*
X'05'	Parameter Error - Invalid Sequence detected
X'07'	Category Not Supported - Returned to any Network Control request received, and also to any Network Services Request on the SSCP-PU Session other than Request Maintenance Statistics.
X'08'	Invalid FM Header - Returned for the following conditions: 1. Begin or Resume Destination Selection is specified while currently "processing" a destination selection. 2. End, Abort, or Suspend Selection is specified when *not* currently "processing" a destination selection. 3. Resume Destination Selection specified when there is no destination selection suspended. 4. Suspend Destination Selection specified when there is already one destination selection suspended. 5. If a destination is suspended and this destination is not for the console. 6. The Type 1 count is $\neq$ X'06'. 7. The "Type" is not X'01' or X'03'. 8. If "Type" = X'03', the "Function" must be X'02', that is, compaction table. 9. For compaction tables, the number of master characters must be ≥ 3, that is, the table may not span RUs. 10. If CDS is specified (inbound support only). 11. If an unsupported medium is specified. 12. If the ERCL field for card or exchange medium is greater than the maximum supported for the designated physical device.

Request Reject Error – Major Code = X'08'

Modifier (Byte 1)	*Description*
X'02'	Intervention Required - Sent as the result of an output device being "not ready" for a period of 1-99 (refer to TIP) minutes while in "attended" mode. Associated LU will return LUSTAT when device is again ready assuming PLU has kept the destination active.
X'0B'	Bracket Race - Returned if the 3776/3777 MLU is "between brackets" and the received FM Data request does not have the BBI set.
X'0C'	Procedure Not Supported - Returned to REQMS request when the type code is not supported.
X'12'	Insufficient Resources - Returned to a session BIND request if the outbound pacing value (RU-9) is larger than the *currently* available number of buffers in the 3776/3777 MLU.
X'13'	Bid Reject - No RTR - Returned if the session is currently "in brackets" and either a BID request or an FM data request with BBI set is received.
X'15'	Function Active - Returned to a BIND received for logical unit that is already bound.
X'1B'	Receiver in Transmit Mode - Returned to an FM Data request received for a session that is currently allocated to a HOSTIN operation. If the session exits send mode without transmitting any data, LUSTAT (RU=0400010000) will be sent to indicate session is now available.

Modifier (Byte 1)	*Description*
X'1C'	Function Not Executable - The current output device being used by the session has intervention required and the terminal is unattended.
X'21'	Invalid Session Parameters - Returned to BIND request if any unacceptable parameters are detected in the BIND request. Also returned to CRV request if EKS (N) and EKS (N-bar) do not agree.
X'25'	Component Not Available - The specified media/subaddress in the received FM Header is either undefined during unattended mode or the associated device is being used in another operation or the device has encountered a permanent failure.
X'48'	CRYPTO Component Failure - The encryption/decryption hardware has encountered a permanent error.

Function Management Header

The 3776 Models 3 and 4 and the 3777 Models 1, 3 and 4, in addition to using the type 1 FM header (transmit and receive), accepts the type 3 FM header from the host provided that the header contains data decompaction information.

The basic type 1 FM header is a six-byte control field that occurs at the beginning of a request unit. The presence of the FM header is indicated in the request header via the Formatted Indicator bit. The header may occur only on beginning-of-chain (BOC) or only-one-(RU)-in-chain (OC) request units. For the 3770, the functions provided by the FM header are:

- Component selection
- Data set delimiting
- String Control Byte (SCB) definition

Each inbound data set originating from the card reader, tape, or the diskette will be framed by FM headers. When the device from which the data originated is the keyboard, i.e. APPL REQ, no FM headers are present. All outbound data should be framed by FM headers. If the 3770 receives data without an FM header (i.e., the Formatted Indicator in the request header is off), the console display is selected.

Type 1 FM Header

The Type 1 FM Header provides Medium/Subaddress selection and destination delimiting. It is a six byte field having the following format:

Byte	*Bit(s)*	*Meaning*
0	0-7	X'06'-Count
1	0	B'0' - Not Concatenated
	1-7	B'0000001' - Type=1
2	0-3	Medium: Output- B'0000' Console B'0001' Exchange B'0010' Card B'0011' Printer
	4-7	Subaddress-Assigned by operator to a physical device via the HOSTOUT procedure
3	0	SRI
	1	B'0'-Demand Select - not supported
	2-7	Reserved

Byte	*Bit(s)*	*Meaning*
4	0-7	Properties
	0-2	Destination Selection: B'000' - Resume (RDS) B'001' - End (EDS) B'010' - Begin (BDS) B'011' - Begin & End (only - ODS) B'100' - Suspend (SDS) B'101' - Abort (ADS) B'110' - Continue (inbound support only) (CDS) B'111' - Reserved
	3	DST - Data Set Transmission (medium = exchange) B'0' - Transmission Exchange Format (T— type disk data set required). B'1' - Basic Exchange Format
	4	Reserved
	5	CMI - B'1' = Compressed
	6	CPI - B'1' = Compacted
	7	Reserved
5	0-7	ERCL - 0-255 for card medium (0 defaults to 80) and exchange medium (if DST = 0), or 1-128 for exchange medium (if DST = 1).

As noted, the disk and tape units are feature options and may be designated as logical readers, printers or punches. The operator may assign the physical devices a medium and subaddress via the keyboard.

If a "BDS" header is received requesting an undefined medium/subaddress, the operator will be prompted to assign the device unless the terminal is in unattended mode in which case a negative response (0825) will be sent immediately rejecting the specified medium/subaddress.

If a medium other than those described is received, a negative response (1008) will be sent to reject the FM header.

Type 3 FM Header

The Type 3 FM Header is used to send a Compaction Table from the host to the terminal. It must be sent as an only chain (OC) and can not be concatenated to any other type of FM Header. The format of the header is as follows:

Byte	*Bits*	*Meaning*
0	0-7	Length - Variable
1	0	FMHC - B'0'
	1-7	Type = B'0000011'
2	0-7	Code = X'02' decompaction table
3-n		Parameters: M followed by Table M = number of master characters Table = The representation of the compact code table (the non-compacted entries). It is transmitted in row major order, starting at the bottom row and omitting the cells in the upper left corner M by M submatrix which represent compacted characters. A decompaction table is required for each session on which compacted data is being transmitted by the host. The number of masters, "M", must be ≥3 or the 3776/3777 MLU will reject the request with "Invalid FM Header" (1008). Also, the number of masters plus non-masters must be exactly what is required to build the table; no verification of this is done by the 3776/3777 MLU.

Byte	*Bits*	*Meaning*
		The table need not be sent prior to receipt of a Begin Destination Selection FM Header with the Compacted (CPI) bit set. However, if compacted data is received prior to a table, a negative response (1001) will be returned. The operator may display the compaction table via the DISPLAY command. (See "Terminal Operator Commands" in Chapter 4).

The number of characters in the decompaction table depends on the number of master characters. The hex values for the variables in the Type 3 FM header are given in the table below.

Number of Master Characters M		*Length of Header* L
Decimal	*Hex*	*Hex*
16	10	14
15	0F	23
14	0E	40
13	0D	5C
12	0C	74
11	0B	8C
10	0A	A0
9	09	B4
8	08	C4
7	07	D3
6	06	E0
5	05	EB
4	04	F4
3	03	FB

The master and non-master characters are defined beginning at byte 4 and ending at byte (L-1).

Network Services

Network services (NS) in the 3776/3777 MLU is limited to (1) logon and logoff operations where messages are routed to the System Services Control Point (SSCP) from the LU, and (2) REQMS/RECFMS processing on the SSCP-PU session. LOGON and LOGOFF messages are initiated by (1) the operator pressing the SSCP REQ key followed by up to 122 bytes of data, (2) automatically via the IPL PROC, or (3) executing an SSCP procedure. The format of the request is as follows:

TH-0	B'00101100' Normal Flow
TH-1	B'00000000'
DAF	OAF from ACTPU
OAF	X'01' - X'06'
TH-4	X'00'
TH-5	X'00'
RH-0	B'00000011' FM Data Request, Only Chain
RH-1	B'10000000' DR1
RH-2	B'00000000'
RU	Max of 122 data bytes.

Request Maintenance Statistics (REQMS) is sent by the SSCP to request that specific network management information be sent back via the RECFMS request. REQMS is sent on the normal flow and has the NS Header X'410304'. The 3776/3777 MLU responds only to the REQMS requests for Link Test Statistics (Type Code X'01'), Summary Error Data (Type Code X'02'); Communications Adapter Data (Type Code X'03') and EC Levels (Type Code X'05'). The format of the REQMS request unit is as follows:

Byte	0-2	X'410304' NS header
		Link Test Statistics
	3-4	X'0000'
	5-6	Reserved. The contents of this field will be echoed on response.
	7	bit 0, reset indicator (note) bits 1-7, type code: B'0000001'
		Summary Error Data
	3-4	X'0000'
	5-6	Reserved. The contents of this field will be echoed on response.
	7	bit 0, reset indicator (note) bits 1-7, type code: B'0000010'
		Communication Adapter Data
	3-4	X'0000'
	5-6	Reserved. The contents of this field will be echoed on response.
	7	bit 0, reset indicator (note) bits 1-7, Type code: B'0000011'
		EC Levels
	3-4	X'0000'
	5-6	Reserved. The contents of this field will be echoed on response.
	7	bit 0, Reserved bits 1-7, type code: B'0000101'

Note: Set to 1 if data is to be reset when RECFMS is sent.

Possible negative response to REQMS is Sense = X'080C0000'. This is returned when the type code is not supported. Another negative response possible is X'10030000' - "Function Not Supported" if RU-0 through RU-4 is not equal to X'4103040000'. Record Formatted Maintenance Statistics (RECFMS) is sent by the 3776/3777 MLU to the SSCP to communicate pertinent network management information. It is sent in response to a REQMS, in which case the format of the RECFMS RU is dictated by the type code received in REQMS, or is sent unsolicited when any communications adapter error counter reaches its limit threshold. The format of the RECFMS request units supported are as follows:

RU	Byte 0-2	X'410384'
	(The remaining bytes of the RU depend on the type code.)	
	Link Test Statistics	
	3-4	X'0000'
	5-6	Reserved. The contents of this field will be echoed on a solicited request and X'0000' on an unsolicited request.
	7	bit 0, solicitation indicator: 1 = solicited; sent in reply to REQMS bits 1-7, type code: B'0000001'

8-11	Station ID: bits 0-11 block no. of sending PU bits 12-31, specified ID of sending PU
12-13	Reserved
14-15	Counter: The number of times the secondary SDLC station has received an SDLC TEST command.
16-17	Counter: The number of times the secondary SDLC station has transmitted an SDLC TEST command. (all counters in binary)

Summary Error Data (Never sent unsolicited)

3-4	X'0000'
5-6	Reserved. The contents of this field will be echoed or a solicited request and X'0000' on an unsolicited request.
7	bit 0, solicitation indicator: 1 = solicited, sent in reply to REQMS bits 1-7, type code: B'0000010'
8-11	Station ID: bits 0-11, block no. of sending PU bits 12-31, specific ID of sending PU
12-13	Reserved
14	Summary counter validity mask: bit 0, set to 0 product check counter is not valid bit 1, set to 1 communication check counter is valid. bit 2, set to 1 SNA error counter is valid. bits 3-7, reserved
15-16	Reserved
17-18	Product check counter
19-20	Communication check counter
21-22	Count of all SNA negative responses originated at this PU (all counters in binary)

Note: When one of the Summary Counters reaches its maximum value, it stays at that value until reset by a request from the host.

Communications Adapter Data

3-4	X'0000'
5-6	Reserved. The contents of this field will be echoed on a solicited request and X'0000' on an unsolicited request.
7	bit 0, solicitation indicator: 0 = unsolicited 1 = solicited; sent in reply to REQMS bits 1-7, type code: B'000011'
8-11	Station ID: bits 0-11, Block No. of sending PU bits 12-31, Specific ID of sending PU
12-13	Reserved
14	Adapter type: B'00000010' SDLC HPCA link adapter (All other values reserved.)
15	Communication adapter counter validity mask, byte 1 bit 0, set to 1 nonproductive timeout Receive Overrun counter is valid. bit 1, set to 1 idle timeout counter is valid. bit 2, set to 1 write retry counter is valid. bit 3, set to 1 overrun counter is valid. bit 4, set to 1 underrun counter is valid. bit 5, set to 1 connection problem counter is valid. bit 6, set to 1 FCS error counter is valid. bit 7, set to 1 primary station abort counter is valid.
16	Communication adapter counter validity mask, byte 2. bit 0, set to 1 command reject counter is valid. bit 1, set to 1 DCE error counter is valid. bit 2, set to 1 write timeout counter is valid. bit 3, set to 1 invalid status counter is valid. bit 4, set to 0 I/O machine check counter is not valid. bit 5-7 Reserved

17	Reserved
18	Non-productive timeout/Receive Overrun counter
19	Idle time out counter
20	Write retry counter
21	Overrun counter
22	Underrun counter
23	Connection problem counter
24	FCS error counter
25	Primary station abort counter
26	Command reject counter
27	DCE error counter
28	Write timeout counter
29	Invalid status counter
30	I/O machine check counter (not valid) (all counters in binary)

EC Levels	
3-4	X'0000'
5-6	Reserved. The contents of this field will be echoed.
7	bit 0, solicitation indicator: 1 = solicited; sent in reply to REQMS bits 1-7, type code = B'0000101'
8-11	Station ID: bits 0-11, block no. of sending PU bits 12-31, specific ID of sending PU
12-13	Reserved
14-n	Implementation defined data describing microcode level.

An unsolicited RECMS (if supported by the host) is sent whenever one of the communications adapter counters reaches its maximum value. All communications adapter counters are reset whenever an unsolicited RECFMS is sent.

The 3776/3777 MLU ignores any negative response returned from the SSCP to the RECFMS request.

Note: Messages to the SSCP are not sequenced or paced, always require a definite response, and are always in EBCDIC.

Unattended Mode

Attended versus unattended mode is specified via the STATUS command. The session BIND (byte 20) is not checked and in no way controls the mode in which the session operates.

Areas where attended/unattended mode has a direct relation to terminal operation are as follows:

1. Intervention required after output started - in attended mode, timeout is started to allow the operator time to ready the output device; in unattended mode, a negative response is sent immediately (Sense = '081C0000').
2. Initial destination selection - if the requested medium/subaddress is not defined or intervention is required initially, the operator is prompted with an operator awareness message if "attended"; otherwise, a negative response is sent immediately (Sense = '08250000').
3. When transmitting and the source device becomes not ready, the destination is aborted immediately in unattended mode.

Console Support

The 3776/3777 MLU allows console data to flow on any established session both inbound and outbound:

Inbound: Data may be sent via the APPL REQ key in which case it is sent only in chain without FM headers. The user may send console data from the reader, disk, or tape by specifying console medium (K) in the appropriate HOSTIN/INPUT procedure (data is framed by FM headers). The data itself will be compressed if allowed by the session BIND, with chaining controlled by the TIP parameter or /*EOC records.

Outbound: Data RUs received without FM headers are directed to the console display. If the console is selected by an FM header, the data may be compressed/compacted. In either case, each RU is totally outputted upon receipt, i.e. messages should not span RUs as partial lines/words will be displayed. Without this restriction, multiple work-station definitions could result in uncontiguous messages being displayed.

In formatting the output, all leading blanks and NL characters are stripped. The message is preceded with a time stamp and session notation.

SCS support is the same as for print medium except that LF, CR, FF, and IRS all result in an NL function. In addition, INP and ENP characters are detected and result in presentation of keyboard/ID reader data being inhibited or enabled respectively.

Note: Presentation is inhibited/enabled on all sessions regardless of which session(s) received the INP or ENP character.

Remote Power Down

If the 3776 (with the Remote Power Down feature) or the 3777 MLU receives a DACTPU with "Final Use" specified (RU byte-1 = X'01') followed by a SDRM link level command, the terminal will send a NSA to the link command and then post a spool message: "Final Use Received". If the terminal is in unattended mode, a power down sequence will be initiated (as soon as all local functions are idle). Prior to the power down sequence, the error log will be written to the control diskette and all spool operations completed.

Note: The 3262 printer will not power down.

Interactive Operator Interface

ID Reader

The ID Reader is activated by the 3770 operator via the SSCP REQ key. Characters may be keyed into the buffer before the badge is inserted. The total number of characters keyed or read from the badge cannot exceed 120. When the badge is read, the buffer is automatically transmitted to the host processor. Printing of the ID Reader data will be inhibited.

Note: A Longitudinal Redundancy Check (LRC) will be performed, but the LRC characters will not be transmitted.

Secure Data

The code functions Inhibit Print (INP) and Enable Print (ENP) are supported by 3770 to allow the host to control entry of secure data at the terminal. Upon receipt of INP, the print-inhibit state is entered. INP and ENP are supported only on the console data stream. When inhibited, messages are overlaid with asterisks when displayed.

When ENP is received, print-inhibit state will be reset.

Operational Considerations for Multiple-Logical-Unit Terminals

The following information concerns the implementation of specific SNA protocols by the 3776/3777 MLU terminals. Refer to Related Publications in Chapter 7 for a list of manuals that provide more general information on System Network Architecture.

Inbound Data from 3770 to Host Processor

The following paragraphs discuss the format and content of the request units (RUs) sent from the various terminal devices to the host processor. Data can be sent compressed, transparent, or transparent and compressed (compression must be allowed in the BIND parameters). In addition data can be sent as exchange (E), card (C), or as console (K) medium. For card medium, records are spanned if allowed in the session BIND (RU byte 15) and if the number of RUs per chain is not restricted (by TIP specification). For more specific information, see HOSTIN procedure and INPUT command discussions in Chapter 4.

Nontransparent Data

Data is sent to the host as follows:

- TRN code is not allowed in data. The terminal does not check for TRN; if TRN is present in the data, transparent mode should be used.
- Trailing blanks are truncated.
- IRS code is appended to the resultant record to denote end of record.
- RU size can vary from zero to 256 or 512 bytes (depending on BIND RU byte 10).

Transparent Data

- Trailing blanks are truncated.
- TRN code followed by a one-byte binary count precedes the truncated data record.
- IRS code is appended to the resultant record.
- RU size can vary from zero to 256 or 512 bytes (depending on BIND RU byte 10).

Inbound Card Medium

The card RUs are sent from the beginning of a data file to the EOF as one destination select and one bracket. The user can delimit jobs or transactions within the bracket by inserting an "end-of-chain" card(s) in the file. Columns 1-6 of the card should contain /*EOC blank (all other columns are ignored). When the 3770 reads this card, the reading will stop and that RU will be sent as the end-of-chain. Reading will resume after the positive response to the chain has been received. The next RU will be a beginning of chain. If the 3770 is bound in a session requesting exception response chains, reading will not stop when a /*EOC is read. The 3770 will not recognize the /*EOC card in transparent decks.

The 2502 has a switch to control the end-of-file condition when the hopper empties; for disk and tape, data sets or files are the delimiters.

Inbound Disk Data

One or more data sets will be sent as a bracket. Each data set for transmit all active, or each data set if concatenated input, or each volume of a multivolume data set will be sent as a chain. Data sets may contain imbedded end-of-chain characters: IUS for T-format, /*EOC for basic exchange. These imbedded characters will be recognized and terminate the current chain except during transparent operations.

The medium defined in the input specification determines the value to be specified in the FM Header ERCL field. For exchange medium, the data set block length (128-byte maximum) is used. For card medium, if the block length is ≤80 bytes and the TIP or STATUS command parameter "Record Length - Extended Definition = NO", the ERCL is set to X'80'; if >80, it is set to the block length. If the TIP or STATUS command parameter "Record Length - Extended Definition = YES", the CDS and ERCL fields in the Type 1 FM Header will be used to indicate any variation of record size from 1 to 255 bytes when the data is transmitted from the tape unit or a diskette. For console medium, ERCL is undefined and is therefore set to X'00'.

Inbound Tape Data

One or more data sets or files will be sent as a bracket. Each data set, if concatenated input, or each volume of a multivolume data set will be sent as a chain. Data sets may contain imbedded end-of-chain characters (/*EOC). This imbedded character will be recognized and terminate the current chain except during transparent operations.

Concatenated Data

If the inbound job specifies multiple inputs or it is reading "all active" disk data sets, a Continue Destination Select (CDS) FM Header will be sent under the following conditions:

1. Any time the input record length changes for exchange medium.
2. For card medium:
   a. When the TIP or STATUS command parameter "Record Length - Extended Definition = NO", if the record length changes and is greater than 80 or if the record length >80 and the next input is ≤80,
   b. When the TIP or STATUS command parameter "Record Length - Extended Definition = YES", any time the record length changes if the device is a tape unit or a diskette.

Outbound Data from Host Processor to 3770

This section discusses the format and content of the request units sent from the host processor to the various terminal destinations. For specific information on output device parameter definitions, see Output command in Chapter 4.

Outbound Card Data

The format and content of the RUs for the punch should be identical to the inbound card formats. The 3776/3777 MLU supports punch records spanned across RUs if specified in BIND RU byte-15.

When the 3770 receives transparent data, it will not examine the characters to be punched; all 256 codes can be punched.

Outbound Diskette Data

Each data set identified by the data set delimiting indicators in the FM header will create a new data set on the diskette. The data set will be closed when an FM header with End Destination Select is received. The contents of the RUs should be formatted as they would be for the final destination device.

When a data set to be written on diskette is received, the 3770 will write either a basic exchange data set or a "transmission" data set. The type of data set is determined by the OUTPUT or HOSTOUT specification for the media/subaddress. Also, the "properties" byte (RU byte 4) of an Exchange medium FM header can specifically require that the output be defined as a T-type data set.

When writing a basic exchange data set, the 3770 uses the record length specified in the FM header or the control characters for the media type specified in the OUTPUT or HOSTOUT specification to deblock the records in the RU. One record per 128-byte sector is written to diskette. If the record length is less than 128, the 3770 pads with nulls. A basic exchange data set may contain multiple chains, but the extent of the chains is lost once the data is written to diskette. Records received with less than the specified record size will be padded with blanks to the specified record size.

If an output error occurs while receiving multivolume chains, recovery may result in duplicate data. This occurs because data chain(s) already received, and written on a previous volume, cannot be purged.

If T-format is specified in the OUTPUT or HOSTOUT procedure, the 3770 will create a "transmission" data set. Two (four, if in 512-byte mode) 128-byte sectors will be written per RU. If the RU contains fewer than 256 (512) bytes of data, the 3770 pads with nulls.

The extent of each chain is maintained by inserting an IUS in the buffer before writing to the diskette. Compressed data is allowed in "transmission" data sets; compacted data is not. Basic exchange and "transmission" data sets cannot be mixed on the same diskette.

Outbound Printer Data

The 3770 will accept print records spanned across RU boundaries, but records may not be spanned across chains. SCBs may be used for data compression. The channel settings may be specified with the Set Vertical Format (SVF) sequence or set locally by the 3770 operator.

SNA Format Controls

The following summarizes the characters from the SNA standard character string (SCS) used by the 3770 keyboard/console printer for format control.

Set Vertical Format (SVF)

EBCDIC = 2BC2

This function sets vertical formatting controls including maximum print line, top margin, bottom margin, and vertical tab (T1...Tn) stops. A one-byte count follows the set vertical format code and is a binary count of the parameters that follow the SVF code (including the count parameter itself). The SVF count code itself sets all vertical formatting controls to their default values. The first three values following the count define the maximum print line, top margin, and bottom margin in that order. A zero value for any of these parameters is a no-op and results in the function retaining its default value. Vertical tab stop values start in the fifth parameter position following the SVF code. Parameters of SVF are one binary byte each. The following sequences (and only these) are valid:

SVF count				
SVF count	MPL			
SVF count	MPL	TM	BM	
SVF count	MPL	TM	BM	T1 . . . Tn

Because it is possible for the current line number to be outside the bounds specified in the set vertical format sequence after the new vertical formats are established, the current line number is reset to the top margin when the SVF code is detected prior to decoding the sequence. Printer forms should therefore be positioned at the top margin. The SVF sequence does not result in any forms movement.

The set vertical format sequence is not generated for inclusion in the 3770-to-host processor data stream.

Maximum Print Line (MPL): This one-byte binary value specifies the last usable line of a page (form). Valid values are from 1 to 127.

The maximum print line value is used to calculate the number of line feeds to perform when a form feed (FF) function is requested.

The default value of the maximum print line is one.

Top Margin (TM): This one-byte binary value specifies the top margin of the page. It is assumed that the forms are positioned at the top margin when the set vertical format sequence is received and any subsequent forms feed function causes a skip to the top margin of the next page. The default value for the top margin is line 1. The top margin value is stored in channel one. Thus, a skip to channel one causes the forms to move to the top margin position.

Bottom Margin (BM): This one-byte binary value specifies the line value following which an automatic skip to the top margin of the next page takes place. Whenever a line positioning function occurs which would cause the current line value to exceed the bottom margin, the skip function is executed. Valid bottom margin values are less than or equal to the maximum print line. If an invalid bottom margin value is detected, an error response is generated and processing of the request unit is terminated immediately. The vertical format parameter for maximum print line remains as specified, but the bottom margin and tab stops retain their default values.

Tab Stop Parameters (T1...Tn): The vertical tab stop parameters set line number values for use with the vertical tab (VT) function or the select (SEL) function. Valid tab stop line values are between the top margin and the bottom margin (X'00' is also valid). The maximum number of stops that can be set is 11. If the number of tab stops exceeds 11, then only the first 11 are set and the remainder are ignored with no error indicated.

Set Line Density (SLD)

EBCDIC = 2BC6

This function specifies the distance to be moved for a single line vertical spacing operation such as a line feed (LF) or new line (NL). A one-byte count field and a one-byte binary parameter follow the set line density code. The count field is a binary count of the parameters that follow the SLD code (including the count parameter itself). The value of the binary parameter (PTS) specifies the vertical spacing distance in standard typographic points, where one point equals 1/72 inch (0.0353 mm). The following sequences (and only these) are valid.

SLD count
SLD count PTS

Points (PTS): This one-byte parameter specifies the number of typographic points in a single line vertical spacing operation. A value of 12 (X'0C') specifies 6 lines per inch (1 line per 4.233 mm). A value of 9 (X'09') specifies 8 lines per inch (1 line per 3.175 mm). A value of 0 specifies the default which is 6 lines per inch.

Vertical Tab (VT)

EBCDIC = 0B

This function moves the print position vertically from its current line number to the line value specified by the next higher vertical tab stop setting. If a vertical tab stop function is set for the current line number, that stop is ignored.

Output Data to 3770: If no vertical tab stops have been set or if the current line number is equal to or greater than the highest tab stop value, the vertical tab function executes the equivalent of a line feed with the following resultant movement:

a. If the current line number equals the bottom margin and the bottom margin is not equal to the maximum print line then the print position is moved to the top margin of the next page.
b. If the current line number equals the maximum print line, then the print position is moved to the top margin of the next page.
c. If neither the (a) nor the (b) condition exists then the print position is moved to the next line.

There is no special consideration if the vertical tab is specified at print position MPP + 1.

Line Feed (LF)

EBCDIC = 25

This function moves the print position vertically from its current position to the next line.

Output Data to 3770: If the current line number equals the bottom margin or the maximum print line, the following can occur:

a. If the current line number equals the bottom margin and the bottom margin is not equal to the maximum print line then the print position is moved to the top margin of the next page.
b. If the current line number equals the maximum print line, then the print position is moved to the top margin of the next page.
c. If neither the (a) nor the (b) condition exists then the print position is moved to the next line.

There is no special consideration if the line feed is specified at print position MPP + 1.

Form Feed (FF)

EBCDIC = 0C

This function moves the print position to the top margin line and the left margin print position of the next page.

Output Data to 3770: If default forms control has been specified (maximum print line = 1), the form feed function executes the equivalent of a NL function. Since the bottom margin must equal 1 if maximum print line = 1, the new line function moves the print position to the left margin of the next line. There is no special consideration if the current position equals MPP + 1.

Record Separator (IRS)

EBCDIC = 1E

This control code performs the function of terminating a line of print, a transparent data stream, or a secure data string. The following is a description of its use in terminating a line of print.

Output Data to 3770: The record separator (IRS) function code forces a carriage return (CR) and line feed (LF) function as follows:

a. If the current line number equals the bottom margin value and the bottom margin value is not equal to the maximum print line value then the print position is moved to the left margin print position and the top margin line of the next form.
b. If the current line number equals the maximum print line value, then the print position is moved to the left margin print position and the top margin line of the next form.
c. If neither the (a) nor the (b) condition exists, then the print position is moved to the left margin on the next line.

There is no special consideration if the IRS code is specified at print position MPP + 1.

New Line (NL)

EBCDIC = 15

Output Data to 3770: The new line function code forces a carriage return (CR) and line feed (LF) function as follows:

a. If the current line number equals the bottom margin value and the bottom margin value is not equal to the maximum print line value, then the print position is moved to the left margin print position and the top margin line of the next form.
b. If the current line number equals the maximum print line value, then the print position is moved to the left margin print position and the top margin line of the next form.
c. If neither the (a) nor the (b) condition exists then the print position is moved to the left margin on the next line.

Note: If data being printed contains compression/expansion characters and if the expansion moves the print position beyond the maximum print position, an automatic carriage return and line feed occurs.

Carriage Return (CR)

EBCDIC = 0D

Output Data to 3770: This function moves the print position from the current position to the left margin. If the current position equals the left margin, the function is effectively a no-op. There is no special consideration if the carriage return function code is specified at print position MPP + 1.

Input Data from 3770: This function is not available and will not be present in the 3770-to-host processor data stream.

Inhibit Print (INP)

EBCDIC = 24

INP is detected only in the console data stream.

Output Data to 3770: This function disables the displaying of keyboard-entered data.

The inhibit print function code is not present in the 3770-to-host processor data stream.

Enable Print (ENP)

EBCDIC = 14

ENP is detected only in the console data stream.

Output Data to 3770: This function restores the displaying of keyboard-entered data.

Input Data from 3770: The enabled print function code is not present in the 3770-to-host processor data stream.

Secure String Reader (SSR)

EBCDIC = 0450

Output Data to 3770: SSR is not supported in the host processor-to-3770 data stream.

Input Data from 3770: If the Operator ID badge reader is used, the 3770 precedes the data from the card with an SSR and appends an IRS code to the reader data.

Select (SEL)

EBCDIC = 04

The SEL function is used for vertical forms control as defined by SVF or as set locally by the operator. The SEL function is followed by a one-byte parameter which specifies the channel number:

Channel	*Select Parameter*
1...9	X'81' ... X'89'
10...12	X'7A' ... X'7C'

The SEL function moves the print position vertically from its current line number to the line value specified by the channel number setting. If the channel number setting is less than or equal to the current line number, forms movement will be to that line number on the next form. If the channel number setting does not contain a line value, the SEL function executes the equivalent of a line feed (LF). An invalid selection sequence results in an error condition.

Output Data to 3770: If SEL is detected in the host processor-to-3770 data stream and the select parameter is valid, the 3770 executes the forms control function. If an invalid select parameter is received, the 3770 sends an error response and immediately terminates processing of the request unit.

Transparent (TRN)

EBCDIC = 35

This control code is used to denote the start of a transparent data stream. It is followed by a one-byte binary count that indicates the number of bytes of transparent data. The transparent data stream is terminated by an IRS (record separator) character.

Undefined Graphics

If an undefined graphic (X'40'-X'FF') or an undefined SCS control code (beginning with a binary '01') is received, the 3770 prints a "-". X'00' is printed as a blank.

SCS Error Summary

The 3776/3777 sends a negative response indicating a parameter error (sense = X'10050000') when any of the following conditions are detected:

BM > MPL
VT > BM
SEL = Invalid Parameter
SVF Count = 0
SVF Spans an RU

SDLC Considerations

Details of the SDLC link level control are included in *IBM Synchronous Data Link Control General Information,* GA27-3093.

Terminal ID

The ID information from the 3770 for the SDLC XID command consists of six bytes. Bytes one and two are fixed; bytes three through six are entered by the user, in hexadecimal notation, as part of the TIP definition. The format is as follows:

Byte	1	2	3	4	5	6
Value	02	00	MM	M J	JJ	SS

Byte 1 (02): Fixed

Byte 2 (00): Fixed

Bytes 3 and first half of 4 (MM M) — Block Number (IDBLK - 12 bits): X'013' for 3776/3777

Second half of byte 4 through byte 6 (J JJ SS) — ID Number (IDNUM - 20 bits) where:
SS = SDLC address
JJJ = Unique terminal identification for use with the SDLC command: Exchange ID (XID)
If exchange ID is not used, the value can be X'000'

For example, assume a 3776 terminal with JJJ = X'00B' and SS = X'C1'. The terminal ID bytes from the 3776 would be sent to the CPU as:

Byte	1	2	3	4	5	6
Hex	02	00	01	30	0B	C1

Fan Out and SNBU

The 3770 terminals use fan-out modems on a multipoint basis only.

Appendix A. Code Charts

Figures A-1 and A-2 show the code charts.

CHAR.	CARD CODE	EBCDIC CODE						HEX
NUL	12-0-1-8-9							00
SOH	12-1-9						7	01
STX	12-2-9					6		02
ETX	12-3-9					6	7	03
PF	12-4-9				5			04
HT	12-5-9				5		7	05
LC	12-6-9				5	6		06
DEL	12-7-9				5	6	7	07
	12-8-9			4				08
RLF	12-1-8-9			4			7	09
SMM	12-2-8-9			4		6		0A
VT	12-3-8-9			4		6	7	0B
FF	12-4-8-9			4	5			0C
CR	12-5-8-9			4	5		7	0D
SO	12-6-8-9			4	5	6		0E
SI	12-7-8-9			4	5	6	7	0F
DLE	12-11-1-8-9		3					10
DC1	11-1-9		3				7	11
DC2	11-2-9		3			6		12
DC3(TM)	11-3-9		3			6	7	13
RES	11-4-9		3		5			14
NL	11-5-9		3		5		7	15
BS	11-6-9		3		5	6		16
IL	11-7-9		3		5	6	7	17
CAN	11-8-9		3	4				18
EM	11-1-8-9		3	4			7	19
CC	11-2-8-9		3	4		6		1A
CU1	11-3-8-9		3	4		6	7	1B
IFS	11-4-8-9		3	4	5			1C
IGS	11-5-8-9		3	4	5		7	1D
IRS	11-6-8-9		3	4	5	6		1E
IUS	11-7-8-9		3	4	5	6	7	1F
DS	11-0-1-8-9	2						20
SOS	0-1-9	2					7	21
FS	0-2-9	2				6		22
	0-3-9	2				6	7	23
BYP	0-4-9	2			5			24
LF	0-5-9	2			5		7	25
ETB(EOB)	0-6-9	2			5	6		26
ESC(PRE)	0-7-9	2			5	6	7	27
	0-8-9	2		4				28
	0-1-8-9	2		4			7	29
SM	0-2-8-9	2		4		6		2A
CU2	0-3-8-9	2		4		6	7	2B
	0-4-8-9	2		4	5			2C
ENQ	0-5-8-9	2		4	5		7	2D
ACK	0-6-8-9	2		4	5	6		2E
BEL	0-7-8-9	2		4	5	6	7	2F
	12-11-0-1-8-9	2	3					30
	1-9	2	3				7	31
SYN	2-9	2	3			6		32
	3-9	2	3			6	7	33
PN	4-9	2	3		5			34
RS	5-9	2	3		5		7	35
UC	6-9	2	3		5	6		36
EOT	7-9	2	3		5	6	7	37
	8-9	2	3	4				38
	1-8-9	2	3	4			7	39
	2-8-9	2	3	4		6		3A
CU3	3-8-9	2	3	4		6	7	3B
DC4	4-8-9	2	3	4	5			3C
NAK	5-8-9	2	3	4	5		7	3D
	6-8-9	2	3	4	5	6		3E
SUB	7-8-9	2	3	4	5	6	7	3F

Sys 360 Byte 0 1 2 3 4 5 6 7

↑ First bit transmitted on the communications line

CHAR.	CARD CODE	EBCDIC CODE							HEX
SPACE	NO PUNCHING	1							40
	12-0-1-9	1						7	41
	12-0-2-9	1					6		42
	12-0-3-9	1					6	7	43
	12-0-4-9	1				5			44
	12-0-5-9	1				5		7	45
	12-0-6-9	1				5	6		46
	12-0-7-9	1				5	6	7	47
	12-0-8-9	1			4				48
	12-1-8	1			4			7	49
¢	12-2-8	1			4		6		4A
.	12-3-8	1			4		6	7	4B
<	12-4-8	1			4	5			4C
(	12-5-8	1			4	5		7	4D
+	12-6-8	1			4	5	6		4E
|	12-7-8	1			4	5	6	7	4F
&	12	1		3					50
	12-11-1-9	1		3				7	51
	12-11-2-9	1		3				6	52
	12-11-3-9	1		3			6	7	53
	12-11-4-9	1		3		5			54
	12-11-5-9	1		3		5		7	55
	12-11-6-9	1		3		5	6		56
	12-11-7-9	1		3		5	6	7	57
	12-11-8-9	1		3	4				58
	11-1-8	1		3	4			7	59
!	11-2-8	1		3	4		6		5A
$	11-3-8	1		3	4		6	7	5B
*	11-4-8	1		3	4	5			5C
)	11-5-8	1		3	4	5		7	5D
;	11-6-8	1		3	4	5	6		5E
¬	11-7-8	1		3	4	5	6	7	5F
–	11	1	2						60
/	0-1	1	2					7	61
	11-0-2-9	1	2				6		62
	11-0-3-9	1	2				6	7	63
	11-0-4-9	1	2			5			64
	11-0-5-9	1	2			5		7	65
	11-0-6-9	1	2			5	6		66
	11-0-7-9	1	2			5	6	7	67
	11-0-8-9	1	2		4				68
	0-1-8	1	2		4			7	69
¦	12-11	1	2		4		6		6A
,	0-3-8	1	2		4		6	7	6B
%	0-4-8	1	2		4	5			6C
_	0-5-8	1	2		4	5		7	6D
>	0-6-8	1	2		4	5	6		6E
?	0-7-8	1	2		4	5	6	7	6F
	12-11-0	1	2	3					70
	12-11-0-1-9	1	2	3				7	71
	12-11-0-2-9	1	2	3			6		72
	12-11-0-3-9	1	2	3			6	7	73
	12-11-0-4-9	1	2	3		5			74
	12-11-0-5-9	1	2	3		5		7	75
	12-11-0-6-9	1	2	3		5	6		76
	12-11-0-7-9	1	2	3		5	6	7	77
	12-11-0-8-9	1	2	3	4				78
`	1-8	1	2	3	4			7	79
:	2-8	1	2	3	4		6		7A
#	3-8	1	2	3	4		6	7	7B
@	4-8	1	2	3	4	5			7C
'	5-8	1	2	3	4	5		7	7D
=	6-8	1	2	3	4	5	6		7E
"	7-8	1	2	3	4	5	6	7	7F

Figure A-1. EBCDIC Code Set (Part 1 of 2)

CHAR.	CARD CODE	EBCDIC CODE								HEX
	12-0-1-8	0								80
a	12-0-1	0							7	81
b	12-0-2	0						6		82
c	12-0-3	0						6	7	83
d	12-0-4	0					5			84
e	12-0-5	0					5		7	85
f	12-0-6	0					5	6		86
g	12-0-7	0					5	6	7	87
h	12-0-8	0				4				88
i	12-0-9	0				4			7	89
	12-0-2-8	0				4		6		8A
	12-0-3-8	0				4		6	7	8B
	12-0-4-8	0				4	5			8C
	12-0-5-8	0				4	5		7	8D
	12-0-6-8	0				4	5	6		8E
	12-0-7-8	0				4	5	6	7	8F
	12-11-1-8	0			3					90
j	12-11-1	0			3				7	91
k	12-11-2	0			3			6		92
l	12-11-3	0			3			6	7	93
m	12-11-4	0			3		5			94
n	12-11-5	0			3		5		7	95
o	12-11-6	0			3		5	6		96
p	12-11-7	0			3		5	6	7	97
q	12-11-8	0			3	4				98
r	12-11-9	0			3	4			7	99
	12-11-2-8	0			3	4		6		9A
	12-11-3-8	0			3	4		6	7	9B
	12-11-4-8	0			3	4	5			9C
	12-11-5-8	0			3	4	5		7	9D
	12-11-6-8	0			3	4	5	6		9E
	12-11-7-8	0			3	4	5	6	7	9F
	11-0-1-8	0		2						A0
~	11-0-1	0		2					7	A1
s	11-0-2	0		2				6		A2
t	11-0-3	0		2				6	7	A3
u	11-0-4	0		2			5			A4
v	11-0-5	0		2			5		7	A5
w	11-0-6	0		2			5	6		A6
x	11-0-7	0		2			5	6	7	A7
y	11-0-8	0		2		4				A8
z	11-0-9	0		2		4			7	A9
	11-0-2-8	0		2		4		6		AA
	11-0-3-8	0		2		4		6	7	AB
	11-0-4-8	0		2		4	5			AC
[	11-0-5-8	0		2		4	5		7	AD
	11-0-6-8	0		2		4	5	6		AE
	11-0-7-8	0		2		4	5	6	7	AF
	12-11-0-1-8	0		2	3					B0
	12-11-0-1	0		2	3				7	B1
	12-11-0-2	0		2	3			6		B2
	12-11-0-3	0		2	3			6	7	B3
	12-11-0-4	0		2	3		5			B4
	12-11-0-5	0		2	3		5		7	B5
	12-11-0-6	0		2	3		5	6		B6
	12-11-0-7	0		2	3		5	6	7	B7
	12-11-0-8	0		2	3	4				B8
	12-11-0-9	0		2	3	4			7	B9
	12-11-0-2-8	0		2	3	4		6		BA
	12-11-0-3-8	0		2	3	4		6	7	BB
	12-11-0-4-8	0		2	3	4	5			BC
]	12-11-0-5-8	0		2	3	4	5		7	BD
	12-11-0-6-8	0		2	3	4	5	6		BE
	12-11-0-7-8	0		2	3	4	5	6	7	BF

CHAR	CARD CODE	EBCDIC CODE								HEX
{	12-0	0	1							C0
A	12-1	0	1						7	C1
B	12-2	0	1					6		C2
C	12-3	0	1					6	7	C3
D	12-4	0	1				5			C4
E	12-5	0	1				5		7	C5
F	12-6	0	1				5	6		C6
G	12-7	0	1				5	6	7	C7
H	12-8	0	1			4				C8
I	12-9	0	1			4			7	C9
	12-0-2-8-9	0	1			4		6		CA
	12-0-3-8-9	0	1			4		6	7	CB
ʃ	12-0-4-8-9	0	1			4	5			CC
	12-0-5-8-9	0	1			4	5		7	CD
Ψ	12-0-6-8-9	0	1			4	5	6		CE
	12-0-7-8-9	0	1			4	5	6	7	CF
}	11-0	0	1		3					D0
J	11-1	0	1		3				7	D1
K	11-2	0	1		3			6		D2
L	11-3	0	1		3			6	7	D3
M	11-4	0	1		3		5			D4
N	11-5	0	1		3		5		7	D5
O	11-6	0	1		3		5	6		D6
P	11-7	0	1		3		5	6	7	D7
Q	11-8	0	1		3	4				D8
R	11-9	0	1		3	4			7	D9
	12-11-2-8-9	0	1		3	4		6		DA
	12-11-3-8-9	0	1		3	4		6	7	DB
	12-11-4-8-9	0	1		3	4	5			DC
	12-11-5-8-9	0	1		3	4	5		7	DD
	12-11-6-8-9	0	1		3	4	5	6		DE
	12-11-7-8-9	0	1		3	4	5	6	7	DF
\	0-2-8	0	1	2						E0
	11-0-1-9	0	1	2					7	E1
S	0-2	0	1	2				6		E2
T	0-3	0	1	2				6	7	E3
U	0-4	0	1	2			5			E4
V	0-5	0	1	2			5		7	E5
W	0-6	0	1	2			5	6		E6
X	0-7	0	1	2			5	6	7	E7
Y	0-8	0	1	2		4				E8
Z	0-9	0	1	2		4			7	E9
	11-0-2-8-9	0	1	2		4		6		EA
	11-0-3-8-9	0	1	2		4		6	7	EB
⑁	11-0-4-8-9	0	1	2		4	5			EC
	11-0-5-8-9	0	1	2		4	5		7	ED
	11-0-6-8-9	0	1	2		4	5	6		EE
	11-0-7-8-9	0	1	2		4	5	6	7	EF
0	0	0	1	2	3					F0
1	1	0	1	2	3				7	F1
2	2	0	1	2	3			6		F2
3	3	0	1	2	3			6	7	F3
4	4	0	1	2	3		5			F4
5	5	0	1	2	3		5		7	F5
6	6	0	1	2	3		5	6		F6
7	7	0	1	2	3		5	6	7	F7
8	8	0	1	2	3	4				F8
9	9	0	1	2	3	4			7	F9
	12-11-0-2-8-9	0	1	2	3	4		6		FA
	12-11-0-3-8-9	0	1	2	3	4		6	7	FB
	12-11-0-4-8-9	0	1	2	3	4	5			FC
	12-11-0-5-8-9	0	1	2	3	4	5		7	FD
	12-11-0-6-8-9	0	1	2	3	4	5	6		FE
	12-11-0-7-8-9	0	1	2	3	4	5	6	7	FF

Figure A-1. EBCDIC Code Set (Part 2 of 2)

CHAR.	CARD CODE	ASCII CODE								HEX
NUL	12-0-9-8-1								P	00
SOH	12-9-1	1								01
STX	12-9-2		2							02
ETX	12-9-3	1	2						P	03
EOT	9-7			3						04
ENQ	0-9-8-5	1		3					P	05
ACK	0-9-8-6		2	3					P	06
BEL	0-9-8-7	1	2	3						07
BS	11-9-6				4					08
HT	12-9-5	1			4				P	09
LF	0-9-5		2		4				P	0A
VT	12-9-8-3	1	2		4					0B
FF	12-9-8-4			3	4				P	0C
CR	12-9-8-5	1		3	4					0D
SO	12-9-8-6		2	3	4					0E
SI	12-9-8-7	1	2	3	4				P	0F
DLE	12-11-9-8-1					5				10
DC1	11-9-1	1				5			P	11
DC2	11-9-2		2			5			P	12
DC3	11-9-3	1	2			5				13
DC4	4-8-9			3		5			P	14
NAK	9-8-5	1		3		5				15
SYN	9-2		2	3		5				16
ETB	0-9-6	1	2	3		5			P	17
CAN	11-9-8				4	5			P	18
EM	11-9-8-1	1			4	5				19
SUB	9-8-7		2		4	5				1A
ESC	0-9-7	1	2		4	5			P	1B
FS	11-9-8-4			3	4	5				1C
GS	11-9-8-5	1		3	4	5			P	1D
RS	11-9-8-6		2	3	4	5			P	1E
US	11-9-8-7	1	2	3	4	5				1F
SPACE	NO PUNCHES						6			20
!	12-8-7	1					6		P	21
"	8-7		2				6		P	22
#	8-3	1	2				6			23
$	11-8-3			3			6		P	24
%	0-8-4	1		3			6			25
&	12		2	3			6			26
'	8-5	1	2	3			6		P	27
(	12-8-5				4		6		P	28
)	11-8-5	1			4		6			29
*	11-8-4		2		4		6			2A
+	12-8-6	1	2		4		6		P	2B
,	0-8-3			3	4		6			2C
-	11	1		3	4		6		P	2D
.	12-8-3		2	3	4		6		P	2E
/	0-1	1	2	3	4		6			2F
0	0					5	6		P	30
1	1	1				5	6			31
2	2		2			5	6			32
3	3	1	2			5	6		P	33
4	4			3		5	6			34
5	5	1		3		5	6		P	35
6	6		2	3		5	6		P	36
7	7	1	2	3		5	6			37
8	8				4	5	6			38
9	9	1			4	5	6		P	39
:	8-2		2		4	5	6		P	3A
;	11-8-6	1	2		4	5	6			3B
<	12-8-4			3	4	5	6		P	3C
=	8-6	1		3	4	5	6			3D
>	0-8-6		2	3	4	5	6			3E
?	0-8-7	1	2	3	4	5	6		P	3F

CHAR.	CARD CODE	ASCII CODE								HEX
@	8-4							7		40
A	12-1	1						7	P	41
B	12-2		2					7	P	42
C	12-3	1	2					7		43
D	12-4			3				7	P	44
E	12-5	1		3				7		45
F	12-6		2	3				7		46
G	12-7	1	2	3				7	P	47
H	12-8				4			7	P	48
I	12-9	1			4			7		49
J	11-1		2		4			7		4A
K	11-2	1	2		4			7	P	4B
L	11-3			3	4			7		4C
M	11-4	1		3	4			7	P	4D
N	11-5		2	3	4			7	P	4E
O	11-6	1	2	3	4			7		4F
P	11-7					5		7	P	50
Q	11-8	1				5		7		51
R	11-9		2			5		7		52
S	0-2	1	2			5		7	P	53
T	0-3			3		5		7		54
U	0-4	1		3		5		7	P	55
V	0-5		2	3		5		7	P	56
W	0-6	1	2	3		5		7		57
X	0-7				4	5		7		58
Y	0-8	1			4	5		7	P	59
Z	0-9		2		4	5		7	P	5A
[	12-8-2	1	2		4	5		7		5B
\	0-8-2			3	4	5		7	P	5C
]	11-8-2	1		3	4	5		7		5D
∧	11-8-7		2	3	4	5		7		5E
—	0-8-5	1	2	3	4	5		7	P	5F
`	8-1						6	7	P	60
a	12-0-1	1					6	7		61
b	12-0-2		2				6	7		62
c	12-0-3	1	2				6	7	P	63
d	12-0-4			3			6	7		64
e	12-0-5	1		3			6	7	P	65
f	12-0-6		2	3			6	7	P	66
g	12-0-7	1	2	3			6	7		67
h	12-0-8				4		6	7		68
i	12-0-9	1			4		6	7	P	69
j	12-11-1		2		4		6	7	P	6A
k	12-11-2	1	2		4		6	7		6B
l	12-11-3			3	4		6	7	P	6C
m	12-11-4	1		3	4		6	7		6D
n	12-11-5		2	3	4		6	7		6E
o	12-11-6	1	2	3	4		6	7	P	6F
p	12-11-7					5	6	7		70
q	12-11-8	1				5	6	7	P	71
r	12-11-9		2			5	6	7	P	72
s	11-0-2	1	2			5	6	7		73
t	11-0-3			3		5	6	7	P	74
u	11-0-4	1		3		5	6	7		75
v	11-0-5		2	3		5	6	7		76
w	11-0-6	1	2	3		5	6	7	P	77
x	11-0-7				4	5	6	7	P	78
y	11-0-8	1			4	5	6	7		79
z	11-0-9		2		4	5	6	7		7A
{	12-0	1	2		4	5	6	7	P	7B
	12-11			3	4	5	6	7		7C
}	11-0	1		3	4	5	6	7	P	7D
~	11-0-1		2	3	4	5	6	7	P	7E
DEL	12-9-7	1	2	3	4	5	6	7		7F

Sys/360 Byte	0	1	2	3	4	5	6	7
ASCII Bit	P	7	6	5	4	3	2	1

P: Not included in the above Hex count

1: First bit transmitted on the communications line

Figure A-2. ASCII Code Set

ASCII - EBCDIC Translations

The following table defines the translation between ASCII and EBCDIC for SNA. Differences for BSC are shown in parenthesis.

ASCII (HEX)	ASCII Character	EBCDIC (HEX)	ASCII (HEX)	ASCII Character	EBCDIC (HEX)
00	NUL	00	30	0	F0
01	Reserved	01	31	1	F1
02	Reserved	02	32	2	F2
03	Reserved	03	33	3	F3
04	Reserved	37	34	4	F4
05	Reserved	2D	35	5	F5
06	Reserved	2E	36	6	F6
07	BEL	2F	37	7	F7
08	BS	16	38	8	F8
09	HT	05	39	9	F9
0A	LF	25	3A	:	7A
0B	VT	0B	3B	;	5E
0C	FF	0C	3C	<	4C
0D	CR	0D	3D	=	7E
0E	Reserved	0E	3E	>	6E
0F	Reserved	0F	3F	?	6F
10	Reserved	10	40	@	7C
11	ENP	14 (11)	41	A	C1
12	INP	24 (12)	42	B	C2
13	SEL	04 (13)	43	C	C3
14	NL	15 (3C)	44	D	C4
15	Reserved	3D	45	E	C5
16	Reserved	32	46	F	C6
17	Reserved	26	47	G	C7
18	CAN	18	48	H	C8
19	Reserved	19	49	I	C9
1A	SUB	3F	4A	J	D1
1B	ESC	27	4B	K	D2
1C	Reserved	1C	4C	L	D3
1D	Reserved	1D	4D	M	D4
1E	RS	1E	4E	N	D5
1F	Reserved	1F	4F	O	D6
20	Space	40	50	P	D7
21	!	4F	51	Q	D8
22	”	7F	52	R	D9
23	#	7B	53	S	E2
24	$	5B	54	T	E3
25	%	6C	55	U	E4
26	&	50	56	V	E5
27	’	7D	57	W	E6
28	(	4D	58	X	E7
29	)	5D	59	Y	E8
2A	*	5C	5A	Z	E9
2B	+	4E	5B	[	4A
2C	,	6B	5C	\	E0
2D	-	60	5D	]	5A
2E	.	4B	5E	∧	5F
2F	/	61	5F	_	6D

ASCII (HEX)	ASCII Character	EBCDIC (HEX)	ASCII (HEX)	ASCII Character	EBCDIC (HEX)
60		79	70	p	97
61	a	81	71	q	98
62	b	82	72	r	99
63	c	83	73	s	A2
64	d	84	74	t	A3
65	e	85	75	u	A4
66	f	86	76	v	A5
67	g	87	77	w	A6
68	h	88	78	x	A7
69	i	89	79	y	A8
6A	j	91	7A	z	A9
6B	k	92	7B	{	C0
6C	l	93	7C	¦	6A
6D	m	94	7D	}	D0
6E	n	95	7E	~	A1
6F	o	96	7F	DEL	07

Appendix B. Character Sets

Figure B-1 shows the printable characters for the various character sets. The International character set is available for all World Trade countries. For a particular country, substitute the characters shown opposite that country for those shown for the International character set. Where no difference is shown, the printable characters are the same as shown for the International set.

The 3776 console line printer can have either a 48-, 64-, or 94-character print belt.

Characters shown for the printer that have no corresponding keyboard key can be printed only when received in data from a host processor or entered into the controller's buffer from an attached input device. Characters in print data that are not present on the line printer print belt will cause a hyphen to print.

There are some exceptions to the hyphen printing as the default character on the 3776 with a 48-character set specified in the controller and installed on the 3776 printer (character sets are shown in Figure B-1). Three "pairs" of characters are logically "OR-ed" together to allow interchangeability between the standard (AN) and the HN character set. The following table shows the interchangeability:

Character Set Specified for 3776 Controller	*Belt Installed on 3776 Printer*	*Data Stream Characters Received*	*Characters Printed*
AN Character Set Specified	AN Belt Installed	% # @) (=	% # @ - - -
	HN Belt Installed	% # @) (=	) (= - - -
HN Character Set Specified	AN Belt Installed	) (= % # @	% # @ % # @
	HN Belt Installed	) (= % # @	) (=) (=

For World Trade countries, the International character set keyboard is required for use with the HN print belt.

The ASCII character set for use in the U.S. and Canada is shown in Figure B-2. The Katakana character set is shown in Figure B-3.

The Operator ID Card Reader character set is shown in Figure B-4.

The EBCDIC and Katakana character sets used by the 1,024-character Console Display are shown in Figures B-5 and B-6.

Refer to the *IBM 3203 Component Description and Operator's Guide,* GA33-1515 for charts of printable characters on the 3203/1416 attached to the 3777.

48-Character Set — AN

Hex	4B	4E	50	5B	5C	60	61	6B	6C	7B	7C	7D	C1-E9	F0-F9
U.S. and Canada	.	+	&	$	*	–	/	,	%	#	@	'	A-Z	0-9
International	.	+	&	$	*	–	/	,	%	#	@	'	A-Z	0-9
Belgium											à			
Brazil				Ç						Õ	Ã			
Denmark/Norway				Å						Æ	Ø			
Finland/Sweden				Å						Ä	Ö			
France										£	à			
Italy										£	§			
Japan				¥										
Portugal										Ã	Õ			
Spain				₧						Ñ				
Spanish-Speaking										Ñ				
Austria/Germany											§			
United Kingdom				£										

Figure B-1. EBCDIC Printable Characters (Part 1 of 4)

48-Character Set —HN

Hex	4B	4D	4E	50	5B	5C	5D	60	61	6B	7D	7E	CI-E9	F0-F9
U. S. and Canada	.	(	+	&	$	*	)	-	/	,	'	=	A-Z	0-9
International	.	(	+	&	$	*	)	-	/	,	'	=	A-Z	0-9

Figure B-1. EBDIC Printable Characters (Part 2 of 4)

64-Character Set

Hex	4A	4B	4C	4D	4E	4F	50	5A	5B	5C	5D	5E	5F	60	61	6B	6C	6D	6E	6F	79*	7A	7B	7C	7D	7E	7F	C1-D9	E0	E2-E9	F0-F9
U.S. and Canada	¢	.	<	(	+	|	&	!	$	*	)	;	¬	-	/	,	%	_	>	?	`	:	#	@	'	=	"	A-R	\	S-Z	0-9
International	[	.	<	(	+	!	&	]	$	*	)	;	^	-	/	,	%	_	>	?	`	:	#	@	'	=	"	A-R	\	S-Z	0-9
Belgium																								à					ç		
Brazil	É							$	Ç												ã		Õ	Ã							
Denmark/Norway	#					|		¤	Å				¬										Æ	Ø							
Finland/Sweden	§					|		¤	Å				¬								é		Ä	Ö					É		
France	°							§															£	à					ç		
Italy	°							é													ù		£	§					ç		
Japan	£					|		!	¥				¬																$		
Portugal			Ç																				Ã	Õ					Ç		
Spain						|			₧				¬										Ñ								
Spanish-Speaking						|							¬										Ñ								
Austria/Germany	Ä							Ü																§					Ö		
United Kingdom	$					|		!	£				¬																		

*The 3521 with Card Print feature cannot print the hex '79' character.

For World Trade countries, substitute the character shown opposite the country for that shown for the International character set; where no difference is shown, the printable characters are the same as those shown for the International character set.

Figure B-1. EBCDIC Printable Characters (Part 3 of 4)

94-Character Set

Hex	4A	4B	4C	4D	4E	4F	50	5A	5B	5C	5D	5E	5F	60	61	6A	6B	6C	6D	6E	6F	79	7A	7B	7C	7D	7E	7F	81-89 91-99	A1	A2-A9	C0	C1-C9	D0	D1-D9	E0	E2-E9	F0-F9
U.S. and Canada	¢	•	<	(	+	|	&	!	$	*	)	;	¬	-	/	¦	,	%	_	>	?	`	:	#	@	'	=	"	a-r	~	s-z	{	A-I	}	J-R	\	S-Z	0-9
International	[	•	<	(	+	!	&	]	$	*	)	;	^	-	/	¦	,	%	_	>	?	`	:	#	@	'	=	"	a-r	~	s-z	{	A-I	}	J-R	\	S-Z	0-9
Belgium																ù									à					¨		é		è		ç		
Brazil	É							$	Ç							ç						ã		õ	Ã							õ		é				
Denmark/Norway	#					|		¤	Å				¬			ø								Æ	Ø					ü		æ		å				
Finland/Sweden	§					|		¤	Å				¬			ö						é		Ä	Ö					ü		ä		å		É		
France	°							§								ù								£	à					¨		é		è		ç		
Italy	°							é								ò						ù		£	§					ì		à		è		ç		
Japan	£					|		!	¥				¬																	—						$		
Portugal			Ç													õ								Ã	Õ					ç		ã				Ç		
Spain						|			₧				¬			ñ								Ñ						¨								
Spanish-Speaking						|							¬			ñ								Ñ						¨								
United Kingdom						|							¬											£						—								
Austria/Germany	Ä							Ü								ö									§					ß		ä		ü		Ö		
United Kingdom	$					|		!	£				¬																									

For World Trade countries, substitute the character shown opposite the country for that shown for the International character set; where no difference is shown, the printable characters are the same as those shown for the International character set.

Figure B-1. EBCDIC Printable Characters (Part 4 of 4)

48 – Character Set, U.S. and Canada, ASCII:
#$ % & ' * + , - . / 0123456789 @ ABCDEFGHIJKLMNOPQRSTUVWXYZ

64 – Character Set, U.S. and Canada, ASCII:
! " #$ % & ' ( ) * + , - . / 0123456789 : ; < = > ? @
ABCDEFGHIJKLMNOPQRSTUVWXYZ [\ ] ^ _ `

94 – Character Set, U.S. and Canada, ASCII:
! " #$ % & ' ( ) * + , - . / 0123456789 : ; < = > ? @
ABCDEFGHIJKLMNOPQRSTUVWXYZ [\ ] ^ _ `
abcdefghijklmnopqrstuvwxyz { ¦ } ~

Figure B-2. ASCII Printable Characters

	HEX	CHARACTER
	40	SP
	41	｡
	42	｢
	43	｣
	44	､
	45	･
	46	ｦ
*	47	ｧ
*	48	ｨ
*	49	ｩ
	4A	£
	4B	.
	4C	<
	4D	(
	4E	+
	4F	|
	50	&
*	51	ｪ
*	52	ｫ
*	53	ｬ
*	54	ｭ
*	55	ｮ
*	56	ｯ
†	58	—
	5A	!
	5B	¥
	5C	*
	5D	)
	5E	;
	5F	¬
†	60	-
	61	/
	6B	,
	6C	%
	6D	_
	6E	>
	6F	?
	7A	:
	7B	#
	7C	@
	7D	'
	7E	=
††	7F	"

	HEX	CHARACTER
	81	ｱ
	82	ｲ
	83	ｳ
	84	ｴ
	85	ｵ
	86	ｶ
	87	ｷ
	88	ｸ
	89	ｹ
	8A	ｺ
	8C	ｻ
	8D	ｼ
	8E	ｽ
	8F	ｾ
	90	ｿ
	91	ﾀ
	92	ﾁ
	93	ﾂ
	94	ﾃ
	95	ﾄ
	96	ﾅ
	97	ﾆ
	98	ﾇ
	99	ﾈ
	9A	ﾉ
	9D	ﾊ
	9E	ﾋ
	9F	ﾌ
*	A1	—
	A2	ﾍ
	A3	ﾎ
	A4	ﾏ
	A5	ﾐ
	A6	ﾑ
	A7	ﾒ
	A8	ﾓ
	A9	ﾔ
	AA	ﾕ
	AC	ﾖ
	AD	ﾗ
	AE	ﾘ
	AF	ﾙ

	HEX	CHARACTER
	BA	ﾚ
	BB	ﾛ
	BC	ﾜ
	BD	ﾝ
††	BE	ﾞ
	BF	ﾟ
	C1	A
	C2	B
	C3	C
	C4	D
	C5	E
	C6	F
	C7	G
	C8	H
	C9	I
	D1	J
	D2	K
	D3	L
	D4	M
	D5	N
	D6	O
	D7	P
	D8	Q
	D9	R
	E0	$
	E2	S
	E3	T
	E4	U
	E5	V
	E6	W
	E7	X
	E8	Y
	E9	Z
	F0	0
	F1	1
	F2	2
	F3	3
	F4	4
	F5	5
	F6	6
	F7	7
	F8	8
	F9	9

*These characters are not displayed by the 3776 Models 3 and 4 and the 3777 Models 2 and 3
†All 3776 Models and the 3777 Models 2 and 3 display X'58' and X'60' as the same character (—).
††The 3776 Models 3 and 4 and the 3777 Models 2 and 3 display X'7F' and X'BE' as the same character (").

Figure B-3. Katakana Character Set

IDR READ	CHAR	EBCDIC XMIT HEX	ASCII XMIT HEX	BSC	SNA
0000	0	F0	30		
0001	1	F1	31		
0010	2	F2	32		
0011	3	F3	33		
0100	4	F4	34		
0101	5	F5	35		
0110	6	F6	36		
0111	7	F7	37		
1000	8	F8	38		
1001	9	F9	39		
1010		7A	3A	OID	OID
1011	%	6C	25	SOR	Start Station
1100	@	7C	40		
1101	¬ EBCDIC Λ ASCII	5F	5E		FS
1110	=	7E	3D		
1111	?	6F	3F	EOC	

Format of magnetically recorded data:

Operator ID Card (Note 3)

SOR	OID	Up to 15 characters (excluding EOC)	EOC	LRC

Credit Card

SOR	Up to 37 characters (excluding EOC)	EOC	LRC

BSC format of data in buffer:

Operator ID Card

ESC	F4	OID	Up to 15 characters (excluding EOC)	EOC	IRS

Credit Card

ESC	F4	Up to 37 characters (excluding EOC)	EOC	IRS

SNA format of data in buffer:

Operator ID Card

04	50	Up to 15 characters (excluding EOC)	IRS

Credit Card

Up to 37 characters of badge data only (excluding EOC)

Notes:

1. A VRC bit is included in IDR read data. This bit is checked by the 3770 but is not included in the transmitted character. The bit is not shown above.
2. The LRC character is checked by the 3770. The LRC character contains a one bit in each bit position for which an even number of one bits occur in the recorded data.
3. The 3777-2 transmits this data as it appears on the badge (preceded by control bytes the same as from a SYS REQ).

Figure B-4. Operator Identification Card Reader Character Set

64-Character Set

	Hex	4A	4B	4C	4D	4E	4F	50	5A	5B	5C	5D	5E	5F	60	61	6B	6C	6D	6E	6F	79	7A	7B	7C	7D	7E	7F	C1-D9	E0	E2-E9	F0-F9
U.S. and Canada		¢	•	<	(	+	|	&	!	$	*	)	;	¬	-	/	,	%	_	>	?	`	:	#	@	'	=	"	A-R	\	S-Z	0-9
International		[	•	<	(	+	!	&	]	$	*	)	;	^	-	/	,	%	_	>	?	`	:	#	@	'	=	"	A-R	\	S-Z	0-9
Belgium																									X					Ç		
Brazil		É							$	Ç												X		Õ	Ã							
Denmark/Norway		#					|		X	Å				¬										Æ	Ø							
Finland/Sweden		X					|		X	Å				¬								X		Ä	Ö					É		
France		X							X															£	X					X		
Italy		X							X													X		£	X					X		
Japan		£					|		!	¥				¬																$		
Portugal				Ç																				Ã	Õ					Ç		
Spain							|			₧				¬										Ñ								
Spanish-Speaking							|							¬										Ñ								
Austria/Germany		Ä					!		Ü	$				^										#	§					Ö		
United Kingdom		$					|		!	£				¬										#	@					\		

For World Trade countries, substitute the character shown opposite the country for that shown for the International character set. Where no difference is shown, the displayable characters are the same as those shown for the International character set. Where a large ☒ is shown, these EBCDIC values are displayed as a blank.

Figure B-5. EBCDIC Character Set for the Console Display on 3776/3777 Models (1,024-character display)

Print Train Images

Each 3203 print train received by the user is accompanied by a series of punched cards representing the characters contained on the train. Generally, this card deck will not be needed because most users will use one of the images supplied in terminal storage. However, if the desired image has been deleted from storage or if an image other than one of those supplied is desired, the 'Define a Print Train Image (TRAIN)' command can be used to place the image into storage. Figure B-6 shows an example of the image card format.

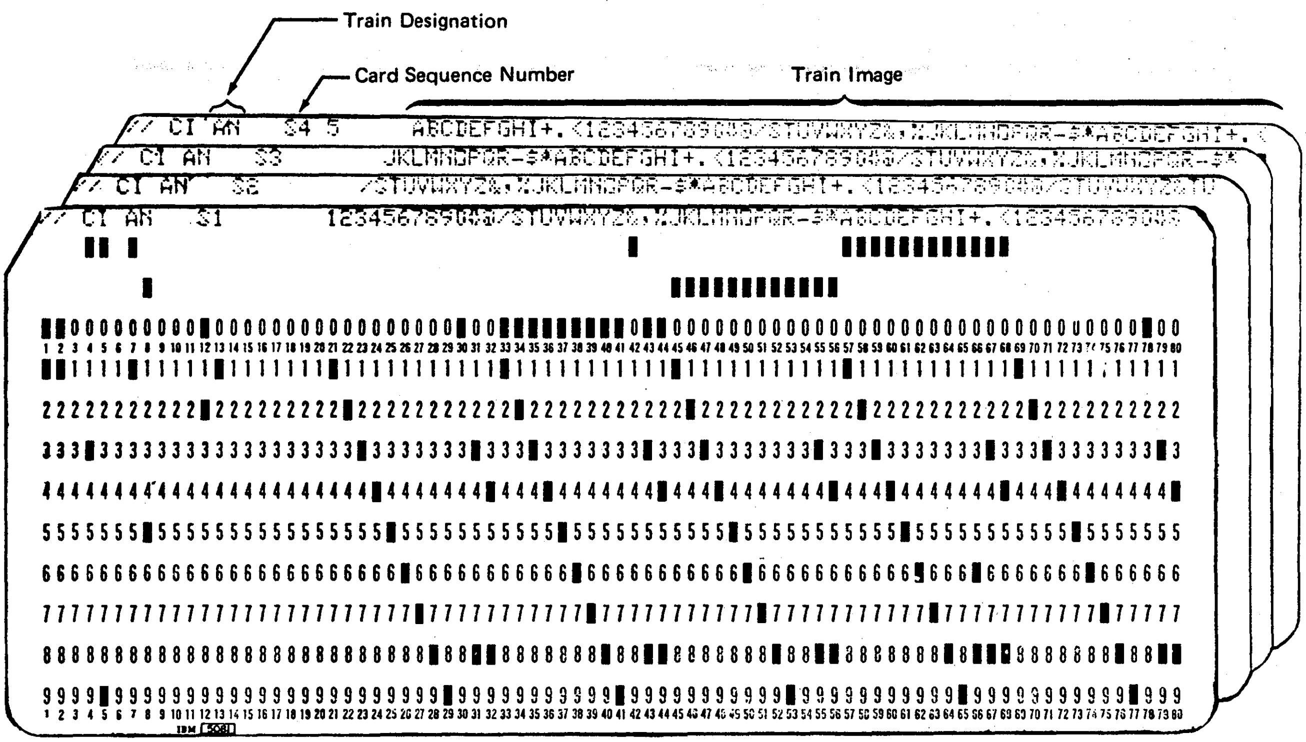


Figure B-6. AN Train Image Cards

Character Charts (3262 Printer)

The information in this and the following section has been taken, for the user's convenience, from the *IBM 3262 Printer Models 2 and 12 Component Description*, GA24-3737. Please refer to the 3262 manual for the latest information.

Bits 4567	Hex 1	00				01				10				11			
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0	NUL				SP	&	-						NU 10	NU 11	NU 12	0
0001	1							/		a	j	NU9		A	J		1
0010	2									b	k	s		B	K	S	2
0011	3									c	l	t		C	L	T	3
0100	4	SEL	ENP	INH						d	m	u		D	M	U	4
0101	5	HT	NL	LF	TRN					e	n	v		E	N	V	5
0110	6		BS							f	o	w		F	O	W	6
0111	7									g	p	x		G	P	X	7
1000	8									h	q	y		H	Q	Y	8
1001	9								NU4	i	r	z		I	R	Z	9
1010	A					NU1	NU2	NU3	:								
1011	B	VT		CSP		.	NU5	'	NU6								
1100	C	FF				<	*	%	NU7								
1101	D	CR				(	)	—	'								
1110	E		IRS			+	;	>	=								
1111	F			BEL		NU 13	NU8	?	NU 14								

Bits 0, 1; 2, 3; Hex 0

Note: Figure B-7 includes character codes and control codes; Figure B-8 is a table of national-use (NU) differences. For those positions in Figure B-7 marked NU, substitute the correct character from Figure B-8. For example, to find the proper character for address X'4A' (NU1) in Figure B-7, look at vertical line 1 in Figure B-8. Follow line 1 until the character for the desired language group is found.

Figure B-7. EBCDIC Character Chart

National Use Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Hex Code	4A	5A	6A	79	5B	7B	7C	5F	A1	C0	D0	E0	4F	7F
Language Device														
U.S. EBCDIC	¢	!	¦	`	$	#	@	¬	~	{	}	\	|	"
International	[	]	¦	`	$	#	@	^	~	{	}	\	!	"
Austrian/German	Ä	Ü	ö	`	$	#	§	^	β	ä	ü	Ö	!	"
Danish/Norwegian	#	¤	ø	`	Å	Æ	Ø	^	ü	æ	å	\	!	"
Finnish/Swedish	§	¤	ö	é	Å	Ä	Ö	^	ü	ä	å	É	!	"
French	°	§	ù	`	$	£	à	^	¨	é	è	ç	!	"
Italian	°	é	ò	ù	$	£	§	^	ì	à	è	ç	!	"
Portuguese	[	]	õ	`	$	Ã	Õ	^	ç	ã	´	Ç	!	"
Spanish	[	]	ñ	`	Pts	Ñ	@	¬	¨	{	}	\	|	"
U.K.	$	!	¦	`	£	#	@	¬	—	{	}	\	|	"
Belgian	[	]	ù	`	$	#	à	^	¨	é	è	ç	!	"
Brazilian	É	$	ç	ã	ç	Õ	Ã	^	~	õ	é	\	!	"
Japanese/English	£	!	¦	`	¥	#	@	¬	–	{	}	$	|	"
Spanish Speaking	[	]	ñ	`	$	Ñ	@	¬	¨	{	}	\	|	"
Canadian French	à	´	ù	`	$	#	@	^	¨	é	è	ç	!	"

Note: This band has 96 unique characters, but only the standard 94 are printable. The extra two are fill characters, and are unaddressable.

Figure B-8 (Part 1 of 3). EBCDIC Character Chart – National Use Differences for a 96-Character-Set Print Band

National Use Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Hex Code	4A	5A	6A	79	5B	7B	7C	5F	A1	C0	D0	E0	4F	7F
Language Device														
U.S. EBCDIC	¢	!	—	`	$	#	@	¬	—	—	—	\	|	"
International	[	]	—	`	$	#	@	^	—	—	—	\	!	"
Austrian/German	Ä	Ü	—	`	$	#	§	—	β	—	—	Ö	!	"
Danish/Norwegian	#	¤	—	`	Å	Æ	Ø	^	—	—	—	\	!	"
Finnish/Swedish	§	¤	—	é	Å	Ä	Ö	^	—	—	—	É	!	"
French	°	§	—	`	$	£	à	^	—	—	—	ç	!	"
Italian	°	é	—	ù	$	£	§	^	—	—	—	ç	!	"
Portuguese	[	]	—	`	$	Ã	Õ	^	—	—	—	ç	!	"
Spanish	[	]	—	`	Pts	Ñ	@	¬	—	—	—	\	|	"
U.K.	$	!	—	`	£	#	@	¬	—	—	—	\	|	"
Belgian	[	]	—	`	$	#	à	^	—	—	—	ç	!	"
Brazilian	É	$	—	ã	Ç	Õ	Ã	^	—	—	—	\	!	"
Japanese/English	£	!	—	`	¥	#	@	¬	—	—	—	$	|	"
Spanish Speaking	[	]	—	`	$	Ñ	@	¬	—	—	—	\	|	"
Canadian French	à	'	—	`	$	#	@	^	—	—	—	¸	!	"

Figure B-8 (Part 2 of 3). EBCDIC Character Chart – National Use Differences for a 64-Character-Set Print Band

National Use Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Hex Code	4A	5A	6A	79	5B	7B	7C	5F	A1	C0	D0	E0	4F	7F
Language Device														
U.S. EBCDIC	—	—	—	—	$	#	@	—	—	—	—	—	—	—
International	—	—	—	—	$	#	@	—	—	—	—	—	—	—
Austrian/German	—	—	—	—	$	#	§	—	—	—	—	—	—	—
Danish/Norwegian	—	—	—	—	Å	Æ	ø	—	—	—	—	—	—	—
Finnish/Swedish	—	—	—	—	Å	Ä	Ö	—	—	—	—	—	—	—
French	—	—	—	—	$	£	à	—	—	—	—	—	—	—
Italian	—	—	—	—	$	£	§	—	—	—	—	—	—	—
Portuguese	—	—	—	—	$	Ã	Õ	—	—	—	—	—	—	—
Spanish	—	—	—	—	Pts	Ñ	@	—	—	—	—	—	—	—
U.K.	—	—	—	—	£	#	@	—	—	—	—	—	—	—
Belgian	—	—	—	—	$	#	à	—	—	—	—	—	—	—
Brazilian	—	—	—	—	Ç	Õ	Ã	—	—	—	—	—	—	—
Japanese/English	—	—	—	—	¥	#	@	—	—	—	—	—	—	—
Spanish Speaking	—	—	—	—	$	Ñ	@	—	—	—	—	—	—	—
Canadian French	—	—	—	—	$	#	@	—	—	—	—	—	—	—

Figure B-8 (Part 3 of 3). EBCDIC Character Chart – National Use Differences for a 48-Character-Set Print Band

Character Sets (3262 Printer)

The 3262 Printer uses 48-, 64-, and 96-character set print bands. In addition, Canadian French bands may contain 48-, 64-, or 116-character sets. Katakana bands contain 127-character sets.

The character sets for all 48-, 64-, and 96-character set bands are shown in Figure B-9. The 116-character Canadian French set is shown in Figure B-10. The 127-character Katakana set is shown in Figure B-11.

PRINT BAND CHARACTERS				
CHARACTERS	HEX CODES	BAND SIZE		
		48	64	96
0-9	F0-F9	X	X	X
NU6	7B	X	X	X
NU7	7C	X	X	X
/	61	X	X	X
S-Z	E2-E9	X	X	X
&	50	X	X	X
	6B	X	X	X
%	6C	X	X	X
J-R	D1-D9	X	X	X
	60	X	X	X
NU5	5B	X	X	X
*	5C	X	X	X
A-I	C1-C9	X	X	X
+	4E	X	X	X
	4B	X	X	X
	7D	X	X	X
NU1	4A		X	X
<	4C		X	X
(	4D		X	X
NU13	4F		X	X
NU2	5A		X	X
)	5D		X	X
	5E		X	X
NU8	5F		X	X
NU12	E0		X	X
–	6D		X	X
>	6E		X	X
?	6F		X	X
:	7A		X	X
=	7E		X	X
NU14	7F		X	X
NU4	79		X	X
NU3	6A			X
a-i	81-89			X
NU10	C0			X
NU11	D0			X
NU9	A1			X
j-r	91-99			X
s-z	A2-A9			X

Note: See Figure B-8 for National Use Differences.

Figure B-9. Print Band Characters

HEX	CHARACTER
40	
41	
42	â
43	
44	
45	
46	
47	
48	ç
49	
4A	à
4B	.
4C	<
4D	(
4E	+
4F	!
50	&
51	
52	ê
53	ë
54	
55	
56	î
57	ï
58	
59	
5A	´
5B	$
5C	*
5D	)
5E	;
5F	^
60	-
61	/
62	Â
63	
64	À
65	
66	
67	
68	Ç
69	
6A	ù
6B	,
6C	%
6D	_
6E	>
6F	?
70	
71	É
72	Ê
73	Ë
74	È
75	
76	Î
77	Ï
78	
79	`
7A	:
7B	#
7C	@
7D	|
7E	=
7F	"
80	
81	a
82	b
83	c
84	d
85	e
86	f
87	g
88	h
89	i
8A	
8B	
8C	
8D	
8E	
8F	
90	
91	j
92	k
93	l
94	m
95	n
96	o
97	p
98	q
99	r
9A	
9B	
9C	
9D	
9E	
9F	
A0	
A1	¨
A2	s
A3	t
A4	u
A5	v
A6	w
A7	x
A8	y
A9	z
AA	
AB	
AC	
AD	
AE	
AF	
B1	
B2	
B3	
B4	
B5	
B6	
B7	
B8	
B9	
BA	
BB	
BC	
BD	
BE	
BF	
C0	é
C1	A
C2	B
C3	C
C4	D
C5	E
C6	F
C7	G
C8	H
C9	I
CA	
CB	ô
CC	
CD	
CE	
CF	
D0	è
D1	J
D2	K
D3	L
D4	M
D5	N
D6	O
D7	P
D8	Q
D9	R
DA	
DB	û
DC	ü
DD	
DE	
DF	
E0	¸
E1	
E2	S
E3	T
E4	U
E5	V
E6	W
E7	X
E8	Y
E9	Z
EA	
EB	Ô
EC	
ED	
EE	
EF	
F0	0
F1	1
F2	2
F3	3
F4	4
F5	5
F6	6
F7	7
F8	8
F9	9
FA	
FB	Û
FC	Ü
FD	Ù
FE	
FF	

Figure B-10. Canadian French 116-Character Set

HEX	CHARACTER
40	SP
41	｡
42	｢
43	｣
44	､
45	･
46	ｦ
47	ｧ
48	ｨ
49	ｩ
4A	£
4B	.
4C	<
4D	(
4E	+
4F	|
50	&
51	ｪ
52	ｫ
53	ｬ
54	ｭ
55	ｮ
56	ｯ
58	—
5A	!
5B	¥
5C	•
5D	)
5E	;
5F	¬
60	−
61	/
6B	,
6C	%
6D	—
6E	>
6F	∿
7A	:
7B	#
7C	@
7D	'
7E	=
7F	"

HEX	CHARACTER
81	ｱ
82	ｲ
83	ｳ
84	ｴ
85	ｵ
86	ｶ
87	ｷ
88	ｸ
89	ｹ
8A	ｺ
8C	ｻ
8D	ｼ
8F	ｽ
8F	ｾ
90	ｿ
91	ﾀ
92	ﾁ
93	ﾂ
94	ﾃ
95	ﾄ
96	ﾅ
97	ﾆ
98	ﾇ
99	ﾈ
9A	ﾉ
9D	ﾊ
9E	ﾋ
9F	ﾌ
A1	—
A2	ﾍ
A3	ﾎ
A4	ﾏ
A5	ﾐ
A6	ﾑ
A7	ﾒ
A8	ﾓ
A9	ﾔ
AA	ﾕ
AC	ﾖ
AD	ﾗ
AE	ﾘ
AF	ﾙ

HEX	CHARACTER
BA	ﾚ
BB	ﾛ
BC	ﾜ
BD	ﾝ
BE	ﾞ
BF	ﾟ
C1	A
C2	B
D3	C
C4	D
C5	E
C6	F
C7	G
C8	H
C9	I
D1	J
D2	K
D3	L
D4	M
D5	N
D6	O
D7	P
D8	Q
D9	R
E0	$
E2	S
E3	T
E4	U
E5	V
E6	W
E7	X
E8	Y
E9	Z
F0	0
F1	1
F2	2
F3	3
F4	4
F5	5
F6	6
F7	7
F8	8
F9	9

Figure B-11. Katakana Character Set

When a 48- or 64-character set band is used, the 26 lowercase (*a* through *z*) alphabetic characters are folded to the corresponding uppercase (*A* through *Z*) alphabetic characters. Characters not found on the band cause a hyphen to print.

Print bands can be interchanged as follows:

- All 48-, 64-, and 96-character set EBCDIC bands can be interchanged. (See **Note** below.)
- The 116-character Canadian French band is interchangeable with the 48- and 64-, and 96-character set Canadian French bands.
- The 127-character set Katakana band is interchangeable with the 48- and 64-character set Japan/English bands.
- The 116-character set Canadian French band cannot be interchanged with the 127-character set Katakana band.

Note: The 64-character set German band cannot be interchanged with bands from other countries.

Appendix C. Card Specifications

2502 Punched Card Specifications

The following corner cuts can be used: C1, C2, C3, or C5.

The following scores are acceptable:

External: M-5, M-7, CF-4, and CF-11 on the high-numbered column end of the card; M-3, M-4, M-5, M-6, M-7, OM-2, OM-3, CF-4, and CF-11 on the column-1 end. Figure C-1 illustrates the positioning requirements for the M-5 and CF-4 scores.

Internal: M-4, M-5, S-1, S-2, ID-1, ID-2, and ID-3.

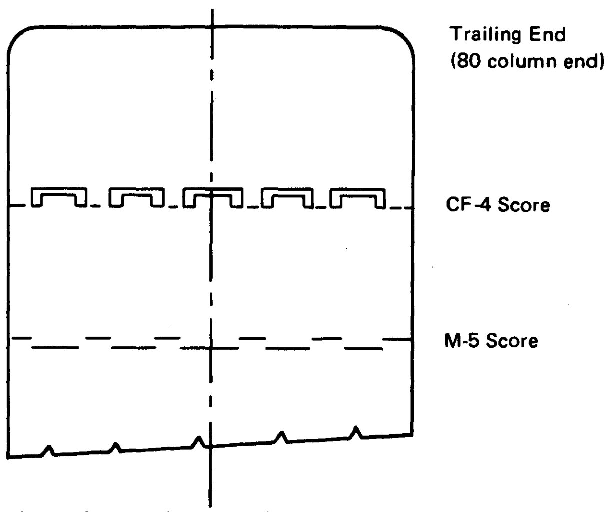


Figure C-1. Positioning of M-5 and CF-4 Scores

Edge-coated, Port-A-Punch®, and heavy duty cards can be used; however, some degradation in performance can be expected.

2502 OMR Card Specifications (3776-1/2 Only)

Reflectance Measurements

Reflectance measurements specified herein have been measured with a Kidder Press Company, Inc., Model 081 Optical Character Tester, infrared section, with a 0.0125 inch diameter aperture. "Average reflectance" means the average of three readings on this test instrument at three separate locations on the card, mark, or erasure. The tester is calibrated using magnesium oxide as 100 percent.

Card Stock

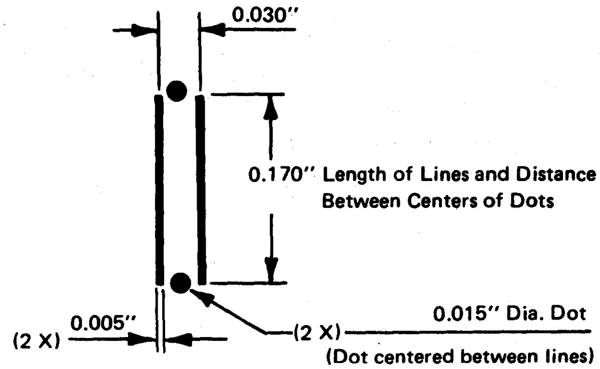
Any card acceptable for use as input to the 2502 can be used for an optical mark document with these provisions:

1. The average reflectance of the card stock must be between a minimum of 80 percent and a maximum of 90 percent.
2. Blemishes and printing in the marking field of the card must reflect at least 85 percent of the average reflectance of that particular card. Thus, a card whose average reflectance is 90 percent may not have a blemish or printed character that indicates less than 0.85 times 90 percent, or 76.5 percent reflectance.
3. White and natural cards are usually satisfactory.

4. Cards with marks in card column 1 must have square or C-5 corner cuts on the leading edge.
5. Only one side of the card may be printed.

Marking Constraints

Figures C-2 and C-3 specify the reflectance, size, and shape of the constraints.



NOTE:
Dots and vertical lines must be printed in reflective ink. (Reflectance must not be below 0.85 percent of the average background reflectance as measured by the Kidder Optical Character Tester, Model 81, which is a product of the Kidder Press Co., Inc.)

Figure C-2. Marking Constraint Specifications

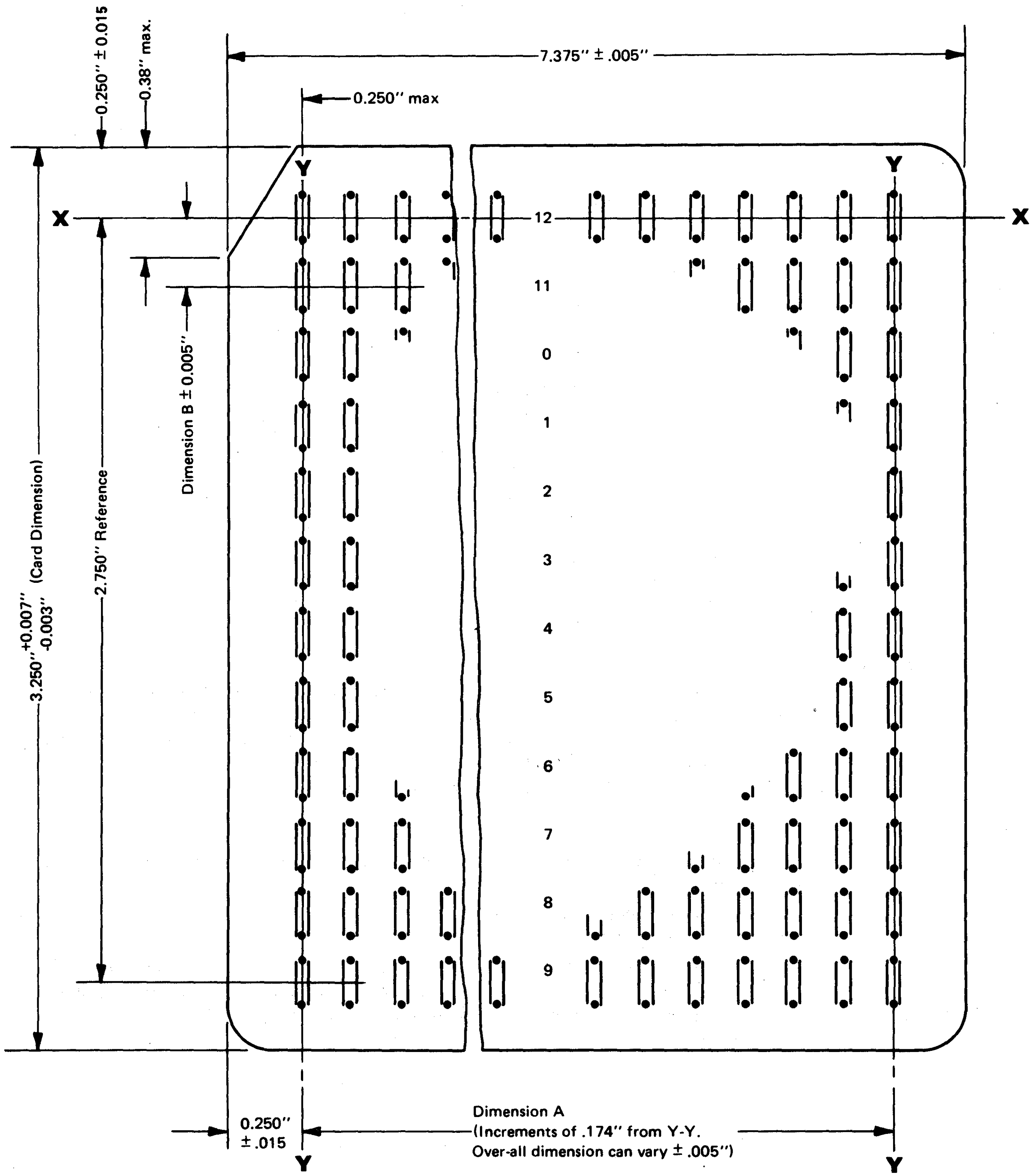
OMR Columns

An OMR column is a vertical arrangement of twelve mark positions. These correspond to the twelve punch positions in a column of a punched card. An OMR column must not contain punching or non-reflective printing or blemishes. The data marks in a column must represent valid codes. OMR columns must be located in odd-numbered columns of the standard card.

OMR Fields

An OMR field consists of one or more OMR columns. These rules apply to OMR fields:

1. No punching may occur either within or to the right of an OMR field to be read by the 2502.
2. At least one blank column must separate the last punch column from the first OMR column (last punch column will contain the IFS character that causes transfer from punch-data to mark-data reading).



Legend:

Y-Y = centerline through card column 1 and 80 on standard tabulating card.
X-X = centerline through row 12 on standard tabulating card.
Dimension A = distance between horizontal center of marking position or punch position and line Y-Y.
Dimension B = distance between vertical center of marking position or punch position and line X-X. This dimension increases in increments of 0.250" (distance from center of marking positions).
= outline of marking position.

NOTE:
Information not to be read by the 2502 and mark constraints must be printed in reflective ink.

Figure C-3. OMR Input Card Specifications

3501 Card Specifications

The 3501 Card Reader can accept cards with the following corner cuts:

- C5 (round) on any corner
- C1, C2, or C3 on upper left or upper right corner

Edge-coated and heavy duty cards can be used; however, some degradation in performance can be expected.

Internal scores are not permitted. The following external scores are permissible:

- M-3, M-4, or M-5 on column 1 end
- M-7 on column-80 end
- CF-11 on any edge

3521 Card Specifications

The 3521 Card Punch can accept cards with the following corner cuts:

- C1, C2, C3, or C5 (round) on any corner

Edge-coated and heavy duty cards can be used.

Cards with the following internal scores can be punched on the 3521 if the Card Read feature is not installed or is disabled:

- M-4, M-5, OM-2, OM-3, ID-1, ID-2, ID-3, and S-1

The following external scores are permitted:

- M-4 or M-6 on the column-80 end

Appendix D. Throughput

Throughput Controlling Factors

The factors controlling throughput in the 3770 are: (1) the transmission time required for a block of records (line-dependent throghput); and (2) the cycle time of the individual input/output device (device-dependent throughput). The total transmission time for a block of records includes the transmission time required to send the control and data characters of the block, the time required by the Data Communication Equipment (DCE) for turning the line around for the acknowledgment response, the transmission time for that response, and another turnaround delay before the next block of data can be transmitted.

Naturally, throughput is limited by the slowest I/O device involved with the job. Factors that affect individual-device rated speeds as stated in this manual for any device are: tolerances on power; mechainical adjustments; opwerating temperatures; component tolerances; and service time induced by the controller. In some cases, data patterns may affect throughput. Tolerances on the rated speeds of an individual device should not exceed 10%.

The following paragraphs show the device speeds and the limiting factor (input device, output device, or line) for each 3770 job.

Note: Abbreviations used in the following paragraphs and tables include:

bpm . . . . buffers per minute
bps . . . . bits per second
char/line or cpl . . . . characters per line
cps . . . . characters per second
cpm . . . . cards per minute
lpm . . . . lines per minute
R/M . . . . records per minute

3776 Console-Mounted Line Printer

The belt printers are rated for speeds up to a certain lpm (lines per minute). These speeds are determined for a nominal situation; that is, one pass of the character set (on the print character belt) over the print line. One vertical line movement (carriage return and index) at the end of each print line is assumed. Selective text patterns may degrade these maximum rated speeds. Also, there are cases (short print line, data dependencies) that can cause printing above the rated speed.

3776 Line Skip and Line Space Speeds

Line Space - 0.034 seconds per line
Line Skip - 6 LPI - 0.014 seconds per line
8 LPI - 0.0104 seconds per line

3776 Line Printer Speeds

The following printer speeds are maximum lines per minute (lpm).

Lines per Minute (lpm) for character set size:	*127**	*94*	*64*	*48*
3776 Model 1/3	80	160	230	300
3776 Model 2/4	160	230	300	400

*Katakana only

Card Input/Output

Reader:	*Rated Speed*
2502 A1	150 cpm
2502 A2	300 cpm
2502 A3	400 cpm
3501	50 cpm
*3521–with Read feature	50 cpm
Punch:	
3521	50 cpm
3521–with Card Print feature	50 cpm
3521–with Katakana Card Print feature	25 cpm

*If Katakana Card Print Feature is installed, read speed is 25 cpm

Diskette

Diskette rotational speed is about 360 rpm, and track-to-track head seek time is approximately 54 ms per track.

Communication Line Throughput

This section and subsequent sections that address communication line performance are valid for both BSC and SDLC machines unless specifically stated otherwise.

The following formula can be used to calculate the throughput rate in records-per-minute for unique job and configuration combinations, or when turnaround times other than those specified in the figures in this appendix are used.

If the result of the calculation indicates that the throughput is less than the maximum throughput rate of the particular input/output device(s), the throughput is considered to be line-dependent. However, if the calculation results in a throughput rate greater than the physical limitations of the particular input/output device(s), the limitations imposed by the device(s) must be used (device-dependent throughput).

BSC

R[N(C) + (5+S)] + TA + R(3+S) = Block Time (ms)*

SDLC Receiving

R[N(C) + 2P + F + 36] + TA + D [(R)(12+2P) + TA] = Block Time (ms)*

SDLC Transmitting

R[N(C) + F + 21 + 2P] + TA = Block Time (ms)*

F = Number of extra flag characters sent:

Where:
- R = Character rate in ms/character (see Figure D-1);
- N = Number of records (cards, for example) per block;
- C = Number of data plus device-control characters/record;
- TA = Turnaround delay (sum of transmit plus receive in ms—see Figure D-1);
- S = Number of leading synchronization characters (pad, sync) required: (5 for 3770 terminals).
- F = Number of extra flag characters sent:
  - 0 for 3777
  - 3 for non 3777

*Does not include host processing time or line propagation time.

P = Number of Pad characters required:
3 for business machine clocking
1 for no business machine clocking

D = Delay factor:
1 for 3777 at 9800 bps and other models at 2400 bps and 4800 bps
0 otherwise

To convert block time in milliseconds to records per minute (R/M—for example: cards per minute or lines per minute), use the following formula:

$$R/M = \frac{60{,}000N}{\text{Block Time (ms)}}$$

Where N = number of records per block

Figure D-1 shows representative modem turnaround times selectable by modem strapping but is not all-inclusive. Modem strapping depends on various factors (such as type of line—two-wire or four-wire, communication facility characteristics, etc.) as explained in the literature (User's Guide) for the particular modem.

Line Rate (bps)	ms/char	Turnaround Time in ms* Half Duplex	Turnaround Time in ms* Duplex Multipoint	Turnaround Time in ms* Duplex Point-to-Point	Common Carrier Type of Communications Service
600	13.33	180 or 500	80 or 200	0	Switched Telephone Network or Leased, Half-Duplex or Duplex,** Private-Line Data Channel
1200	6.67	180 or 500	80 or 200	0	Switched Telephone Network or Leased, Half-Duplex or Duplex,** Private-Line Data Channel
2000	4.00	400	8.75 or 200	0	Switched Telephone Network or Leased, Half-Duplex or Duplex,** Private-Line Data Channel
2400	3.33	150 or 400	8.75, 25, or 200	0	Switched Telephone Network or Leased, Half-Duplex or Duplex,** Private-Line Data Channel
4800	1.67	300	35	0	Switched Telephone Network or Leased, Half-Duplex or Duplex,** Private-Line Data Channel
7200	1.11	---	100	0	Leased or Private Line
9600	0.833	---	150-200	0	Leased or Private Line

*The turnaround time shown does not include the internal delay of the modem, communication channel propagation delay, or internal delay of the terminal or host processor. Consult the literature for the particular modem used.

**The communication channel may be duplex. The 3776-1,2 and 3777-1 operation is half-duplex. The 3776-3,4 and 3777-3,4 operation is either half-duplex or duplex depending on line and host facilities.

Figure D-1. Character Rates and Representative Turnaround Delays

For Space Compression/Expansion, use the following for the number of characters:

The number of punched columns plus single blank columns;

plus

2 control characters for each group of from 2 to 63 consecutive blank columns (plus 2 more control characters for a group of over 64 blank columns).

System Performance

One Input, One Output

3776 Model 1

	Output							
	Line Printer Character Set:					*Line Speed in bps**		
	48	*64*	*94*	*3521*	*Diskette‡‡*	*1200*	*2400*	*4800*
Input								
2502 A1	RI	RI	RIO	RO	RI	L	RI	RI
2502 A2	RIO	RO	RO	RO	RI	L	L	RI
3501 **	RI	RI	RI	RIO	RI	RI	RI	RI
3521	RI	RI	RI	--	RI	RI	RI	RI
Diskette‡	RO	RO	RO	RO	---	(See "Diskette Performance")		
Line‡‡								
4800 bps	L	RO	RO	RO	(See "Diskette Performance")			
2400 bps	L	L	L	RO				
1200 bps	L	L	L	RO				

RO = Performance limited by output device
RI = Performance limited by input device
RIO = Performance limited by either input or output device
L = Performance limited by line.

*All line throughput ratings have been stated with no turnaround delay, unless otherwise indicated. The line limitations are based upon two print lines per full 256-byte buffer, or four print lines per full 512-byte buffer. As the number of print lines per buffer increases, or with shorter lines or data compression, the line-limiting effect is decreased. 512-byte buffer operation improves the throughput when turnaround delay is considered.

**Due to physical design, if the 3501 is not serviced in time, the reader will miss a complete feed cycle (it must complete that cycle before the next one can start). Thus, in some cases the rated performance of the 3501 may be affected by up to 10%.

‡Diskette to printer throughput is based on two print lines per 256-byte buffer, or 4 lines per 512-byte buffer. Fewer print lines per buffer can decrease performance.

‡‡When transmitting ETX buffers line to diskette, the diskette data set will be closed on each ETX received. Closing a data set requires an access to track 0 which affects throughput depending on the number of tracks crossed.

Figures D-10 through D-13 show nominal throughput of the 2502 Models at communications line speeds of 1200, 2000, 2400, and 4800 bps.

	Output							
	Line Printer Character Set:					*Line Speed in bps**		
	48	*64*	*94*	*3521*	*Diskette‡‡*	*1200*	*2400*	*4800*
Input								
2502 A1	RI	RI	RI	RO	RI	L	RI	RI
2502 A2	RI	RIO	RO	RO	RI	L	L	RI
3501 **	RI	RI	RI	RIO	RI	RI	RI	RI
3521	RI	RI	RI	--	RI	RI	RI	RI
Diskette‡	RO	RO	RO	RO	---	(See "Diskette Performance")		
Line‡‡								
4800 bps	L	L	RO	RO	(See "Diskette Performance")			
2400 bps	L	L	L	RO				
1200 bps	L	L	L	RO				

RO = Performance limited by output device
RI = Performance limited by input device
RIO = Performance limited by either input or output device
L = Performance limited by line.

*All line throughput ratings have been stated with no turnaround delay, unless otherwise indicated. The line limitations are based upon two print lines per full 256-byte buffer, or four print lines per full 512-byte buffer. As the number of print lines per buffer increases, or with shorter lines or data compression, the line-limiting effect is decreased. 512-byte buffer operation improves the throughput when turnaround delay is considered.

**Due to physical design, if the 3501 is not serviced in time, the reader will miss a complete feed cycle (it must complete that cycle before the next one can start). Thus, in some cases the rated performance of the 3501 may be affected by up to 10%.

‡Diskette to printer throughput is based on two print lines per 256-byte buffer, or 4 lines per 512-byte buffer. Fewer print lines per buffer can decrease performance.

‡‡When transmitting ETX buffers line to diskette, the diskette data set will be closed on each ETX received. Closing a data set requires an access to track 0 which affects throughput depending on the number of tracks crossed.

Figures D-10 through D-13 show nominal throughput of the 2502 Models at communications line speeds of 1200, 2000, 2400, and 4800 bps.

	Output							
	3203 Line Printer Character Set:					*Line Speed in bps*		
	48	*52*	*63*	*127**	*Diskette*	*4800*	*7200*	*9600*
Input								
2502 A1	RI	RI	RI	RI	RI	RI	RI	RI
2502 A2	RI	RI	RI	RIO	RI	RI	RI	RI
2502 A3	RI	RI	RI	RIO	RI	RI	RI	RI
Diskette	(See Chart below)					(See "Diskette Performance")		

*Katakana print train

RI = Performance limited by input device
RIO = Performance limited by input or output device .

All line throughput ratings are stated with zero turnaround delay. Card input ratings are based on three cards per 256-byte buffer and six cards per 512-byte buffer.

Diskette to Printer - 3770 Nonexchange Diskette (BSC)

Print Line Length	*Print Speed**	*Diskette Speed 256-byte buffer*	*Diskette Speed 512-byte buffer*
40 char	950 lpm	158 bpm	79 bpm
60	895	222	111
80	790	262	131
128	492	262	131

*The lpm values shown are for an AN train. When a train with a speed rating lower than these numbers is used, the print speed will be the lesser of the number shown or the speed rating of the train.

Line to printer, card to line, and diskette performance information is presented in later sections of this appendix.

Two Inputs, Two Outputs

3776 Dual Data Path Operation–BSC

Refer to the section on the "Operating Characteristics (3776-1/3776-2/3777-1) in Chapter 2 for a discussion of Dual Data Path operation.

The tables below estimate the effects of Dual Data Path operation on terminal performance. The first table shows the printer and card I/O speeds for various combinations of character set (printer), line speed (communications), and line length (printer). The throughput experienced by Job 1 is dependent on the parameters shown in the tables, the buffer size used, and the devices used in the Dual Job. The throughput may be higher than that shown in the tables.

	2400 bps			*4800 bps*		
	127 cpl	*80 cpl*	*40 cpl*	*127 cpl*	*80 cpl*	*40 cpl*
	cpl=characters per line					
LINE to PRINTER - lines per minute (lpm) 3776-1 Belt Size						
48-char set	110 lpm	170 lpm	270 lpm	210 lpm	260 lpm	270 lpm
64	110	165	230	185	220	230
94	100	160	160	160	160	160
LINE to PRINTER-lpm 3776-2 Belt Size						
48-char set	120 lpm	180 lpm	370 lpm	210 lpm	330 lpm	370 lpm
64	110	180	300	210	270	300
94	100	180	230	210	230	230
CARD to DISKETTE - cards per minute (cpm) 3776-1 with 48-char set belt						
2502A1	100 cpm	115 cpm	125 cpm	60 cpm	100 cpm	115 cpm
2502A2	100	150	150	75	130	150
3501	30	35	40	20	30	40
3521	40	40	40	30	40	40
DISKETTE to CARD - cpm						
3521	40 cpm	40 cpm	40 cpm	30 cpm	40 cpm	40 cpm
CARD to DISKETTE - cpm 3776-2 with 48-char set belt						
2502A1	75 cpm	75 cpm	90 cpm	60 cpm	75 cpm	110 cpm
2502A2	150	150	150	75	100	150
3501	30	35	40	20	25	40
3521	40	40	40	30	30	40
DISKETTE to CARD - cpm						
3521	40 cpm	40 cpm	40 cpm	25 cpm	30 cpm	40 cpm

Job 1 performance may be decreased by more than shown in the preceding chart when Job 1 is running concurrently with a diskette-to-diskette Job 2. The rates given in the table below are for 4800 bps, 0 turnaround delay, 48-character set belt. Printer speed is measured in lines per minute (lpm) and diskette speed in buffers per minute (bpm). The line lengths include the NL (New Line) character. The rates shown in the following chart do not take into account data or space compression, diskette read/write errors that may be resolved by automatic retries, or line errors.

256-byte buffer		*128 cpl*	*64 cpl*	*32 cpl*
3776-1	Job 1	200 lpm	250 lpm	270 lpm
	Job 2	30 bpm	35 bpm	40 bpm
3776-2	Job 1	210 lpm	330 lpm	360 lpm
	Job 2	30 bpm	50 bpm	60 bpm
512-byte buffer				
3776-1	Job 1	210 lpm	260 lpm	270 lpm
	Job 2	15 bpm	30 bpm	35 bpm
3776-2	Job 1	210 lpm	330 lpm	360 lpm
	Job 2	15 bpm	30 bpm	35 bpm

3777 Model 1 Dual Data Path Operation—BSC

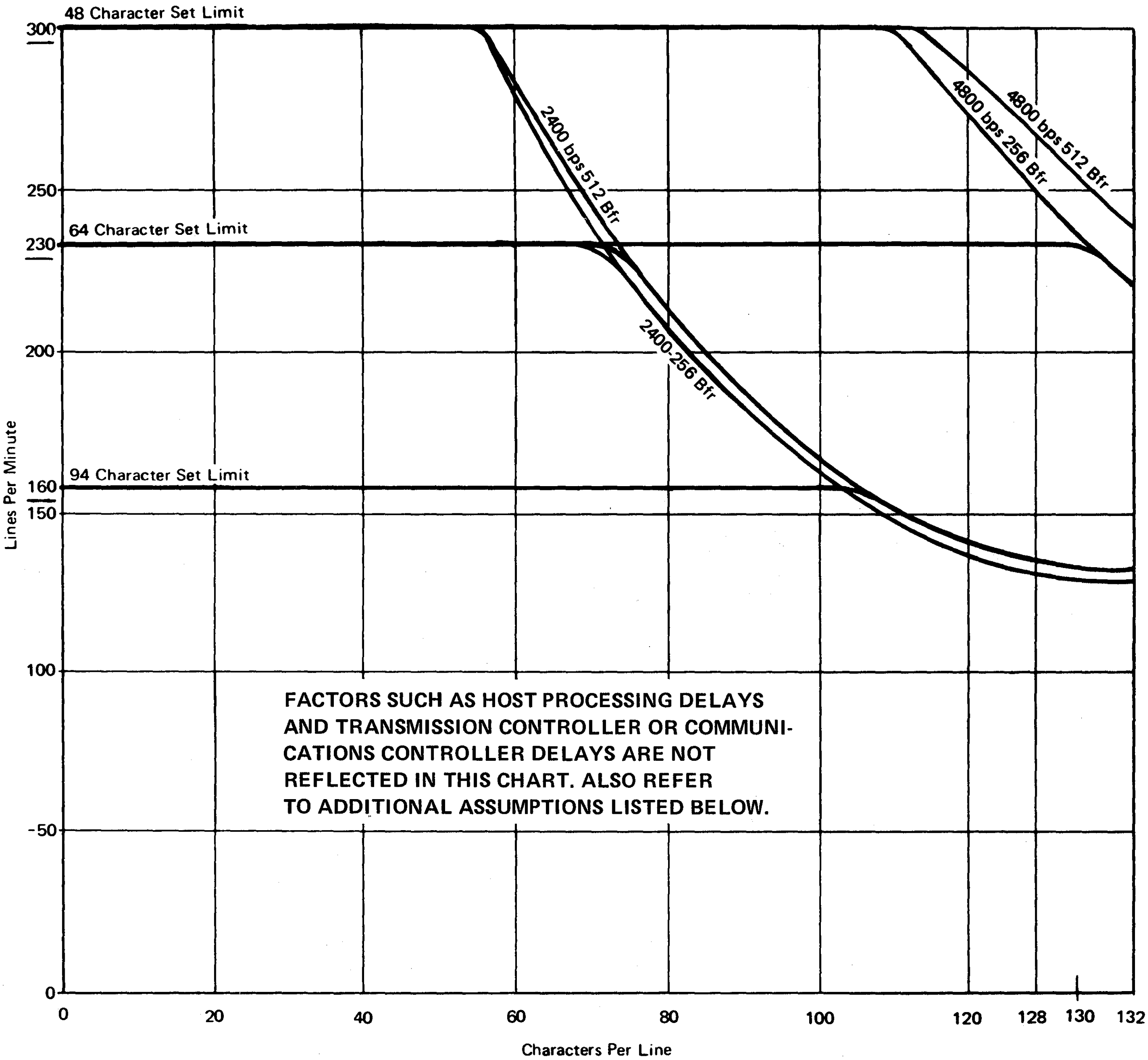
The table below estimates the effects of Dual Data Path operation on terminal performance. The throughput experienced by the line-to-printer job depends on the parameters shown in the table, the buffer size used, and the devices used in the Dual Job. The throughput may be higher than that shown in the table.

	4800 bps			9600 bps		
	127 cpl	80 cpl	40 cpl	127 cpl	80 cpl	40 cpl
	cpl = characters per line					
LINE to PRINTER - lines per minute (lpm)						
AN-48 Char-set	250 lpm	400 lpm	755 lpm	475 lpm	765 lpm	1000 lpm
GN-63 Char-set	250	400	710	475	655	760
CARD to DISKETTE - cards per minute (cpm)						
2502 A1	150 cpm	150 cpm	150 cpm	150 cpm	150 cpm	150 cpm
2502 A2	200	200	200	190	200	200
2502 A3	200	200	200	190	200	200
DISKETTE to DISKETTE - buffers per minute (bpm)						
256-byte	70 bpm	70 bpm	70 bpm	70 bpm	70 bpm	70 bpm
512-byte	45	45	45	40	40	45

Device Performance - Online

The following charts estimate online performance for various devices, and indicate the effects of various parameters on performance.

Printer Performance

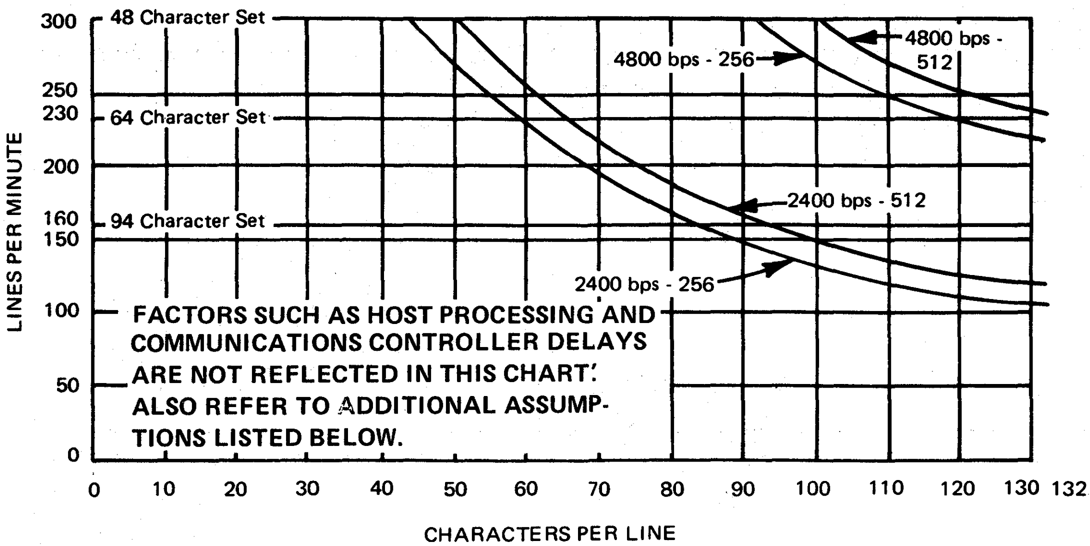


ASSUMPTIONS:

The curves shown are based on the following assumptions:

1. Perfect Transmissions — no CRC errors.
2. Zero modem turnaround delay — four-wire half-duplex communication facility.
3. No propagation delay through the modems or the communication network.
4. Other factors such as host processing delay are not taken into account.
5. "Characters Per Line" includes any compression and any printer forms handling characters (except line feed characters) sent on the communication facility.
6. A full buffer is always received (with partial print line depending on line length).
7. ASCII character sets may exhibit approximately 4% lower performance

Figure D-2. 3776 Model 1 Line-to-Printer Throughput (BSC)



ASSUMPTIONS:

The curves shown are based on the following assumptions:

1. Perfect Transmissions — no CRC errors.
2. Zero modem turnaround delay — four-wire half-duplex communication facility.
3. No propagation delay through the modems or the communication network.
4. Other factors such as host processing delay are not taken into account.
5. "Characters Per Line" includes any compression and any printer forms handling characters (except line feed characters) sent on the communication facility.
6. A full buffer is always received (with partial print line depending on line length).
7. These curves are for EBCDIC only.

Figure D-3. 3776 Model 1 Line-to-Printer Throughput (SDLC)

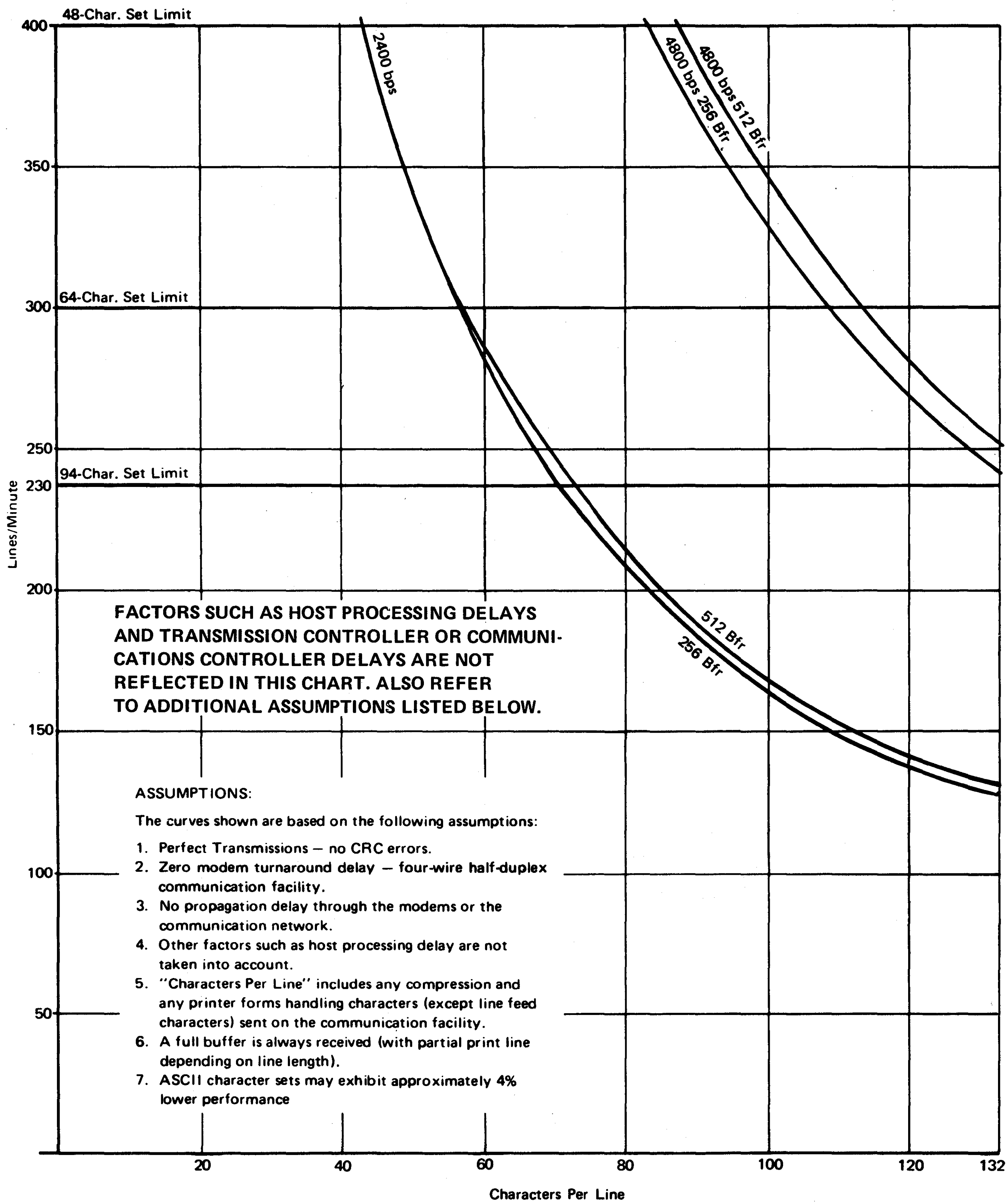
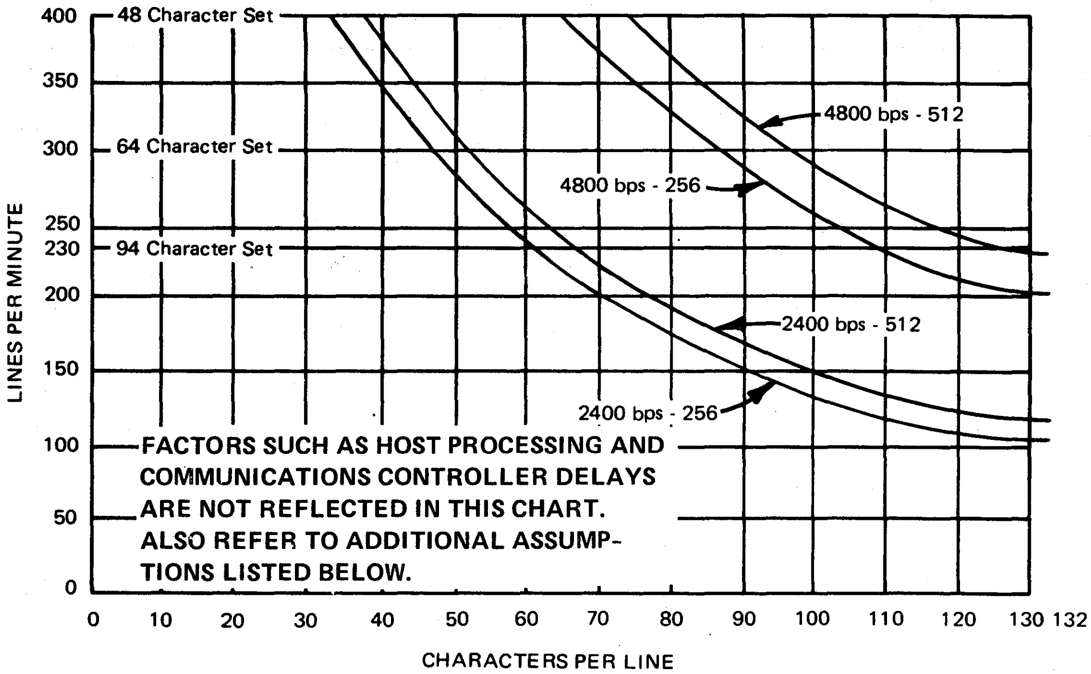


Figure D-4. 3776 Model 2 Line-to-Printer Throughput (BSC)

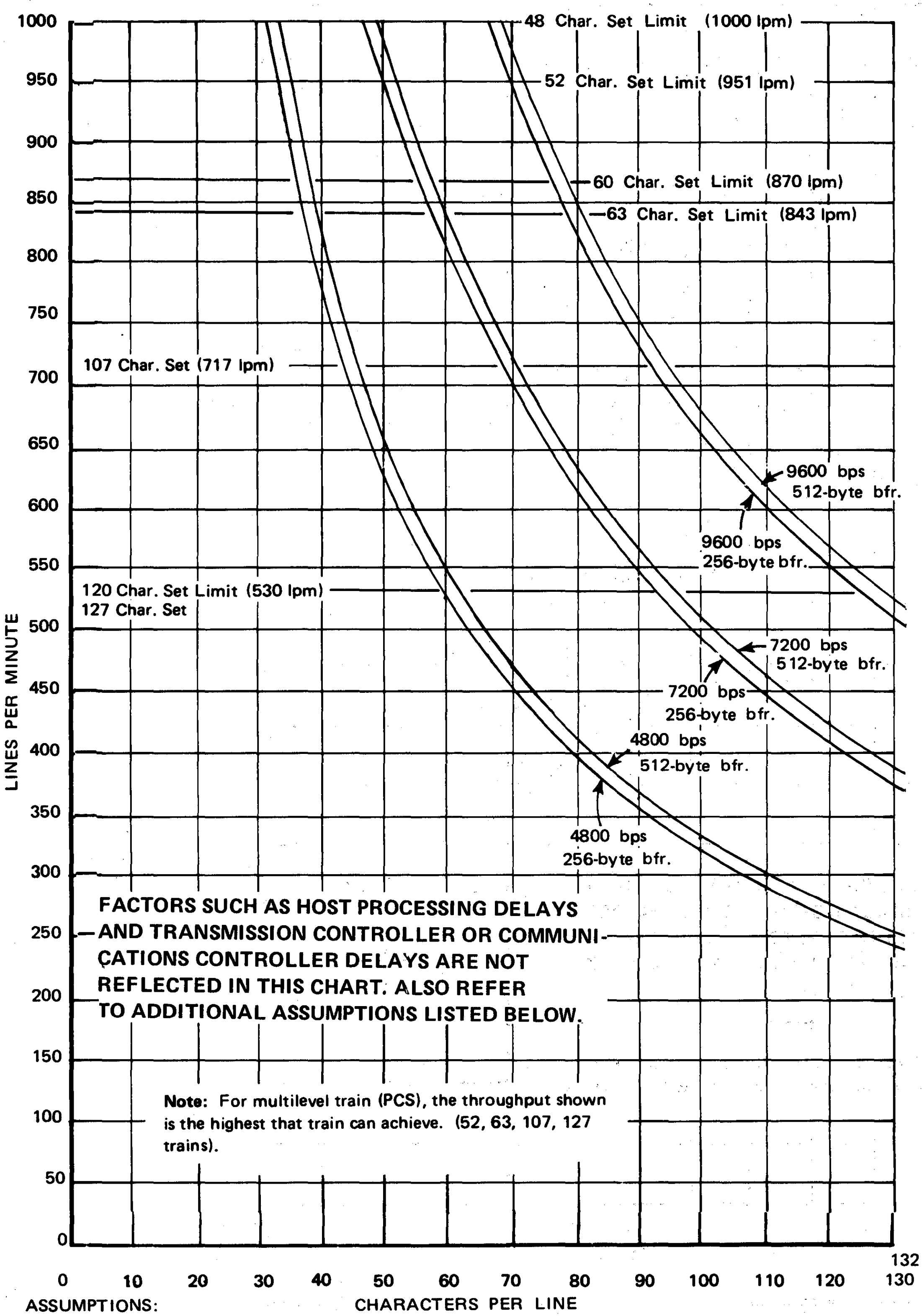


ASSUMPTIONS:

The curves shown are based on the following assumptions:

1. Perfect Transmissions — no CRC errors.
2. Zero modem turnaround delay — four-wire half-duplex communication facility.
3. No propagation delay through the modems or the communication network.
4. Other factors such as host processing delay are not taken into account.
5. "Characters Per Line" includes any compression and any printer forms handling characters (except line feed characters) sent on the communication facility.
6. A full buffer is always received (with partial print line depending on line length).
7. These curves are for EBCDIC only.

Figure D-5. 3776 Model 2 Line-to-Printer Throughput (SDLC)

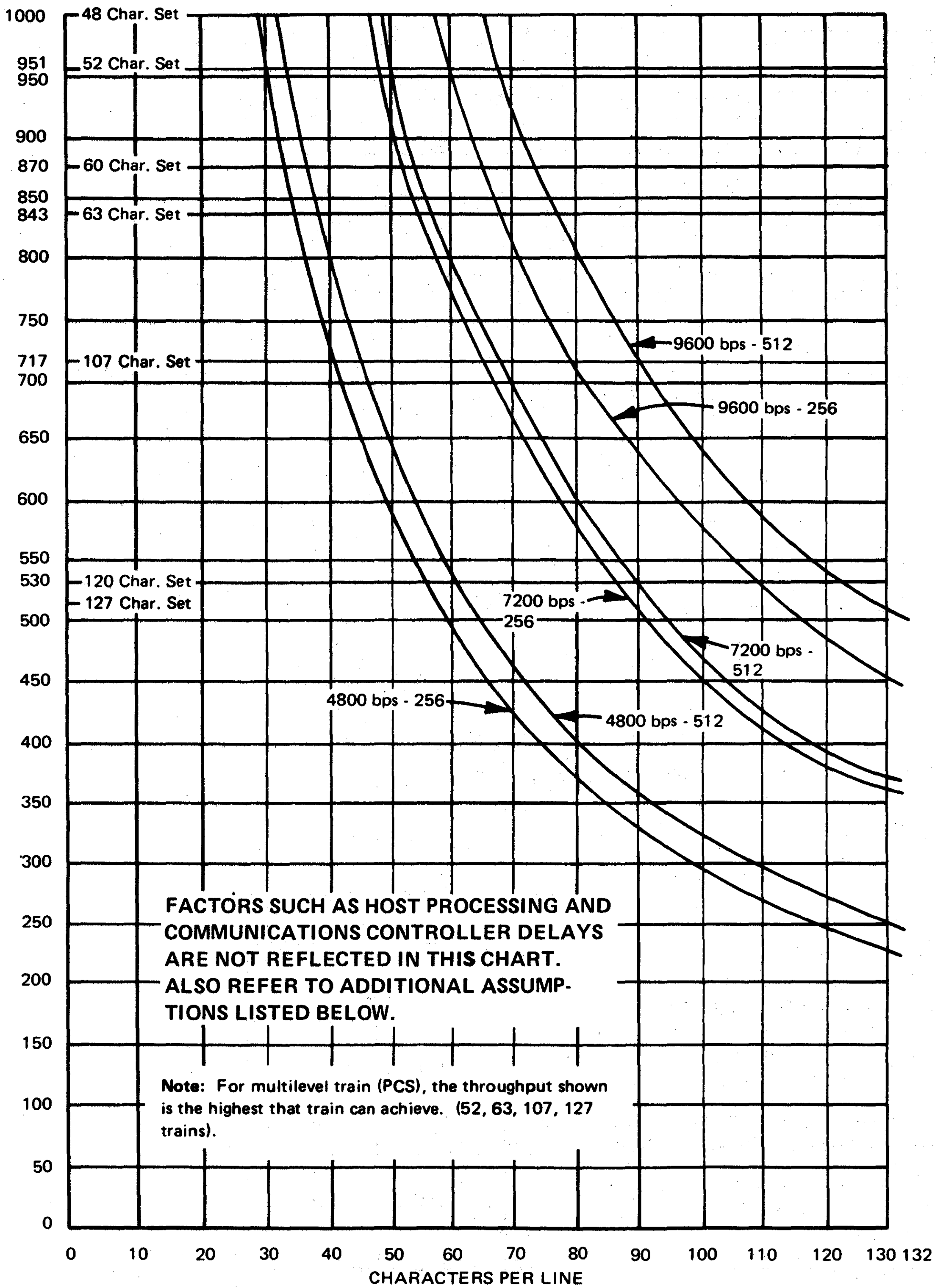


ASSUMPTIONS:

Curves shown are based on the following assumptions:

1. Perfect transmission — no CRC errors.
2. Zero modem turnaround delay — four-wire half-duplex communication facility.
3. No propagation delay through the modems or the communication network.
4. Other factors such as host processing delay are not taken into account.
5. 'Characters Per Line' includes any compression and any printer forms handling characters (except line feed characters) sent on the communication facility.
6. A full buffer is always received (with partial print line depending on the line length).
7. ASCII character sets may exhibit approximately 4% lower performance.

Figure D-6. 3777 Model 1 Line-to-Printer Throughput (BSC)



ASSUMPTIONS:

Curves shown are based on the following assumptions:

1. Perfect Transmissions — no CRC errors.
2. Zero modem turnaround delay — four wire half duplex communication facility.
3. No propagation delay through the modems or the network.
4. Other factors such as host processing delay are not taken into account.
5. "Characters Per Line" includes any compression and any printer forms handling characters (except line feed characters) sent on the communication facility.
6. A full buffer is always received (with partial print line depending on line length).
7. These curves are for EBCDIC only.

Figure D-7. 3777 Model 1 Line-to-Printer Throughput (SDLC)

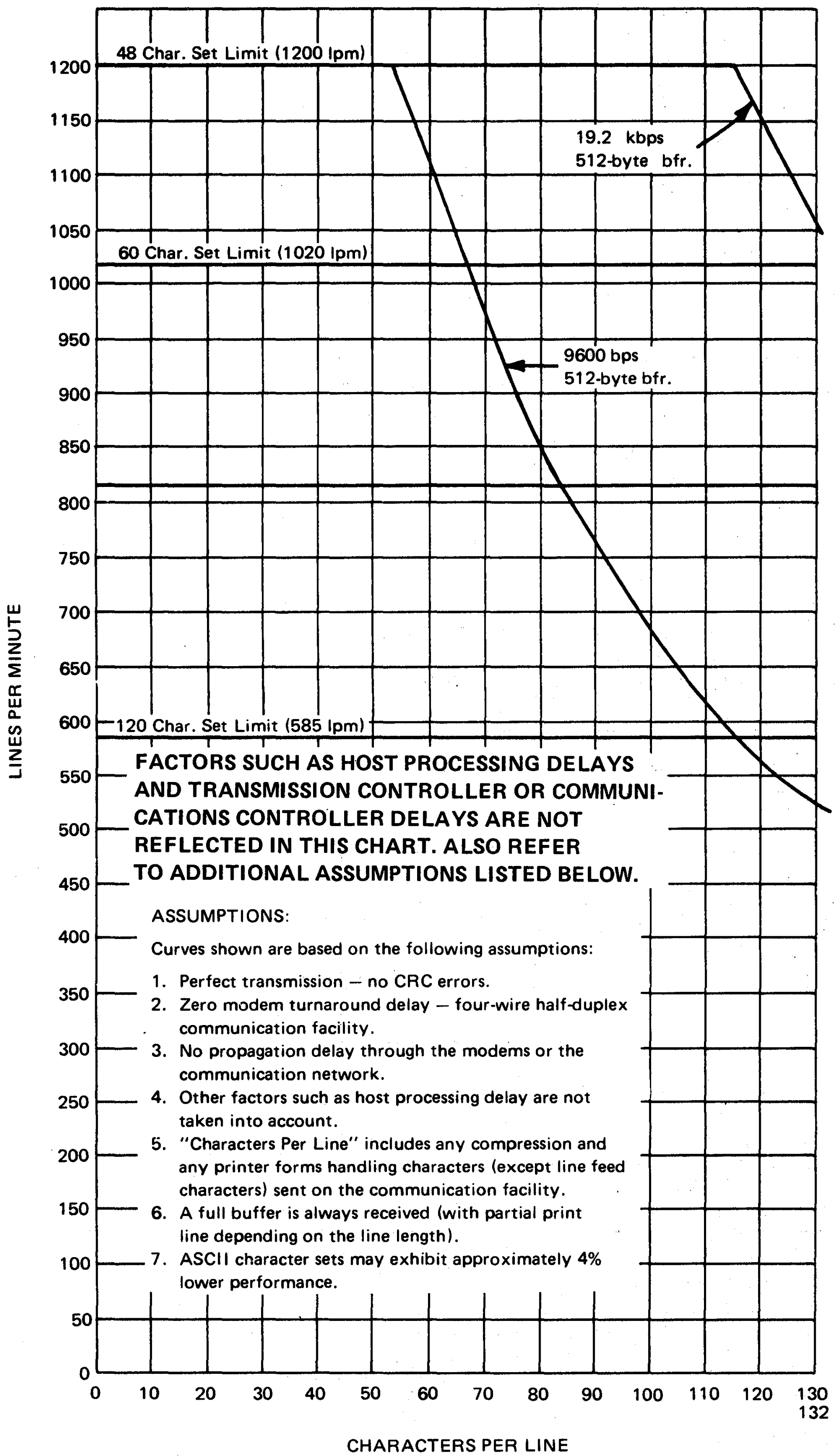


Figure D-8. 3777 Model 1 Line-to-Printer (1200 lpm) Throughput (BSC)

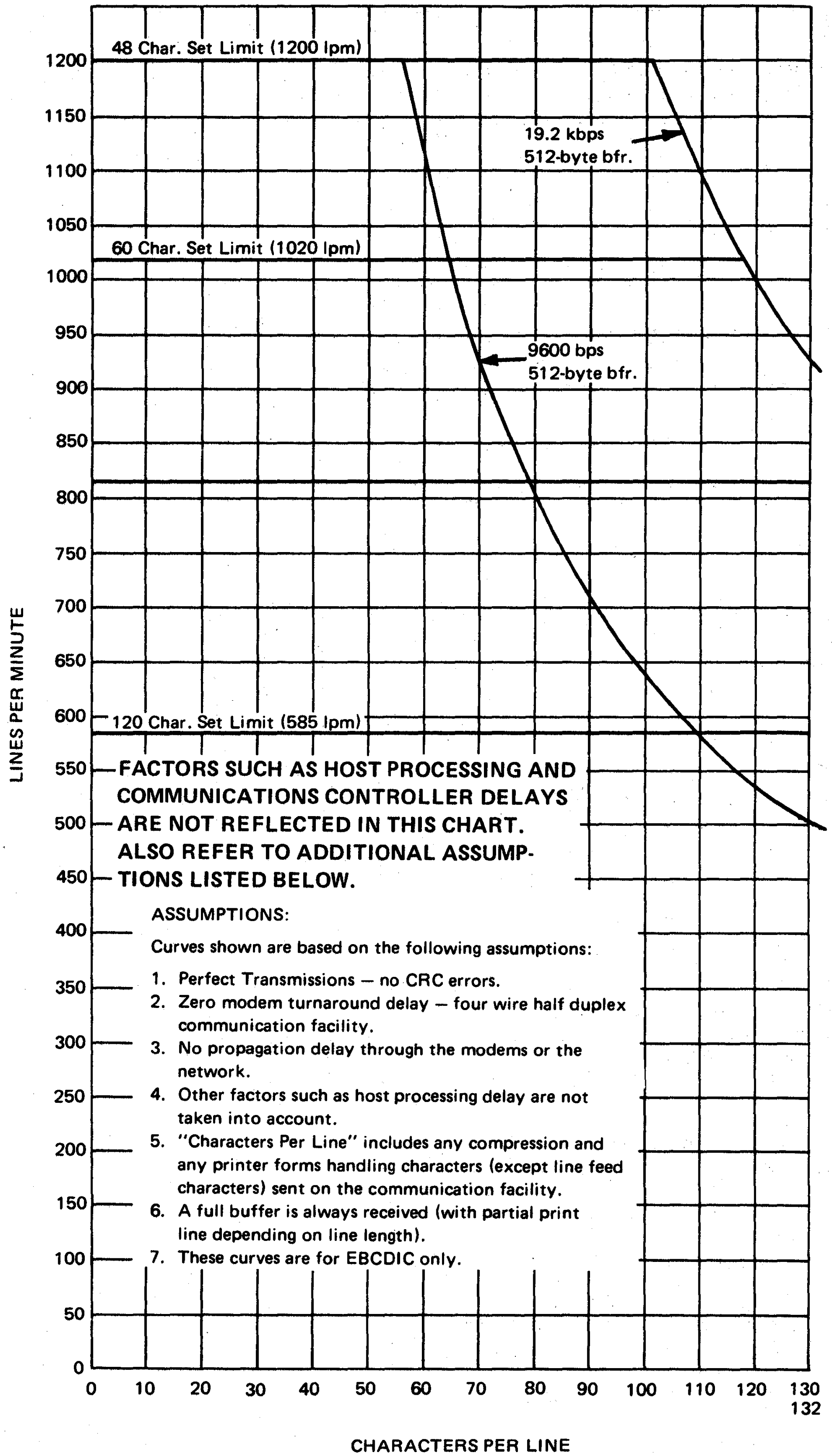
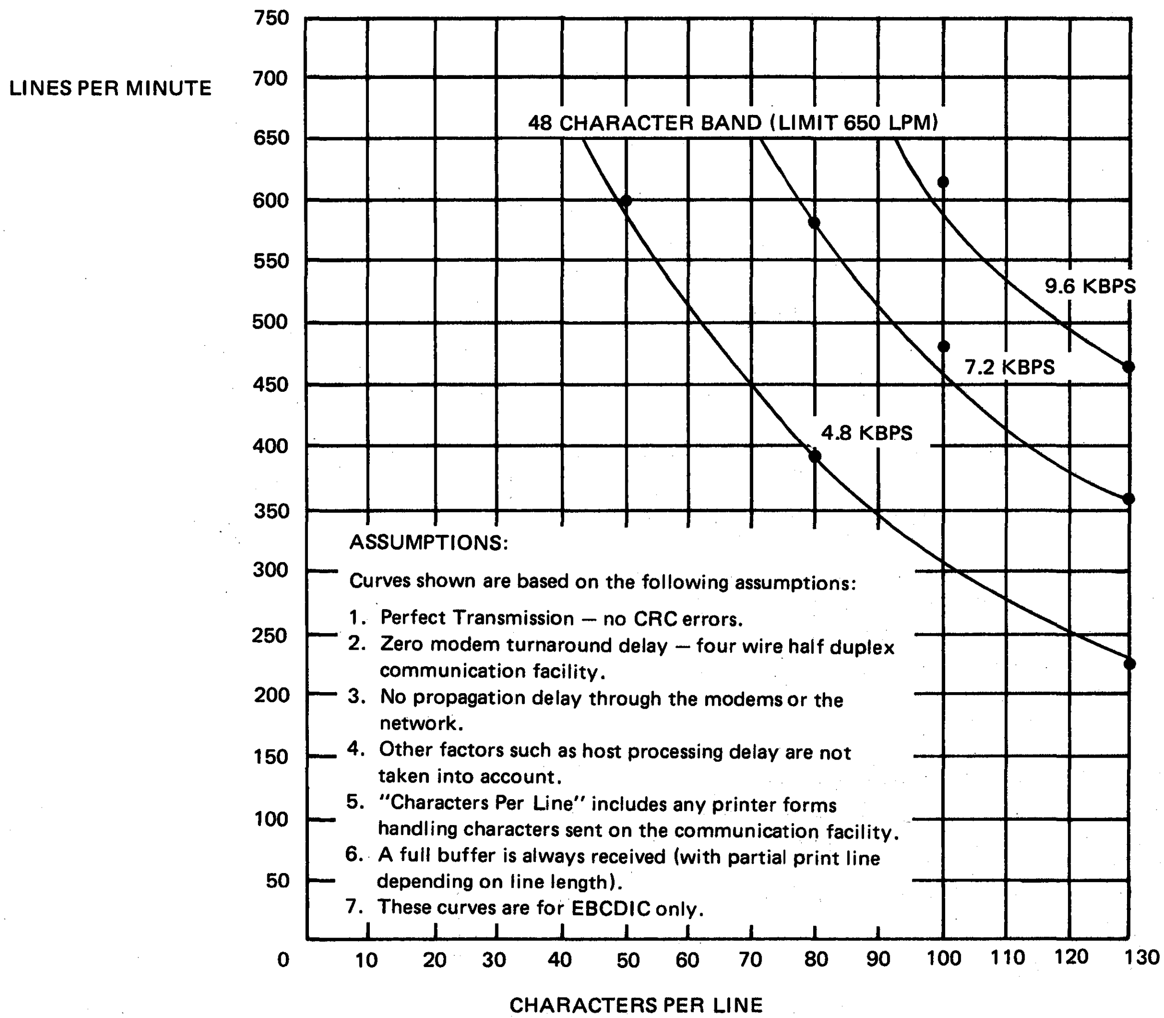


Figure D-9. 3777 Model 1 Line-to-Printer (1200 lpm) Throughput (SDLC)

3262 Model 2 Printer Performance

The speeds shown in Figures D-10 through D-13 are the nominal rated speeds of the printer. However, these speeds may be degraded depending on:

- Host processor link speed
- Data organization
- Application program
- Print line length



Curves plotted under the following conditions:

ONE 3262-2 PRINTER
256 BYTE RU'S
3,1 PACING
ALPHAMERIC DATA
NO COMPRESSION/COMPACTION

Figure D-10. One 3262-2 Printer, 48 Character Band–Nominal Throughput

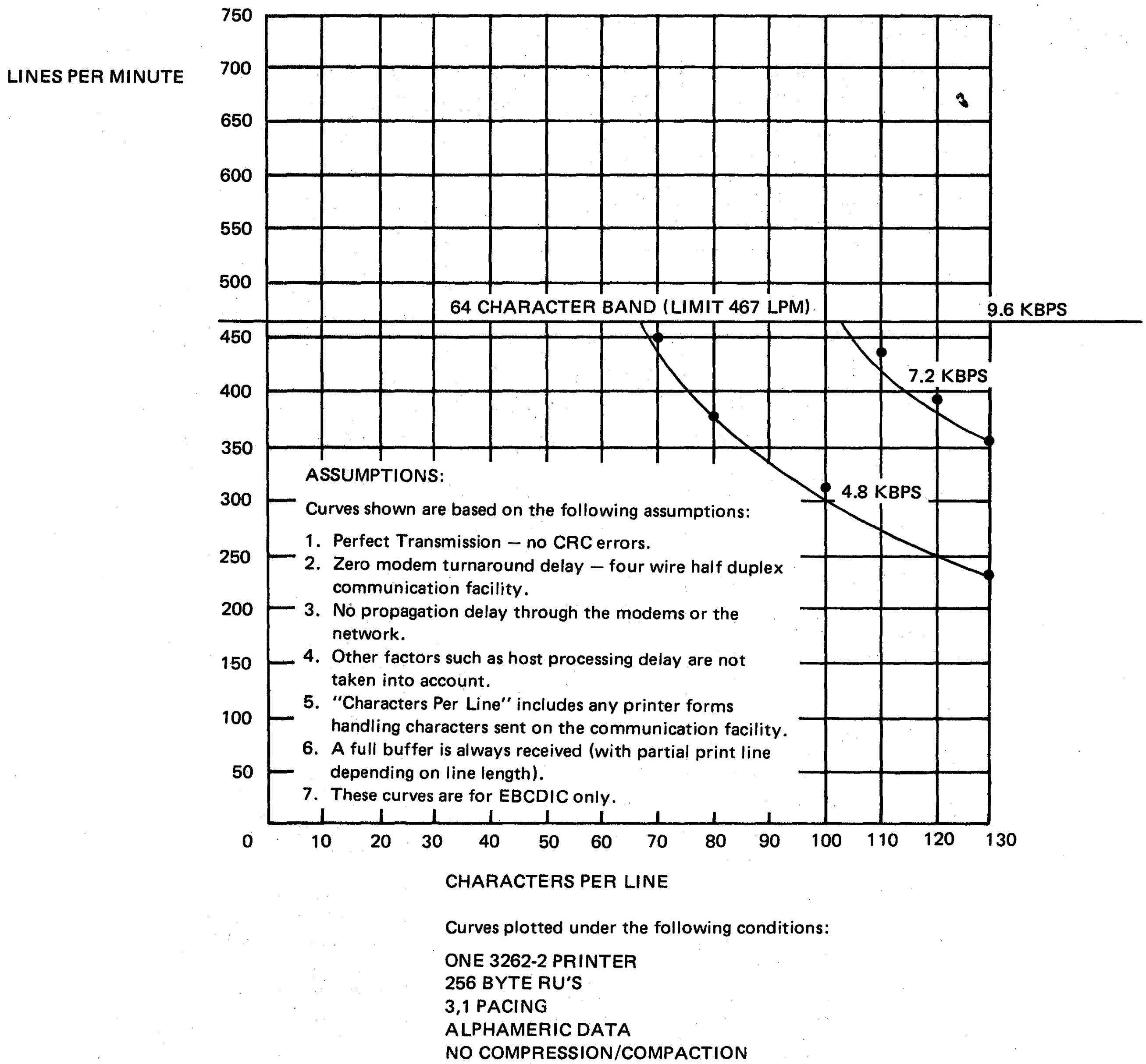


Figure D-11. One 3262-2 Printer, 64 Character Band–Nominal Throughput

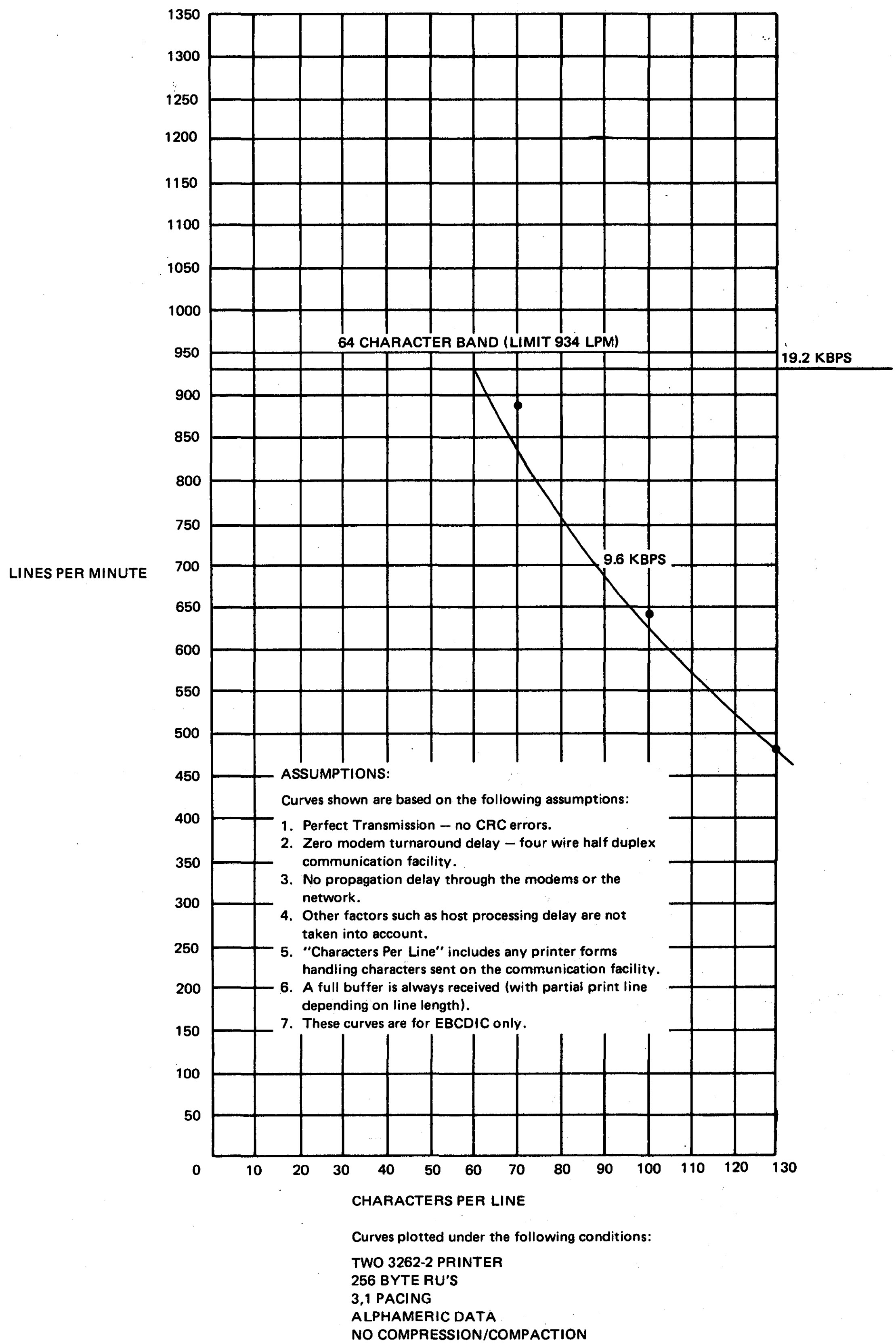
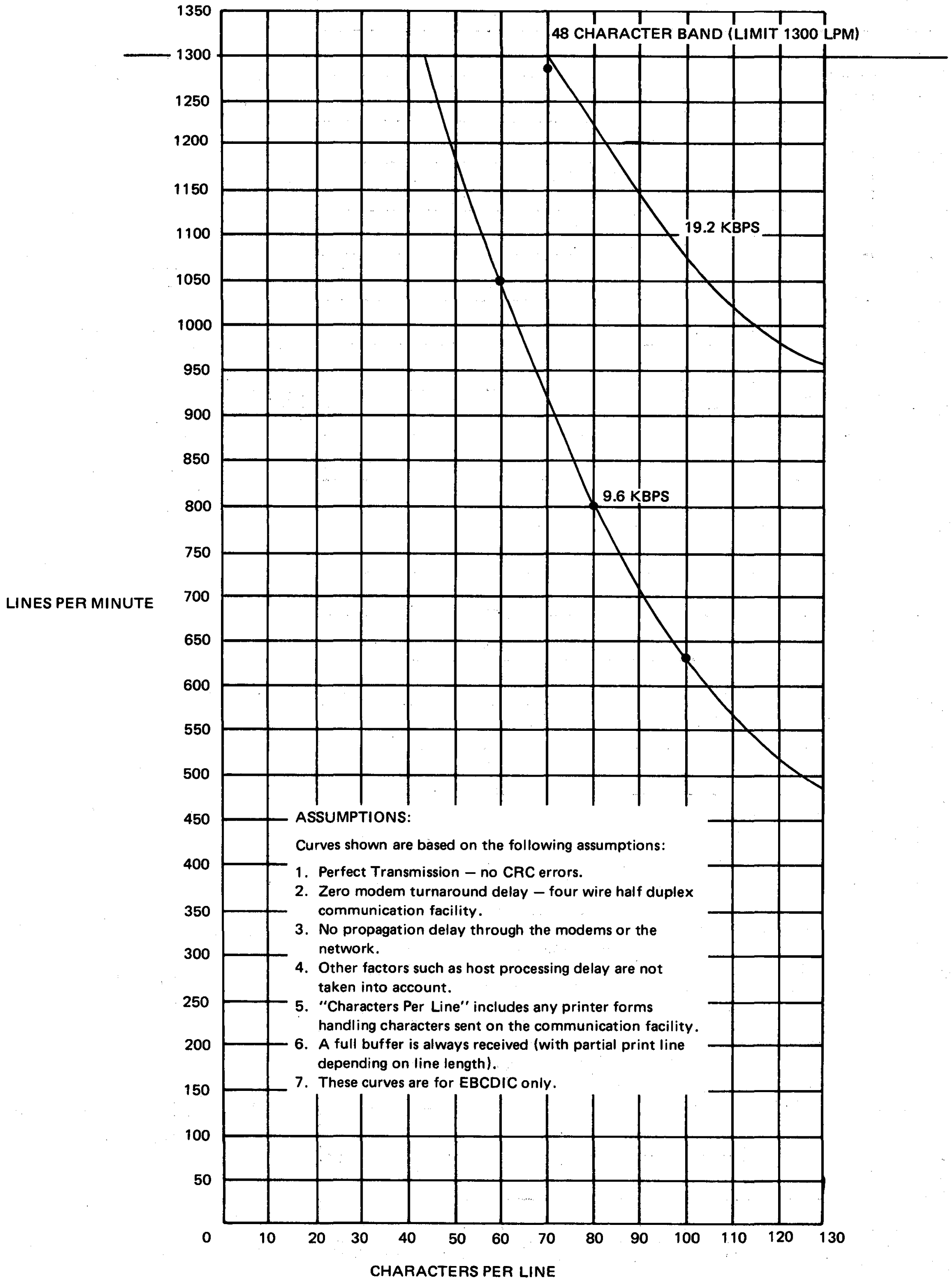


Figure D-13. Two 3262-2 Printers, 64 Character Band–Nominal Throughput



Curves plotted under the following conditions:

TWO 3262-2 PRINTER
256 BYTE RU'S
3,1 PACING
ALPHAMERIC DATA
NO COMPRESSION/COMPACTION

Figure D-12. Two 3262-2 Printers, 48 Character Band—Nominal Throughput

Diskette Performance - BSC Models

The following tables estimate diskette performance on various 3776/3777 terminals in BSC mode.

Communication Line Performance

The information given below is based on the following assumptions:

1. Error free transmission
2. Full 256- or 512-byte buffers
3. Zero modem turnaround, network propagation, and host processing delays.

Diskette to Line - bpm

Terminal	*Buffer Size*	*Line Speed-bps*			
		1200	*2400*	*4800*	*9600*
3776-1, -2	256	30 bpm	57 bpm	110 bpm	
3776-1, -2	512	15	29	59	
3777-1	256			120	190 bps
3777-1	512			60	105

Line to Diskette (3770 Nonexchange Diskette) - bpm

Terminal	*Buffer Size*	*Line Speed-bps*			
		1200	*2400*	*4800*	*9600*
3776-1, -2	256	30 bpm	52 bpm	99 bpm	
3776-1,-2	512	15	29	55	
3777-1	256			120	120 bpm
3777-1	512			60	70

Effective Card Rate Online

The chart represents effective cards per minute (Eff. cpm) speed when transmitting diskettes that were loaded with card data offline.

Terminal	*Buffer Size*		*Line Speed-bps* *4800*			*9600*		
		Data Char. Per Card →	40	60	80	40	60	80
		Eff. cpm ↘						
3776-1,-2	256		700	450	345			
	512		770	520	390			
3777-1	256		750	495	402	1325	795	630
	512		770	536	402	1430	1000	750

Performance with Diskettes Created on IBM 3740

The tables below estimate the performance of the 3776-1/3776-2/3777-1 when processing diskettes originating from an IBM 3740. The communication line performance assumptions, noted previously, apply to those tables showing communication line performance. The following terms are used in these tables:

Record Size: The IBM 3740 record contains the number of data characters shown plus enough space characters to fill an 80-byte record.

IBM 3740 Records Per Minute: Indicates the number of 3740 records processed per minute (R/M).

Dual Data Path - Simultaneous Operations

- Line to Printer - 63-character line, 48 character set
- Diskette to Diskette - with Record Compression

Terminal	*Buffer Size*	*Record Size*	*Line Speed 4800*		*9600*	
			3740 R/M	*lpm*	*3740 R/M*	*lpm*
3776-1	256	40	130	270		
		60	115	270		
		80	100	265		
	512	40	135	265		
		60	120	260		
		80	110	260		
3776-2	256	40	115	360		
		60	100	355		
		80	90	355		
	512	40	120	350		
		60	110	345		
		80	95	340		
3777-1	256	40	225	510	215	950
		60	190	500	185	950
		80	170	495	160	950
	512	40	240	525	235	985
		60	205	515	200	985
		80	185	510	180	970

Diskette to Diskette with Record Compression (Offline)

Terminal	*Record Size*	*IBM 3740 R/M 256-Byte Bfr*	*512-Byte Bfr*
3776-1,-2	40	140 R/M	140 R/M
	60	125	130
	80	115	120
3777-1	40	225	245
	60	195	210
	80	175	185

Diskette to Line

- Record Compression while transmitting diskette - Online Compression
- Transmission of 3770-mode diskette that resulted from offline diskette-to-diskette Record Compression operation - Effective IBM 3740 records per minute (*Eff*.R/M)

Terminal	*Buffer Size*	*Record Size*	*Line Speed-bps 4800 On Line*	*4800 EffR/M*	*9600 On Line*	*9600 EffR/M*
3776-1, 2	256	40	170R/M	740R/M		
		60	170	495		
		80	170	385		
	512	40	170	785		
		60	170	525		
		80	170	400		
3777-1	256	40	330	770	335R/M	1300R/M
		60	330	515	332	870
		80	325	400	332	665
	512	40	330	795	335	1575
		60	330	530	332	1035
		80	330	410	332	800

Appendix E. Data Format

Note: For reference purposes and in the interest of diskette compatibility between models, this appendix includes some information on 3773/3774/3775 nonprogrammable and programmable terminals.

Diskette Track Formats

Track/Sector Assignment – 3776/3777 and other 3770 Non-Programmable Models

3776-1/3776-2/3777-1 and Non-Programmable 3770 Models

Track	Sector	Use
00	1-6 7 8 9-26	Not Used Volume Label Data Set Label for † Job Definition Record Data set labels for User Data Sets
01	1, 2 3-26	Job Definition Records User Data
02-73	1-26	User Data

†See exception for SDLC exchange diskettes under "TRACK 00- INDEX TRACK".

3776-3/3776-4/3777-3

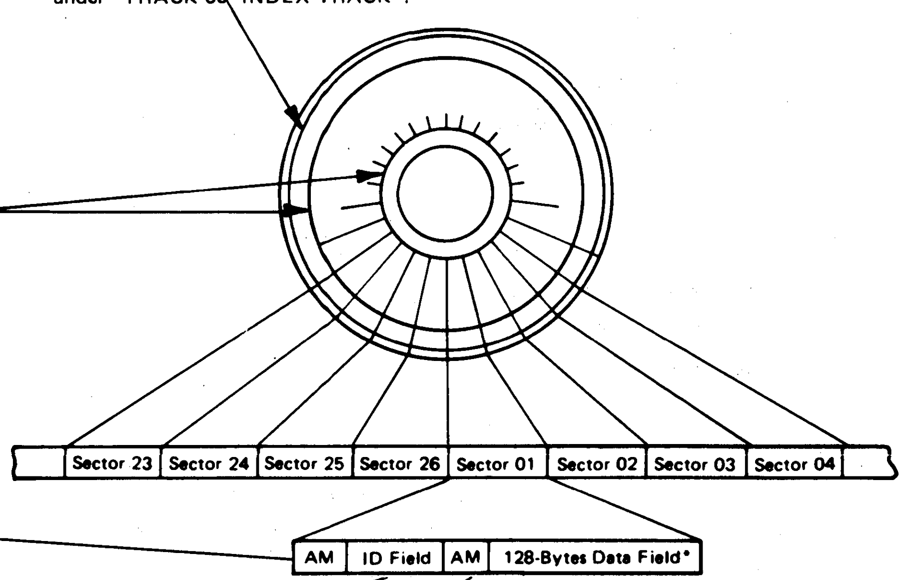
Track	Sector	Use
00	1-6 7 8-26	Not Used Volume Label Data Set Labels for User Data Sets
01-74	1-26	User Data

TRACK 00–INDEX TRACK

The first track on a diskette is called the index track and is numbered 00. The index track's 26 sectors are reserved for system and data set label information. Each record on the index track has a record length of 80 characters. The first six sectors of the index track are not used by the 3770, but may contain information if the diskette was used on another system or machine. Sector 7 contains the volume label, which is written as shown in Figure E-2. Sector 8 contains the data set label for the Job Definition Record (except on SDLC exchange diskettes where Sector 8 is used for user data set labels); sectors 9 through 26 (18 sectors) contain data set labels for user data sets. The data set labels are written as shown in Figure E-3.

TRACKS 01 THROUGH 73–DATA TRACKS

Track 01, Sectors 1 and 2 are reserved for Job Definition Records (up to 5 job definitions may be stored in these two sectors). Track 1, sectors 3 through 26, and tracks 2 through 73 (all sectors) are used to store customer data. The job Definition Records are always identified as inactive, and cannot be transmitted, printed, or accessed in any way, except to read the job definition from the diskette into the controller for executing the job.



AM1 (ADDRESS MARKER 1)

Identifies bytes between this address mark and the following address mark as the address field of the sector.

Sector and track number used to identify the record.

EITHER AM2 OR AM3

These address markers both identify the following field (that is, the bytes between AM2 or AM3 and the next address marker) as a data field. AM2 indicates that the field contains a good record; AM3 indicates that the field contains a bad sector or a deleted record.

To read or write information, the diskette device locates the correct track and sector by reading the ID Field. When the correct field is located, the drive reads 128 bytes of data from two (four if 3776/3777 in 512-byte mode) sector data fields (256 or 512 bytes total) during a read operation, or writes 128 bytes of data into two (four if 3776/3777 in 512-byte mode) sector data fields (256 or 512 bytes total) during a write operation.

*** 80-byte field for Index Track.**

Note: The ID field and the data field each have two cyclic redundancy check (CRC) characters that the drive uses for automatic error checking.

Figure E-1. Diskette Track Formats (Part 1 of 2)

Track/Sector Assignment—Programmable 3770 Models

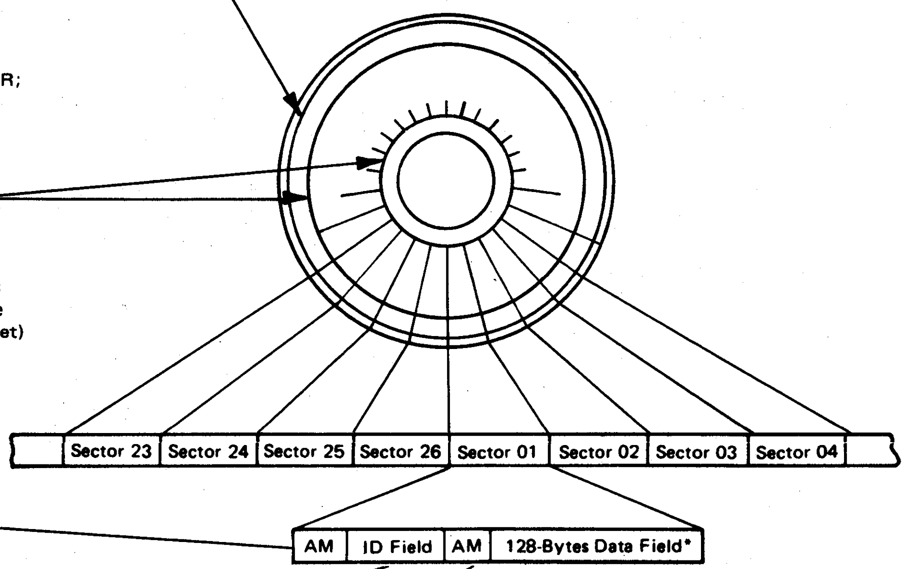
Track	Sector	Use
00	1-4 5 6 7 8-26	Not Used Error Map Not Used Volume Label System- and User-Named Data Set Labels
01-74	1-26	User Data

TRACK 00—INDEX TRACK

The first track on a diskette is called the index track and is numbered 00. The index track's 26 sectors are reserved for system and data set label information. Each record on the index track has a record length of 80 characters. The first four and the sixth sectors of the index track are not used by the 3770, but may contain information if the diskette was used on another system or machine. Sector 5 contains the error map in the format TTSS where TT is the track number and SS is the logical record number of the defective sector. Sector 7 contains the volume label, which is written as shown in Figure E-2. Sectors 8 through 26 (19 sectors) contain data set labels for system-named data sets such as SYS.PGM, SYS.IBM, SYS.TDS, SYS.SUPR, and SYS.INTR; and user-named data sets. The data set labels are written as shown in Figure E-3.

TRACKS 01 THROUGH 74-DATA TRACKS

These tracks are used to store the data sets as defined by the data set labels on Track 00. On a 3770 nonexchange diskette, track 01 is allocated to the OJDR data set. This space may be deallocated (by deleting the data set) if the diskette is never to be used on a nonprogrammable 3770.



AM1 (ADDRESS MARKER 1)

Identifies bytes between this address mark and the following address mark as the address field of the sector.

Sector and track number used to identify the record.

EITHER AM2 OR AM3

These address markers both identify the following field (that is, the bytes between AM2 or AM3 and the next address marker) as a data field. AM2 indicates that the field contains a good record; AM3 indicates that the field contains a bad sector or a deleted record.

To read or write information, the diskette device locates the correct track and sector by reading the ID Field. When the correct field is located, the drive reads 128 bytes of data from two sector data fields (256 bytes total) during a read operation, or writes 128 bytes of data into two sector data fields (256 bytes total) during a write operation.

*80-byte field for Index Track.

Note: The ID field and the data field each have two cyclic redundancy check (CRC) characters that the drive uses for automatic error checking.

Figure E-1. Diskette Track Formats (Part 2 of 2)

DISKETTE VOLUME LABEL TRACK 00—SECTOR 07

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
V	O	L	1	•	•	•	•	•	•	b	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	•	•	•

40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
•	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*	*	X	*	*	*	X	W

b=blank (space character - X'40')

X=These fields contain information if the diskette was used on another machine type. Refer to the publication GA21-9182, for information contained in these fields.

*=See below.

0-3 Volume Label. Contains VOL1.

4-9 Volume ID. The volume ID field contains IBMIRD when the diskette is received from IBM. It is changed to 3770 when the Diskette Create function is performed on the 3770 (changed to 3777M2 by the 3777-2). On the 3776/3777 MLU, the operator can set the field.

10 Accessibility Indicator. Must be a space character for the 3770 to read or write the diskette. The 3770 sets it to a space character when the Diskette Create function is performed.

24-36 System Code. On the 3776/3777 MLU, contains 'IBM3770' plus six spaces written at creation.

37-50 Owner Identification. Contains 3770, 377X, or space characters as described in "Special Requirements Indicator", "Extent Arrangement Indicator", and "Owner Identification (ID) Field" in this appendix. On the 3776-3/3776-4/3777-3, the operator can key in data for this field during the Create Diskette (CDISK) command.

72 **Extent Arrangement Indicator. Contains 'P' or space character as described under "Extent Arrangement Indicator" in this appendix. Replaced by a space character on the MLU models when a data set is deleted.

73 **Special Requirements. Contains a space for basic exchange diskettes or an 'R' as described under "Special Requirements Indicator" in this appendix.

75 Physical Record Length. Must be a space character (indicating 128 bytes per sector) for the 3770 (and 3777-2) to read or write the diskette.

76-77 Sector Sequence Information. Must be a space character or 01. If not, will cause "no record found" condition when attempting to read on 3770.

79 Label Standard. Always W.

80-127 Reserved. Contains space characters.

**These indicators may be left blank on early machines.

Figure E-2. Diskette Volume Label

DISKETTE DATA SET LABEL TRACK 00–SECTORS 8-26

Note: Sector 8 is reserved for Job Definition Record label on 3770 nonexchange diskettes; sectors 9-26 are for user data set labels.

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
H	D	R	1	b	*	*	*	*	*	*	*	*	X	X	X	X	X	X	X

20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
X	X	*	*	*	*	*	*	*	*	*	*	*	X	*	*	*	*	*	*

40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
*	b	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	X	X	X

60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
X	X	X	X	X	X	*	*	*	*	*	*	*	*	*	*	*	*	*	b

b=blank (space character - X'40')

X=These fields may contain information if the diskette was used on another machine type. Refer to the publication GA21-9182, for infor- information that may be contained in these fields.

*=See below.

00-03 Label Identifier. Contains HDR1.

05-12 Data Set Name. Will be OJDR for Job Definition Record (Sector 8). Not used on MLU models.

For system defined jobs, non MLU models, data set names are:

SC00 – Card Reader-to-Diskette
SL00 – Communication Line-to-Diskette
SD00 – Diskette-to-Diskette Compress
Note: 00 is incremented for multiple data sets.

For MLU models, default data set names are SLXX, where XX is any unique number.
3777-2 Spooling/IPL diskette:

SYS IPL (if present)
SYS MSGS

3777-2 Diskette Input Device, and 3776/3777 MLU—eight-character names (maximum):
AXXXXXXX – A must be alphabetic; some system-defined data set names are less than eight characters long.

22-26 Block Length. $\leq$ 80 for 3777-2 Diskette Input
$\leq$ 128 for Basic Exchange Data Sets
$\leq$ 128 or 256 for programmable 3770 models.
= 128 for exchange diskettes. } nonprogrammable
= 256 for 3770 diskettes and 3777-2 spooling diskettes. } nonprogrammable
= 512 for 3776/3777-1 with EXTEND BUFFER on.
= 256 or 512 for T-type data sets on 3776/3777 MLU models.

27 Record Attribute. Contains space character for 3770 diskettes; "don't care" for exchange diskettes; 'B' for 3777-2 spooling diskette.

28-32 Beginning of Extent (BOE). Described under "Special Requirements Indicator" in this appendix.

34-38 End of Extent (EOE). Described under "Special Requirements Indicator" in this appendix.

39 Record/Block Format. Contains space character for 3770 diskette "don't care" for exchange diskettes; 'U' for 3777-2 spooling diskette. The 3777-2 checks this field for a 'U' (unique to the 3777-2).

40 Bypass Indicator. Space character indicates active data set, 'B' indicates inactive data set.

42 Write Protect Indicator. Must be a space character for 3770 to write on this data set. If set to 'P', 3770 cannot write. It is set to a space character by the 3770 Data Set Create function. The operator of the 3777-2 cannot set the Write Protect Indicator to protect data sets.

43 Exchange Type Indicator. Contains a space character, 'E', or 'T' as described under "Exchange Type Indicator" in this appendix.

44 Multivolume Indicator. A space character indicates that a data set is contained on one diskette; a 'C' indicates that a data set is continued on another diskette; an 'L' indicates that this is the last diskette of a continued data set. This field is always a space character on 3777-2 spooling diskettes.

45, 46 Volume Sequence Number. On the 3776/3777 MLU, specifies the sequence (01-99) of volumes in a multivolume data set.

47-52 Creation Date. On the 3776/3777 MLU, contains creation date of data set in format YYMMDD.

53-56 Record Length. On the 3776/3777 MLU, must be a space characters.

66-71 Expiration Date. May contain expiration date if non-3770 exchange diskette. Set to all 9's on 3770-created data sets. Contains expiration date on 3776/3777 MLU in same format as Creation Date.

72 Verify/Copy Indicator. Written by 3776/3777 MLU at Data Set Creation. Modified by Change Label function.

73 Data Set Organization. Contains 'D' for 3770 diskettes; "don't care" for exchange diskettes; space for 3776/3777 MLU.

74-78 End of Data (EOD). Identifies the address of the next available sector (exchange) or next available logical record (nonexchange).

80-81 Medium and Subaddress. For 3776-1, -2/3777-1 SNA only.

95-107 System Code. On the 3776/3777 MLU, contains 'IBM3770' plus six spaces written at Data Set Creation.

Note: The 3776/3777 MLU terminals write spaces in the following fields at Data Set Creation: 41, 57-65, 79-94, 108-127.

Figure E-3. Diskette Data Set Label

Diskette Compatibility

This section amplifies the information on the preceding two charts, volume and data set labels, and the following chart on diskette compatibility.

Exchange Type Indicator

Byte 43 in the data set label defines the format of the data within the data set. It is used along with the block length field of the data set label, the owner identification, extent arrangement indicator, and special requirements indicator of the volume label to determine diskette compatibility between the different 3770 terminal models. The exchange type indicator defines formats as follows:

Space (Basic Exchange Data Set)

- Any bad sector control records found in this data set are the 'relocated sequentially' type.
- Maximum of 128 bytes logical record length
- Fixed length records, unblocked and unspanned
- Physical record length of 128 bytes
- Data set name is a simple name up to 8 characters
- Data must be recorded exclusively in either EBCDIC or ASCII and must be in the same code as the data set label

E

An 'E' indicates that no summation of attributes exists. All supported fields must contain values that accurately describe the data set. All unsupported fields must contain space characters. These data sets (except for the IBM 3777-2) are compatible with card reader-to-line data from the IBM 2770 and IBM 3780. Block length may be 256- or 512-bytes. The format is as illustrated in Figure E-5. The IBM 3777-2 sets block length to 256 and record/block format to 'U' on spooling diskettes, indicating variable length records in a fixed length block. E-type data sets can not be processed on the 3776-3,4 or 3777-3.

T

A 'T' defines a data set similar to that defined by an 'E' except that the first record will contain a Type 1 function management header (FMH). The FMH is created along with the data set and contains information about the source of the data set. The T-format data set is created by a 3770 SDLC terminal. On models where the keyboard-to-diskette function is permitted, modification of existing records is permitted. Block length will be 256-bytes except on models with the Extend Buffer switch, in which case it may be 512-bytes.

Special Requirements Indicator

An 'R' in Byte 73 of the volume label indicates that all of the data sets on this volume are on tracks that were recorded in a "logically nonsequential" order by the IBM 3770 system. The sequence is used to optimize performance. Sectors are read/written two (four for 512-byte buffer) at a time. For an exchange data set on this kind of diskette, the programmable models read or write the exchange data set one sector at a time. Use of a "logically sequential" order requires that the diskette make one complete revolution between reading/writing of each sector, thus, reducing throughput. The extent fields of the data set label reflect the logical addresses.

Note: Because early IBM 3770 systems did not set this field, the owner ID field was used. For this "logically nonsequential" sequence, the owner ID field is set to '3770'. The 3776/3777 MLU terminal does not check the owner ID field and requires an 'R' in this field to correctly read or write T-format data sets on the diskette.

Beginning of Extent

Beginning of extent (BOE) specifies the beginning address of the extent. It contains a decimal address of the first logical record. This field is of the format CCHRR where:

CC = Track address (01-74)
H = Reserved; must be decimal zero
RR = Record address
(01-26 for 128-byte record)
(01-13 for 256-byte record)
(01-07 for 512-byte record)

The proper values must be entered when the label is created. A system, when writing the label, must check BOE and EOE to ensure that another extent is not assigned to the physical records of this data set.

End of Extent

End of extent (EOE) specifies the ending address of the extent. It contains the decimal address of the last logical record of the extent. This field has the same format as BOE and is entered and used as described above.

Medium and Subaddress (3776-1,-2/3777-1 SNA Only)

Medium (Byte 80) – 0 = Console
1 = Diskette
2 = Card

Subaddress (Byte 81) – Valid subaddresses are 0-F in hexadecimal (0-15 in decimal)

Extent Arrangement Indicator

Byte 72 of the volume label indicates the arrangement of the extents on the volume. The values entered in this field define the arrangements as follows:

Space

- The only constraints on the arrangement of the extents on the volume are (1) they must not overlap other extents and (2) they must begin and end at the addresses specified in their BOE and EOE fields in their associated data set labels.
- Unallocated space on the volume may appear anywhere on the volume other than on track 0, provided that it does not overlap any of the extents assigned in their associated BOE and EOE fields.
- Unallocated space need not be in a single extent or in contiguous extents and it need not be assigned a data set label.
- In order to assign space to a new extent (with the exception of the first extent on the volume), it is necessary to check all of the HDR1 labels to ensure that the assigned space does not overlap any of the previously assigned extents.
- The data set labels may appear in any of the label records on track 0. They need not be arranged contiguously or in the sequence of the extents they describe. Unused label records may be interspersed with those used to describe data sets.

P

- The extents of the volume must be arranged contiguously beginning at track 1, record 1. All unallocated space follows the last data set extent on the volume.
- The data set labels must be arranged contiguously beginning at track 0, record 8, and they must be arranged in the same sequence as the extents they describe. All unused label records appear following the last label record to which an extent is assigned.
- If unused space is created preceding any of the extents, or preceding any of their associated labels, then one of the following actions must be taken:

  1. Rearrange the extents and/or the labels on the volume to eliminate the unused space.
  2. Change the value of this label field to a space character.

A basic exchange data set may be recorded on a volume with either a 'space' or a 'P' in this field. The value for this field is set to a 'P' by the Diskette Create function. On the MLU models, it will be changed to a 'space' if a data set is deleted. Non-MLU terminals cannot write on the diskette if this field is not set to 'P'.

Note: Because early IBM 3770 systems did not set this field, the owner ID field is set to '3770' or '377X', depending on the sequence used.

Owner Identification (ID) Field

On some of the early terminals, the special requirements and extent arrangement indicators were not yet defined in the volume label. These terminals set and use the owner ID field, Bytes 37-40, as follows:

3770 (Nonexchange Diskette)

The data is recorded as described in "Special Requirements Indicator" above. The exchange-type indicator may be set to 'space', 'E', or 'T'.

377X (BSC Exchange Diskette)

The data is recorded both logically and physically in a sequential order. The data sets are formatted as described for an 'E' under "Exchange Type Indicator" for the purpose of 2770/3780 compatibility. However, the exchange type field is set to a space so that other systems can process the data. These data sets are read/written two (four for 512-byte buffers) sectors at a time.

Spaces (Basic Exchange Diskette)

On programmable models and SDLC machines, the owner ID field is set to spaces for basic exchange diskettes. The data is recorded both logically and physically in a sequential order. The data sets are formatted as described for a 'Space' under "Exchange Type Indicator" so that other systems can process the data.

Note: On nonprogrammable models in SDLC mode, basic exchange diskettes can be created only from data received over the communication line.

Note: On non-MLU models in SDLC mode, basic exchange diskettes can be created only from data received over the communications line.

Pertinent Vol 1 Label Fields			Pertinent HDR1 (Data Set) Label Fields		Support Provided By 3770 Communication Terminals									
					Binary Synchronous Communications (BSC)				Synchronous Data Link Control (SDLC)					
Owner ID	Extent Arrangement Indicator	Special Requirements Indicator	Block Length	Exchange Type Indicator	3773/3774/ 3775 Non-Programmable		3776-1, -2, 3777-1		3773/3774/3775 Nonprogrammable		3776-1, -2, 3777-1		3776-3, -4,, 3777-3, -4	
Bytes 037-050	Byte 072 (5)	Byte 073 (5)	Bytes 022-026	Byte 043	Diskette	Data Set	Diskette	Data Set	Diskette	Data Set	Diskette	Data Set	Diskette	Data Set
'3770'	'P'	'R'	256	'E'	Create	Read Write	Create	Read Write	Create	Read	Create	Read	Create	
			512					R/W				Read		
			1-128	Blank										
			256	'T'						Read Write		Read Write		Read (8) Write (2,8)
			512									Read Write		Read (8) Write (2,8)
'377X'	'P'	Blank	1-128	Blank	Create	Read(1) Write(7)	Create	Read(1) Write(7)		Read(1)		Read(1)		
			256	'E'										
Blank	'P'	Blank	1-128	Blank		Read		Read	Create	Read Write(2)	Create	Read Write(2)		Read Write
			256	'E'										
Any Owner ID	'P' or Blank	Blank	1-128	Blank		Read		Read		Read Write(4) (2)		Read Write(4) (2)	Create	Read Write
			256	'E'										

Figure E-4. Diskette Compatibility (Part 1 of 2)

Description of Terms:

Owner ID - Identifies the owner of the diskette volume.

Extent Arrangement Indicator - Indicates the arrangement of the extents on the diskette volume.

Space - There are no restrictions upon the arrangements of the extents, except that they cannot overlap.

'P' - The extents must be arranged contiguously, without any overlap.

Special Requirement Indicator - Used to describe special data accessing requirements. The 'R' character and the blank space mean the following:

"Space" - No special accessing requirements.

'R' - Indicates that the data is recorded in the normal 3770 system manner.

Exchange Type Indicator - Indicates that the data set has certain specified attributes. It is used as a summary indicator for certain other fields in the data set label. The meaning of the letters follows:

"Space" - A blank indicates that the data set is a Basic Exchange type of data set, with blocks of 128 bytes or less.

'E' - An 'E' indicates that the data set is recorded in the default block size used by the machine that created the data set. The format of the data set can be found in the appropriate manual(s) associated with the creating machine.

'T' - This data set is similar to an 'E' type of data set, but it also contains information about the source of the data, and it is created by SDLC machines.

NOTES:

1. Two sectors are read or written during a read or write operation. An RJE terminal using BSC can process either 2 or 4 sectors.
2. Data can be written from the line only.
3. VOL1 Label byte 072 must be 'P'.
4. On some of the early 3770 terminals, VOL1 bytes 072 and 073 did not print on the diskette listing, in this case use Owner ID = 3770 or 377X. For the 3770MLU, byte 072 must be P and byte 073, must be R.
5. The 3773 machine cannot 'list' a diskette.
6. Writes 128 byte blocks only.
7. Bytes 037-050 may be any owner ID.
8. Extent arrangement indicator, byte 072, is blank.

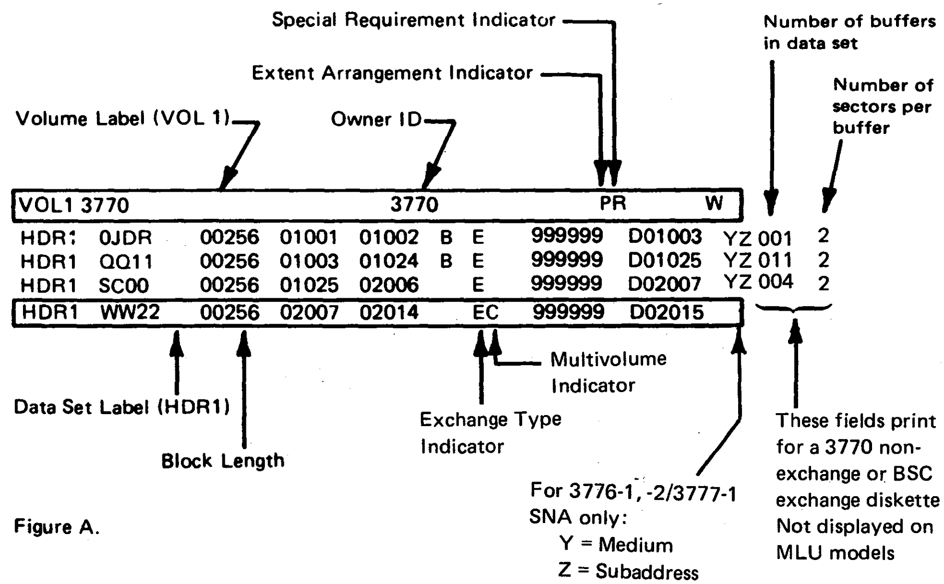


Figure A.

To Use This Chart:

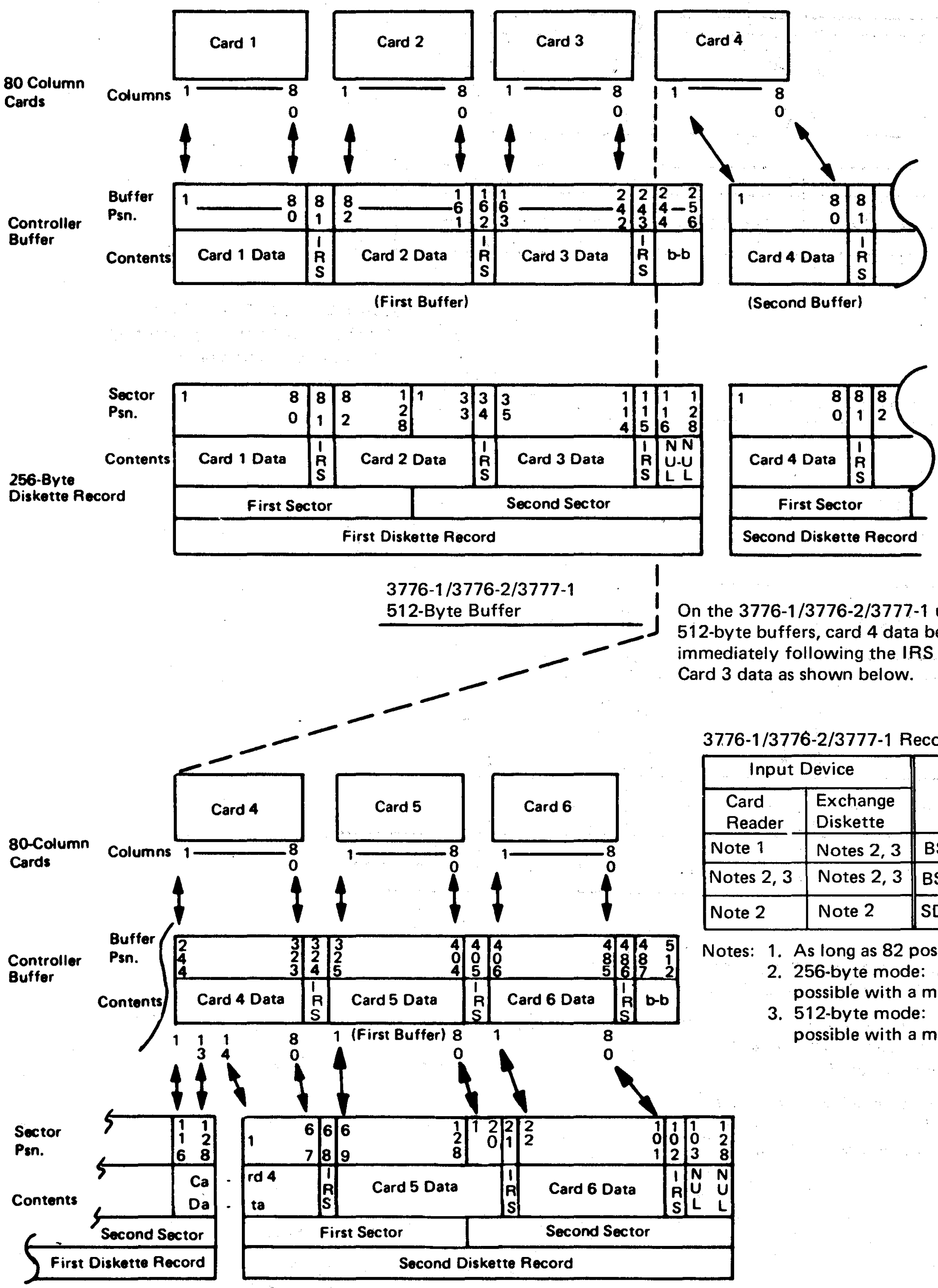
1. Obtain a listing of the diskette to be compared.
2. Examine the 'pertinent' fields in the VOL1 and HDR1 labels and compare them with the chart. (Refer to Figure A) This procedure will identify a row in the chart.
3. Once a row has been located, look at the right side of the chart under BSC or SDLC and find the machine that will process the diskette.
4. After the machine has been located, it can be determined—
   a. If the diskette can be created on the chosen machine.
   b. If the selected terminal can read and/or write on the diskette.

Machine Categories:

3770 = 3773, 3774, 3775 (nonprogrammable)
3770RJE = 3776-1/3776-2/3777-1
3770MLU = 3776-3/3776-4/3777-3/3777-4

Figure E-4. Diskette Compatibility (Part 2 of 2)

Card Image Formats

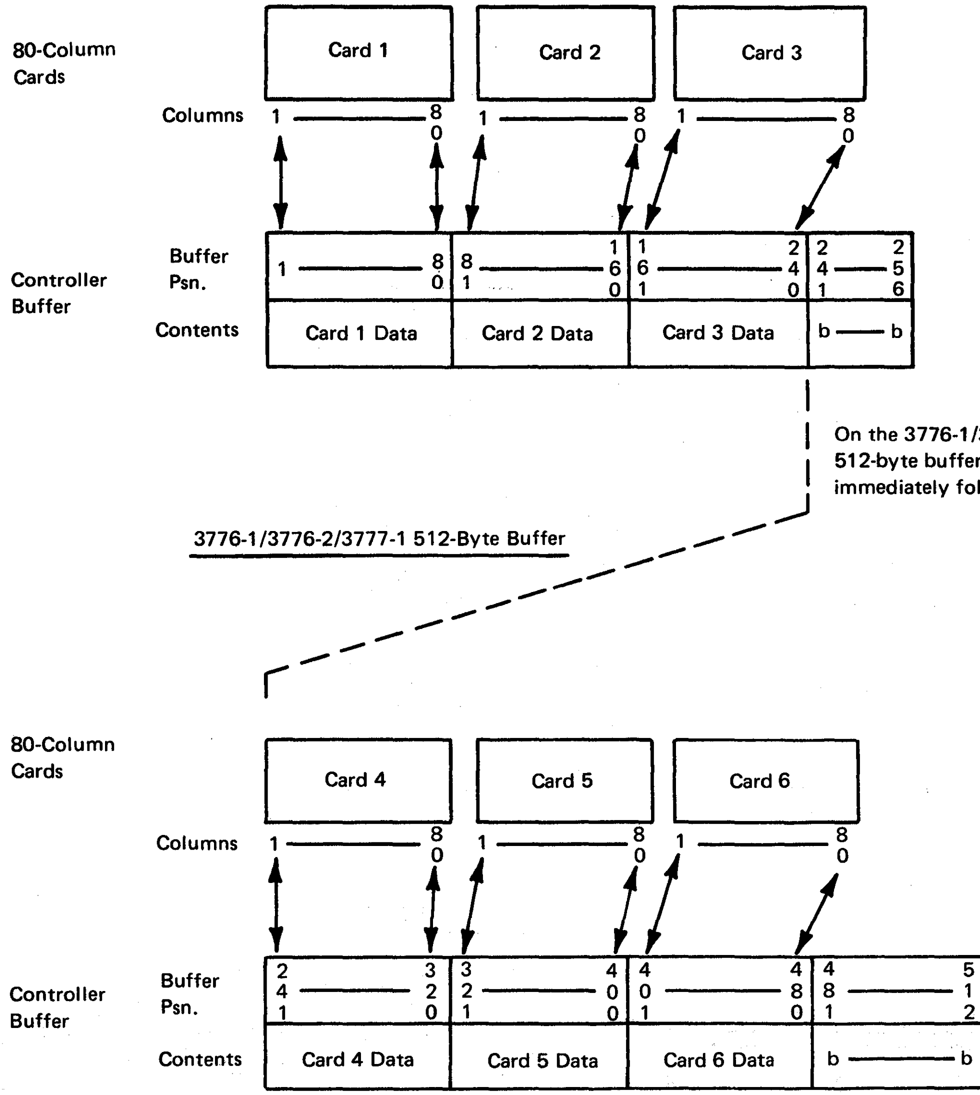


3776-1/3776-2/3777-1 Record Compression Table

Input Device		Output Line Type	
Card Reader	Exchange Diskette		
Note 1	Notes 2, 3	BSC (Machines with BSC only)	
Notes 2, 3	Notes 2, 3	BSC position	Machines with BSC/SDLC Switch
Note 2	Note 2	SDLC position	

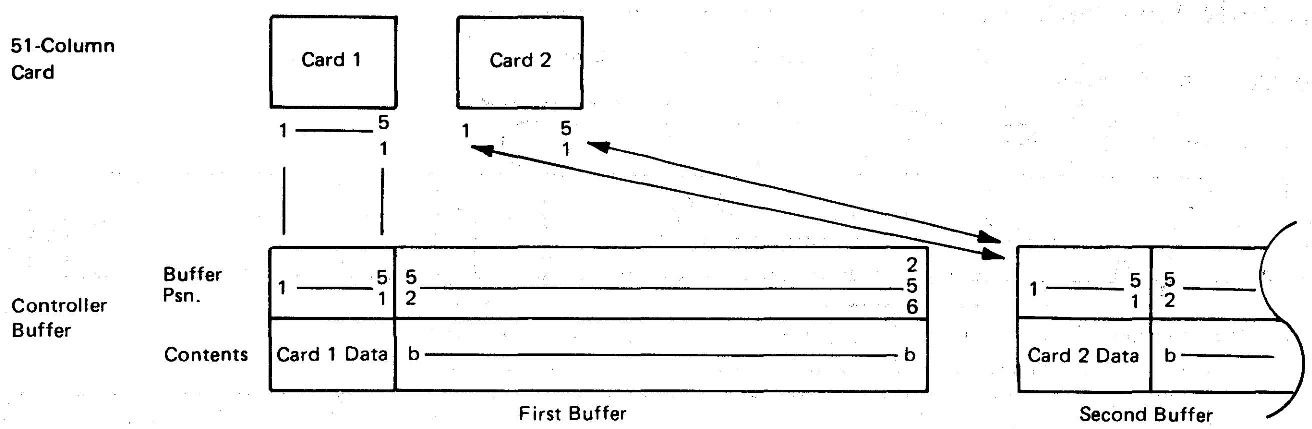
Notes:
1. As long as 82 positions remain in buffer.
2. 256-byte mode: as many full records/cards as possible with a maximum of 256 bytes.
3. 512-byte mode: as many full records/cards as possible with a maximum of 511 bytes.

Figure E-5. 80 Column Card Data, BSC Non-Transparent



- BSC Transparent data can be written onto the diskette; see description under "Diskette Record" in Chapter 2.
- Three cards (six cards with 3776-1/3776-2/3777-1 512-byte buffer) are always contained in each buffer, regardless of the number of blanks contained in the card.
- IRS characters are not inserted to delineate card data.

Figure E-6. 80 Column Card Data, BSC Transparent



- BSC Transparent Data can be written on the diskette; see description under "Diskette Record" in Chapter 2.
- One card is always contained in each buffer.

Figure E-7. Short Card Data, BSC Transparent

Magnetic Tape Formats

Labeled Tape Contents

Single Data Set on One Volume

BOT	gap	VOL	HDR'	HDR2	gap	TM	Data	gap	TM	EOF1	EOF2	gap	TM	gap	TM

Single Data Set on Multiple Volumes

(first volume shown; this Data set is continued on another volume)

BOT	gap	VOL1	HDR1	HDR2	gap	TM	Data	gap	TM	EOV1	EOV2	gap	TM	

Multiple Data Sets on One Volume

BOT	gap	VOL1	HDR1	HDR2	gap	TM	Data	gap	TM	EOF1	EOF2	gap	TM	HDR1	HDR2	gap	TM	Data	gap	TM	EOF1	EOF2	gap	TM	gap	TM

Multiple Data Sets on Multiple Volumes

(first volume shown; last Data Set on this volume is continued on another volume)

BOT	gap	VOL1	HDR1	HDR2	gap	TM	Data	gap	TM	EOF1	EOF2	gap	TM	HDR1	HDR2	gap	TM	Data	gap	TM	EOV1	EOV2	gap	TM

Legend:

BOT	–	Beginning of tape (load point marker)	
VOL1	–	Tape Volume Label; a short gap precedes the first information.	
HDR1	–	Tape Data Set Label 1	Data Set Header Labels
HDR2	–	Tape Data Set Label 2	
TM	–	Tape Mark, written to separate information on the tape; preceded by a short gap	
EOF1	–	End of File Label 1	"End of Data Set" labels
EOF2	–	End of File Label 2	
EOV1	–	End of Volume Label 1	
EOV2	–	End of Volume Label 2	
IBG	–	Inter Block Gap (not shown); separates blocks of data on the tape; spacing depends on block size specified.	

Figure E-8. Labeled Magnetic Tape Contents

Magnetic Tape Volume Label

Position	Field Name and Contents
0-2	Label Identifier. Contains VOL
3	Volume Label Number. 1
4-9	Volume Identifier. User-specified name; checked on input.
10	Accessibility. Space character (X'40') written at label creation; not checked on input or output.
11-15	Volume Directory Pointer. Spaces written at label creation; Not checked on input or output.
16-36	Reserved. Spaces written at label creation; not checked on input or output.
37-50	Owner identifier. User-specified name written at label creation; not checked on input or output.
51-79	Reserved. Spaces written at label creation; not checked on input or output.

Figure E-9. Magnetic Tape Volume Label

Magnetic Tape Data Set Label 1

Position	Field Name and Contents
0-2	Label Identifier. Contains HDR
3	Data Set Label Number. 1
4-20	Data Set Identifier. User-specified name; checked on input. The name can be a maximum of 17 characters and is padded to the right with blanks to fill the field.
21-26	Aggregate Indicator. Volume identifier on which this dataset begins; written on output; checked on input.
27-30	Volume Sequence Number. Sequence of volume for multi-volume dataset; written as 0001 on first volume; written on output; checked on input.
31-34	Dataset Sequence Number. Sequence of datasets; set to 0001 for first dataset (unless the data set is continued from another volume); incremented for each new dataset; not checked on input.
35-38	Generation Number. Set to 0001 on output; not checked on input.
39-40	Version Number of Generation. Set to 00 on output, not checked on input.
41-46	Creation Date. Contains creation date of data set in format YYMMDD. Written on output; not checked on input.
47-52	Expiration Date. Contains expiration date of data set in format YYMMDD. Written on output; not checked on input.
53	Data Set Security. 0 written on output; not checked on input.
54-59	Block Count. 000000 written on output; not checked on input.
60-72	System Code. IBM3770 + 6 Blanks written on output; not checked on input.
73-79	Reserved. Space characters (X'40') written on output; not checked on input.

Figure E-10. Magnetic Tape Data Set Label 1

Magnetic Tape Data Set Label 2

Position	Field Name and Contents
0-2	Label Identifier. Contains HDR
3	Dataset Label Number. 2
4	Record/Block Format. Contains F for fixed-length or V for variable-length records. Written on output; checked on input.
5-9	Block Length. User-specified from 18-4000.
10-14	Record Length. User-specified from 18-255.
15	Reserved. Space character (X'40') written on output; not checked on input.
16	Volume Switch. Contains 0 if data set begins on this volume; 1 if data set begins on another volume.
17-33	Job/Job - Step Identifier. Space character written on output; not checked on input.
34,35	Tape Recording Technique. Space characters written on output; checked on input.
36	Control Characters. Contains A (for ANSI code) or M (for machine code) for type of print control characters for print medium data. Contains a space character for card medium data. Written on output; checked on input.
37	Reserved. Space character written on output; not checked on input.
38	Record Attribute. B or space written on output, checked on input (B,space,S and R accepted)
39-41	Reserved.
42-46	Tape Drive Serial No.
47	Checkpoint Dataset Indicator.
48-79	Reserved.

Space characters written on output; not checked on input.

Figure E-11. Magnetic Tape Data Set Label 2

Tape End-of-File and End-of-Volume Label Differences

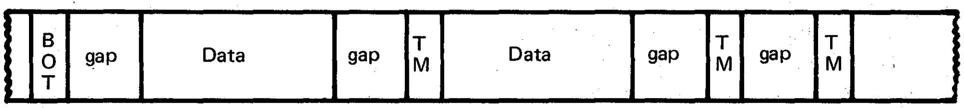
Field Name	Position	Length	Contents
EOF1 LABEL			
	as for HDR1 with the following exceptions		
Label Identifier	0	3	EOF
Block Count	54	6	Written on output, not checked on input
EOF2 LABEL			
	as for HDR 2 with the following exception		
Label Identifier	0	3	EOF
EOV1 LABEL			
	as for HDR1 with the following exceptions		
Label Identifier	0	3	EOV
Block Count	54	6	Written on output, not checked on input
EOV2 LABEL			
	as for HDR 2 with the following exception		
Label Identifier	0	3	EOV
UTL1-8			
	Not written on output - skipped on input.		

Figure E-12. Magnetic Tape EOF and EOV Label Differences.

Unlabeled Tape Contents

Single File on One Volume

Multiple Files on One Volume



Legend:

BOT — Beginning of tape (load point marker); a short gap precedes the first information written on the tape.

TM — Tape Mark; written to separate information on the tape; preceded by a short gap.

IBG — Inter Block Gap (not shown); separates blocks of data on the tape; spacing depends on block size specified.

Notes:
1. Single File on Multiple Volumes (multiple-volume file) is not supported by the 3776/3777 MLU terminals.
2. The terminal system keeps track of the file numbers by counting, from the BOT, the TMs at the end of each data file.

Figure E-13. Unlabeled Magnetic Tape Contents

Appendix F. Features, Care, and Handling of IBM Diskettes

The diskette (see Figure F-1) used by the 3770 is available from your IBM Information Records Division (IRD) representative as IBM part number 2305830. This diskette can be distinguished from other IBM diskettes by a white upper-left label with black printing.

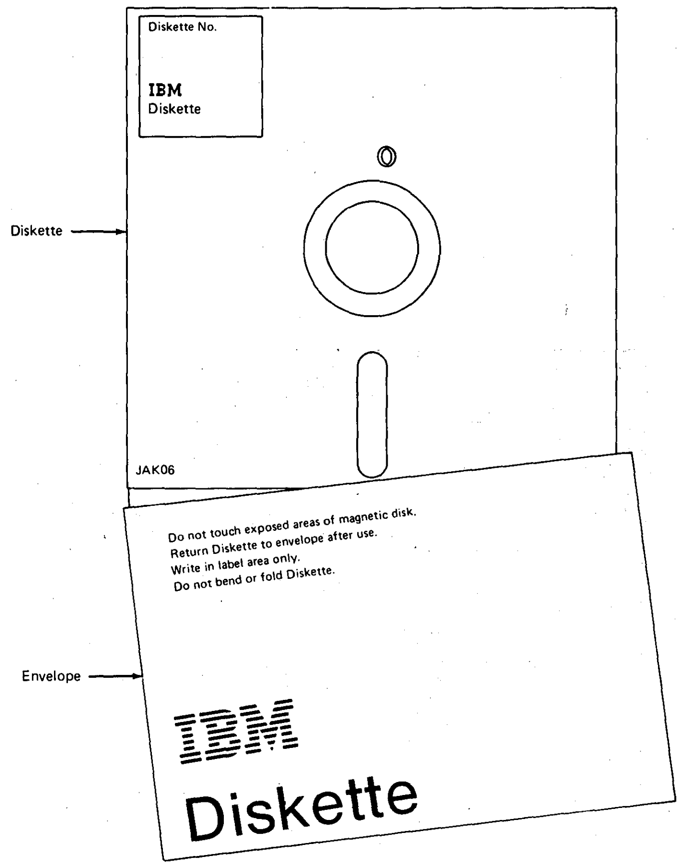


Figure F-1. IBM Diskette

The IBM diskette is manufactured and tested by IBM. At the time of shipment to the customer, the diskette is error-free. "Error-free" means that the disk surface has no manufacturing defects that would prevent accurate writing of data onto or reading of data from the disk.

Labels

Two types of labels are used on the diskette–a permanent label and a temporary adhesive label.

Permanent Diskette Label

This label is permanently affixed to the diskette. It can be used to record permanent information, such as the diskette identification number, for quick visual identification of the diskette. (See "External Labels.")

Temporary Adhesive Identification Label

This label can be used to describe data stored on the diskette or to record other temporary information about the diskette. (See "External Labels.")

Physical Features (Figure F-2)

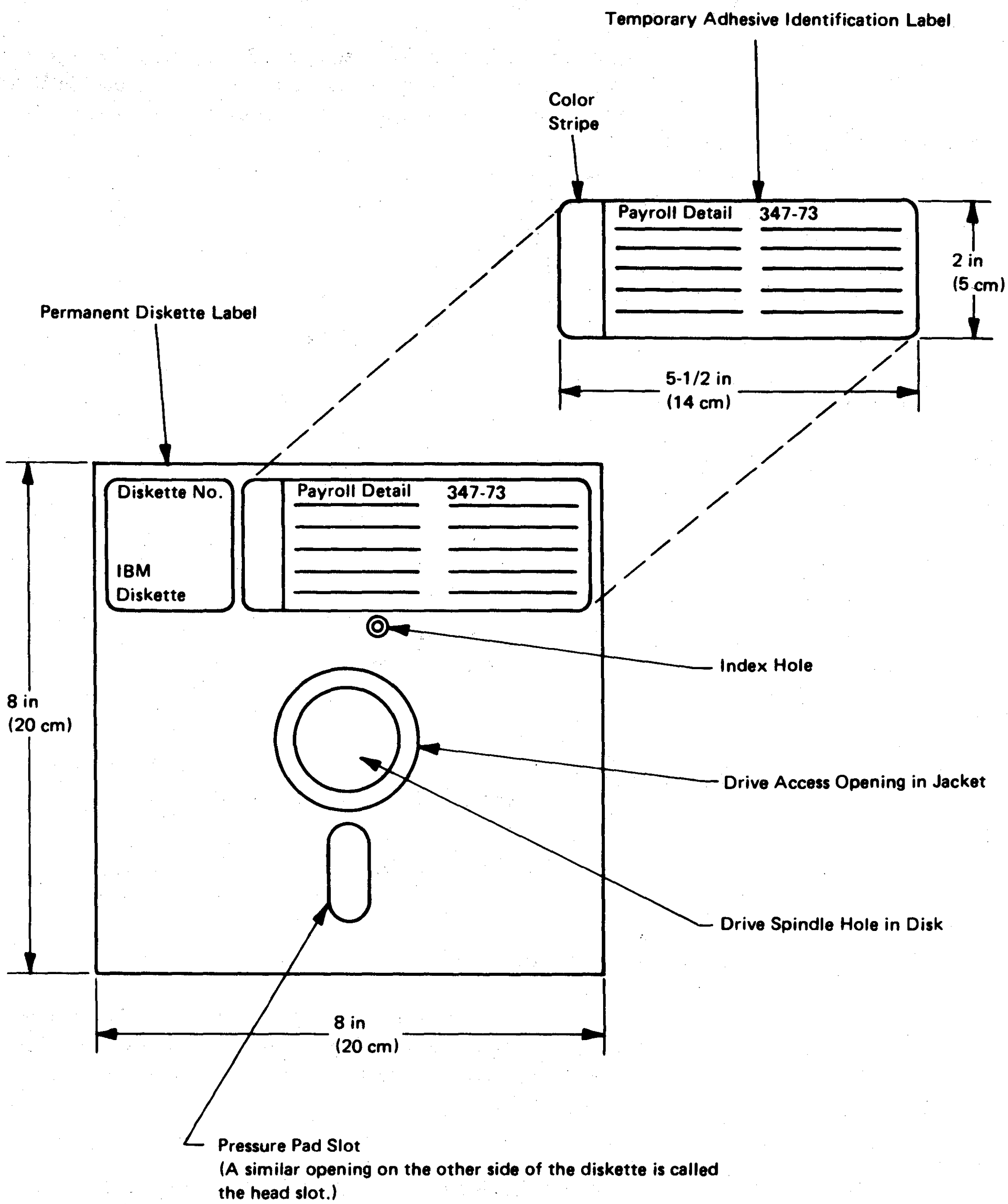


Figure F-2. Diskette Features

Index Hole

As shown in Figure F-2, a hole in the jacket (outer circle) exposes the index hole in the disk (inner circle). When these two holes are aligned as the disk revolves during data processing operations, a beam of light shining on one side of the diskette is sensed from the other side and used for timing functions.

Drive Access Opening and Drive Spindle Hole

After the diskette has been placed in the machine and the disk drive spindle has been inserted into the drive spindle hole in the disk (inner circle), the drive mechanism clamps onto a portion of the disk exposed by the drive access opening in the jacket (outer circle).

Pressure Pad Slot and Head Slot

The head slot (an opening on the other side of the diskette similar to the pressure pad slot shown in Figure F-2) exposes the recording surface of the disk as the disk turns in its jacket in the machine. The data recording and sensing unit of the diskette drive, which is called a "read/write head" and is similar to the record/playback head in a tape recorder, moves to specified positions along the length of the slot. Moving to a specified position is called "accessing a track." Data is recorded only on the side of the diskette that contains the head slot.

External Labels

Diskette users need to know two types of information about any diskette they are using, without having to use a machine to read the data. One type is information describing the physical disk, and this is the purpose of the permanent diskette label. The other type is information describing the data recorded on the disk, and this is the purpose of the temporary adhesive identification label.

"Permanent Diskette Label" Information

Information describing the physical disk should be recorded on the permanent label with a fiber-tip or ballpoint pen. The following two items are examples of such information:

a. A serial number assigned to the diskette.
b. The date the diskette was first used.

"Temporary Adhesive Identification Label" Information

Information directly related to the data stored on the diskette or about diskette processing is more temporary and subject to change, and should be recorded on the removable adhesive paper label. The following items are examples of such information:

a. What data is stored on the diskette–job name and number.
b. Who entered the data.

> CAUTION
> Information should be written on this label while the diskette is in the envelope or before the label has been affixed to the diskette. This prevents damaging or contaminating the recording surface of the disk. (An opening at the top of the protective envelope allows writing on the label while the diskette is still enclosed in the envelope.)

Whenever a new job is started on the diskette, the old information on the label should be crossed out but *not* erased. Crossing out instead of erasing information provides an audit trail as well as helping to keep the disk clean [that is, free of erasure droppings]. When a label becomes full, it should be removed before a new label is affixed. New labels pasted on top of old labels can cause a buildup that affects machine performance. Labels should not be affixed to the reverse side of the jacket, nor should they cover any of the holes.

Labels should be replaced every six months, whether filled or not. Otherwise, the adhesive may harden so that the label is difficult to remove.

IBM provides 30 blank temporary labels with each five diskettes purchased, six labels in each of the following color stripes: red, blue, yellow, green, and gray. Additional temporary identification labels may be ordered from the IBM IRD representative.

Color stripes can be used as coding to identify certain types of information at a glance. For example, color coding for an insurance installation might be:

Red	·	Reserved for program storage; do not use for data.
Green	·	For general data use.
Blue	·	Reserved for keying claims.
Yellow	·	For local or personal files (operator or job statistics, lists of job charge numbers, and so forth) not to be used for general data.
Gray	·	Reserved for new policy data.

IBM recommends that descriptive information about a diskette never be written on the diskette's envelope, because the diskette very likely may not always be returned to the same envelope after each use. In such an instance, the information on the envelope would not correctly describe the enclosed diskette.

Handling and Care

Diskettes may be used in the normal office environment.

Storage

Diskettes should always be stored in the following environment:

Temperature: 50° to 125°F (10.0° to 51.5°C)
Relative Humidity: 8% to 80%
Maximum Wet Bulb: 85°F (29.4°C)

Diskettes that are to be available for immediate use should be supported so that they do not lean or sag. They should not, however, be subjected to compressive stresses. Permanent deformation may result from improper storage.

Diskettes that are not needed for immediate use should be stored in their original shipping cartons, with each diskette in its protective envelope. The cartons should be stored either horizontally or vertically, and diskettes in the cartons should not be subjected to compressive force.

If a diskette has been exposed to temperatures outside of the machine's environmental range, five minutes acclimation time should be allowed before use. The diskette should be removed from its shipping container during this time.

Shipping and Receiving

- Ship Diskettes inside a suitable mailer. Such mailers are available from your IBM IRD representative.
- Always label the package: DO NOT EXPOSE TO HEAT OR SUNLIGHT.
- Upon receiving a diskette, check for carton and diskette damage. A damaged carton indicates possible damage to the disk or its protective jacket, either of which could damage the diskette drive if the diskette is used.
- Diskettes can be safely exposed to temperatures from -40°F (-40°C) to +125°F (+51.5°C) during shipment.

To properly package a single diskette for mailing, IBM recommends that you place the diskette in its protective envelope, and then in a single diskette carton. (See "Diskette and Associated Supplies Availability.")

For mailing any multiples of five diskettes, IBM recommends the following:

- Place each diskette in its protective envelope.
- Place each five diskettes in a 5-pack box (the box in which each five diskettes were originally shipped to you by IBM).
- Place each 5-pack box within a die-cut. (A die-cut is a piece of cardboard with the center cut to the size of the 5-pack box.) A 5-pack box held by a die-cut is partially insulated from shock and damage due to rough handling during shipment.
- Insert top and bottom pads for 5, 10, or 30 5-pack box cartons.
- Place the 5-pack boxes within the appropriate size 5-pack cartons.

Note: Fill any open space in partially filled 5-pack boxes and shipping cartons with a suitable filler. The filler must not be a material that can contaminate the diskette or enter the diskette jacket. Never fill open areas so full that diskettes are compressed tightly, because compression can cause diskettes to warp excessively.

Handling

Damaged diskettes should not be inserted into a disk drive. Diskettes that are physically damaged (torn, creased, warped) or contaminated may cause the read/write head to lift from the diskette, resulting in operation errors, equipment errors, or head contamination.

Placing heavy objects on diskettes can damage them.

- Return the diskette to its protective envelope whenever it is removed from the disk drive and whenever you are writing on a label affixed to the diskette.
- Do not use clips.
- Never write with an erasable pencil on a diskette or an identification label affixed to the diskette. IBM recommends using a fiber-tip or ballpoint pen.
- Do not touch or clean the disk surface.
- Keep diskettes away from magnetic fields and from ferromagnetic materials that might be magnetized. Any diskette exposed to a magnetic field may lose information.
- Do not expose diskettes to excessive heat or sunlight.

Diskette Replacement

If diskettes are physically damaged (torn, folded, creased), they must be replaced. If the recording surface becomes contaminated with foreign material, the diskette must be replaced. It is particularly important that diskettes that are contaminated with sticky fluids (such as soft drinks or coffee with sugar) or with abrasive substances (such as metal filings) on the recording surface *not* be placed in a 3770 diskette device. Placing such a diskette into the diskette device can contaminate the read/write head, damaging the equipment and causing operation errors. Furthermore, contaminants can be passed on to a clean diskette. If a foreign substance is spilled onto the diskette jacket, it may be carefully removed and the data recovered *only* if the contaminant has not reached the recording surface. After the data is recovered, such a diskette should be discarded.

Diskette and Associated Supplies Availability

The following supplies are available from your IBM Information Records Division representative:

Item	*Sold in Multiples of*	*Weight (in lbs)*
Diskettes*	5	1-1/4
Temporary Adhesive Identification Labels	30	----
5-Pack Box, Empty	30	17
Protective Envelopes (replacement)	50	5
Shipping Carton for 30 5-Packs	25	55
Top and Bottom Pads for above carton	50	25
Shipping Carton for 10 5-Packs	25	20
Top and Bottom Pads for above carton	50	8-1/2
Shipping Carton for 5 5-Packs	25	14
Top and Bottom Pads for above carton	50	3
Shipping Carton for 1 5-Pack	25	10
Shipping Carton for Single Diskette	25	7
Die-Cut (spacer) for a 5-Pack	25	5-1/2

*Diskettes are shipped in one 5-pack box for each five diskettes ordered, with each diskette enclosed in a protective envelope. Each 5-pack box also contains a "Recommended Handling Information Sheet" and a package containing 30 blank diskette labels, six each in red, blue, yellow, green, and gray colors.

Appendix G. ASCII Feature Differences

ASCII-coded machines are available in the U.S. and Canada by special feature. This appendix describes the differences in appearance and operation between the ASCII-coded and the EBCDIC-coded machines. Where no differences are described, appearance and operation of ASCII-coded machines are as described throughout this manual for EBCDIC-coded machines. BSC Transparent operation is not possible using ASCII.

Keyboard

The ASCII keyboard is similar in appearance to the EBCDIC keyboard, but has 48 graphic keys and provides 94 characters. This 94-character set is shown in Appendix B.

3521 Card Punch

The ASCII 64-character set (see Appendix B) is provided for the 3521 Card Print feature. Data punched on the 3521 will be punched in the Hollerith representation of the ASCII code, as shown in Appendix A.

Operational Differences

Keyboard

The INDEX key on the ASCII keyboard performs no function when pressed by itself. Pressing the INDEX key in conjunction with the CODE key causes the console printer to perform a line feed function, and does not store a character in the buffer.

BSC Space Compression/Expansion

The control character sequence inserted by the 3770 to identify compressed spaces is the ASCII GS character (hex '1D') followed by a character (binary number) specifying the number of omitted spaces. The binary numbers representing the omitted spaces are as follows:

Number of Spaces	*ASCII: 7*	*6*	*5*	*4*	*3*	*2*	*1*
2	1	0	0	0	0	1	0
3	1	0	0	0	0	1	1
.				.			
.				.			
.				.			
63	1	1	1	1	1	1	1

2502/3782 with Optical Mark Read

The mark-read-transfer character used to indicate the end of a punched data field and transfer to mark-read mode is the ASCII FS character (card code 11-9-8-4, hex '1C').

Control Characters

The following tabulation shows the EBCDIC control characters and the equivalent ASCII characters:

EBCDIC	*ASCII*
IRS	RS
NL	LF (BSC) or NL (SNA)
IGS	GS
IFS	FS

Substitute the ASCII character shown for the equivalent EBCDIC character wherever it appears in this manual. The EBCDIC LF character has no equivalent ASCII character.

3776 Performance

Rated printer performance of the ASCII 3776 will be about 2% less than the EBCDIC 3776.

Abbreviations

ACK	affirmative acknowledgment
AM	access method
ANS	Automatic Network Shutdown
APPL	application program (in CPU)
ASCII	American National Standard Code for Information Interchange
ATTN	attention (key)
BB	beginning of bracket
BBP	begin bracket pending
BDS	beginning of data set
BETB	between brackets
BIU	basic information unit
BLU	basic link unit
BM	bottom margin (character)
BOC	beginning of chain
bpm	buffers per minute
bps	bits per second
BS	backspace (character)
BSC	Binary Synchronous Communications
BTU	basic transmission unit
CCITT	International Telephone and Telegraph Consultative Committee
CD	change direction
CFD	control field descriptor
CICS	Customer Information Control System
CLSDST	Close Destination
cpl	characters per line
cpm	cards per minute
cps	characters per second
CPU	central processing unit
CR	carriage return/carrier return (character)
CRC	cyclic redundancy check
DAA	data access arrangement
DAF	destination address field
DCE	data circuit-terminating equipment
DDC	Abbreviation for the Japanese nonswitched CCITT X.21 interface
DFC	data flow control
DLC	data link control
DOS	Disk Operating System
DR	definite response
EB	end of bracket
EBCDIC	Extended Binary Coded Decimal Interchange Code
EDS	end of data set
EIA	Electronic Industries Association
ENP	enable print (character)
ENQ	enquiry
EOB	end of block
EOC	end of chain
EOF	end of file
EOM	end of message
EOT	end of transmission
ESC	escape (character)
ETB	end of transmission block
ETX	end of text
EX	exception response
FCS	frame check sequence
FD	field descriptor
FID	format identification
FM	function management
FF	form feed (character)
FS	field separator (character)
HT	horizontal tabulation (character)
ID	identification
IFS	intermediate field separator (character)
IGS	information gap separator
IMS	Information Management System
INB	in brackets
INP	Inhibit Print (character)
I/O	input/output
IRS	interrecord separator (character)
ISO/IS	International Organization for Standardization/International Standard
ITB	end of intermediate transmission block
IUS	information unit separator (character)
JES	Job Entry Subsystem
k	kilo, that is, 1000 (as in kilobits)
K	1,024 (as in bytes of storage)
LF	line feed (character)
LM	left margin (character)
LRC	longitudinal redundancy check
lpm	lines per minute
LU	logical unit
MH	message header
MLU	multiple logical unit
MOC	middle of chain
MPL	maximum print line (character)
MPLC	multipoint line control
MPP	maximum print position (character)
N/A	not applicable
NAK	negative acknowledgment
NCP	network control program
NL	new line (character)
no-op	no operation
NPR	numeric position readout
NPRO	non-process run out
NTT	Nippon telephone and telegraph
NUL	null (character)
OAF	origin address field
OC	only one (RU) in chain
OLT	online test
OMR	Optical Mark Read
OPNDST	Open Destination
OS	Operating System
PIU	path information unit
PTT	Postal Telephone and Telegraph
PU	physical unit
PVS	Program Validation Services
RES	Remote Entry Services
RESP	response
RH	request header/response header
RJE	Remote Job Entry
RJP	Remote Job Processor
RM	right margin (character)

R/M	records per minute
RS	record separator (character)
RSCS	Remote Spooling Communications Subsystem
RTAM	Remote terminal access method
RU	request unit/response unit
RVI	reverse interrupt
SCB	String Control Byte (character)
SCS	SNA character string
SDLC	Synchronous Data Link Control
SDT	Start Data Traffic
SEL	select (character)
SHF	set horizontal format (character)
SNA	Systems Network Architecture
SNBU	switched network back up
SOH	start of heading
SPOOL	simultaneous peripheral operations online
SSCP	system services control point
SSR	secure string reader (character)
STX	start of text
SVF	set vertical format (character)
TCAM	Telecommunications Access Method
TH	transmission header
TM	top margin (character)
TRN	transparent (character)
TS	transmission services
TTD	temporary text delay
VFC	vertical forms control
VM/370	IBM Virtual Machine Facility/370
VS	Virtual Storage
VT	vertical tabulation (character)
VTAM	Virtual Telecommunications Access Method
WACK	wait-before-transmit-positive acknowledgment

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abort: To prematurely discontinue a job.

access method: A technique for moving data between main storage and input/output devices.

application program: A program written for or by a user that applies to his own work.

ASCII (American National Standard Code for Information Interchange): *The standard code, using a coded character set consisting of 7-bit coded characters (8 bits including parity check), used for information interchange among data processing systems, communication systems, and associated equipment. The ASCII character set consists of control characters and graphic characters.

ASP: Asymmetric multiprocessing system. An extension to the IBM System/360 Operating System that provides increased automation of computer operations for large-scale data processing installations. See also JES3.

asynchronous: Without regular time relationship; unexpected or unpredictable with respect to the execution of a program's instructions.

audible alarm: An alarm that is activated when predetermined events occur that require operator attention or intervention for system operation.

automatic answering: The capability to automatically respond to an incoming call over a switched network.

***batch processing:** (1) The processing of data or the accomplishment of jobs accumulated in advance in such a manner that each accumulation thus formed is processed or accomplished in the same run. (2) Processing of data accumulated over a period of time. (3) Loosely, the execution of computer programs serially. (4) Pertaining to the technique of executing a set of computer programs such that each is completed before the next program of the set is started. (5) Pertaining to the sequential input of computer programs or data. (6) In real-time systems the processing of related transactions that have been grouped together.

batch session: A session established between a communication controller and the host system for the purpose of transmitting batches of records or messages.

bid: In the contention form of invitation or selection, an attempt by the computer or a station to seize control of a line so that it can transmit data.

bidder: In SNA, the logical unit defined at session initiation as having to request and receive permission from the other LU to begin a bracket. Contrast with first speaker. See also bracket protocol.

Binary Synchronous Communications (BSC): Use of a standardized set of control characters and control character sequences for synchronous transmission of binary-coded data between stations in a data communication system.

block: In BSC, a segment of data transmitted as a unit, framed by appropriate transmission control characters, and causing a line turnaround to verify the accuracy of the transmission.

bracket: (1) In VTAM, an exchange of one or more messages between an application program and a logical unit that accomplishes some task defined by the user as uninterruptable. (2) In SNA, an uninterruptible unit of work, consisting of one or more chains of request units and their responses, exchanged between two logical units. Examples are data base inquiries/responses, update transactions, remote job entry output sequences to work stations, and similar applications. The request/response header (RH) of the first request of the first chain of the bracket indicates "begin bracket," and the RH of the first request of the last chain of the bracket indicates "end bracket."

bracket protocol: (1) In SNA, a data flow control protocol in which exchanges between logical units (LUs) are achieved through the use of brackets, with one LU designated at session initiation as the first speaker, and the other LU as the bidder. The bracket protocol involves bracket initiation and termination rules. (2) A method of communication in which a new bracket is not started until the bracket in progress is completed.

buffer: *A routine or storage used to compensate for a difference in rate of flow of data, or time of occurrence of events, when transmitting data from one device to another.

CCITT (International Telephone and Telegraph Consultative Committee): An international organization that promotes the standardization and coordination of worldwide communication facilities.

central processor: (1)* Synonym for central processing unit. (2) See also host processor.

chaining of RUs: See RU chain.

clocking: In binary synchronous communication, the use of clock pulses to control synchronization of data and control characters.

common carrier: A government-regulated private company that furnishes the general public with telecommunications service facilities; for example, a telephone or telegraph company.

cyclic redundancy check (CRC): A system of error checking performed at both the sending and receiving station after a block check character has been accumulated. See also longitudinal redundancy check.

data access arrangement (DAA); sometimes called "Protective Coupler": A Federal Communications Commission (FCC) registered device that contains protective circuitry for direct attachment of data equipment to the U.S. public switched network.

data circuit-terminating equipment (DCE): Any equipment whose function is to convert the communication terminal signals into a form suitable for transmission over a communication facility, and to convert signals received from the communication facility into a form suitable for transfer to the communication terminal. The DCE may be a modem or other type of signal-converter equipment.

data link: (1) An assembly of those parts of two data terminal equipments that define the protocol together with their interconnecting data circuit. This assembly enables a data source to transfer data to a data sink. (2) The communication channel, modem, and communication controls of all stations connected to the communication channel, used in the transmission of information between two or more stations. (3) The physical connection and the connection protocols between the host and communication controller nodes via the host data channel. (4) Contrast with communication line.

Note: A communication line is the physical medium; e.g., a telephone wire, a microwave beam. A data link includes the physical medium of transmission, the protocol, and associated communication devices and programs–it is both logical and physical.

data set: The data written on a disk (or other storage medium) for retrieval through use of a particular data set name.

diskette: A thin, flexible magnetic disk and a semi-rigid protective jacket, in which the disk is permanently enclosed.

diskette storage device: A direct access storage device that uses diskettes as the storage medium.

display: (1)* A visual presentation of data. (2) To present a display image on a display surface. (3) Deprecated term for display device.

duplex: Pertaining to a simultaneous, independent, two-way transmission (transmission in both directions). (Contrast with *half-duplex.*)

EIA (Electronic Industries Association): An organization that promotes standardization and cooperation among electronic equipment industries.

extent: A continuous space on a direct access storage volume, occupied by or reserved for a particular data set, data space, or file.

first speaker: In SNA, the logical unit (LU) defined at session initiation as (1) having the freedom to begin a bracket without requesting permission from the other LU to do so, and (2) winning contention if both LUs attempt to begin a bracket simultaneously. Contrast with bidder. See also bracket protocol.

frame: In SDLC, the vehicle for every command, every response, and all information that is transmitted using SDLC procedures. Each frame begins and ends with a flag.

frame check sequence (FCS): In SDLC, sixteen bits in a frame that contain transmission-checking information.

***function:** (1)* A specific purpose of an entity, or its characteristic action. (2)* In data communication, a machine action such as carriage return or line feed.

function management (FM): In SNA, the layer of functional capability between the application layer and the transmission subsystem. It includes data flow control and function management data (FMD) services.

generate: (1)* To produce a computer program by selection of subsets from skeletal code under the control of parameters. (2) To produce assembler language statements from the model statements of a macro definition when the definition is called by a macro instruction.

half-duplex: Pertaining to alternating, one-way transmission (transmission in one direction at a time). (Contrast with *duplex.*)

HASP: Houston automatic spooling program. A computer program that provides supplementary job management, data management, and task management functions such as control of job flow, ordering of tasks, and spooling. See also JES2.

header label: A file or data set label that precedes the data records on a unit of recording media.

host CPU: See host processor.

host processor: (1) The central or controlling processing unit in a multiple processing unit configuration. (2) In a VTAM telecommunication system, the processing unit in which VTAM resides. Devices attached by channels to the host processor are said to be local devices. Remote devices must be attached to the host processor via a local communications controller.

IBM Virtual Machine Facility (VM/370): A time sharing system control program that consists of: (1) a control program (CP) that manages the resources of an IBM System/370 computing system in such a way that multiple remote terminal users have a functional simulation of a computing system (a virtual machine) at their disposal, and (2) the conversational monitor system (CMS), which provides general time sharing, program development, and problem solving facilities.

indexed data set: A type of data set in which records are stored and retrieved on the basis of keys that are within each record and are part of the data record itself.

input job stream: Synonym for input stream.

input stream: The sequence of job control statements and data submitted to an operating system on an input unit especially activated for this purpose by the operator. Synonymous with input job stream, job input stream.

interactive: Pertaining to an application in which each entry calls forth a response from a system or program, as in an inquiry system or an airline reservation system. An interactive system may also be conversational, implying a continuous dialog between the user and the system.

***interleave:** To arrange parts of one sequence of things or events so that they alternate with parts of one or more other sequences of things or events and so that each sequence retains its identity.

interleaving: (1) The act of accessing two or more bytes or streams of data from distinct storage units simultaneously. (2) The alternating of two or more operations or functions through the overlapped use of a computer facility.

JES2: A functional extension of the HASP II program that receives jobs into the system and processes all output data produced by the job.

JES3: A functional extension of the ASP program that receives jobs into the system and processes all output data produced by the job.

job: A set of data that completely defines a unit of work for a computer. A job usually includes all necessary computer programs, linkages, files, and instructions to the operating system.

job definition: A series of job control statements that define a job.

job entry subsystem (JES): A system facility for spooling, job queuing, and managing I/O. See also JES2, JES3.

job input stream: Synonym for input stream.

job output stream: Synonym for output stream.

job stream: See input stream, output stream.

leased facility: A non-switched private-line communication facility dedicated to a single customer; may be point-to-point or multipoint.

logical unit: (1) In VTAM, the combination of programming and hardware of a teleprocessing subsystem that comprises a terminal. (2) In SNA, one of three types of network addressable units (NAUs). It is the port through which an end user accesses function management in order to communicate with another end user. It is also the port through which the end user accesses the services provided by the system services control point (SSCP). It must be capable of supporting at least two sessions—one with the SSCP, and one with another logical unit. It may be capable of supporting many sessions with other logical units.

logoff: (1) The procedure by which a user ends a terminal session. (2) In VTAM, to request that a terminal be disconnected from a VTAM application program.

logon: (1) The procedure by which a user begins a terminal session. (2) In VTAM, to request that a terminal be connected to a VTAM application program.

longitudinal redundancy check (LRC): A system of error checking performed at the receiving station after a block check character has been accumulated.

LU-LU session: In SNA, a session between two logical units in the network. It provides communication between two end users, each associated with one of the logical units.

LU-SSCP session: In SNA, a session between a logical unit and the system services control point (SSCP). It is used to support logical unit-related control and use of the communication system. Each logical unit in the network participates in a session with the SSCP that provides services for that logical unit.

message: *An arbitrary amount of information whose beginning and end are defined or implied. (3) For BSC devices, the data unit from the beginning of a transmission to the first ETX character, or between two ETX characters. (4) A sequence of characters used to convey data. The sequence usually consists of three parts: the heading, the text, and one or more characters used for control or error-detection purposes.

message header: The leading part of a message that contains information such as the source or destination code of the message, the message priority, and the type of message.

modem: A "modulation/demodulation" device. A device that converts business machine output into signals suitable for transmission over a communication facility (modulation), and that converts signals received over a communication facility into input acceptable to a business machine (demodulation).

MULTI-LEAVING support: Fully synchronized two-directional transmission of a variable number of data streams between terminals and a computer, using BSC facilities.

multipoint line: A line or circuit interconnecting several stations. Synonymous with multidrop line.

multipoint network: In data communication, a configuration in which more than two terminal installations are connected. The network may include switching facilities.

network: (1) The assembly of equipment through which connections are made between terminal installations. (2) In data communication, a configuration in which two or more terminal installations are connected.

network control program (NCP): A program, generated by the user from a library of IBM-supplied modules, that controls the operation of the communication controller.

network control program/virtual storage: Any of the NCP versions supported under OS/VS or DOS/VS.

Operating System/Virtual Storage (OS/VS): A compatible extension of the IBM System/360 Operating System that supports relocation hardware and the extended control facilities of System/370.

OS/VS1: A virtual storage operating system that is an extension to OS/MFT.

OS/VS2: A virtual storage operating system that is an extension to OS/MVT.

output stream: Diagnostic messages and other output data issued by an operating system or a processing program on output devices especially activated for this purpose by the operator.

pacing: (1) In data communication, a technique by which a receiving station controls the rate of transmission of a sending station to prevent overrun. (2) In SNA, a mechanism that permits a receiving connection point (CP) manager to control the data transfer rate (the rate at which it receives request units) on the normal flow. It is used to prevent overloading a receiver with unprocessed requests when the sender can generate requests faster than either the receiver or the network can process them. (3) In the NCP, a means for limiting the number of basic information units (BIUs) sent to a logical unit on an SDLC link until the logical unit acknowledges its ability to receive more BIUs.

physical unit (PU): In SNA, one of three types of network addressable units; a PU is associated with each node that has been defined to a system services control point (SSCP). A PU controls the resources local to its associated node. The SSCP establishes a session with the physical unit as part of the bring-up process.

point-to-point connection: In data communication, a connection established between only two data stations. The connection may include switching facilities.

point-to-point line: A data link that connects a single remote station to the computer; it may be either switched or nonswitched.

POWER/VS: A spooling system that provides automatic staging of unit record input and output and priority scheduling for programs executed under its control.

program validation services: In the 3790 Communication System, a set of IBM-provided programs that are executed in the host system to check the syntax of statements in 3790 programs, test the programs, and format the programs for later processing by subsystem support services.

relative data set: A data set consisting of records that are accessed according to their relative position from the beginning of the data set.

remote entry services (RES): In OS/VS1, the set of functions added to the Job Entry Subsystem that allows jobs and their associated data to be entered from remote devices, processed at the central system, and then transmitted back to remote devices.

***remote job entry (RJE):** Submission of jobs through an input unit that has access to a computer through a data link.

remote terminal access method (RTAM): A facility that controls operations between the job entry subsystem (JES2 and JES3) and remote terminals.

request: (1) A directive (by means of a basic transmission unit) from an access method that causes the network control program to perform a data-transfer operation or auxiliary operation. (2) In SNA, synonym for request unit.

request header: In SNA, a request/response header that indicates a request.

request/response header (RH): In SNA, a control field, attached to a request/response unit (RU), that specifies the type of RU being transmitted–request or response–and contains control information associated with that RU.

request/response unit (RU): In SNA, the basic unit of information entering and exiting the transmission subsystem. It may contain data, acknowledgment of data, commands that control the flow of data through the network, or responses to commands.

request unit: In SNA, the request/response unit following a request header. Synonymous with request.

RTAM generation: The process of assembling the desired RTAM facilities and link editing them into VS1.

RU chain: In SNA, a set of related request units (RUs) that are consecutively transmitted on a given data flow. The chain is the unit of recovery; if one of the RUs in the chain cannot be processed, the entire chain must be discarded. Each RU belongs to only one chain, which has a beginning and an end indicated via control bits in the request headers for the RU chain. Each RU is marked as first-of-chain, last-of-chain, middle-of-chain, or only-element-of-chain. Response units are always sent as only-element-of-chain.

SDLC link: A data link over which communications are conducted using the synchronous data link control (SDLC) discipline.

session: (1) The period of time during which a user of a terminal can communicate with an interactive system; usually, the elapsed time from when a terminal user logs on the system until he logs off the system. (2) The period of time during which programs or devices can communicate with each other. (3) In SNA, a logical connection, established between two network addressable units (NAUs) to allow them to communicate. The session is uniquely identified by a pair of network addresses, identifying the origin and destination NAUs of any transmission exchanged during the session.

spooling: (1)*The reading of input from and the writing of output onto auxiliary storage concurrently with job execution in a form suitable for later processing or output operations.

station: (1) One of the input or output points of a system that uses communication facilities; for example, the telephone set in the telephone system or the point where the business machine interfaces with the channel on a leased private line. (2) In SNA, one of the input or output points on an SDLC data link. (3) One or more computers, terminals, or devices at a particular location.

subsystem: A secondary or subordinate system, usually capable of operating independently of, or asynchronously with, a controlling system.

supervisor: (1) The part of a control program that coordinates the use of resources and maintains the flow of host processor operations.

switched network: A network in which a dialed, point-to-point connection can be completed between any two stations.

switched network backup (SNBU): An optional facility that allows a user to specify, for certain types of stations, a switched line to be used as an alternate path (backup) if the primary line becomes unavailable or unusable.

Synchronous Data Link Control (SDLC): A discipline for the management of synchronous, transparent, serial-by-bit information transfer over a data communication channel. SDLC includes comprehensive detection and recovery procedures for transmission errors introduced by the communication channel.

synchronous transmission: Transmission in which the sending and receiving devices are operating continuously at substantially the same frequency and are being maintained, through correction, in a desired phase relationship.

system generation (SYSGEN): The process of selecting desired functions and operations of a system from various options and assembling and link-editing the IBM-supplied control program components that constitute an operating system.

systems network architecture (SNA): The total description of the logical structure, formats, protocols, and operational sequences for transmitting information units through the communication system. Communication system functions are separated into three discrete areas: the application layer, the function management layer, and the transmission subsystem layer. The structure of SNA allows the ultimate origins and destinations of information–that is, the end users–to be independent of, and unaffected by, the specific communication-system services and facilities used for information exchange.

system services control point (SSCP): In SNA, a network addressable unit that provides services via a set of command processors (network services) supporting physical units and logical units. The SSCP must be in session with each logical unit and each physical unit for which it provides services. It also provides services for the network operators or administrators who control the configuration. The SSCP is commonly located at a host node.

telecommunications access method (TCAM): a method used to transfer data between main storage and remote or local terminals. Application programs use either GET and PUT or READ and WRITE macro instructions to request the transfer of data, which is performed by a message control program. The message control program synchronizes the transfer, thus eliminating delays for terminal input/output operations.

terminal: (1)*A point in a system or communication network at which data can either enter or leave. (2) A device, usually equipped with a keyboard and some kind of display, capable of sending and receiving information over a communication channel. (3) In VTAM, an end point in a telecommunication network; that is, a physical or logical unit, a start-stop or BSC device, or a 3270 Information Display System.

time-out: (1) A time interval allotted for certain operations to occur; for example, response to polling or addressing before system operation is interrupted and must be restarted. (2) A terminal feature that logs off a user if an entry is not made within a specified period of time.

transaction: In batch or remote batch entry, a job or job step.

transaction data set: A data set used to store transaction records that are to be batch-transmitted to the host processor and which are made available to the 3770 operator for transaction verification and correction.

transmission header (TH): In SNA, a control field attached to a basic information unit (BIU) or to a BIU segment, and used by path control. It is created by the sending path control component and interpreted by the receiving path control component.

transparent: In data communication, pertaining to information that is not recognized by the receiving program or device as transmission control characters.

turnaround time: (1)*The elapsed time between submission of a job and the return of complete results. (2) In data communication, the actual time required to reverse the direction of transmission from send to receive or vice versa when using a half-duplex circuit. For most communications facilities, there will be time required by line propagation and line effects, modem timing, and machine reaction. A typical time is 200 milliseconds on a half-duplex telephone connection.

two-way alternate communication: (SC1) A mode of data communication such that information is transferred in both directions one direction at a time.

two-way alternate data mode: Synonym for two-way alternate communication.

two-way simultaneous communication: (SC1) A mode of data communication such that information may be transferred simultaneously in both directions.

two-way simultaneous data mode: Synonym for two-way alternate communication.

unattended operation: The transmission and reception of messages, through the use of automatic features, by a station that is unattended by an operator.

universal character set (UCS): A printer feature that permits the use of a variety of character arrays.

user: Anyone who requires the services of a computing system.

utility program: *(1) A computer program in general support of the processes of a computer; for instance, a diagnostic program, a trace program, a sort program. Synonymous with service program. (2) A program designed to perform an everyday task such as copying data from one storage device to another.

virtual telecommunications access method (VTAM): A set of programs that control communication between terminals and application programs running under DOS/VS, OS/VS1, and OS/VS2.

voice-grade channel: A channel suitable for transmission of speech, digital or analog data, or facsimile, generally with a frequency range of about 300 to 3000 cycles per second.

Appendix H. Tape Handling and Storage

Tape Handling

A tape reel that is not is use on a tape unit should always be stored in its container. Procedures should be established to protect magnetic tape from contamination, which causes degraded tape unit performance. Some common rules are:

1. Never leave tape reels or containers exposed. Tape may be damaged, or dust accumulating on the tape or in the container can contaminate the tape.
2. Erasing a tape reel identification label is a cause of contamination. Use new labels when changing reel identification. Select a label with an adhesive backing that does not leave a residue and that can be applied and removed easily.
3. Never allow a loose end of tape to trail on the floor; dirt picked up in this manner can reach the tape transport and be passed on to other sections of the tape.
4. Do not allow smoking in areas where tape is in use. Ashes contaminate tape. Live ashes can permanently damage the tape surface.
5. Don't touch the tape edges through the reel openings or press on the reel flanges. Such pressure will compress the tape and damage its edges.
6. Be very careful when removing the write-enable ring. Always unload tape before removing the write-enable ring; never remove the ring while the tape is loaded on the tape unit.

Note: Never turn power down on a terminal with a tape loaded on an attached 3411. This can cause tape stretching and result in the tape becoming not legible or not usable. Use the TAPE command and specify RUN (rewind and unload) before turning power down on a terminal when a tape is loaded.

Tape Storage

To prevent tape contamination and damage during storage, follow these procedures:

1. Before a tape is stored, secure the loose end of tape with a tape end retainer to prevent the tape from unwinding in the container.
2. Always store tape in an upright position. Never store tapes flat or in stacks; accidental damage or reel warpage may result.
3. Store tapes in a cabinet or shelf elevated from the floor and away from sources of paper and dust. Dust can be transferred from the outside of the container to the reel during load and unload operations.

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Component Description for the
IBM 3776 and 3777
Communication Terminals

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