

**Systems**

**IBM 3270 Information  
Display System  
Component Description**

**IBM**

## Preface

This publication provides management, programmers, and system analysts with detailed reference material relating to the IBM 3270 Information Display System. The 3270 display system comprises the following units:

- IBM 3271 Control Unit, Models 1, 2, 11, and 12
- IBM 3272 Control Unit, Models 1 and 2
- IBM 3275 Display Station, Models 1, 2, 11, and 12
- IBM 3277 Display Station, Models 1 and 2
- IBM 3284 Printer, Models 1, 2, and 3
- IBM 3286 Printer, Models 1 and 2
- IBM 3288 Line Printer, Model 2

### ORGANIZATION OF THIS PUBLICATION

The information in this publication has been organized as follows:

The Introduction contains a general description of the individual 3270 units and features, and presents local and remote attachment configurations.

The "System Concepts" section contains functional concepts of the 3270 units and of various features. Included are such concepts as data buffering and display image and printout formatting. Display, keyboard, selector pen, printer, and operator identification card reader operations are described in detail.

The section "Commands and Orders" describes in detail the functions of the commands and orders that can be executed by the 3270.

The "Local Operations" section outlines the unique operations of locally attached 3270 systems. Described are operations with the channel, selection, command initiation and chaining, status bit definition, and error recovery procedures.

The "Remote Operations-BSC" section discusses the unique operations of remotely attached 3270 systems using Binary Synchronous Communication (BSC) line discipline. Described are (BSC) procedures, the functions and usage of data link control characters, 3270 command, selection, and polling operational sequences (including interaction with the access method and the channel program), remote 3270 command chaining, and error recovery procedures.

The "Remote Operation-SDLC" section discusses the operation of remotely attached 3270 systems using Synchronous Data Link Control (SDLC) line discipline. This section describes command operation, data transfer, and error recovery procedures.

Four appendixes ("Indicators and Controls", "Configurators", "Buffer Address I/O Interface Codes", and "World Trade Keyboards and I/O Interface Codes"), a Glossary, and an Index complete this publication.

### *Sixth Edition (November 1975)*

This is a major revision of, and obsoletes, GA27-2749-4. This edition adds information in the Introduction section about the 3271 Control Unit, Models 11 and 12, and 3275 Display Station, Models 11 and 12, which communicate with the central processing system via synchronous data link control (SDLC) line discipline. The Remote Operation – SDLC section has been added to describe the operation of remotely attached 3270 systems employing SDLC. The configurators contained in Appendix B have been revised, and new configurators have been added to include the models 11 and 12, 3271 and 3275 units. Minor changes and corrections have been made throughout the manual. All technical changes are indicated by a vertical line to the left of the change.

Changes are periodically made to the information herein; before using this publication, refer to the latest System/360 and System/370 Bibliography GA22-6822 for the editions that are applicable and current.

Requests for copies of IBM publications should be made to your IBM representative or to the IBM branch office serving your locality.

Text for this publication has been prepared with the IBM SELECTRIC® Composer.

A form is provided at the back of this publication for reader's comments. If the form has been removed, comments may be addressed to IBM System Communications Division, Product Publications, Dept. 52L, Neighborhood Road, Kingston, N.Y., 12401.

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## REFERENCED PUBLICATIONS

This document assumes that the reader has read the following publications, as appropriate:

- *IBM System/360 Principles of Operation*, GA22-6821
- *IBM System/370 Principles of Operation*, GA22-7000
- ● *General Information-Binary Synchronous Communications*, GA27-3004
- *IBM Synchronous Data Link Control General Information*, GA27-3093
- *IBM 2701 Data Adapter Unit Component Description*, GA22-6864
- *IBM 2703 Transmission Control Component Description*, GA27-2703
- *Introduction to the IBM 3704 and 3705 Communications Controllers*, GA27-3051

- *IBM System/3 Model 10 Components Reference Manual*, GA21-9103
- *IBM System/3 Model 10 Multi-line/Multi-point Binary Synchronous Communications Reference Manual*, GC21-7573
- *IBM Systems Network Architecture General Information*, GA27-3102
- *Virtual Storage Supplement*, GC20-0001, for *IBM System/360 and System/370 Bibliography*, GA22-6822

The following publications may also be of interest:

- *An Introduction to the 3270 Information Display System*, GA27-2739
- *Operator's Guide for IBM 3270 Information Display Systems*, GA27-2742

## Abbreviations

A	Attention
ACK	positive acknowledge
AID	Attention Identification
ALPHA	alphanumeric
A/N	alphanumeric/numeric
ASCII	American Standard Code for Information Interchange
Async	asynchronous
Atb	attribute
B	Busy
BB	begin bracket
BCC	block check character
BIU	basic information unit
BOC	bus out check
bps	bits per second
BSC	Binary Synchronous Communications
C	column
CAW	channel address word
CC	control check
CC (flag)	Chain Command
CCC	copy control character
CCW	channel control word
CE	Channel End
char	character
Cmd	command
CNCL	cancel
cps	characters per second
CPU	central processing unit
CR	Command Reject
CRT	cathode-ray tube
CSW	channel status word
Ctl	control
CU	control unit
CUE	Control Unit End

D	display
DAA	data access arrangement
DB	Device Busy
DC	Data Check
DE	Device End
Dec	decimal
DEL	delete
DISC	disconnect
DLE	data link escape
DR	definite response
DUP	duplicate
EAU	Erase All Unprotected
EBCDIC	Extended Binary-Coded-Decimal Interchange Code
EB	end brackets
EC	Equipment Check
EFI	expedited flow indicator
EM	end of message
ENQ	enquiry
EOF	end of field
EOI	end of inquiry
EOR	end of record
EOT	end of transmission
ERP	error recovery procedure(s)
ESC	escape
ETB	end of transmission block
ETX	end of text
EUA	Erase Unprotected to Address
EX (response)	exception
FF	forms feed
FID	format identifier
FIE	function interpret error
FM	field mark
FM	function management

## Abbreviations (cont)

GP	General Poll	RH	request/response header
Hex	hexadecimal	RNR	request not ready
Hz	Hertz	R/R	request/response
		RR	request ready
I (format)	information	RU	request response unit
IC	Insert Cursor	RVI	reverse interrupt
ident	identification		
Ind	indicator	S (format)	sequenced
INS	insert	SA	selection addressing
IOS	Input/Output Supervisor	SBA	Set Buffer Address
IR	Intervention Required	SDLC	synchronous data link control
ITB	end of intermediate transmission block	SF	Start Field
		SIOF	Start I/O Fast Release
Kbd	keyboard	SM	Status Modifier
		SNA	systems network architecture
LRC	longitudinal redundancy check	SNRM	set normal response mode
LU/SSCP	logical unit/system services control point	SOH	start of heading
		SOR	start of record
MDT	modified data tag	SP	space, Specific Poll
		SPD	selector pen detect
NA or N/A	not applicable	S/S	status and sense
NAK	negative acknowledge	STX	start of text
NCP	network control program	SUB	substitute
NL	New Line	Sw	switch
NS (format)	nonsequenced	SYN	synchronous idle
NSA	nonsequenced acknowledgement		
NUL	null	TC	Transmission Check
		TCU	transmission control unit
OC	Operation Check	TH	transmission header
		TTD	temporary text delay
P	printer, protected		
PA	program access	U	unprotected
PF	program function	UC	Unit Check
PSI	primary to secondary indicator	UE	Unit Exception
PT	Program Tab	US	Unit Specify
R	row	V	volts
RA	Repeat to Address	VFC	vertical forms control
Rd Mod	Read Modified	VTAM	virtual telecommunications access method
Req	request		
ROL	request online	WACK	wait before transmit
		WCC	write control character



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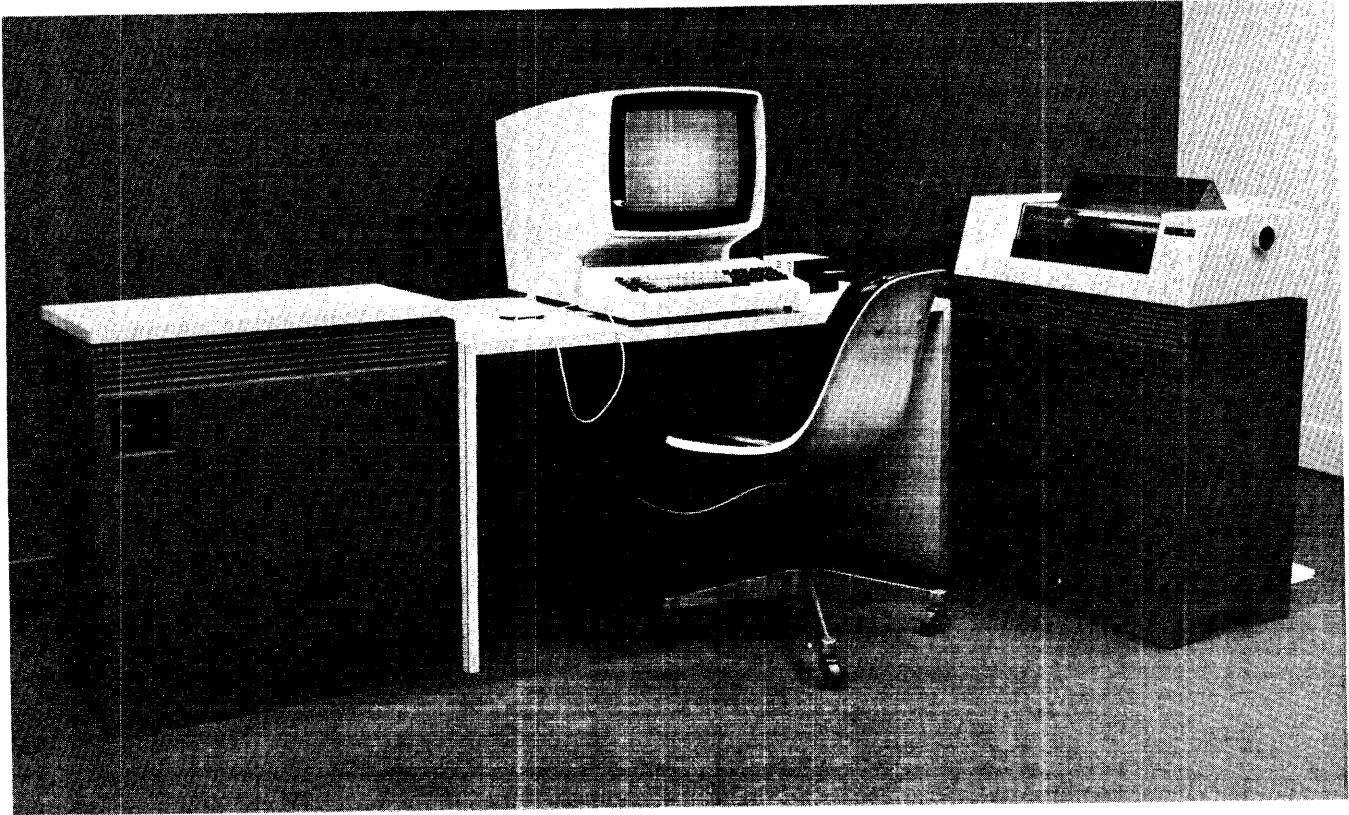
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The IBM 3270 Information Display System (frontispiece) is a new family of display products that can be tailored to meet the needs of all alphanumeric display applications. The 3270 system offers the user a wide selection of components and configurations. Also available are a large variety of standard and special features which improve performance, provide additional operational capability, and permit expansion of the display system.

The 3270 system can attach locally (via cable) or remotely (via common carrier or equivalent facilities) to a host system. Remote systems employ Binary Synchronous Communication (BSC) or Synchronous Data Link Control (SDLC) line discipline.

Host systems that can operate with 3270 display systems when locally attached or remotely attached, using BSC operating mode, are:

1. System/360 Models 25, 30, 40, 50, 65, 67\*, 75, 85, and 195.
2. System/370 Models 115, 125, 135, 145, 155, 158, 165, 168, and 195.
3. System/3 Models 10 and 15.

Remote 3270 display systems that operate via the SDLC operating mode can be attached to the following host systems: System/370 Models 115, 125, 135, 145, 155-II, 158, 158 MP, 165-II, 168, and 168 MP.

## DISPLAY SYSTEM COMPONENTS

The 3270 Information Display System has three basic components: control unit, display station, and printer.

### Control Unit

The control unit provides for the 3270 System's attachment to a data processing system. It directs the operation of up to 32 attached 3270 display stations and printers. There are two basic control units for the 3270 system:

#### 3271 Control Unit

- Models 1 and 11 - 480 character buffer capacity.
- Models 2 and 12 - 1,920 character buffer capacity.

\*The System/360 Operating System (OS) will support attachment in 65 mode only.

- Models 1 and 2 attach to a System/360 or System/370 via modems and a binary synchronous communications (BSC) data link, and operate with any of the following: an IBM 2701 Data Adapter Unit, an IBM 2703 Transmission Control Unit, an Integrated Communications Adapter, or an IBM 3705 Communications Controller.
- Models 1 and 2 attach to System/3, Model 10, via a System/3 Binary Synchronous Communications Adapter or to System/3, Model 15, via the Local Communications Adapter.
- Models 11 and 12 attach to a System/370 via modems and a synchronous data link control (SDLC) communications link, and operate in Network Control Program (NCP) mode with an IBM 3704 or 3705 Communications Controller.

### 3272 Control Unit

- Model 1 - 480 character buffer capacity.
- Model 2 - 1,920 character buffer capacity.
- Attaches to a System/360 or System/370 via a selector, multiplexer, or block multiplexer channel.

## Display Station

The display station provides image display of data transmitted from the data processing unit. A display station with an attached keyboard enables the user to enter, modify, or delete data on the display, and to cause the revised display to be returned to the processing system for storage or additional processing. There are two basic display stations for the 3270 system:

### 3275 Display Station

- Models 1 and 11 - 480 character buffer capacity.
- Models 2 and 12 - 1,920 character buffer capacity.
- Models 1 and 2 - Standalone units that attach to a System/360 or System/370, via modems or data access arrangements (DAA) and any of the following: an IBM 2701, an IBM 2703, an Integrated Communications Adapter, or an IBM 3705 Communications Controller.
- Models 1 and 2 - Attach to System/3, Model 10 or 15, via a Binary Synchronous Communications Adapter or via the Local Communications Adapter.
- Models 11 and 12 - Attach to System/370 via modems and an (SDLC) communications link, and operate in NCP mode with a 3704 or 3705 Communications Controller.

### 3277 Display Station

- Model 1 - 480 character display image.
- Model 2 - 1,920 character display image.
- Model 1 attaches to a 3271 control unit (all models) or to a 3272 control unit, model 1 or 2.
- Model 2 attaches to a 3271 control unit, model 2 or 12, or to a 3272 control unit, model 2.
- Models 1 and 2 attach to the 3791 Controller (3790 Communication System).

### Printer

The printer provides printed copy of data displayed at a display station or data transmitted from the data processing system. There are three basic printers for the 3270 system:

#### 3284 Printer

- Model 1 - 480 character buffer capacity with a 40-cps printout rate, a minimum carriage return speed of 12 inches per second, and a line feed speed of 125 ms\*.
- Model 1 attaches to a 3271 or a 3272 control unit (all models).
- Model 2 - 1,920 character buffer capacity with a 40-cps printout rate, a minimum carriage return speed of 12 inches per second, and a line feed speed of 125 ms\*.
- Model 2 attaches to a 3271 model 2 or 12 or to a 3272 control unit, model 2.
- Model 3 - no buffer is provided; the printout rate is 40 cps, a minimum carriage return speed of 12 inches per second, and a line feed speed of 125 ms\*.
- Model 3 attaches to a 3275 display station (all models).

#### 3286 Printer

- Model 1 - 480 character buffer capacity with a 66-cps printout rate, a minimum carriage return speed of 15 inches per second, and a line feed speed of 125 ms\*.
- Model 1 attaches to a 3271 or a 3272 control unit (all models).
- Model 2 - 1,920 character buffer capacity with a 66-cps printout rate, a minimum carriage return speed of 15 inches per second, and a line feed speed of 125 ms\*.
- Model 2 attaches to a 3271, model 2 or 12, or to a 3272 control unit, model 2.

### 3288 Line Printer (Model 2 only)

- Model 2 - 1,920 character buffer capacity. The average print rate is 120 lines per minute; executes new lines (NL), one every 47 ms.
- Model 2 attaches to a 3271 control unit, model 2 or 12, or a 3272 control unit, model 2.

## DISPLAY SYSTEM CONFIGURATIONS

### Local Attachment

Locally attached 3270 display systems (Figure 1) use a 3272 Control Unit, Model 1 or 2. The 3272 control unit, model 1, can communicate with up to 32 devices, consisting of model 1 3277 display stations, and 3284 or 3286 model 1 printers. The 3272 control unit, model 2, can attach up to 32 devices, consisting of model 1 or model 2 3277 display stations, 3284 or 3286 model 1 or 2 printers, and 3288 model 2 line printers. At least one display station with a keyboard must be attached to any control unit. The 3272 is attached to a System/360 or System/370 through a block multiplexer, byte multiplexer, or selector channel via one of the eight control unit positions on the channel interface. The channel provides the 3272 with data to be displayed and with control information needed to direct the operation of the display station or printer attached to the 3272. Separate buffer storage in the display stations or printers holds digitally coded data for display or printing.

### Remote Attachment

Remote attachment differs from local attachment in the medium through which the control unit and system channel communicate. In a local configuration, the control unit is cabled directly to the system channel. In remote attachment, common carrier (or equivalent customer) facilities of unlimited length are employed to communicate between the host and the 3270 system.

Two types of remote attachment are available: binary synchronous communication (BSC) data link mode or synchronous data link control (SDLC) operating mode. Display data and control information are relayed from the system channel to a control unit by a TCU, an integrated communications adapter, or a communications controller in binary synchronous communications (BSC) mode of operation, or by using a communications controller in synchronous data link control (SDLC) operating mode.

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\*Used to determine the indexing time only for paper advance between printouts.

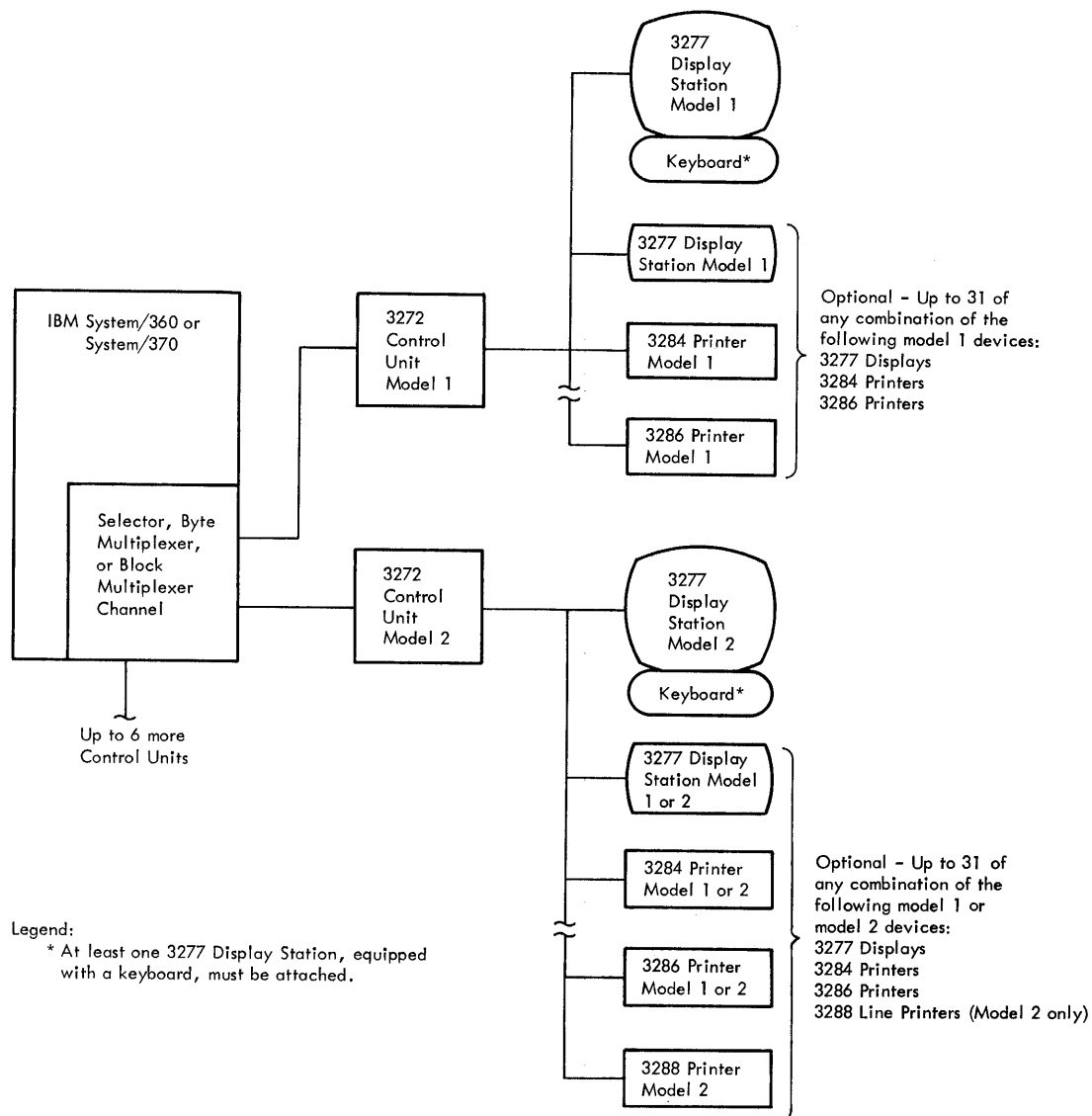


Figure 1. Locally Attached 3270 Display System

Transmission is via modems and common carrier non-switched network communication facilities, such as telephone lines, microwave transmission, or satellite, or switched facilities (BSC mode only). See Figure 2.

#### *Remotely Attached 3270 Systems Using BSC Operating Mode*

A 3271 control unit, model 1 or 2, or a 3275 display station, model 1 or 2, is used to remotely attach a 3270 system to the teleprocessing network employing BSC operating mode, allowing communication with a host System/360 or System/370. A 2701 data adapter unit, 2703 transmission control unit, 3705 communications controller, or equivalent integrated communications adapter, depending upon the host system and channel

selected, connects the teleprocessing network to the host system channel.

The 3271 control unit model 1 can attach up to 32 devices, consisting of model 1 3277 display stations and 3284 or 3286 model 1 printers.

The 3271 control unit model 2 can attach up to 32 devices, consisting of model 1 or model 2 3277 display stations, 3284 or 3286 model 1 or 2 printers, and 3288 model 2 line printers. One display station with a keyboard must attach to each control unit. The model number of the display station and the control unit must be the same.

The 3275 display station, model 1 or 2, provides added convenience for remote locations that require a single display device. The 3275 functions as a control unit and display station, and is, therefore, more economical than a 3271 with a single 3277 attached. The 3275 capabilities can

be expanded by attaching a 3284 printer, model 3, to provide a paper copy of displayed messages. The 3275 can be attached to (multidropped from) the same non-switched communication line as other 3270 display systems and other IBM products that use the BSC mode of operation or, with the Dial feature installed, it can be attached using a point-to-point common carrier switched network.

#### *Remotely Attached Systems Using SDLC Operating Mode*

When employing SDLC line discipline, the 3270 system is remotely attached to a host System/370 via a 3271 control unit, model 11 or 12, or a 3275 display station, model 11 or 12, over a teleprocessing network. A 3704 or 3705 communications controller is required for this configuration. Display data and control information are relayed from the host system channel by the communications controller to the 3271 or 3275 model 11 or 12 unit, via modems and common carrier voice grade lines.

The 3271 control unit model 11 can communicate with up to 32 devices, consisting of model 1 3277 display stations, or 3284 or 3286 model 1 printers.

The 3271 control unit model 12 can direct the operation of up to 32 model 1 or 2 3277 display stations, 3284 or 3286 printers, or 3288 model 2 printers.

At least one display station with a keyboard must attach to a control unit.

The 3275 display station model 11 or 12 does not require a control unit for attachment to a non-switched line teleprocessing network. When a paper copy of a computer message is desired, a 3284 model 3 printer can be attached to the 3275 display station. The 3275 display station, model 11 or 12, can be attached to the same non-switched remote communication line as other 3270 systems and other IBM products that use the SDLC mode of operation.

#### **Teleprocessing Networks and Modems**

Remotely attached 3270 display systems that use BSC or SDLC line discipline operate in half-duplex transmission mode on half-duplex or full-duplex communication facilities.

The 3271, model 1 or 2, can attach to a multipoint non-switched line network. The 3275, model 1 or 2, can operate in multipoint mode on non-switched lines or on switched network lines when the Dial feature is installed.

The 3271 and 3275, models 11 and 12, can attach to multipoint non-switched line networks. Messages may be simultaneously transmitted and received by the 3704 or 3705 units on full-duplex facilities (duplex-multipoint operation), when two or more SDLC devices are multidropped and attached to the same communications controller.

IBM modems that can be used in remote systems that employ BSC or SDLC line control (specified in Figure 2) are as follows:

- 3872, model 1 (2,400 bps)
- 3874, model 1 (4,800 bps)
- 4872, models 1 and 3 (4,800 bps)
- 3875, model 1 (7,200 bps)

Switched network backup is a method of replacing a failing non-switched line with a switched communications system. This capability is available when using the IBM 3872 and 3875 Modems. The 3875 operates on non-switched lines at transmission speeds of 7,200 and 3,600 bps, and on switched lines at speeds of 3,600 and 1,800 bps. The 3872 operates at transmission speeds of 2,400 and 1,200 bps on both non-switched and switched lines. If an excessively high error rate occurs while operating on a non-switched line at the maximum transmission speed (7,200 or 2,400 bps), the speed is reduced by one half at both modems used in the system, and a check is made for a continued high-error rate. If the error rate is still high, the display-terminal operator establishes a switched-line connection by dialing the 2701 (or equivalent unit). If the 3872 or 3875 Modem was operating at half speed when the error condition began, the operator establishes the switched-line connection without first changing the transmission speed. The lower line speeds that are available for dial operation (1,800 or 1,200 bps) may be used if too many errors occur while using the higher line speeds.

#### **FEATURES**

Features for the 3270 display system are categorized as Specify or Special. A Specify (standard) feature is one that must be chosen to make a display system functional. A Special feature is an optional one that may improve performance, provide additional operational capability, or permit expansion of the display system.

Appendix B shows configurator diagrams of local and remote 3270 systems, including features.

#### **Specify Features**

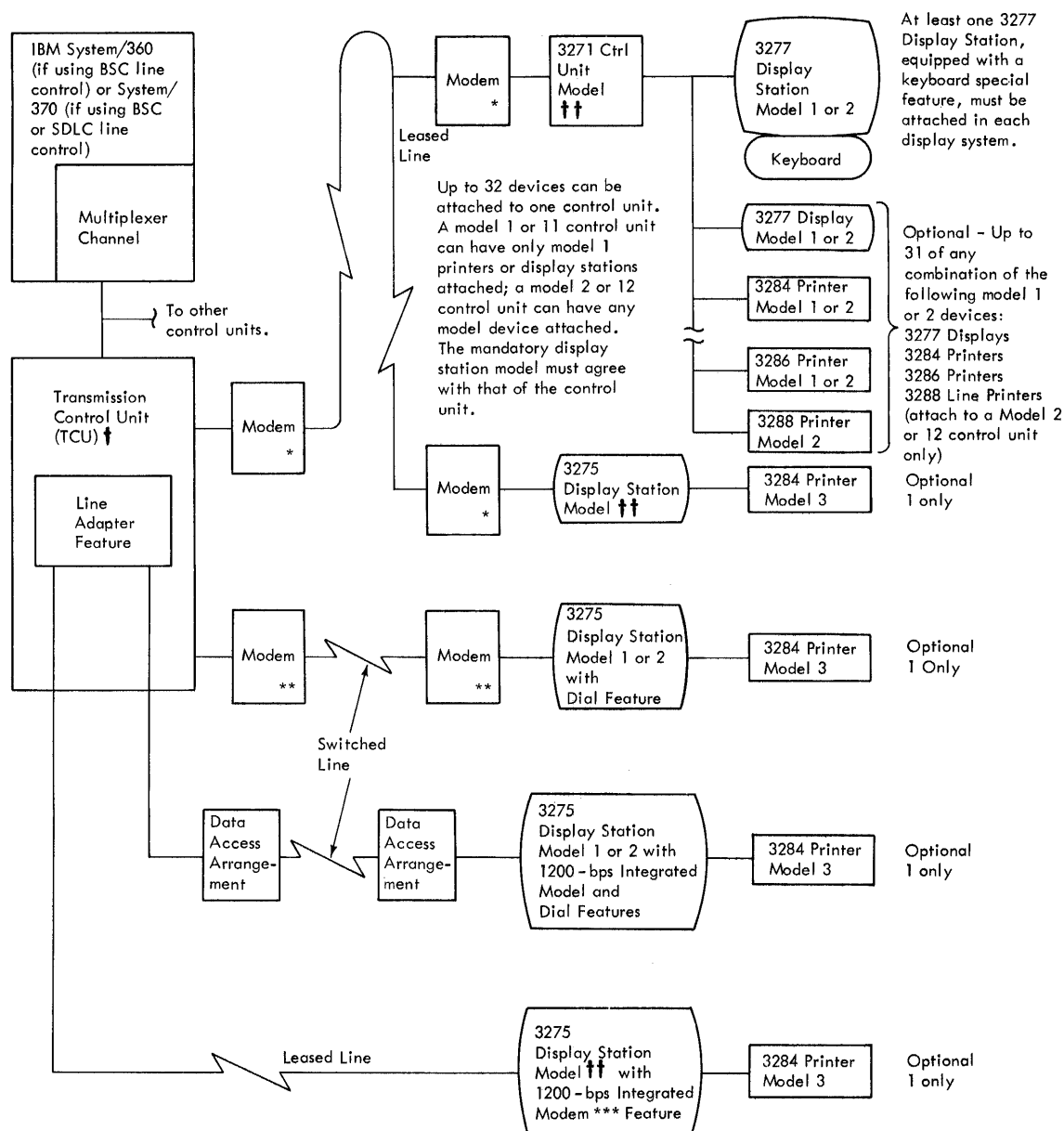
##### *Power*

All 3270 units in the United States operate with 115V, 60-Hz power. The 3271 and 3272 control units, however, can be specified to operate from any one of three power sources: 115V, 60 Hz; 208V, 60 Hz; or 230V, 60 Hz. All units available through the IBM World Trade Corporation can operate from one of eight different power sources.

##### *3271 Control Unit, Model 1 and 2, and 3275 Display Station, Model 1 and 2*

*EBCDIC or ASCII Transmission Code.* Either EBCDIC or ASCII transmission code must be selected for each remotely attached 3271 Control Unit, Model 1 or 2, or





† 2701 Data Adapter Unit, 2703 Transmission Control (non-switched with external modem only), 3705 Communications Controller, or equivalent Integrated Communication Adapter. Additionally, the 3705 Communications Controller attaches to a selector or block multiplexer channel. Using BSC mode, the choice of unit is dependent upon the processing system model, the type of channel, and the communication network selected. A 3704 or 3705 Communications Controller is required when using SDLC mode of operation.

†† 3271 Control Unit, Model 1 or 2, and 3275 Display Station, Model 1 or 2, are required for BSC operation. 3271 Control Unit, Model 11 or 12 and 3275 Display Station, Model 11 or 12, are required when using the SDLC operating mode.

\* IBM 3872, 3874, 3875, or 4872 Modems (or equivalent), as required. When switched network backup capability is provided, an IBM 3872, 3874, or 3875 modem is used, with a dial telephone attached, to communicate with the transmission control unit.

\*\* 1200-bps operation only.

\*\*\* 1200-bps operation only, on non-switched line.

Figure 2. Remotely Attached 3270 Display System

3275 Display Station, Model 1 or 2, employing BSC operating mode, to correspond with the transmission code that is used by the central processing system.

#### *3275 and 3277 Display Stations, 3284 and 3286 Printers, and 3288 Line Printer*

**EBCDIC or ASCII\* Character Set.** An EBCDIC character set (United States EBCDIC or World Trade language), or an ASCII character set A or set B must be specified for 3275 and 3277 display stations, and for 3284 and 3286 printers that are used in remotely attached systems. Also, an EBCDIC or ASCII character set must be specified for the character belt of the 3288 Line Printer, used in a remotely attached system.

The ASCII A character generator displays and prints the 64 ASCII characters, but substitutes the logical OR ( | ) and logical NOT ( ¬ ) for the exclamation mark ( ! ) and circumflex ( ^ ). The ASCII B character generator displays and prints the standard 64 ASCII characters. ASCII character generators are mutually exclusive with other character generators.

**Monospace Character Generator.** EBCDIC character sets for languages used in World Trade are designated as character generator features. Monospace character generators for display stations and printers are available in languages for the following countries: United States, Austria, Belgium, Denmark, France, Finland, Germany, Italy, Norway, Portugal (and Portuguese-speaking countries), Spain (and Spanish-speaking countries), Sweden, and United Kingdom. The Belgian, French, and Italian character generators or belts are the same as the United States EBCDIC character generator or belt, and provide the character set that is shown in the outlined sections of Table 1. The character sets for the other languages are shown in the outlined sections of the tables in Appendix D.

#### *3284 and 3286 Printers*

**Pin-Feed Platen.** This feature permits the feeding of marginally punched continuous forms paper and allows a choice of 120, 126, or 132 print positions per line for the 3284 and 3286 printers. See *IBM 1443 2203 Form Design Considerations*, Form GA24-3488, for forms design considerations and limitations.

#### *3288 Line Printer*

**X Error Print.** This feature for the 3288 Line Printer automatically prints an X in the first print position on the print line immediately below the last line that was normally printed, after a printout in which an error has occurred.

**Vertical Forms Control.** The Vertical Forms Control (VFC) feature on the 3288 Line Printer allows the forms to advance under program control, after initial presetting of the VFC Selector switches by the operator. The switches can be set for a forms length of 00-99 print lines, and must be set every time a different length form is inserted in the line printer. The VFC feature is invoked by the programmed insertion of a Forms Feed (FF) character (hex 0C) in the data stream. Upon detection of the FF character, the printer automatically skips to a predetermined print line on the next form.

#### **Special Features**

##### *3271 and 3272 Control Units (All Models)*

**Device Adapter.** Every 3271 and 3272 Control Unit has one built-in device adapter. This adapter provides a control unit with the facilities necessary to communicate with, and service, up to four devices (display stations or printers). Since each control unit can operate with up to 32 devices, up to 7 device adapters can be added to a basic control unit.

##### *3271 Control Unit and 3275 Display Station (All Models)*

**1200-bps Transmission Speed.** All models of the 3271 control unit and 3275 display station can communicate with a central processing unit from a remote location, via communication facilities, at speeds of 1200, 2000\*\*, 2400\*\*, 4800, or 7200 bps.

At other than 1200-bps rate, the modem must provide the necessary clocking. At the 1200-bps transmission rate, clocking is not provided by the modem. When this situation exists, a 1200-bps transmission speed feature is required to provide the needed clocking.

##### *3271 Control Unit, Models 1 and 2, and 3275 Display Station, Models 1 and 2*

**4800-/7200-bps Transmission Speed.** Installing this feature in a 3271 Control Unit, Model 1 or 2, or a 3275 Display Station, Model 1 or 2, permits operation with communication facilities at speeds of 4800 or 7200 bps. Clocking is provided by the modem.

\*American National Standard Code for Information Interchange, X3.4-1968. (Not available in WTC countries.)

\*\*2000 and 2400 bps are base machine transmission rates for the 3271 and 3275 models 1 and 2. 2000, 2400, 4800, and 7200 bps are base machine transmission rates for the 3271 and 3275 models 11 and 12. 2000 bps is not available to World Trade customers.

### *3271 Control Unit, Models 11 and 12, and 3275 Display Station, Models 11 and 12*

**ASCII Transmission Code.** This feature allows attachment to central processing systems that communicate, via SDLC mode, with ASCII code for data, and may be installed on the 3271 Control Unit, Model 11 or 12, and the 3275 Display Station, Model 11 or 12.

### *3271 Control Unit, Models 1 and 2*

**Copy.** This feature is available for the 3271 Control Unit, Models 1 and 2\*\*, and provides the ability to control the exchange of buffer information between display stations, or display stations and printers that are attached to the same control unit.

### *3275 and 3277 Display Stations (All Models)*

**Keyboards.** A variety of keyboard features are available. Variations among keyboards include 78- and 66-key versions: operator console, data entry, data entry-keypunch layout, typewriter EBCDIC, and typewriter ASCII layouts (Figure 7). Also, keyboards are available in various languages including American English, and languages applicable to the following countries served by the IBM World Trade Corporation: Austria, Belgium, Denmark, France, Finland, Germany, Italy, Norway, Portugal (and Portuguese-speaking countries), Spain (and Spanish-speaking countries), Sweden, and United Kingdom. Refer to the figures in Appendix D for the keyboard layouts and characters used for the WTC languages listed above.

The 66-key keyboard fulfills the basic needs of the display operator. The 78-key keyboard provides expanded operator-to-program message flexibility with 12 additional keys for the use of the application program.

The operator console key layout, which is similar to an IBM 1052 Model 7 keyboard, is available only as a 78-key keyboard. The data entry key layout and the data entry-keypunch layout, which is similar to the keyboards on the 29 Card Punch and 129 Card Data Recorder, are available only as 66-key keyboards.

**Keyboard Numeric Lock.** Although this feature is available for all keyboards, its primary application is in a data entry environment where large quantities of numeric data are being entered into the system. It restricts entry mainly to numeric characters. Attempted entry of other characters is blocked and the operator is alerted to the keying error.

**Selector Pen.** This feature provides a light-sensitive pen with which an operator can identify a portion of a displayed message for entry into the data processing system.

**Audible Alarm.** The audible alarm feature can be installed on any display station. This feature sounds a short audible tone whenever an operator enters a character in the next-to-last position of the display image or whenever the tone is called for under program control.

**Key Lock.** This feature provides key-operated control over communication with the program. With the key off, the unit will be unavailable to the program, and the display operator will be unable to input messages to the program.

**Operator Identification Card Reader.** This feature provides a card reader unit to permit an operator to identify himself to a program. Identification cards for the card reader may be ordered with up to 37 numeric characters of customized encoded information, or they may be obtained prerecorded with a unique code for use as security cards.

### *3275 Display Station (All Models)*

**Printer Adapter.** This feature provides a 3275 Display Station with control circuitry and cable connection outlets to permit attachment of a 3284 Printer, Model 3.

### *3275 Display Station, Models 1 and 2*

**Dial.** This special feature, when installed in a 3275 Display Station Model 1 or 2, allows communication with the TCU via a common carrier switched telephone network and the Line Adapter special feature or equivalent modem. EBCDIC or ASCII transmission code may be used. BSC point-to-point contention switched line discipline is used. Clocking is obtained from the 3275. Transmission speeds of 600 or 1200 bps can be manually selected by the display station operator. A DISCONNECT toggle switch is provided to terminate a call.

**1200-bps Integrated Modem.** This special feature is a modem that is installed within the 3275. The 1200-bps Integrated Modem provides the electrical interface between a 3275 Display Station and common carrier non-switched telephone lines or, when the Dial feature is selected, between a 3275 (Model 1 or 2) and a switched telephone network. When Dial is installed on the 3275 (Model 1 or 2), the integrated modems are attached to the telephone lines by data access arrangements, which are coupling devices that are available from the common carrier. The 1200-bps Integrated Modem operates at transmission speeds of 600 or 1200 bps on switched telephone lines and at 1200 bps on non-switched lines. The setting of the BIT RATE switch on the 3275 must agree with the transmission rate established by the TCU.

\*\*The copy function is available for the 3271 Control Unit, Models 11 and 12, as part of the base machine.

*1200-bps Integrated Modem with Auto Answer.* This feature is applicable to the 3275 Display Station, Model 1 or 2, with the Dial feature. Auto answer allows the line adapter to automatically respond to a ringing signal from the TCU without operator intervention. After answering a call, if a transmission is not made within 20 seconds, the 3275 will automatically be disconnected from the telephone line. This feature is available to U.S. customers only.

## SUMMARY

The IBM 3270 Information Display System is a new family of display products that can be tailored to meet the needs of all alphanumeric display applications through superior configuration and feature flexibility.

- It can be a remote standalone unit (3275), with or without a 3284 Printer, Model 3, attached or it can be a local or remote cluster using respectively a 3272 or 3271 control unit and up to 32 units (3277's, 3284's, 3286's, and 3288's) attached to each control unit.
- It can include 480-character display stations, large-capacity 1920-character display stations, or both.

- It can also include printers (40 or 66 cps or 120 lines per minute).
- It can be attached locally (directly to the channel) or remotely (through communications facilities) to a data processing system.
- It is compatible in line discipline with other IBM BSC or SDLC products.

The 3270 Display System also has exceptional feature flexibility:

- It offers typewriter, data entry, data entry–keypunch layout, and operator console keyboards (with control and/or program function keys) and a selector pen.
- It provides local data-transfer rates of up to 650,000 cps and remote line speeds of up to 7200 bps (using a modem such as the IBM 3875).
- It includes data security enhancement features, such as a key lock, an operator identification card reader, and the ability to enter data at a display station without having the data displayed.

Each unit in the 3270 Display System (except the 3284 Printer, Model 3) has its own buffer for storing data (Figure 3). The capacity of each buffer is the same as the character capacity of its device: buffers for Model 1 units can store 480 characters; buffers for Model 2 units can store 1920 characters. Buffers are checked to determine that all characters in the buffers have correct parity. A parity check error occurs when circuitry detects one or more characters with bad parity.

The 3275, as a standalone display station, contains its own control unit and executes commands in the same way as the 3271 with one device attached. The 3275 contains one buffer which it uses both for preparing and displaying data. When a printout is required at an attached 3284 Printer, Model 3 (which has no buffer), the 3275 buffer is used to format and store the printer data.

When not executing a command operation, the 3271 and 3272 control unit hardware continually performs an internal poll of all attached devices. Internal polling is performed to determine the current device status and whether the device has an I/O pending condition.

The current status of each device indicates to the control unit whether or not the device is available, ready, or busy. This information is recorded in the associated device adapter in the control unit.

When an I/O pending condition is detected at a device, polling stops and the control unit communicates solely with that device. When communication is ended, the control unit commences polling at the next sequential device.

Additionally, when the program addresses a specific device, the control unit stops the sequential polling and polls the addressed device to obtain its latest status. If

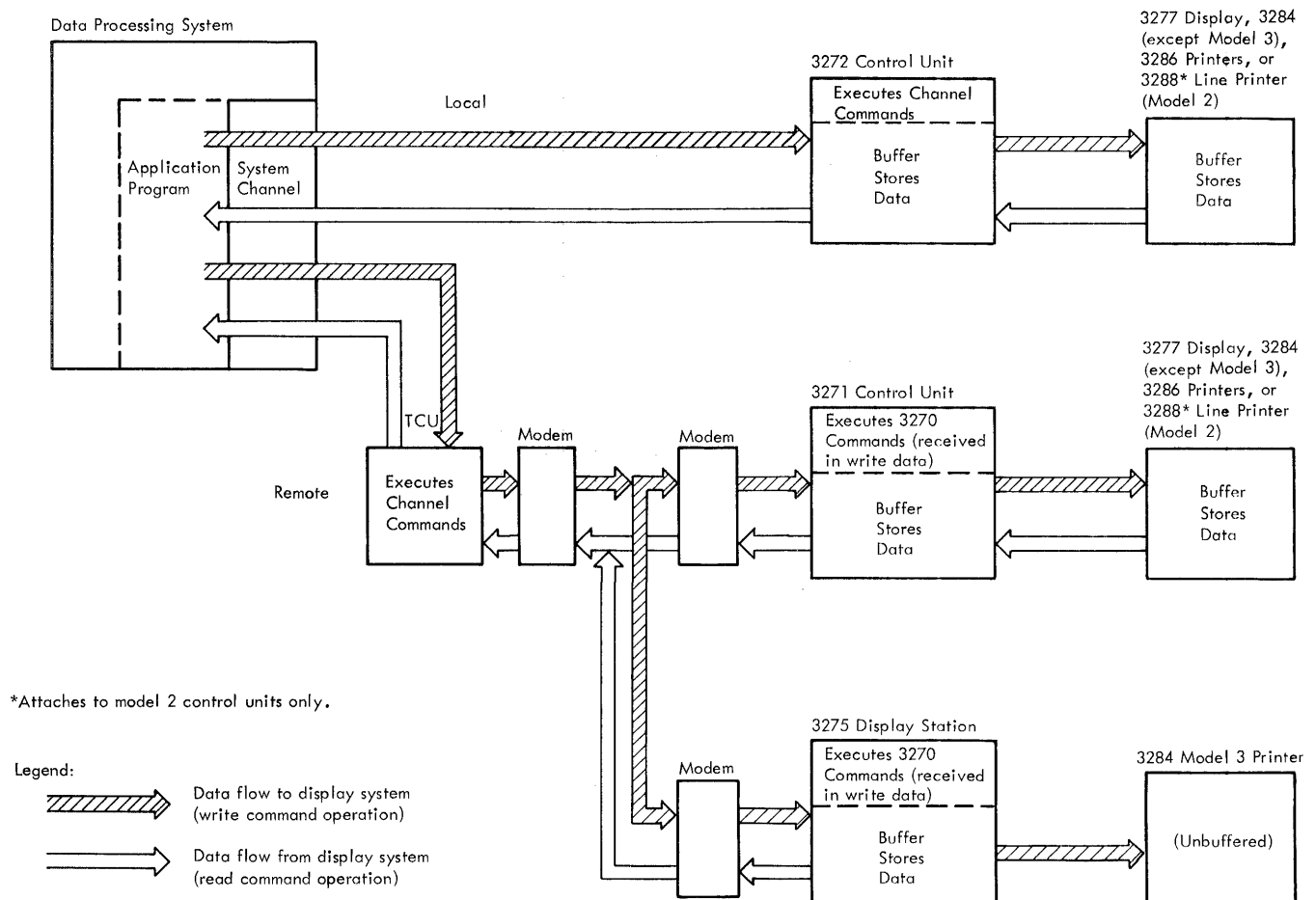


Figure 3. Data Flow between Data Processing System and 3270 Display System

conditions permit, the control unit communicates solely with that device until the operation is completed. At that time, sequential polling is resumed.

## DISPLAY OPERATIONS

Display data that is stored in a 3277 or 3275 Display Station buffer is presented to the operator on a cathode-ray tube (CRT) screen in the form of alphameric characters and symbols. A visible display is produced when an electron beam in the CRT strikes the phosphor-coated CRT screen, causing the portion of the coating struck by the beam to glow briefly. The display is redrawn continuously (regenerated) from the display buffer to maintain a constant image on the screen. Because each display has a regeneration buffer, the display image can be automatically updated when the data is modified by the application program. When a keyboard is attached, input messages can be

generated at the keyboard and displayed on the screen as they are composed.

The image on a 480-character unit is displayed on 12 horizontal rows of 40 characters each (Figure 4). The image on a 1920-character unit is displayed on 24 horizontal rows of 80 characters each.

The following section provides information on the functions and operation of display stations and their associated special features. No distinction is made between the 3277 and 3275 Display Stations since each unit has the same display capabilities. Additionally, no distinction is made between various keyboard special features unless they are pertinent to the topic being discussed.

### Unformatted and Formatted Display Images

There is a fixed relationship between each 3277 and 3275 buffer storage location and its related character position on the display screen (Figure 4). Buffer address locations are

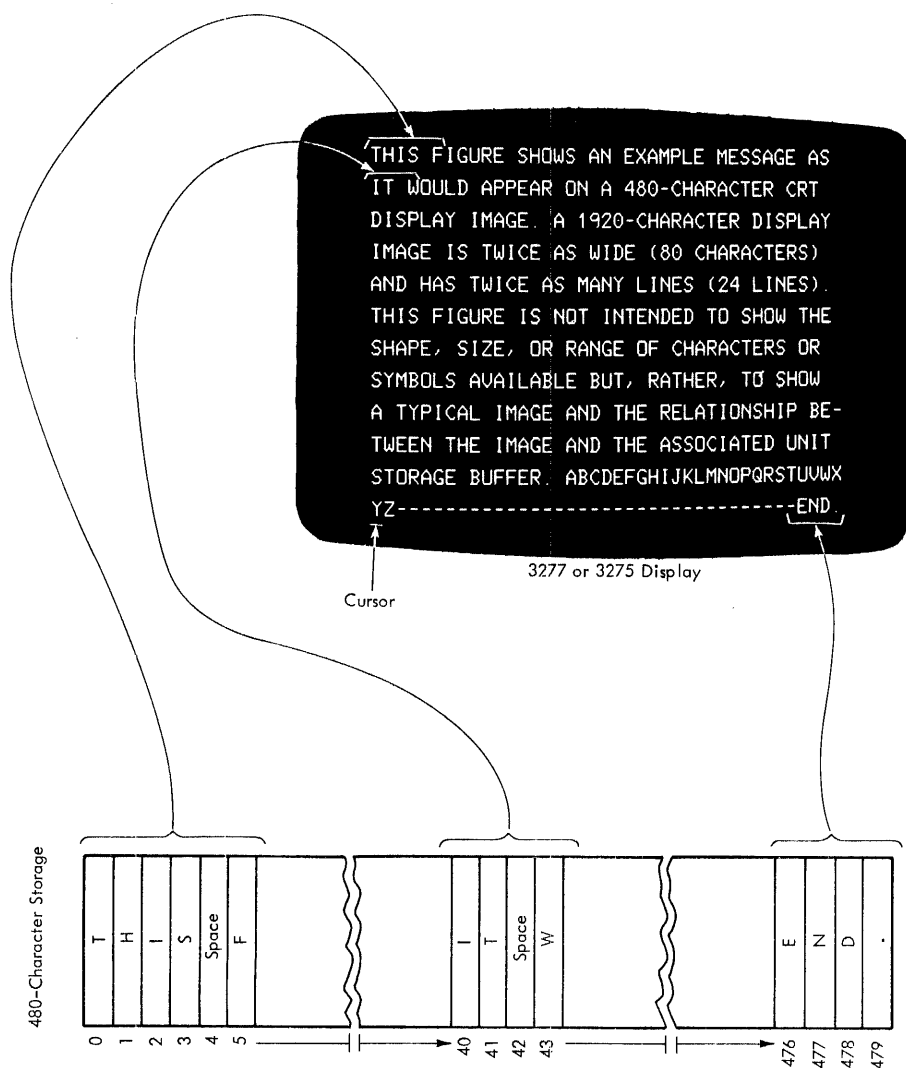
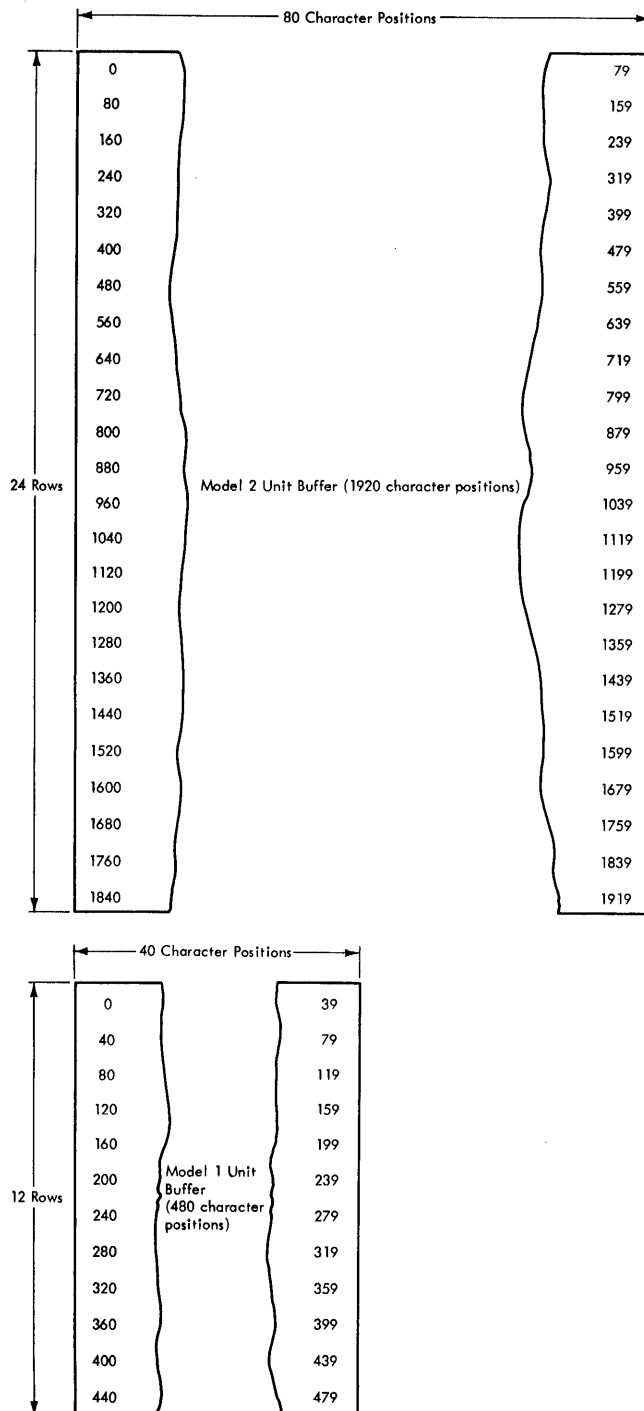


Figure 4. Display Station Buffer and Display Image Screen Character Position Relationships (Unformatted Display)

referenced from 0 (the first displayable character location in the upper left corner of the screen) to 479, or 1919 (the last displayable character location in the bottom right corner of the screen). Figure 5 shows the layouts of these address locations for both size display buffers. By using



Note: See Appendix C for hexadecimal equivalents.

Figure 5. Buffer Addressing Layouts for Model 1 and Model 2 Devices

these address locations under appropriate commands, a program can load a display station buffer with many combinations of control and data characters to present to the operator a display image that exactly fits the application. A total of 93 character codes may be transferred from the system processor and stored in the display station buffer. These include the uppercase and lowercase alphameric characters and special characters shown in Tables 1 and 2. They include printer control characters EM, NL, and FF (which is displayed as < for the 3288 Line Printer), and two selector-pen-detectable control characters (? and >), also shown in Tables 1 and 2. Additionally, they include attribute characters described below under "Display Fields".

An application program can communicate with a display operator using one of two basic methods. In one method, the display screen is left unformatted and the display operator uses the screen in a free-form manner. In the second method, the display image is completely or partially formatted (organized or arranged) by the application program.

The display image shown in Figure 6 illustrates the flexibility available with 3270 display image formatting. In this example the visible characters represent displayed data stored in the display buffer. Character positions indicated by dotted squares represent buffer locations where control characters are stored. Dotted characters represent display data that is defined by the program as not displayable, that is, not visible to the operator. In all display images, control characters stored in a display unit buffer are not displayed; data characters may or may not be displayed, depending upon program definition.

```

NAME : JOHN B DOE
SALARY 12523
JOB TITLE : WRITER
PHONE #: 383-7628

```

Figure 6. Examples of Display Image Fields (Formatted Display)

### Display Fields

The control characters (dotted squares) shown in Figure 6 are constructed by the program. They define the characteristics or attributes of the data that follow them and are called attribute characters. Each attribute character plus all the data following it up to the next attribute character is called a field. When a field "wraps" the screen, the field continues from the last character location in the buffer to the first location in the buffer until it is terminated by an attribute character. Figure 6 shows eight fields.

Organizing the display data into fields facilitates display operations for the program and for the operator. Fields are also used in most 3270 programming operations: functions

Table 1. United States I/O Interface Code - EBCDIC

		00				01				10				11				Bits 0,1
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bits 2,3
Hex 1 ↓ Bits 4567		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	Hex 0 ←
0000	0	NUL	DLE			SP	&	—									0	
0001	1	SOH	SBA					/		a	j			A	J		1	
0010	2	STX	EUA		SYN					b	k	s		B	K	S	2	
0011	3	ETX	IC							c	l	t		C	L	T	3	
0100	4									d	m	u		D	M	U	4	
0101	5	PT	NL							e	n	v		E	N	V	5	
0110	6			ETB						f	o	w		F	O	W	6	
0111	7			ESC	EOT					g	p	x		G	P	X	7	
1000	8									h	q	y		H	Q	Y	8	
1001	9		EM							i	r	z		I	R	Z	9	
1010	A					¢	!		:									
1011	B					.	\$	,	#									
1100	C	FF	DUP		RA	<	*	%	@									
1101	D		SF	ENQ	NAK	(	)	—	'									
1110	E		FM			+	;	>	=									
1111	F		ITB		SUB		⌞	?	"									

Notes:

- Character code assignments other than those shown within all outlined areas of this chart are undefined. If an undefined character code is programmed, the character that will be displayed is not specified. The character displayed by the 3277 or 3275 for a given undefined character code may be different for other devices. IBM reserves the right to change at any time the character displayed for an undefined character code.
- Lowercase alphabetic characters (shown within the dotted outlined area) are converted to uppercase by the display station or printer and displayed or printed as uppercase characters.
- NL, EM, FF, DUP, and FM control characters are displayed or printed as 5, 9, <, \*, and ; characters, respectively, except by the printer under format control, in which case NL and EM do not result in a character being printed.
- Bit 0 is assigned and bit 1 is always a 1 for the following characters: attribute, write control (WCC), copy control (CCC), CU and device address, buffer address, sense, and status. Bit 0 is assigned so that each character can be presented by a graphic character within the solid outlined areas of the chart. See Table 3.
- This table also applies for Belgian, French, and Italian monospace I/O interface codes and graphics.
- The | character (hex 6A) is not displayed and is printed by the 3288 only.



Table 2. United States I/O Interface Code - ASCII

					<div> <div>b<sub>7</sub></div> <div>b<sub>6</sub></div> <div>b<sub>5</sub></div> </div>							
					<div> <div>0000</div> <div>0001</div> <div>0100</div> <div>0101</div> <div>1000</div> <div>1001</div> <div>1100</div> <div>1101</div> </div>							
b <sub>4</sub>	b <sub>3</sub>	b <sub>2</sub>	b <sub>1</sub>	Hex 0 Hex 1	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P		p
0	0	0	1	1	SOH	SBA	! !	1	A	Q	a	q
0	0	1	0	2	STX	EUA	"	2	B	R	b	r
0	0	1	1	3	ETX	IC	#	3	C	S	c	s
0	1	0	0	4	EOT	RA	\$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6		SYN	&	6	F	V	f	v
0	1	1	1	7		ETB	'	7	G	W	g	w
1	0	0	0	8			(	8	H	X	h	x
1	0	0	1	9	PT	EM	)	9	I	Y	i	y
1	0	1	0	A	NL	SUB	*	:	J	Z	j	z
1	0	1	1	B		ESC	+	;	K	[	k	
1	1	0	0	C	FF	DUP	,	<	L	\	l	
1	1	0	1	D		SF	-	=	M	]	m	
1	1	1	0	E		FM	.	>	N	^	n	
1	1	1	1	F		ITB	/	?	O	_	o	

Notes:

1. Character code assignments other than those shown within all outlined areas of this chart are undefined. If an undefined character code is programmed, the character that will be displayed is not specified. The character displayed by the 3277 or 3275 for a given undefined character code may be different for other devices. IBM reserves the right to change at any time the character displayed for an undefined character code.
2. Lowercase alphabetic characters (shown within the dotted outlined area) are converted to uppercase by the display station or printer and displayed or printed as uppercase characters.
3. NL, EM, FF, DUP, and FM control characters are displayed or printed as 5, 9, <, \*, and ; characters, respectively, except by the printer under format control, in which case NL and EM do not result in a character being printed.
4. Attribute, write control (WCC), copy control (CCC), CU and device address, buffer address, sense, and status characters are assigned as specified in Table 3 so that each character can be represented by a graphic character within the solid outlined portion of this chart.
5. ASCII A option displays and prints | and ^ for interface codes 21 and 5E (hex), respectively. ASCII B option displays and prints ! and ^ for codes 21 and 5E (hex), respectively.

Table 3. Assignments for Internal 6-Bit Structured Data

Bits 2–7	Graphic	EBCDIC	ASCII	Bits 2–7	Graphic	EBCDIC	ASCII
00 0000	SP	40	20	10 0000		60	2D
00 0001	A	C1	41	10 0001	/	61	2F
00 0010	B	C2	42	10 0010	S	E2	53
00 0011	C	C3	43	10 0011	T	E3	54
00 0100	D	C4	44	10 0100	U	E4	55
00 0101	E	C5	45	10 0101	V	E5	56
00 0110	F	C6	46	10 0110	W	E6	57
00 0111	G	C7	47	10 0111	X	E7	58
00 1000	H	C8	48	10 1000	Y	E8	59
00 1001	I	C9	49	10 1001	Z	E9	5A
00 1010	¢, [	4A	5B	10 1010	¡ (EBCDIC)	6A	7C
00 1011	.	4B	2E	10 1011	,	6B	2C
00 1100	<	4C	3C	10 1100	%	6C	25
00 1101	(	4D	28	10 1101	—	6D	5F
00 1110	+	4E	2B	10 1110	>	6E	3E
00 1111	!, !	4F	21	10 1111	?	6F	3F
01 0000	&	50	26	11 0000	0	F0	30
01 0001	J	D1	4A	11 0001	1	F1	31
01 0010	K	D2	4B	11 0010	2	F2	32
01 0011	L	D3	4C	11 0011	3	F3	33
01 0100	M	D4	4D	11 0100	4	F4	34
01 0101	N	D5	4E	11 0101	5	F5	35
01 0110	O	D6	4F	11 0110	6	F6	36
01 0111	P	D7	50	11 0111	7	F7	37
01 1000	Q	D8	51	11 1000	8	F8	38
01 1001	R	D9	52	11 1001	9	F9	39
01 1010	!, ]	5A	5D	11 1010	:	7A	3A
01 1011	\$	5B	24	11 1011	#	7B	23
01 1100	*	5C	2A	11 1100	@	7C	40
01 1101	)	5D	29	11 1101	'	7D	27
01 1110	;	5E	3B	11 1110	=	7E	3D
01 1111	¬, ^	5F	5E	11 1111	"	7F	22

**Note:** The following characters are internally handled as 6-bit structured data: graphic, attribute, AID, write control (WCC), copy control (CCC), CU and device address, buffer address, status, and sense. When any character is received by the CU, only the low-order 6 bits are used. When any of these characters is transmitted to the program, the CU assigns the appropriate EBCDIC code. If transmission is in ASCII, the CU translates the EBCDIC code to ASCII code prior to transmission.

For example, to use this table to determine the hex code transmitted for an attribute character, first determine the values of bits 2–7. Select this bit configuration in the table under "Bits 2–7". The hex code that will be transmitted (either in EBCDIC or ASCII) is to the right of the bit configuration.

Use this table also to determine equivalent EBCDIC and ASCII hex codes and their associated graphic characters. See Table 2, Note 5, for ASCII A and B graphic character differences for ASCII codes 21 and 5E (hex).

Graphic characters for the United States I/O interface codes are shown. Graphic characters for EBCDIC 4A, 5A, 5B, 7B, 7C, and 7F might differ for particular World Trade I/O interface codes. Refer to the applicable table in Appendix D for possible graphic differences when these codes are used.

that involve the storage, display, printing, or transmission of data are primarily field-oriented. Some operations performed on fields that wrap the screen are terminated by the last buffer address rather than by the field terminating attribute. This effect is noted in the descriptions of the specific operations.

Attribute characters, in addition to defining the start of a field, define the following field characteristics for all character locations contained in that field:

- Protected (from modification by a display operator) or unprotected (available for the operator to modify or enter data). The unprotected definition classifies a field as an input field.
- Alphameric (an input field in which an operator can enter alphabetic, numeric, or symbol characters) or numeric (has special meaning for protected fields, data entry keyboards, and the Numeric Lock special feature).
- Character display (non-display, display, intensified display).
- Detectable or nondetectable (by use of the selector pen).
- Tab stop positions (first character position of unprotected fields).

Each attribute character occupies one of the 480- or 1920-character locations in the buffer, but it cannot be displayed or printed. During a display or a printout, its character location appears as a space. Table 4 shows the bit definition for an attribute character.

Attribute characters are treated as characters that are protected from operator intervention; that is, they cannot be replaced by alphameric characters entered from the keyboard or modified by use of the selector pen. However, the Modified Data Tag bit (7) of the attribute character can be changed by an operator, as described in Table 4. Also, attribute characters are not protected from being overwritten by alphameric data that is included in the data stream of a Write or Erase Write command. When the operator uses the CLEAR key, attribute characters and all characters in a formatted buffer are erased.

**PROGRAMMING NOTE:** Refer to "Selector Pen Operations" for use of intensified field attributes when formatting selector-pen-detectable fields.

## KEYBOARD OPERATIONS

Keyboards, which may be attached to a 3277 or 3275, enable the operator to change, edit, or create character displays except within fields, defined by attribute characters, as protected from keyboard operations by the program. As messages are being composed or modified by keyboard operations, the changes are inserted in the buffer and displayed on the subsequent display regeneration cycle.

When the operator completes an operation and presses the ENTER key, an I/O pending occurs. In local, this causes an interruption to inform the program; the program may then read the modified data fields from the display buffer. In remote, an interruption cannot be generated; instead the modified data fields are read automatically in response to a Poll sequence.

## Cursor

A special symbol (that resembles an underscore), called a *cursor*, is displayed beneath a character or character position on the display screen to indicate where the next

**Table 4. Attribute Character Bit Definition**

Attribute character bit assignments are summarized as follows:

X	1	U/P	A/N	D/SPD	Reserved	MDT	
0	1	2	3	4	5	6	7

EBCDIC Bit	Field Description
0	- Value determined by contents of bits 2–7. See Table 3.
1	- Always a 1.
2	- 0 = Unprotected 1 = Protected
3	- 0 = Alphameric 1 = Numeric (causes automatic upshift of data entry keyboard)
	<i>Note:</i> Bits 2 and 3 equal to 11 causes an automatic skip. See text.
4 & 5	- 00 = Display/not selector-pen detectable. 01 = Display/selector-pen detectable. 10 = Intensified display/selector-pen detectable. 11 = Nondisplay, nonprint, nondetectable.
6	- Reserved. Must always be 0.
7	- Modified Data Tag (MDT); identifies modified fields during Read Modified command operations.  0 = Field has not been modified. 1 = Field has been modified by the operator. Can also be set by program in data stream.

*Note:* Bits 0 and 1 are not decoded when received by the 3270. When transferring characters to the CPU, bit 1 is a 1 and bit 0 is set (as shown in Table 3), depending upon the character being transferred. All attribute characters are part of the defined character set. The default option (bits 2 through 7 all set to 0) results in an unprotected, alphameric, displayed, nondetectable field.

character entered from the keyboard will be stored (Figure 4). For example, when the cursor is displayed under one character in a line of characters, that character can be changed or deleted by keyboard action. Also, if the cursor is displayed under a position without a display character, a character can be inserted in that position by keyboard action. All of these operations, when performed on a formatted display, cause the MDT bit (bit 7) of the attribute character for the field to be set to 1. However, when the cursor appears beneath a character in a protected field or an attribute character, that position cannot be modified by keyboard action, and the MDT bit is not set.

One and only one cursor is always displayed on the display. A cursor check occurs when the display station circuitry detects no cursor or more than one cursor in the buffer. When the display is turned on, the cursor is automatically generated and displayed in the first location on the screen. The cursor can be repositioned by the keyboard operator and also by the program. The cursor is not affected by field attributes nor by the Key Lock special feature; it is displayed even when positioned in a non-display/nonprint field and when the Key Lock special feature (if installed) is turned off.

### Keyboards

Four types of keyboards are available for the 3277 and 3275 Display Stations: typewriter, data entry, data entry—keypunch layout, and operator console keyboard. All keyboards have special symbol keys and control keys for entering data. The type of keyboard determines the characters and symbols that can be key-entered from the display station but does not determine which type of characters and symbols can be transmitted from the system for the display image.

Variations between keyboards include 66-key and 78-key versions. The 66-key keyboard provides all the basic operator keys. The 78-key keyboard provides expanded operator-to-program message flexibility with 12 additional keys that may be defined to fit the requirements of the application program. The four basic types of keyboards, shown in Figure 7, are defined below. Refer to Appendix D for WTC keyboard key layouts and nomenclature.

**Typewriter Keyboard** - This keyboard provides the basic typewriter key layout. Alphameric keys are encoded with both lowercase and uppercase codes. The typewriter keyboard is available with Program Function keys PF1 through PF12 (78-key version) or without (66-key version).

**Data Entry Keyboard** - This keyboard provides the basic data-entry type of key layout. When characters are entered in a numeric field, the keyboard is automatically upshifted to take advantage of the grouped numeric keys (bold-outlined in Figure 7). The data entry keyboard contains 66 keys, including Program Function keys PF1 through PF5.

**Data Entry Keyboard—Keypunch Layout** - This keyboard has the same keys and features as are found on the data entry keyboard. The key layout of this keyboard more closely resembles the layout of the 29 Card Punch and 129 Card Data Recorder. In many cases the layout is identical to the keypunch units except for function key designations. This keyboard is recommended for data entry applications.

**Operator Console Keyboard** - This keyboard provides an IBM 1052 Model 7 type of key layout. It has 78 keys which include Program Function keys PF1 through PF12.

### Key Functions

Alphameric character keys encompass the complete 63-character EBCDIC and 64-character ASCII character sets (as shown within the bold outline in Tables 1 and 2, respectively) including Space.

Alphabetic characters can be entered into the display buffer in either uppercase or lowercase code, depending upon the position of the SHIFT key, from the typewriter or operator console keyboard. Only uppercase alphabetic codes can be entered from the data entry keyboards. All alphabetic characters in the buffer (uppercase or lowercase codes) are displayed as uppercase characters.

Keyboard entry of an alphameric character into the display buffer occurs at the cursor location, provided the cursor is located in an alphameric character location within an unprotected data field. (An attempt to enter an alphameric character into a protected data field or into an attribute character location is blocked.) Successful keyboard entry of the alphameric character causes the cursor to advance to the next character location within the unprotected data field.

### Automatic-Skip

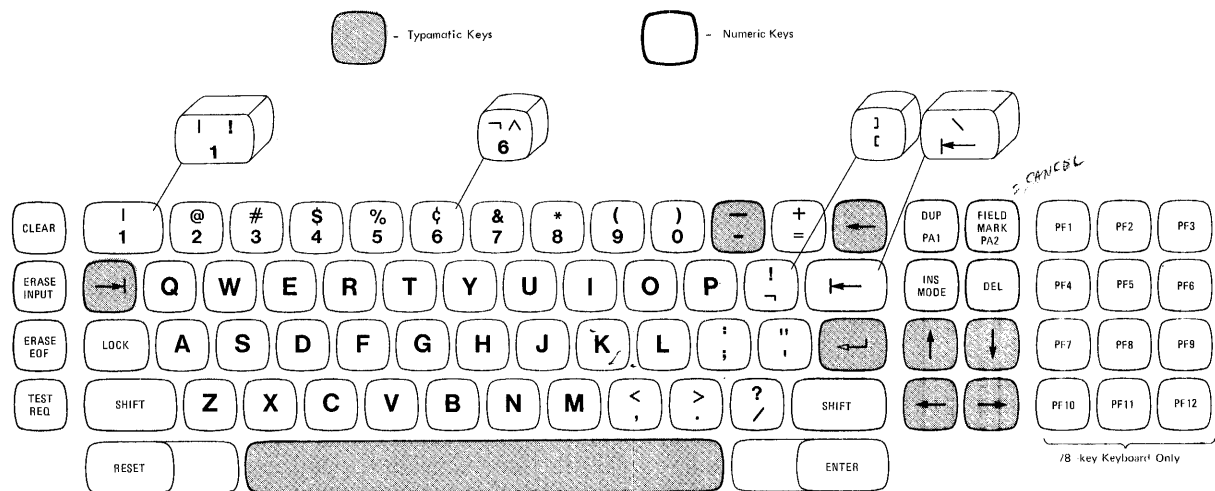
Upon entry of a character into the last character location of an unprotected data field, the cursor is repositioned according to the attribute character describing the next field.

If the attribute character defines the next field as (1) alphameric and either unprotected or protected, or (2) numeric and unprotected, the cursor skips the attribute character, and is positioned to the first character location in that field.

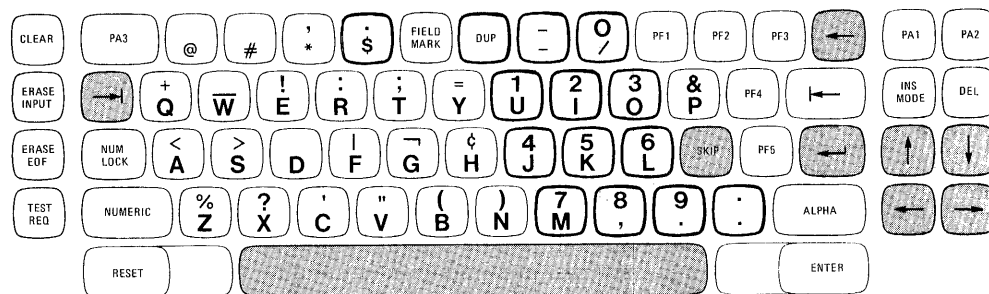
If the attribute character defines the field as numeric and protected, the cursor automatically skips that field and is positioned to the first character location of the next unprotected field.

### Character-Oriented Keys

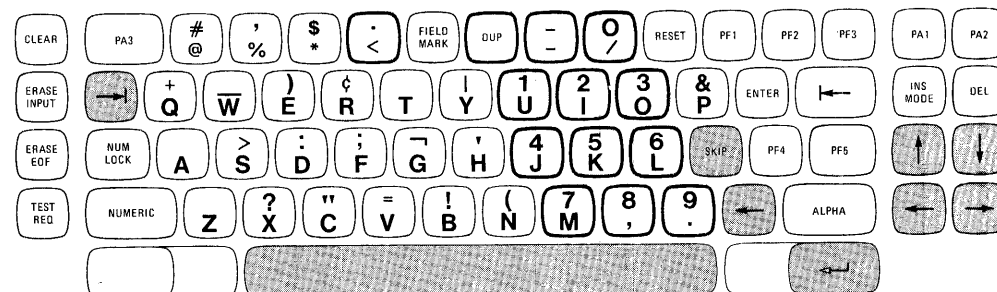
A cluster of four keys (located to the right of the main keyboard) moves the cursor one location at a time into any character location: These are: ↑ (Up), ↓ (Down), → (Right), and ← (Left). A fifth key, the backspace key, occupies its



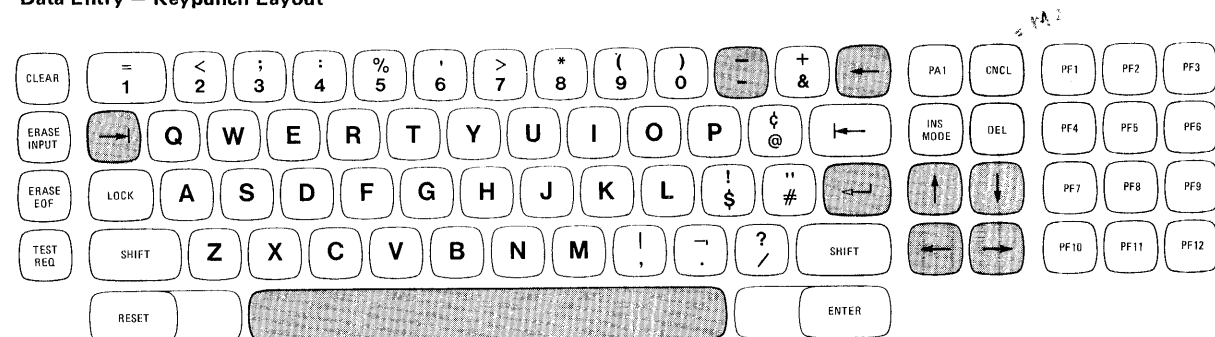
**Typewriter Keyboard (EBCDIC) - The ASCII typewriter keyboard which accommodates both ASCII-A and ASCII-B character set options has four different keys, shown above keyboard.**



**Data Entry**



**Data Entry - Keypunch Layout**



**Operator Console**

**Figure 7. Basic Keyboards for 3277 and 3275 Display Stations**

normal position on the main keyboard. It is also designated by ← and performs the same functions as the move-cursor-left key. The cursor may be moved into any character location, including unprotected and protected alphameric character and attribute character locations, through the use of these keys. Operation of these keys does not affect the MDT bit.

These keys are all capable of causing the cursor to wrap. Horizontal wrap always involves a vertical movement; the cursor repositions to the next or preceding row of characters. Vertical wrap due to operation of the Up or Down keys involves no horizontal movement; the cursor stays in the same character column.

These keys all have typamatic operation at a repeat rate of approximately ten operations per second. (When a typamatic key is fully pressed, its function is repeated as long as the key is held pressed.)

#### *Field-Oriented Keys*

Any of four keys move the cursor to the first position in a field. All four key operations can cause the cursor to wrap from the end of the last line on the display and to continue at the beginning of the top line. Operation of these keys does not affect the MDT bit.

→ (Tab) Key - Moves the cursor to the first character location of the next unprotected data field. In a display with no unprotected fields, the cursor is repositioned to character location 0. The Tab key has typamatic capability at a repeat rate of approximately ten operations per second.

← (Backtab) Key - When the cursor is located in the attribute character or the first alphameric character location of an unprotected data field or in any character location of a protected data field, this key moves the cursor to the first alphameric character location of the first preceding unprotected data field. When the cursor is located in any alphameric character location of an unprotected data field other than the first location, this key moves the cursor to the first alphameric character location of that field. In a display with no unprotected fields, the cursor is repositioned to character location 0. The Backtab key has no typamatic capability.

↵ (New Line) Key - Moves the cursor to the first unprotected character location of the next line. If the display has no unprotected data fields, the cursor is repositioned to character location 0. If the display contains no fields, the cursor is repositioned to the first character position of the next line. The New Line key has typamatic capability at a rate of approximately ten operations per second.

SKIP Key (Data Entry Keyboards Only) - Performs the same functions as the Tab key.

#### *ERASE EOF (Erase to End Of Field)*

If the cursor is located in an alphameric character location in an unprotected data field, this key clears the character location occupied by the cursor and all remaining character locations in that field to nulls. The operation can wrap from the end of the last line on the display to the beginning of the top line. The cursor does not move as a result of operating this key, and the MDT bit is set to 1.

Operation of this key when the cursor is located in an attribute character location or is within a protected data field disables the keyboard; no character locations are cleared, the cursor is not moved, and the MDT bit is not set.

#### *ERASE INPUT Key*

This key clears all unprotected character locations to nulls, resets MDT bit to 0 in unprotected fields, and repositions the cursor to the first unprotected character location on the screen.

In a buffer with only protected data fields, no character locations are cleared and the cursor is repositioned to character location 0.

If the display contains no field, the entire buffer is cleared to nulls and the cursor is repositioned to location 0.

#### *INS (Insert) MODE Key*

This key lights the INSERT MODE indicator and places the keyboard controls in an insert mode of operation, regardless of the cursor location.

If the cursor is located in an unprotected data field having a null character either in the character location identified by the cursor or in any character location in the field beyond the cursor, operation of an alphameric key causes that alphameric character to be entered at the cursor and the MDT bit to be set to 1. The character formerly occupying the cursor location and all remaining characters within the field (except for null characters or characters to the right of null characters) will be shifted one character location to the right. If the location identified by the cursor location at the time of the insert operation is a null, no character shifting occurs.

After all null characters at or beyond the cursor location in the field have been overwritten, or if there were no null characters, operation of an alphameric key causes the keyboard to become disabled. Attribute characters remain in their fixed character locations and are not shifted as part of the insert operation.

If more than one row of characters is contained within the field, a character occupying the last character location in the row is shifted into the first character location of the next row.

Operation of an alphameric key while in insert mode when the cursor is located in an attribute character location or is within a protected data field disables the keyboard; no

character locations are cleared, the cursor is not moved, and the MDT bit is not set.

Operation of the RESET key returns the keyboard to normal mode.

#### *DEL (Delete) Key*

If the cursor is located in an alphameric character in an unprotected field, operation of the DEL key will delete the character from the character location occupied by the cursor and set the MDT bit to 1 (if it had not previously been set). The cursor will not move. All remaining characters in the unprotected field, to the right of the cursor and on the same row, will shift one character location to the left. Vacated character locations at the end of the row will be filled with nulls. If the unprotected field encompasses more than one row, characters in rows other than the row identified by the cursor will not be affected.

Operation of this key when the cursor is located in an attribute character location or is within a protected data field disables the keyboard; no character locations are cleared, the cursor is not moved, and the MDT bit is not set.

#### *RESET Key*

The RESET key is used to recover from a *keyboard* operation that has resulted in a disabled keyboard. When a keyboard is disabled, no other keyboard operations are honored. The RESET key will not reset a disabled keyboard when a command is being executed for the device to which the keyboard is attached or when a parity error or cursor check is detected in the device buffer.

#### *DUP (Duplicate) Key*

Operation of this key causes a unique character code to be entered into the display buffer, a standard Tab key operation to be performed, and the MDT bit to be set to 1. The DUP key is provided only on the typewriter, data entry, and data entry-keypunch layout keyboards. The DUP character provides a means of informing the application program that a "duplicate" operation is indicated for the rest of the field in which it is located. The DUP character is transferred as a DUP code (Tables 1 and 2) when the data is read from the display to the program. No duplicate operation is performed at the 3270 CU. The DUP character, when stored in a device buffer, is displayed or printed as an asterisk (\*).

Operation of this key when the cursor is located in an attribute character location or is within a protected data field disables the keyboard; no character locations are cleared, the cursor is not moved, and the MDT bit is not set.

#### *FIELD MARK Key*

Operation of this key causes a unique character code to be entered into the display buffer and the MDT bit to be set to 1. The field mark character provides a means of informing the application program of the end of a field in an unformatted buffer or subfield in a formatted buffer. The field mark character is transferred as an FM code (Tables 1 and 2) when the data is read from the display to the program. The field mark character, when stored in a device buffer, is displayed or printed as a semicolon (;). The field mark is not provided on operator console type keyboards.

Operation of this key when the cursor is located in an attribute character location or is within a protected data field disables the keyboard; no character locations are cleared, the cursor is not moved, and the MDT bit is not set.

#### *Program Attention Keys*

These keys solicit program action by causing an I/O pending to occur at the device. The program is notified of the interruption by an Attention status indication in locally attached systems and by responding to a poll in remotely attached systems. In remotely attached systems that are using a 3275 Display Station, the display screen will momentarily go blank while the program accepts and responds to the attention signal. An Attention identification (AID) character is generated at the time of the interruption to identify which key caused the interruption, but the MDT bit is not affected. The Program Attention keys are: CLEAR, ENTER, CNCL (cancel), TEST REQ, all Program Function (PF) keys, and the Program Access (PA) keys. Operation of the CLEAR key also causes the entire display buffer to be cleared to nulls and positions the cursor to character location 0.

Operation of any Program Attention key disables the keyboard, lights the INPUT INHIBITED indicator, and extinguishes the SYSTEM AVAILABLE indicator.

*Note:* Not all Program Attention keys are available on each type of keyboard. See Figure 7.

#### **Numeric Lock Special Feature Operation**

When the Numeric Lock special feature is installed, the characters (0–9), (.), minus sign (-), and DUP may be entered by the operator in a field identified in the attribute byte as numeric and unprotected. Operation of any other key which can enter a displayable character lights the INPUT INHIBITED indicator and disables all keys except the RESET key. Operation of the RESET key enables the keyboard (if disabled), and the INPUT INHIBITED light goes out. The nondisplay/nonprint attribute bits 4, 5 and MDT bit 7 operate normally.

On a data entry or data entry–keypunch layout keyboard (Figure 7), the Numeric Lock special feature is disabled while the ALPHA or NUMERIC key is operated.

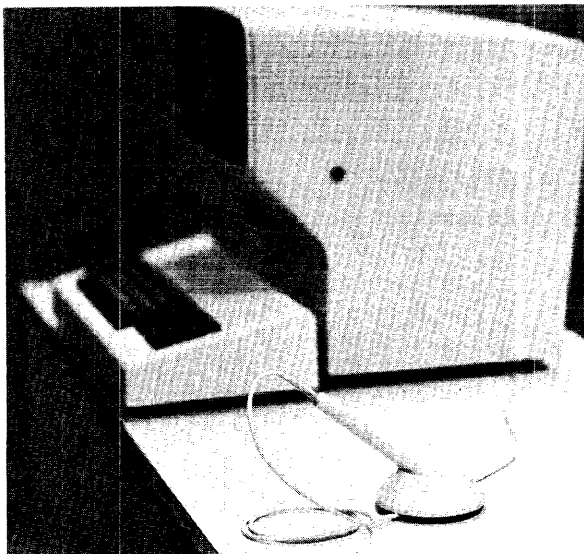
On a typewriter or operator console keyboard, the characters that can be entered in the field identified in the attribute byte as numeric and unprotected are (0–9), (.), and minus sign (-); in addition, on typewriter keyboards when the SHIFT or the LOCK key is operated, the DUP character may be entered by the operator. It is not possible to disable the Numeric Lock special feature for entry of other displayable characters.

*Note:* On Austrian/German, Belgian, Danish, French, Italian, Norwegian, Portuguese, and Spanish keyboards with the Numeric Lock feature installed, the comma (,) replaces the period (.) as a valid numeric character.

#### **Keyboard Disabled (INPUT INHIBITED indicator is on)**

When INPUT INHIBITED is on, the keyboard and other input devices are disabled. In cases caused by operator key action, the input inhibited condition can be cleared by using the RESET key unless one of the following conditions coexists:

1. A command is being executed for a device to which the keyboard is attached.
2. A card is being read at the Operator Identification Card Reader.
3. The 3284 Printer, Model 3, is in the process of printing.
4. A parity error or cursor check is detected in a device buffer. (The INPUT INHIBITED indicator will be off as long as the RESET key is pressed, but will turn on when the RESET key is released.)
5. The security key lock is in the off position. (This condition is cleared by turning on the security key lock.)



**Figure 8. Selector Pen**

The conditions that can be cleared by using the RESET key are:

1. A Program Attention key operation prior to initiation of a command for a device with an attached keyboard.
2. A selector-pen attention operation prior to initiation of a command for a device with an attached keyboard.
3. The operator initiated the input inhibited condition by pressing an alphameric key not included in the numeric key grouping when the Numeric Lock special feature is installed.
4. The operator tried to change the data displayed in a protected display field. (The CLEAR key can also be used in this case, which places nulls in all buffer positions and turns on the INPUT INHIBITED indicator. INPUT INHIBITED can then be turned off by pressing the RESET key prior to initiation of a command for a device with an attached keyboard.)

#### **INDICATORS AND CONTROLS**

See Appendix A for functions of indicators and controls.

#### **SELECTOR PEN OPERATIONS**

The Selector Pen, shown in Figure 8, is a light-sensitive pen that can detect the light emitted from characters displayed on the 3275 or 3277. With the Selector Pen, the operator can select from a list or table of displayed items and can then cause those selections to be identified to the application program.

The Selector Pen is operated by pressing the tip of the pen against the screen on fields programmed for selector-pen operations.



## Selector Pen Field Format

A field that is to be used for selector-pen operations must be defined in the following format:

SPD (Selector Pen Detectable) Field	Data Character	Preceding field (on the same line as the SPD field).
	3 Space or Null Characters	Three space or null characters must precede the attribute character defining the SPD field unless the attribute character is the first character on the line.
	Attribute Character	The attribute character defines the field as displayed and selector pen detectable. (An SPD field may be protected or unprotected, alphameric or numeric.)
	Designator Character	The designator character which defines the type of operation that will be performed by detection on this field.
	Displayed Data	One or more displayed alphameric characters for sensing by the selector pen.
	3 Space or Null Characters	Three space or null characters are required when a new field follows on the same line as the SPD field.
	Attribute Character	Succeeding field (on the same line as the SPD field).
	Data Character	

The attribute character, the designator character, and displayed alphameric characters must be on the same line. If the field extends beyond one line, only those characters on the same line as the attribute character can be detected by the Selector Pen. A maximum of six detectable fields in the 3277 or 3275 Model 1, or 12 detectable fields in the 3277 or 3275 Model 2 may precede the last detectable field on any given line. When mixing detectable and non-detectable fields, a maximum of 14 mixed fields on both Model 1 or Model 2 3277 and 3275 units may precede the last detectable field on any given line. Therefore, in this situation, a nondetectable field could be one character in length.

## Designator Characters

Designator characters are used to define two types of selector-pen fields: selection fields and attention fields. Each type of field performs a different selector-pen operation.

The selection field is defined by a question mark (?) designator character. When the Selector Pen detects on a selection field, the MDT bit in the attribute character for that field is set (1) in the display buffer. Also, the designator character is automatically changed on the screen to a greater than (>) sign to provide a visible indication to the operator that the detection was successful. If a mistake was made and the operator again detects on that same field, the > reverts to a ? and the MDT bit for that field is reset (0).

The attention field is defined by a space or null designator character. A detection on an attention field causes an I/O pending (attention) at the display. This I/O pending indicates to the program that the selector-pen operation has been completed. The program may then issue a Read Modified command to obtain the address of each field that was selected or modified by the operator.

## PROGRAMMING NOTES:

1. The application programmer should be aware that high intensity/unprotected fields can be modified by the display station operator to become selector-pen-detectable fields.
2. Use of the Selector Pen feature is anticipated to be such that the program will correlate the address of each SPD field with the data associated with it. Therefore, to minimize TP line loading, channel loading, and buffer size requirements, only the addresses of selector-pen-detected fields are required to be sent to the application program; the field data is not included.
3. Users who wish to combine selector-pen-detect input with keyboard input must use the keyboard to generate the I/O pending. Use of the Selector Pen on an attention field to generate the I/O pending will result in transmission of only the addresses of the fields in which the MDT bit was set.

Figure 9 shows a sample display with fields defined for selector-pen operation. In this sample, "FULL", "50MG", and "4 TIMES" are all preceded by > designator characters to indicate that they were selected by the operator. When the operator detects on the word "EXIT", which has no displayed designator character, an I/O pending will occur and the program will read the locations of the four selected fields.

## PRINTER OPERATIONS

Printers for the 3270 Display System are used to provide a printed copy (for future reference) of information that is displayed at a 3277 or 3275, or of information written from the program. Printed data appears in the same alphameric characters and symbols that appear on a display image, and printouts can be formatted in the same manner as a display image. Cursor information is ignored by the printer.

Two types of printers are available, a buffered printer and an unbuffered printer. The buffered printer, with its own buffer and a unique device address, can be attached to a 3271 or 3272 and operates in the same manner as a 3277.

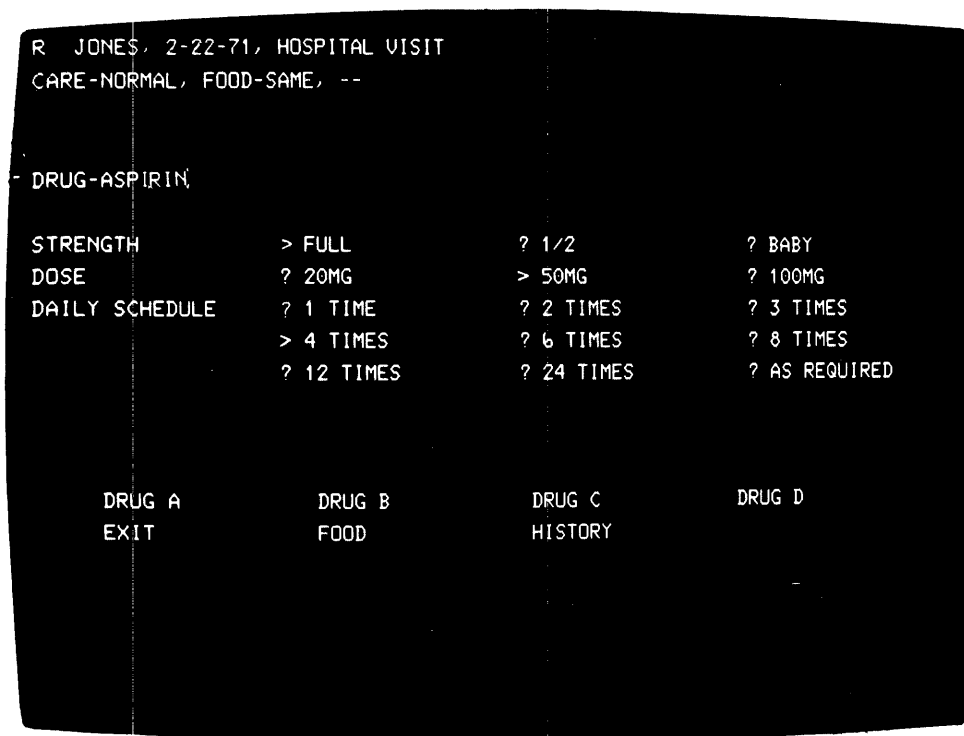


Figure 9. Sample Display Screen for Selector Pen Operations

The buffered printer includes the 3284 and 3286, Models 1 and 2, and the 3288 Model 2 Line Printer.

The unbuffered printer is the 3284 Printer Model 3 that is provided for attachment to the 3275. The relationship between the 3284, 3286, or 3288 Printer buffer or the 3275 Display Station buffer and a printout is shown in Figure 10.

#### Print Line Formatting

Printout operations are specified by a Write command or a Copy command (3271 only), addressed to the printer. The print line format in which the data is to be printed from the buffer can be specified as part of the command in one of three printer formats. These formats simply define the print line length: 40, 64, or 80 character positions per line. If a format is not specified, the print line length is determined by platen length on 3284 and 3286 printers, while the line length is 132 character positions on the 3288 Line Printer.

**PROGRAMMING NOTE:** To duplicate the copy function when operating with the 3272 local CU, the display buffer must be read and then written to the printer.

#### NL, EM, and FF Printer Orders

NL, EM, and FF printer orders are transferred as part of the data stream from the application program. They are stored in the buffer as data.

The NL order is executed only when encountered in a print field during a printout that does not have a line-length

format specified. When an NL order is encountered in the buffer, the printer performs a new line function. If no NL order is encountered before the printer reaches the end of a line (as determined by the maximum carriage length), the printer automatically performs a line feed and continues printing. NL orders are not executed when located in a nondisplay/nonprint field; instead, they are treated as alphameric characters and printed as spaces. In addition, they are not executed when they are encountered in a print field during a printout that uses a line length format; instead, they are printed as the graphic "5".

For buffered printer operation (described in the paragraph titled "Buffered Printer Operation"), EM orders are executed only when they are encountered in a print field during a printout that does not have line-length format specified. EM orders are not executed when they are located in a nondisplay/nonprint field. They are treated as alphameric characters and printed as spaces. When encountered in a print field of a printout that uses line length format, they are not executed; instead, they are printed as a graphic 9. For unbuffered printer operation (described in the paragraph titled "Unbuffered Printer Operation"), EM orders are executed when encountered, whether or not line length format is specified. When an EM is encountered, the printing operation is terminated. None of the data following the EM order in the buffer is printed.

Valid FF orders are executed by the 3288 Line Printer during printouts, both with and without a line-length format specified. (The FF order is completely described in

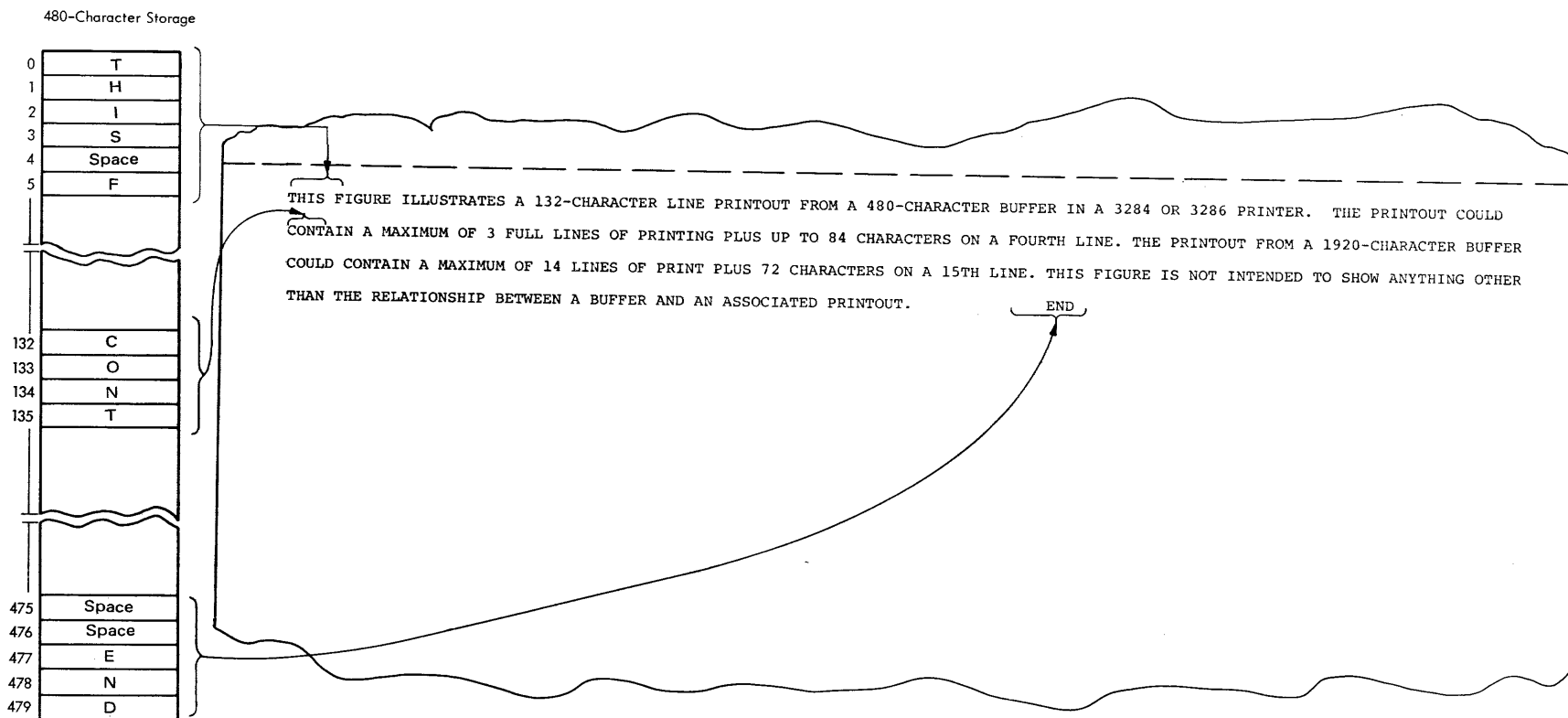


Figure 10. Relationship between Buffer Data and Printed Data

the section “VFC Operations”.) When a valid FF order is encountered in the print field of a 3288 Line Printer with the VFC feature installed, the print form indexes to a predetermined print line on the next form.

### Buffered Printer Operations

When a command specifying a printout is received from the system, the contents of the addressed printer are transferred to the 3271 or 3272 buffer, where they are modified and transferred back to the printer. The printout starts after the control unit-to-printer buffer transfer is completed.

During the print operation, if line format is specified, data characters in the printer buffer are scanned one line at a time before they are printed. A line feed is executed after each line is printed. If a line contains one or more space characters only, a line feed is performed to cause a blank line in the printout. When null characters, attribute characters, or alphameric characters in nonprint field are encountered, they are treated as follows:

1. If embedded in a print line, they are printed as spaces.
2. If they constitute an entire line, they are ignored and the line feed is not performed; as a result, a blank line does not appear in the printout, and the data is compressed vertically one line.

When line length format is not specified, printout of the buffer data begins at buffer location 0 and continues until the last position of the buffer is printed or until a valid EM character is encountered. Each print line is left-justified. At the end of each printout, a final line feed is executed so that the printer is ready to start the next printout. When the print terminating EM order appears in the first print position of the print line, a final line feed is not executed because the printer is already positioned at the left margin for the next printout.

### Unbuffered Printer Operations

Attachment of an unbuffered printer to a 3275 does not affect operations between the 3275 and the system. However, when a printout is being executed, the 3275 will be busy to all other requested command operations.

When a command specifying a printout is received from the system, the 3275 transfers its printer data to the printer. As characters are transferred to the printer, display regeneration continues and the cursor advances on the display screen by one position with each character transferred.

Data is not scanned before printout. Attribute characters, null characters, and alphameric characters in nondisplay/nonprint fields are transferred as spaces. When these characters constitute an entire line, that line will be printed as spaces and a blank line will appear in the printout. The print operation is terminated with the

printing of the last buffer position, unless an EM order is encountered first.

The NL order is executed only when the line length format is not specified. Whether or not line length format is specified, EM orders are executed when encountered.

At the end of each printout, a final line feed is executed so that the printer is ready to start the next printout, except when the print terminating EM order appears in the first print position of the print line, in which case a final line feed is not executed because the printer is already positioned at the left margin for the next printout.

### VFC Operations

The VFC Specify feature for the 3288 Line Printer provides the ability to vertically index forms under program control to a predetermined print line. Special inks and preprinted forms containing index marks are not required to make this feature operational.

When a valid Forms Feed (FF) order is encountered in the buffer during a printout, the form indexes to a predetermined line. Printing begins on the predetermined line; the first print position, the buffer location containing the FF character, is printed as a space character. Printing and indexing continues until the printout is terminated by an EM order in a buffer that does not have a line-length format specified, or when the last character location is printed in a buffer with a line-length format specified. The printer is “busy” while printing and indexing.

There is no limit on the number of FF orders that can be included in the printer buffer or on the frequency of their occurrence. However, for an FF order to be considered valid and thus initiate indexing, FF characters must be placed in buffer locations corresponding to the first position of a print line in a field designated either print or non-print. This can be accomplished by placing the FF character in the following locations:

1. The first character location of a printer message.
2. After a valid NL order.
3. After the last printable character position of any line (e.g., in character position 41 in a buffer with a line-length format of 40 characters per line specified, or in character position 133 in a buffer without a line-length format specified).

An FF order in any other position in the printer buffer is considered invalid; the index operation is not executed, and the FF character prints as a “<” character. The < character prints regardless of whether a print line-length format is specified. A valid FF order prints as a space character. If a valid FF order is encountered when the form is located at the predetermined index stop line, the index operation will be executed, and a blank form will result.

Before beginning VFC printouts, forms must be loaded in the printer and aligned to the print line where indexing

should stop and printing begin. If the forms are not aligned properly while initially being loaded, all forms will be misprinted. VFC circuitry synchronizes with the index stop line on the form as the cover is closed and the printer goes from Not Ready to Ready. If the cover must be raised or if a Not Ready condition occurs, the form must be checked to ensure that the index stop line is in the proper position before reclosing the cover. After closing the cover, proper alignment can be verified by operating the Carriage Restore pushbutton and noting that the form indexes to the proper line of the next form.

The two VFC decade selector switches must be set to the number corresponding to the total number of print lines from one index stop line to the next for each VFC application. There can be up to 99 lines between successive index stop lines. When uniform length forms are used, the setting for the switches is computed by multiplying the forms length, in inches, by 6 (e.g., for 11-inch forms, the switches should be set at 66).

**PROGRAMMING NOTE:** If a 3288 buffer containing FF characters (hex 0C) is read back by the program, the FF characters are returned to the program as 8C (EBCDIC hex) or C6 (ASCII hex). This is a hardware function of all 3270 control units and should not be mistaken as an error.

**PROGRAMMING NOTE:** The time required to index paper during a VFC operation is determined as follows:

$$\text{time (ms)} = 45 + 13.6 (N-2)$$

Where N = the number of lines to be moved in the VFC operation.  
N is a variable, equal to or greater than 2, with a maximum value equal to the setting of the VFC decade selector switches.

### Error Conditions

Four error conditions may be encountered at both the buffered and unbuffered printers. In each of the following cases, when an error is detected, the program is notified. (Power should *never* be removed from unbuffered printers during a printout; the error conditions that may be returned to the program are unpredictable if this is done.) Printer error conditions are:

**Not Ready.** A printer is defined as not ready when it is out of paper, its cover is open, or it is mechanically disabled (unable to advance to its proper position). When a 3284 or 3286 printer mechanism experiences a "printer hang" condition (see Glossary) during a printout, the printer will stay busy with an Equipment Check (EC) present. For 15 seconds, the mechanism will automatically attempt to recover. If the recovery attempt is successful, the printer will return to the Ready condition. If the recovery attempt is not successful after 15 seconds, the printer will become Not Ready, as indicated by Intervention Required (IR) status.

If a printer is not ready at the start of a printout, or if it becomes not ready during a printout operation, the print operation terminates. Error status is sent to the channel once when the condition occurs during a printout and again each time a printout is initiated.

**Character Generator or Sync Check Errors.** The characters printed by a buffered or an unbuffered printer are a function of the character generator or character belt (for 3288) installed. The character sets available are identical with those available for displays. When transferred to a printer, the keyboard orders of DUP and FM are printed as \* and ;. When an incorrectly formed character is printed during a printout, no attempt is made to substitute or alter the character. When the printout operation is completed, a new line function is executed and an X is printed (Specify feature on 3288).

**Parity Error.** If a parity error is detected on a character about to be printed, the graphic X is printed in place of the character with bad parity. The printout continues until all printable characters have been printed. The printer then executes a new line function and prints a graphic X as the last character of the print operation. The isolated X character (Specify feature on 3288) serves to indicate the detection of the parity error.

**Command Chaining.** In local operations, if any command is chained to a command that initiates a print operation, an error condition occurs: no printout is performed, the command is aborted, and the system channel is notified of the error. In remote operations, if command chaining is attempted, error status is sent to the system channel but the printout is completed.

### KEY LOCK

The Key Lock is a security-enhancement special feature that provides a key-controlled lock for 3275 and 3277 display stations. When the key is in the "off" position or is removed from the display station, the message buffer is "locked", which prevents entry, modification, and display of data. The display station is unavailable to programmed read or write operations and operator inputs such as keyboard entry, card reader entry, and selector pen operations.

Programmed attempts to access display stations that have the key turned off or removed from the lock result in responses being returned to the CPU by the 3270 devices. 3270 responses are device- and operation-dependent. They are summarized in the following table:

Device	Operation	Response
Local 3277	All	UC, IR Status, and Sense
Remote 3277	Specific Poll	IR Status and Sense
	General Poll	EOT
	Selection Addressing Sequence	RVI
3275	Specific Poll	No response (Timeout)
	General Poll	EOT
	Selection Addressing Sequence	No response (Timeout)

**PROGRAMMING NOTE:** When no response is received from a 3275 after a Specific Poll or selection addressing sequence, a General Poll should be issued. An EOT response to the General Poll indicates that the 3275 buffer is locked.

#### OPERATOR IDENTIFICATION CARD READER

The Operator Identification Card Reader (Figure 11) is a special feature for attachment to a 3277 or 3275. It reads a small magnetic card encoded with a unique identification number for accounting or security purposes. When the operator places one of these cards into the reader, the text

on the card is read into the display buffer, at the location identified by the cursor, in non-display mode. It is not displayed on the screen. After the card is read, an I/O pending is generated at the display to inform the program that this text can be retrieved and transferred to main storage.

#### Card Format

The identification number on each card contains from 4 to 40 consecutive characters in the following sequence:

SOR
Ident Number
EOR or EOI
LRC

Start of Record (SOR) character (graphic #)

1 to 37 of the coded characters defined in the chart on the following page.

Either an End of Record (EOR) character (graphic ") or an End of Inquiry (EOI) character (graphic @).

An LRC character which may be used by the program for comparison for a parity check.



Figure 11. Operator Identification Card Reader

When the SOR character is read from the card, an attribute character is entered automatically into the cursor-identified location of the buffer provided the cursor is at an unprotected character location. This attribute character defines the card data field following it as protected, alphameric, nondisplay/nonprint. As the rest of the card data is read into the buffer, it is stored starting at the first character location after this attribute character. As each character is stored in the buffer, the cursor advances one buffer location. The cursor advancement is all the operator sees on the screen since the field is nondisplay/nonprint.

#### Character Configuration for Numeric Data

The Numeric character code is a 4-bit, binary-coded decimal (BCD) subset with odd parity, which uses the bit configurations shown below.

An odd parity bit for each character must be used. Additionally, a longitudinal redundancy character is placed at the end of the information data. The LRC character is protected by an odd parity bit of its own.

Data is recorded beginning at the right-hand side of the card, with the stripe at the top of the card as you face the magnetic material.

#### Operator Identification Card Codes

Bits					Character	I/O Interface (See Note 4)	
P	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>		EBCDIC	ASCII
1	0	0	0	0	0	F0	30
0	0	0	0	1	1	F1	31
0	0	0	1	0	2	F2	32
1	0	0	1	1	3	F3	33
0	0	1	0	0	4	F4	34
1	0	1	0	1	5	F5	35
1	0	1	1	0	6	F6	36
0	0	1	1	1	7	F7	37
0	1	0	0	0	8	F8	38
1	1	0	0	1	9	F9	39
1	1	0	1	0	(Special - See Note 1)	7A	3A
0	1	0	1	1	SOR	7B	23
1	1	1	0	0	EOI (See Note 3)	7C	40
0	1	1	0	1	Field Separator	7D	27
0	1	1	1	0	(Unassigned)	7E	3D
1	1	1	1	1	EOR (See Note 2)	7F	22

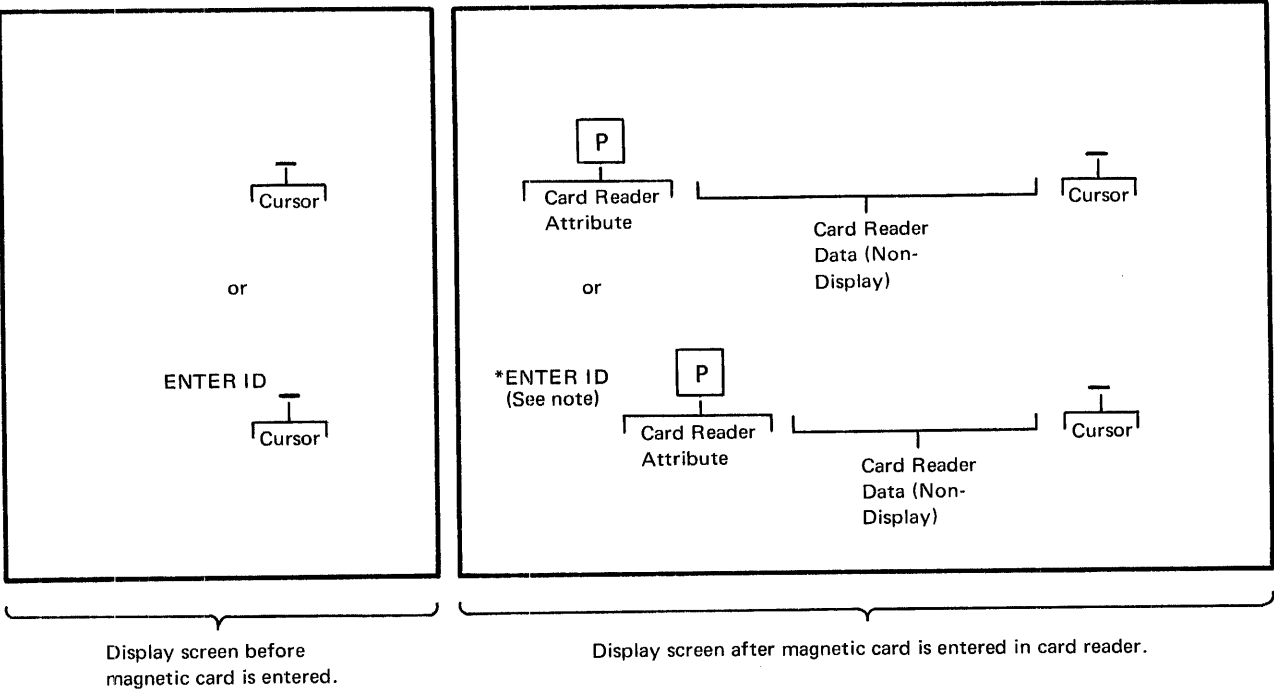
#### Notes:

1. This character is reserved for operator identification only and must be located in the first data position.
2. EOR (End of Record) is a termination character for identification cards.
3. EOI (End of Inquiry) may also be used as a termination character.
4. Programmers use only the four least-significant bits of the hex codes.

**Differences in Card Reader Operation because of Screen Format Used**

There are differences in the content of the data stream sent to the application program, depending upon whether the

display screen is formatted or unformatted.  
When using an unformatted screen (that is, a screen without attribute characters or fields), the operation of the 3275 and 3277 results in identical data streams, as follows:



Note: The enter ID is not displayed because it is within a nondisplay field, defined by the card reader attribute character.

AID	}	Set to indicate card reader input.
Cursor Address		
SBA	}	Address of the first data character following the attribute byte. The card reader data followed by any additional information present in the buffer. The additional information could have been initiated by the application program as ENTER ID as shown in the example or entered by the operator before the card reader operation was started.
Start of Data Address		
Data		

Note that for both the 3275 and 3277, with an unformatted screen, the card reader data is the first text in the data stream presented to the application program.



The card reader operation formats the screen because of the automatic entry at the cursor position of the attribute character (by the card reader).

A formatted screen has at least one attribute character defined at initial presentation. This may be the only attribute character, as in the instruction sequence ENTER ID, one of many attributes may be required, for example, in the instruction sequence NAME, RANK, ID CARD READER.

Operation of the 3275 and 3277 with the card reader is identical when formatted screens are used.

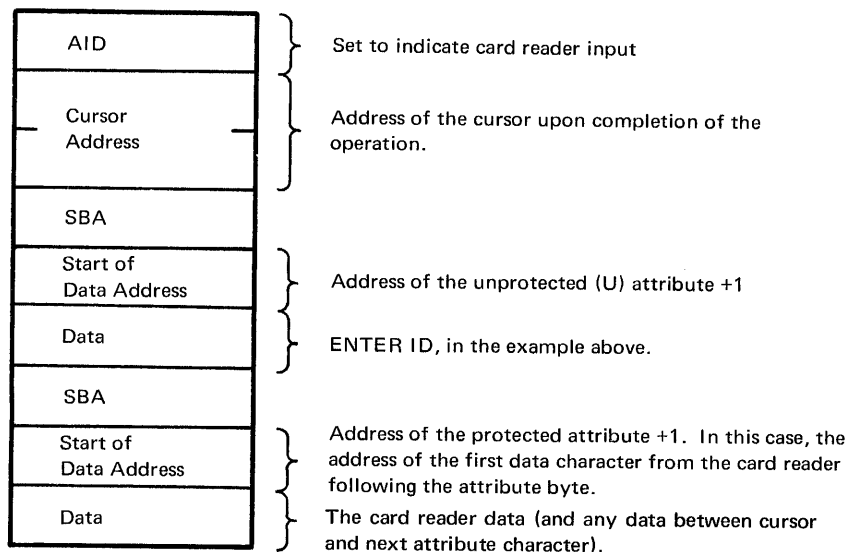
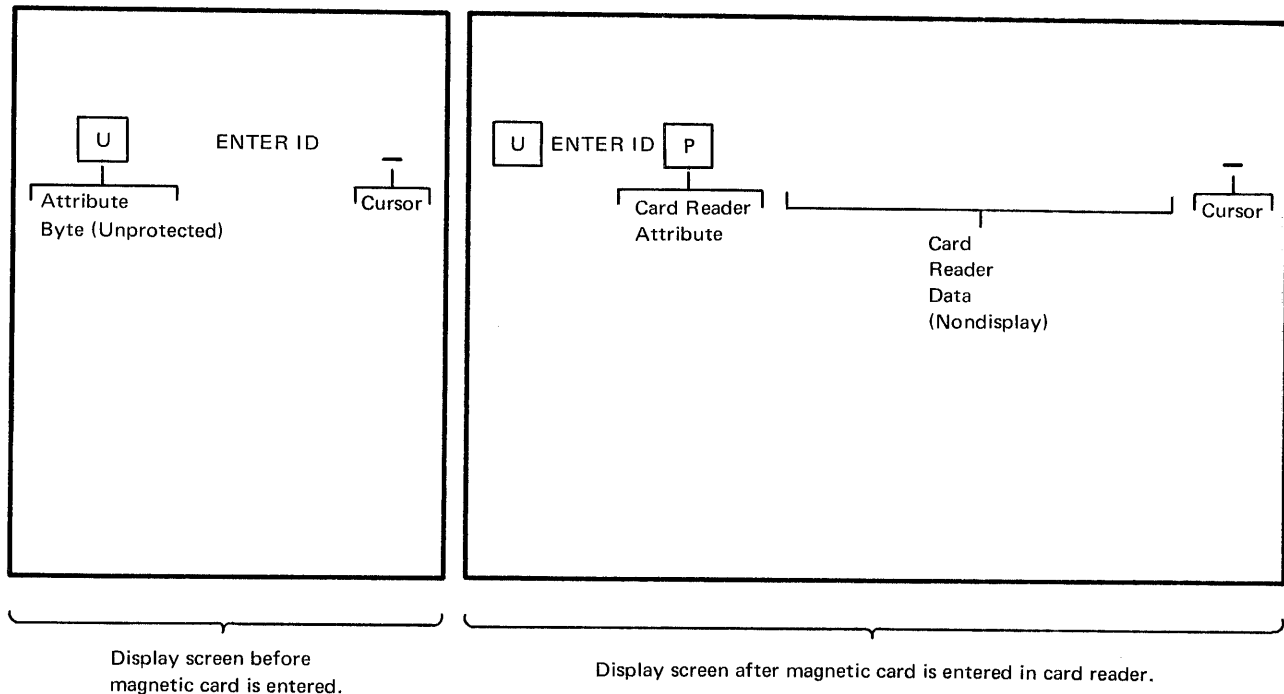
The 3275 and 3277 send two fields (new data field and previous data field), with the MDT bits set, to the

application program, because the 3275 and 3277 treat all information from the card reader as data until after the information is written into the buffer. Also, the MDT bit is set in the card reader attribute byte that was initiated when the data was entered.

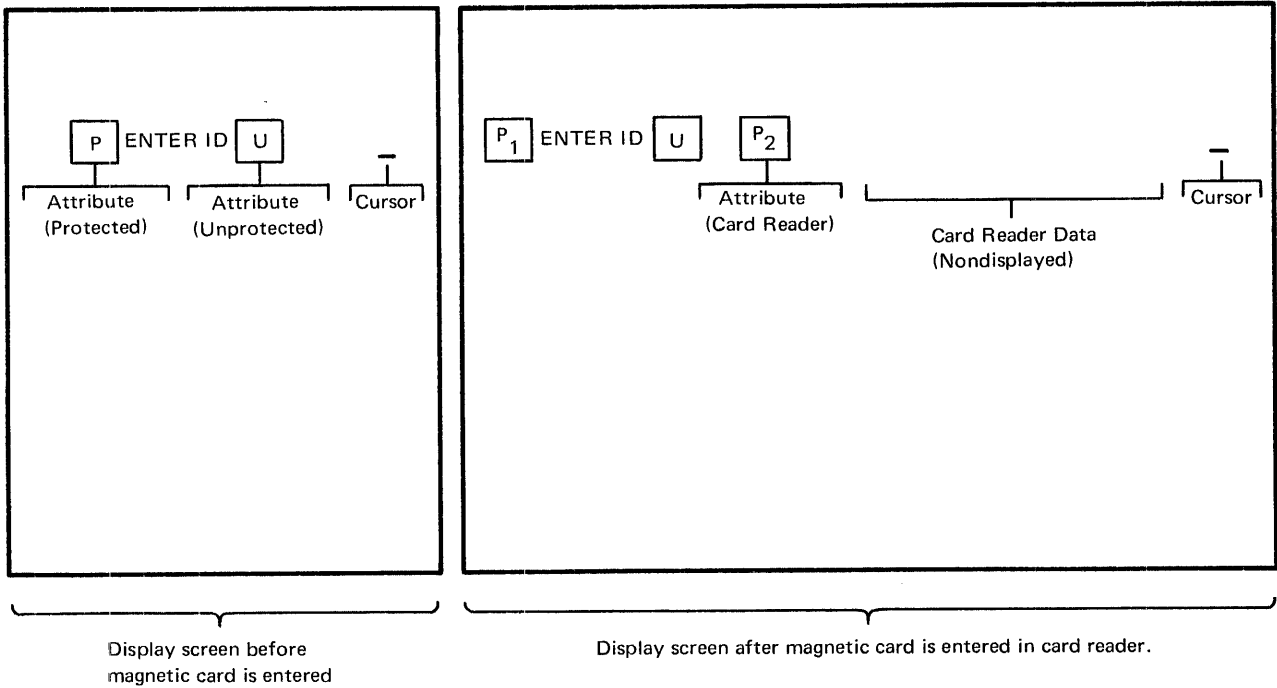
The following examples are included to help clarify operation of the card reader with a formatted screen.

#### Example 1:

If the card reader field is set up as an unprotected field containing instruction information, the 3275 and 3277 data stream is as follows:



Example 2:  
 If the card reader field is set up as an unprotected field,  
 with the cursor directly following an unprotected attribute,  
 the 3275 and 3277 data stream is as follows:



Note: Rules for positioning modified data on formatted screens apply.  
 The position of card reader data in the data stream depends on  
 the field position in the format.

AID	}	Set to indicate card reader input.
Cursor Address		
SBA	}	Address of cursor upon completion of operation.
Start of Data Address		
SBA	}	Address of the unprotected (U) attribute character +1. In the example above it will be, the address of the P <sub>2</sub> attribute character.
Start of Data Address		
Data	}	The card reader data (and any data between cursor and next attribute character).

## Error Conditions

Card data will not be read into the buffer if any one of the following error conditions exists when the card is read by the card reader:

- The SOR character at the beginning of the card is not successfully transferred to the display buffer.
- The cursor is located in a protected field.
- The cursor is located in an attribute character location.
- The display is busy performing another operation.

## PROGRAMMING NOTES:

The proper use of the card reader as an identification and data-entry device requires that the application program perform certain validity tests. The following guidelines are recommended for proper operation:

1. No field should be accepted as card reader input unless the card reader AID code is set.
2. For preformatted displays, the application program must know the location of the field defined to receive the card reader data and the exact location of the entered data, based upon the hardware operation that was previously defined. The use of the cursor address present in the data stream, in combination with the AID byte to ensure card reader input, is an additional technique that can be used to ensure the integrity of the data.  
For unformatted displays, the card reader data is always presented as the first data entry in the input record to the application.
3. For preformatted displays, it is advisable to terminate the card data field with another attribute byte. No more than 40 character positions are required in the card data field.
4. Upon completion of the read operation, the application program should check for the presence of the EOI or EOR character as the next to the last byte of card input. Absence of this character means the card reader data has not been successfully transferred.

This condition can occur under the following error conditions:

- a. Detection of a parity error on any data character or EOR or EOI character.
  - b. Interruption of normal data flow from the card reader.
  - c. The cursor has been moved to an attribute character location. This means the field defined for card reader input is too small or the cursor was not initially positioned at the beginning of a correct length field.
5. Upon completion of the read operation and a successful check for the EOI or EOR character, the LRC character may be used for a parity check to ensure integrity of the data.  
Because of the makeup of the magnetic card reader byte (4 bits plus parity bit), only the right-hand four bits are of concern. The application should set up a 1-byte field initialized to X'OB'. This is the SOR character which is not in the data stream but which was used in computing the LRC. As each character is checked for legality, it is exclusively ORed into this field. This operation should include the EOR/EOI character and the LRC, resulting in the byte containing zero. If the byte is nonzero, it means the resultant of the check on the data characters (including EOR/EOI) does not equal the LRC, and a parity error has occurred.
  6. If the card input field is to be reused, the application program must remove the hardware-generated attribute byte and card reader input data. The location of this byte should be known to the application, since it occurs at the cursor position before card reader input and can, additionally, be derived from the input data stream by using one less than the start of the data address preceding the card input data.  
The card field may be reused if more than one card input is required or the original attempt was unsuccessful and the application program desires to retry the operation.
  7. Text for all fields having the MDT bit set is transferred to main storage when the card reader data is retrieved in response to the card reader generated I/O pending.
  8. Cursor must be moved out of the card-reader-generated field before further keyboard activity will be allowed.
  9. An FE test card is available for system validation. The FE test card data (in 4-bit code) is as follows:  
BB1234567890123456789012345678955ABDEF7

## Commands and Orders

Program control of 3270 operations is accomplished with a flexible set of commands and orders. Commands are issued by the channel program to initiate such operations as the total or partial writing, reading, and erasing of data in a selected 3270 device buffer. Orders can be included in write data streams, either alone or intermixed with display or print data.

Two types of orders are available. One type is executed as it is received by the 3271, 3272, or 3275. This type is used to position, define, and format data being written into the buffer; to erase selected unprotected data in the buffer; and to reposition the cursor. The second type of orders specifies printer format. These orders are initially stored in the buffer as data, and are executed only during a print operation.

### COMMANDS

Four basic types of commands are executed by the 3270 system:

1. Write commands, which are used to transfer data and orders from main storage to the 3270 system.
2. Read commands, which transfer 3270 buffer data, keyboard key data, and, for remote configurations, status information to main storage.
3. Control commands, which cause certain printer or display station operations.
4. Sense command (local configurations only), which transfers to main storage a byte of sense data that reflects certain control or check conditions existing in the device or control unit to which the command was addressed.

Table 5 lists the commands, and associated codes, that can be executed by the 3270 system.

Table 5. Local and Remote Command Codes

Command	Local	Remote		
	EBCDIC Hex	EBCDIC Hex	ASCII Hex	Graphic
Write	01	F1	31	1
Erase/Write	05	F5	35	5
Read Buffer	02	F2	32	2
Read Modified	06	F6	36	6
Copy	N/A	F7	37	7
Select	0B	N/A	N/A	N/A
Erase All				
Unprotected	0F	6F	3F	?
No Operation	03	N/A	N/A	N/A
Sense	04	N/A	N/A	N/A

### Timing Considerations

The rate at which data is transferred between main storage of the data processing system and a device attached to the 3270 display system depends on: the information-transfer capability of the channel, whether data or command codes are transferred, and whether a local or remote 3270 system is attached.

In a local configuration, the 3272 control unit provides information to and accepts it from the channel at a byte rate established by the channel or by the CU, whichever is the slower rate. The maximum data-transfer rate for a Write command operation is 650,000 bytes per second. For a read operation, the maximum data-transfer rate is 400,000 bytes per second.

When a remotely attached 3270 display system is in operation, the rate at which data is transferred between the data processing system's main storage and the 3271 control unit depends on the type of transmission control unit and on the modems and communication facilities used. The 3270 system accepts data from and provides it to the transmission control unit/communication facility at the byte rate established by the transmission control unit/communication facility.

All command operations that direct movement of data to and from the 3270 system result in transfer of data between the control unit and a device buffer. When commands are not being performed, the control unit and device buffer cycle asynchronously, and the last image displayed by a previous command is continuously regenerated at a visible rate.

The control unit contains the timing controls required to move data between the CU and device buffers. To accomplish a data transfer to a control unit buffer from a device buffer, as, for example, during a Read command, the device buffer must first shift to the buffer position where data will initially be sent. Because buffers are loaded one position at a time, a 480-character device buffer can be filled faster than a 1920-character buffer. When performing a read or write type command, the average time required to transfer data from a 1920-character device buffer to the control unit is approximately 50 ms. When performing a Write command with a 1920-character position buffer, approximately 80 ms (average time) is needed for buffer transfers, since the device buffer contents must first be brought from the device to the control unit, where these contents are updated and then returned to the device.

An average time of approximately 30 ms is required to transfer data from a 480-character device buffer to a 480-character control unit buffer while performing a read

type operation, and approximately 40 ms is needed for 480-character buffer transfers while executing a Write command. To obtain the total command execution time, the time needed to transfer information between the channel and the CU must be determined and added to the buffer transfer times given here.

During the short time periods when information is transferred between buffers, the display buffer regeneration cycle is suspended, causing the display image to blink momentarily.

### Read Commands

Two read-type commands are executed by the 3270: Read Buffer and Read Modified. Read Buffer, which is provided primarily for diagnostic purposes, causes the entire contents of the selected 3275, 3277, 3284 (Model 1 or 2), 3286 (Model 1 or 2), or 3288 (Model 2) buffer to be read into main storage. The operation initiated by Read Modified is determined by 3275 or 3277 operator actions. The information read during execution of Read Modified could consist of fields of data modified by keyboard, data entered by the card reader, buffer addresses or data of selector pen fields, or the code of a Program Function or Program Access key.

In remote configurations, reading is normally accomplished by a General or Specific Poll sequence (described later under "Remote Operations"). In local configurations, an operator action that requires program interaction causes an attention interrupt; the program would respond to this attention interrupt with a read command. In remote, the 3271 or 3275 cannot generate attention interrupts. Instead, the program should issue poll sequences periodically. Upon receipt of a poll sequence, the 3271 or 3275 hardware initiates one of three operations:

1. If status and sense information is pending, this information is sent to the TCU.
2. If an operator action has occurred that requires reading by the program, and status and sense information is not pending, a hardware-generated Read Modified command operation is performed by the 3271 or 3275.
3. If no operator action has occurred and status and sense information is not pending, the 3271 or 3275 sends End of Transmission (EOT) to the TCU, terminating the operation.

**PROGRAMMING NOTE:** Unsolicited read commands are not recommended because the information read by these commands may be incomplete.

During a Read Buffer or Read Modified operation, a SUB character (3F in EBCDIC, 1A in ASCII) is sent in place of any byte that has bad parity. Also, a Data Check sense condition is recorded. Normal transmission of the read data then continues until the usual ending point. At that time, the operation ends as follows: (1) in local, Unit

Check is sent in the ending status byte; (2) in remote, the transmission is terminated with ENQ in place of ETX or ETB.

### Read Buffer Command

Execution of the Read Buffer command causes all data in the addressed device buffer, from the buffer location at which reading starts through the last buffer location, to be transferred to main storage. This command is provided primarily for diagnostic purposes. The transfer of data begins:

1. From buffer address 0 if the Read Buffer command is unchained, or if it is chained from either a Sense, Select, No Operation, or Copy command.
2. From the current buffer address if the Read Buffer command is chained from either a Write, Erase/Write, Read Modified, or another Read Buffer command. Regardless of where the transfer of data begins, data transfer from the buffer will terminate when the last character location in the buffer has been transferred, or before the last character location has been transferred as follows: (1) in local configurations, when the channel byte count reaches 0 or (2) in remote configurations, when the last character of a text block has been transferred (described in the "Remote Operations" section).

The transferred data stream begins with a three-character read heading consisting of the AID character followed by a two-character cursor address. The contents of all buffer locations are transferred, including nulls. Start Field (SF) order codes are inserted by the 3270 before each attribute character to identify the beginning of each field. An example of the read data stream follows:

AID	Cursor Addr	SF (1D)	Attribute Character	Text
-----	-------------	---------	---------------------	------

SF (1D)	Attribute Character	Text	SF (1D)	Attribute Character	etc.
---------	---------------------	------	---------	---------------------	------

The possible cursor address byte configurations are shown in Appendix C. The possible AID (Attention Identification) byte configurations are shown in Table 6. An AID configuration other than 60 or E8 is set when the operator at the selected display station has performed an operation that requires program intervention; these operations are (1) pressing a Program Function or Program Access key, (2) entering a card into the card reader, or (3) with the selector pen, detecting on an attention field. The attribute character is shown in Table 3.

Table 6. Attention ID (AID) Configurations

AID	Hex Character (EBCDIC)	Hex Character (ASCII)	Graphic Character	Read Modified Command Operation	Resultant Transfer to CPU
No AID generated (Display or Display Station)	60	2D	—	Rd Mod	If performing a remote polling operation, no read operation occurs; otherwise, field addresses and text in the modified fields are transferred.
No AID generated (Printer)	E8	59	Y	Rd Mod	
ENTER key	7D	27	'	Rd Mod	AID code and cursor address, followed by an SBA order, attribute address +1, and text for each modified field. Nulls are suppressed.
PF 1 key	F1	31	1	Rd Mod	
PF 2 key	F2	32	2	Rd Mod	
PF 3 key	F3	33	3	Rd Mod	
PF 4 key	F4	34	4	Rd Mod	
PF 5 key	F5	35	5	Rd Mod	
PF 6 key	F6	36	6	Rd Mod	
PF 7 key	F7	37	7	Rd Mod	
PF 8 key	F8	38	8	Rd Mod	
PF 9 key	F9	39	9	Rd Mod	
PF 10 key	7A	3A	:	Rd Mod	
PF 11 key	7B	23	#	Rd Mod	
PF 12 key	7C	40	@	Rd Mod	
Operator Identification Card Reader	E6	57	W	Rd Mod	
Selector Pen Attention	7E	3D	=	Rd Mod	AID code, cursor address, and field addresses only; no data.
PA 1 key	6C	25	%	Short Rd	AID code only.
PA 2 (CNCL) key	6E	3E	>	Short Rd	
PA 3 key	6B	2C	,	Short Rd	
CLEAR key	6D	5F	—	Short Rd	
TEST REQ key	F0	30	0	Tst Req Rd	A test request message. AID transferred on Read Buffer only.

**Note:** Graphic characters for the United States I/O interface codes are shown. If a World Trade I/O interface code is used, refer to the applicable table in Appendix D for possible graphic character differences.

#### Read Modified Command

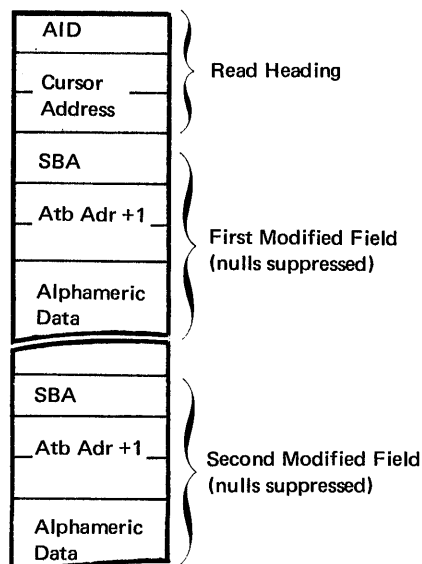
Read Modified initiates one of three operations, as determined by operator actions at the display station: (1) Read Modified, (2) Short Read, or (3) Test Request Read. Table 6 lists the operator actions and the resulting Read Modified command operation initiated by each action. Read Modified commands are not normally used for remote configurations since polling initiates a hardware-generated Read Modified operation if AID is generated and if status is not pending.

A major feature of Read Modified command operations is null suppression. When operations start at a device, the device buffer is cleared to all nulls (1) when the operator turns power on or presses the CLEAR key, or (2) when the erase portion of an Erase/Write command is executed with that device selected. Also, selected portions of a buffer can be cleared to nulls by the Erase All Unprotected command and certain orders. During Read Modified command operations, all modified characters are sent to main storage; null codes are not sent.

**Read Modified Operation.** During a Read Modified command, if an AID other than Selector Pen Attention, a PA key, or CLEAR key is generated, all fields that have been modified by keyboard, selector pen, or operator identification card reader activity are transferred to the program. All nulls are suppressed during data transfer and thus are not included in the read data stream. As a field is modified by the operator, the modified data tag (MDT) bit is set in the attribute byte for that field. Then, when a read modified operation is performed, successive attribute bytes are examined for a set MDT bit. When the bit is found, the data in the associated field is read (with nulls suppressed) before the next attribute byte is examined.

The first three bytes of the read data stream are always the AID code (Table 6) and the two-byte cursor address; these bytes are called the “read heading”.

Following the read heading is the alphameric data of each modified field. The data for each field is preceded in the data stream by a hardware-generated Set Buffer Address (SBA) order code followed by the two-byte buffer address of the first character position in that field (the attribute address +1). Thus, the read data stream when data has been modified is as follows:



If selector-pen-attention AID is generated, fields are not transferred to main storage during the Read Modified operation. Instead, when a set MDT bit is found (indicating selector pen and/or keyboard activity), only the SBA order code and the attribute address +1 are transferred.

Note that if fields are modified by the keyboard but completion of the modification is signaled by a selector-pen-attention operation, a resulting Read Modified operation will read only the address of the modified fields, not the modified data.

The buffer location at which the search begins for attribute bytes that define modified fields is a function of command chaining. This location is:

1. Buffer address 0, if the Read Modified command is unchained or is chained from a Copy, Select, Sense, or No Operation command.
2. The current address if the Read Modified command is chained from a Write, Erase/Write, Read Modified, or Read Buffer command.

The search for modified-field attribute bytes ends when the last buffer location is checked or, during 3272 operations, when the channel byte count reaches zero.

The transfer of read data is terminated as follows:

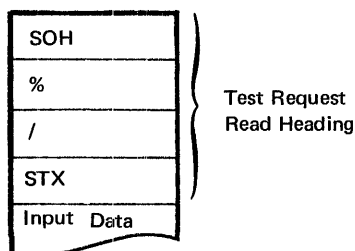
1. If the last modified field is wrapped from the last buffer location (479 or 1919) to the first location, the operation is terminated after all data in the field is transferred (nulls are suppressed). The buffer address at the end of the operation is the address of the next attribute byte in the buffer. For example, if a modified field extends from address 1900 (the attribute byte) to address 79 (wrapped field), the data from address 1901 through 79 is transferred (nulls are suppressed); in this case the read operation is terminated with the buffer address set to 80 (the attribute byte of the next field).
2. If the buffer does not contain a wrapped modified field and if the channel byte count has not reached zero (local operation only), the modified data stream is terminated when the last modified field is transferred; at the end of the operation, the buffer address is set to 0.
3. During 3272 operations, if the channel byte count reaches zero before all modified data is transferred, read operations are terminated and the remaining modified data is not transferred. The buffer address after termination is undefined.

If the buffer is formatted (contains fields) but none of the fields has been modified, the read data stream consists of the three-byte read heading only.

If the buffer is unformatted (contains no fields), the read data stream consists of the three-byte read heading followed by all alphameric data in the buffer (nulls are suppressed), even when part or all of the data has not been modified. Since an unformatted buffer contains no attribute bytes, no SBA codes or address characters are included in the data stream and the modification of data cannot be determined. Data transfer starts at address 0, regardless of command chaining, and continues to the end of the buffer. At the end of the operation, the buffer address is set to 0. This read operation can also be terminated by the channel byte count reaching zero before all data is read; in this case, the buffer address after termination is undefined.

**Short Read.** The Read Modified command causes a short read operation if the CLEAR, CNCL, or a PA key has been pressed at the selected device. During the Short Read operation, only an AID byte is transferred to main storage. This AID byte identifies the key that was pressed.

**Test Request Read.** The Read Modified command causes a Test Request Read operation if the TEST REQ key has been pressed at the selected device. The Test Request Read data stream sent to main storage is as follows:



The Test Request Read heading is generated by hardware. The remainder of the data stream is the same as described previously for Read Modified operations excluding the three-byte read heading (AID and cursor address). If the buffer is unformatted, all alphameric data in the buffer is included in the data stream (nulls are suppressed), starting at address 0. If the buffer is formatted, each attribute byte is examined for a set MDT bit. Each time a set MDT bit is found, the alphameric data in the field associated with that bit is sent to main storage (nulls are suppressed); if no MDT bits are set, the read data stream consists of the Test Request Read heading only. The buffer location at which the search for MDT bits begins and the transfer of data ends is the same as described for Read Modified operations.

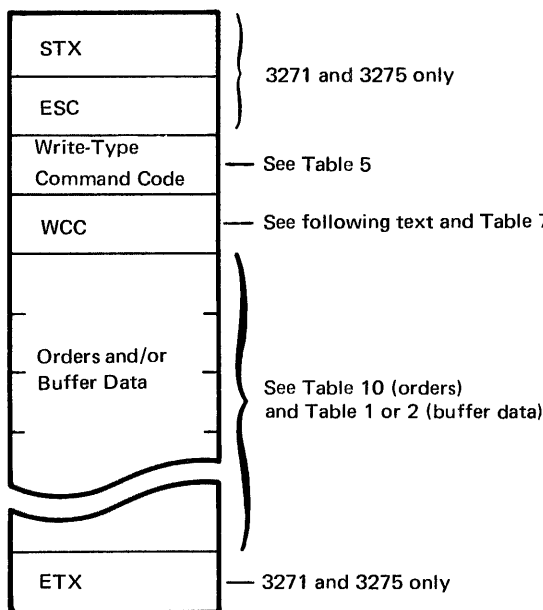
Test Request Read function usage is determined by the access method. Normally, the operator would (1) clear the display, (2) enter test request data in a predefined format, and then (3) press the TEST REQ key.

### Write Commands

Two write-type commands, Write and Erase/Write, are used by the channel program to load, format, and selectively erase device buffer data. These commands can also initiate certain device operations such as starting the printer, resetting the keyboard, and sounding the audible alarm. Write and Erase/Write operations are identical except that Erase/Write causes complete erasure of the selected buffer before the write operation is started. Thus, Erase/Write is used to load the buffer with completely new data, whereas Write can be used to modify existing buffer data. Because of this, the 3271 and 3272 initiate a device-to-control unit buffer transfer before Write command operations, but not before Erase/Write command operations.

### Write Command

The bytes received by the 3271, 3272, or 3275 for Write command operation consist of a command code, a write control character (WCC), and any orders and/or new buffer data needed to modify the existing buffer contents. The 3271 or 3275 also receives appropriate framing (data-link control) characters. The sequence of bytes is as follows:



The minimum Write command data stream to the 3272 consists of one byte, a write control character (WCC). (This is assured since the byte count field of the write CCW must be set to a minimum of 1 or else the command code is not sent to the 3272.) The minimum Write command data stream to the 3271 or 3275 consists of framing characters (STX, ESC, and ETX) and the command code. To be meaningful, a WCC byte should follow the command code; if ETX follows the command code, an all-zero WCC byte is generated by hardware, and command execution is ended normally. An order or display/print data byte that immediately follows the command code is interpreted as a WCC by hardware.

The WCC byte format is as follows:

•	.1	Printout Format	Start Print	Sound Alarm	Kbd Restore	Reset MDT Bits	
0	1	2	3	4	5	6	7

\*Determined by the configuration of bits 2–7. See Table 3.



Table 7 describes the function of each WCC bit. When the WCC specifies an operation that does not apply to the selected device (for example, if the Sound Alarm bit is set and the selected device does not have the audible alarm feature), the specified operation is not performed and status or sense information is not generated. When the WCC byte is followed by order or display/print data bytes, only the Reset MDT Bits function, if specified, is performed before the write operation; any other WCC function is deferred until all data is written and all orders are performed.

Table 7. Write Control Character (WCC)

Bit	Explanation
0	Determined by the contents of bits 2–7 as shown in Table 3.
1	Always a 1.
2, 3	Define the printout format, as follows: = 00 - The NL order in the data stream determines print line length. = 01 - Specifies 40-character print line. = 10 - Specifies 64-character print line. = 11 - Specifies 80-character print line.
4	Start Printer bit. When set to 1, initiates a printout operation at completion of the write operation.
5	The Sound Alarm bit. When set to 1, sounds the audible alarm at the selected device at the end of the operation if that device has an audible alarm.
6	The Keyboard Restore bit. When set to 1, restores operation of the keyboard by resetting the INPUT INHIBITED indicator. It also resets the AID byte at the termination of the I/O command.
7	Reset MDT bits. When set to 1, all MDT bits in the selected devices' existing buffer data are reset before any data is written or orders are executed.

Orders and buffer data can follow the WCC character. (Orders are described later in this section, following the "commands" description.) Buffer data can be written into any specified location of the buffer without erasing or modifying data in the other buffer locations. Data characters are stored in successive buffer locations until an order is encountered in the data stream which alters the buffer address, or until all the data has been entered. During the write operation, the buffer address is advanced one location as each character is stored.

The buffer location where data entry starts depends upon the following considerations:

1. The starting location may be specified by a Set Buffer Address order that follows the WCC. (This order is described later in this section under "Orders".)
2. The starting location will be the buffer address containing the cursor if the Write command is not chained or if it is chained from a control or Sense command.
3. The starting location will be the current buffer address if the Write command is chained from a Read or another Write command.

The formatting and placement of write data and the modification of existing buffer data are described under "Orders".

#### PROGRAMMING NOTES:

1. If commands are being chained, the Write or Erase/Write command with the Start Print WCC bit set must be the last command in the chain. If not:
  - a. The 3272 aborts the Write or Erase/Write command that specifies Start Print.
  - b. The 3271 or 3275 performs the print operation and aborts the next command.
2. The Printout Format bits are honored only if the Start Print bit is set in the same WCC.
3. In 3271 operations, if a Write command that includes data is chained from a previous Write command, a Set Buffer Address (SBA) order should immediately follow the WCC to define the starting location at which data entry is to start; this permits recovery in case of an error condition that requires retransmission of that data.
4. Every text message to a 3275 must have an SBA order immediately following the WCC to enable recovery from a line error.

**PROGRAMMING RESTRICTION:** A Write command should not be chained from an Erase All Unprotected command. If it is, the operation is undefined.

#### Erase/Write Command

Execution of the Erase/Write command performs two operations: an erase operation and a write operation. For its erase operation, this command clears the entire device buffer to nulls (all zero characters), positions the cursor to character location 0, and resets the buffer address to 0.

Erase/Write then performs the write and WCC operations in the same manner as a Write command. If no WCC is sent, the Erase/Write command will not erase the buffer.

#### Control Commands

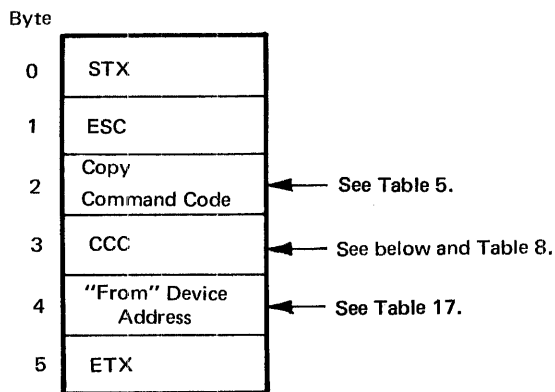
Control commands initiate certain control unit and/or device operations not involved with the transfer of data (other than status). Four control-type commands are executed by the 3270: Copy, Select, Erase All Unprotected, and No Operation. Copy is valid for the 3271

only. Select and No Operation are valid for the 3272 only, and Erase All Unprotected is valid for the 3271, 3272, and 3275.

#### Copy Command

This command is executed by a 3271 only, and is invalid for the 3272 and 3275. Copy is used to transfer buffer data from one device to another device attached to the same 3271. The selected device is the “to” device, the one to which buffer data will be transferred. The “from” device, the source of the buffer data to be copied, is identified in the second of two bytes that follow the Copy command code; the first byte, called the Copy Control Character (CCC), identifies the type of data to be copied. The CCC can also, at the “to” device, start print operations, specify the printout format for those operations, and sound the audible alarm.

The Copy data stream is as follows:



The CCC-byte format is as follows:

*	1	Printout Format		Start Print	Sound Alarm	Type of Data to be Copied	
0	1	2	3	4	5	6	7

\*Determined by the configuration of bits 2–7. See Table 3.

Table 8 describes the function of each CCC bit. A CCC and address byte must always follow the command code; if they do not, the 3271 aborts the command and generates error status.

Copy command operations are similar to Write command operations. After the 3271 accepts the Copy data stream, it initiates the transfer of all 480 or 1920 bytes from the “from” device buffer to the 3271 buffer. Upon completion of this transfer, the 3271 inserts nulls in all character locations that do *not* contain the type of data

specified by CCC bits 6 and 7. The updated control unit buffer contents (480 or 1920 bytes) are then transferred to the selected (“to”) device. At the completion of Copy command operations, the cursor is in the same character location at the “to” device as it was at the “from” device at the start of operations.

The “from” device buffer can be “locked” (made incapable of being copied) by writing a protected/alphanumeric attribute byte (bit 2=1 and 3=0) in address 0.

**PROGRAMMING NOTE:** Although not essential for locking, it is recommended that a null be written in address 1 of the buffer to facilitate possible future use of the address 1 position.

The Copy command can specify as the “from” device the same device that is selected (the “to” device). This procedure provides a means of programming selective device buffer “erase” operations as specified by CCC bits 6 and 7. In this case, the device buffer contents are transferred to the control unit, nulls are inserted as

Table 8. Copy Control Character (CCC)

Bit	Explanation
0	Determined by the contents of bits 2–7 as shown in Table 3.
1	Always a 1.
2, 3	Define the printout format as follows: = 00 - The NL order in the data stream determines print line length. = 01 - Specifies a 40-character print line. = 10 - Specifies a 64-character print line. = 11 - Specifies an 80-character print line.
4	The Start Printer bit. When set to 1, initiates a printout operation at the “to” device after buffer transfers are completed.
5	The Sound Alarm bit. When set to 1, sounds the audible alarm at the “to” device after buffer transfers are completed if that device has an audible alarm.
6, 7	Define the type of data to be copied as follows: = 00 - Only attribute characters are copied. = 01 - Attribute characters and unprotected alphanumeric fields (including nulls) are copied. Nulls are transferred for the alphanumeric characters not copied from the protected fields. = 10 - All attribute characters and protected alphanumeric fields (including nulls) are copied. Nulls are transferred for the alphanumeric characters not copied from the unprotected fields. = 11 - The entire contents of the storage buffer (including nulls) are copied.

determined by the CCC, and the resulting buffer contents are transferred back to the same device buffer.

#### PROGRAMMING NOTES:

1. Copy should not be chained *from* a Write or Erase/Write command, since it will destroy the data already written for the selected device.
2. If the CCC Start Print bit is set and commands are being chained, Copy should be the last command of the chain. If not, the 3271 aborts the subsequent command.

#### Select Command

Select is an immediate command that is executed only by the 3272; it is invalid for the 3271 and 3275. The 3272 executes a Select command by performing a device-to-3272 buffer transfer. If not preceded by a Select command, this same buffer transfer operation is performed as part of an initial (unchained) Write, Read Modified, or Read Buffer command.

The advantages of Select command usage are realized when the 3272 is attached to a block multiplexer channel or to a byte multiplexer channel operating in forced burst mode for the complete data transfer. Upon receipt of Select, the 3272 sends Channel End as initial status to the channel. This frees a block multiplexer channel to perform other operations. Upon successful completion of the buffer transfer, the 3272 sends Device End status asynchronously to the channel. Upon receipt of this status by the channel, a chain operation to the desired command (Write, Read Modified, or Read Buffer) must be initiated for effective use of the Select command. Note that device-to-3272 buffer transfer time is not part of the execution time for this command.

At the conclusion of the command following the Select command, the 3272 again issues Device End status. At this point, the channel may chain to another command of the same type or it may disconnect. If a chaining operation is performed, another Select command is unnecessary since the addressed device buffer contents are already in the 3272 buffer.

Thus, the Select command is used to separate the device-to-3272 buffer transfer operation portion of a Write, Read Modified, or Read Buffer command from the actual execution of the command. By doing so, the channel can use the buffer transfer time for other operations.

#### Erase All Unprotected Command

This command performs five functions at the addressed device:

1. Clears all unprotected buffer character locations to nulls.
2. Resets to 0 the MDT bit for each unprotected field.
3. Unlocks the keyboard.
4. Resets the AID byte.
5. Repositions the cursor to the first character location in the first unprotected field of the buffer.

If the entire buffer is protected, buffer data is not cleared and MDT bits are not reset. However, the keyboard is unlocked, AID is reset, and the cursor is repositioned to buffer address 0.

In local configurations, Erase All Unprotected is an immediate-type command. Upon acceptance of this command, the 3272 goes "busy" and sends Channel End initial status to the channel. Upon successful completion of this command, the 3272 sends Device End status asynchronously to the channel and then goes "not busy".

**PROGRAMMING RESTRICTION:** Erase All Unprotected should not be chained to a Write, Erase/Write, or Copy command. If it is, the resulting operation is not defined.

#### No Operation Command

This command is valid for the 3272 only. It performs no functional operation in the 3272, but may be used to retrieve pending status. No Operation is an immediate command, and therefore Channel End and Device End normally will be presented as initial status unless pending status or a busy condition exists.

#### Sense Command

Sense is valid for the 3272 only. It should be issued in response to Unit Check status for further definition of the Unit Check condition. The 3272 responds to Sense by sending one byte of sense data to the channel. Because any command to the 3272 other than No Operation, Sense, or Test I/O causes the sense data to be reset, Sense should be issued following receipt of Unit Check status to ensure that valid sense information is retrieved.

The sense byte configuration is as follows:

CR	IR	BOC	EC	DC	US	CC	OC
0	1	2	3	4	5	6	7

Table 9 summarizes the significance of each sense bit. The various sense and status bit combinations are described in Tables 14, 15, and 16.

#### ORDERS

Orders can be included in Write or Erase/Write command data streams, either alone or intermixed with display or print data. Two types of orders are available: printout format orders and buffer control orders. Printout format orders are initially stored in the buffer as data and are subsequently executed only during a print operation; these orders are described in the "Systems Concept" section under "Printer Operations".

Table 9. Sense Bit Description

Bit	Name	Significance
0	Command Reject (CR)	Set if the 3272 has received an invalid command; the valid commands are listed in Table 5.
1	Intervention Required (IR)	Set if a command, other than Sense, was addressed to a device that is unavailable or is in the "not ready" condition.
2	Bus Out Check (BOC)	Set if the 3272 has detected bad parity on any command or data byte received from the channel.
3	Equipment Check (EC)	Set if: (1) the 3272 has asynchronously detected a parity check on data received from a device in response to an internal poll for attention status (the internal poll is tried twice before EC is set), (2) a printer error occurs. If this is a device-detected condition, Unit Specify is also set.
4	Data Check (DC)	Set if: (1) the 3272 or a device has detected bad parity on data transferred internally or between the 3272 and a device during command operations, (2) a 3277 has detected a cursor check, or (3) a device has detected a buffer check. If this is a device-detected condition, Unit Specify is also set.
5	Unit Specify (US)	Set if the sense bits resulted from a device-detected error.
6	Control Check (CC)	Set when the 3272 has detected a timeout condition. (The addressed device fails to perform a specified operation or respond to the 3272 within a specified period of time.)
7	Operation Check (OC)	Set when the 3272 has received a valid command or order that it cannot execute, as follows: 1. SBA, RA, or EUA order specifies an illegal buffer address. 2. Write data stream ends before all required bytes of SBA, RA, EUA, or SF order sequence are received. 3. Write, or Erase/Write with Start Print bit set in WCC, is chained to the next command; the print operation is suppressed.

The following paragraphs describe buffer control orders, which are executed as they are received in the write data stream by the 3271, 3272, or 3275; these orders are not stored in the buffer. Six buffer control orders (see Table 10) are provided (1) to position, define, and format data being written into the buffer, (2) to erase selected unprotected data in the buffer, and (3) to reposition the cursor.

#### Start Field (SF) Order

This order identifies to the control unit that the next byte in the write data stream is an attribute character. (The attribute character is described in Table 4.) The control unit then stores the next byte (the attribute character) at the current buffer address. As the attribute character is stored, the control unit sets a control bit at that address; this bit identifies the byte as an attribute character during subsequent program or device operations with the buffer data.

*Note:* The byte immediately following the SF order in the data stream is always stored as an attribute character, even when the byte is actually an order or an alphanumeric data character.

During execution of a Read Buffer command, the control unit automatically inserts SF order codes in the read data stream immediately before each attribute character. This permits identification of the attribute characters by the program and also permits correct storage of attribute characters in the buffer if the read data is used for subsequent write operations.

#### Set Buffer Address (SBA) Order

This three-byte order specifies a new buffer address from which write operations are to start or continue. Set Buffer Address orders can be used to write data into various areas of the buffer. An SBA order can also precede another order in the data stream (1) to specify the starting address for a

Table 10. Buffer Control Orders and Order Codes

Order Sequence  Order	Byte 1 (Order Code)		Byte 2	Byte 3	Byte 4
	EBCDIC (Hex)	ASCII (Hex)			
Start Field (SF)	1D	1D	Attribute Character <sup>1</sup>		
Set Buffer Address (SBA)	11	11	1st Address Byte <sup>3</sup>	2nd Address Byte <sup>3</sup>	
Insert Cursor (IC)	13	13			
Program Tab (PT)	05	09			
Repeat to Address (RA)	3C	14	1st Address Byte <sup>3</sup>	2nd Address Byte <sup>3</sup>	Character to Be Repeated <sup>2</sup>
Erase Unprotected to Address (EUA)	12	12	1st Address Byte <sup>3</sup>	2nd Address Byte <sup>3</sup>	

**Notes:**

1. Table 4 shows attribute byte and Table 3 shows coding of this byte.
2. Tables 1 and 2 show coding of this byte.
3. Appendix C lists the two-byte code for each possible address. To be valid, this address must not exceed 479 (if issued to a Model 1) or 1919 (if issued to a Model 2).

PT, RA, or EUA order; (2) to specify the address at which an attribute byte is to be stored by an SF order; or (3) to specify the address at which the cursor is to be repositioned by an IC order.

**PROGRAMMING NOTE:** Every text message to a 3275 must have an SBA order immediately following the WCC to enable recovery from a line error.

If the SBA order specifies an invalid address (greater than 479 if Model 1 or 1919 if Model 2), the write operation is terminated at this point.

When a Read Modified command is executed and an attribute character (initially sent to the device by writing an SF order) is detected with the MDT bit set, the CU inserts, in place of the attribute, an SBA code followed by the two-byte buffer address of the first character in the modified field (attribute address +1). This permits identification by the CU of fields that are modified. When a Read Modified command is executed in a remote 3270 unit, this three-byte sequence is always sent in the same text block. Remote 3270 units do not split this sequence between two successive blocks.

**Insert Cursor (IC) Order**

This order repositions the cursor to the location specified by the current buffer address. Execution of this order does

not change the current buffer address. For example, if IC is issued when the current buffer address is 160 and the cursor is at location 80, the cursor is removed from location 80 and inserted at location 160. The current buffer address at the end of this operation would remain 160.

**Program Tab (PT) Order**

The PT order advances the current buffer address to the address of the first character position of the next unprotected field. If the PT is issued when the current buffer address is the location of an attribute byte of an unprotected field, the buffer address advances to the next location of that field (one location). In addition, if the PT order in the write data stream does not follow a control command, order, or order sequence such as WCC, IC, or RA (3-character sequence), nulls are inserted in the buffer from the current buffer address to the end of the field, regardless of the value of bit 2 (protected/unprotected) of the attribute character for the field. When the PT order follows a control command, order, or order sequence, the buffer is not modified.

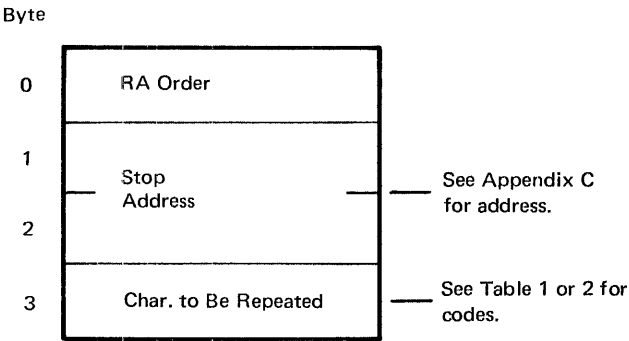
The PT order stops its search at the last location in the buffer. If an attribute character for an unprotected field is not found by this point, the buffer address is set to location 0. (If the PT order finds an attribute character for an unprotected field in the last buffer location, the buffer address is also set to zero.)

To continue the search for an unprotected field, a second PT order must be issued immediately following the first one. Since the current buffer address was reset to 0 by the first PT order, the second PT order begins its search at buffer location 0. If the previous PT order was still inserting nulls in each character location when it terminated at the last buffer location, the new PT order will continue to insert nulls from buffer location 0 to the end of the current field.

**PROGRAMMING RESTRICTION (FOR REMOTE OPERATIONS):** Successive PT orders, without intervening characters or other orders (not including the Insert Cursor order), should not be issued to a 3271 Model 2 Control Unit when the buffer (1) contains one unprotected field or (2) is unformatted. To do so may cause the Write command to be aborted and error status to be generated.

**Repeat to Address (RA) Order**

The RA order stores a specified alphameric or null character in all buffer locations, starting at the current buffer address and ending at (but not including) the specified stop address. This stop address and the character to be repeated are identified by the three bytes immediately following the RA order in the write data stream, as follows:



The third character following the RA order is always interpreted as the character that will be repeated. If an invalid stop address (greater than 479 if a Model 1, or 1919 if a Model 2) is specified, the write operation is terminated at this point without storing the character.

When the stop address is lower than the current buffer address, the RA operation wraps from the bottom row of the buffer to the top row. When the stop address equals the current address, the specified character is stored in all buffer locations.

Attribute characters can be overwritten by the RA order.

**PROGRAMMING RESTRICTION (FOR 3271 AND 3275 ONLY):** If the RA order specifies storing a character in more than 480 locations, the write operation may be aborted and error status generated.

**Erase Unprotected to Address (EUA) Order**

The EUA order inserts nulls in all unprotected buffer character locations, starting at the current buffer address and ending at, but not including, the specified stop address. This stop address is specified by two address bytes which immediately follow the EUA order in the write data stream. If an invalid address (greater than 479 if a Model 1, or 1919 if a Model 2) is specified, the write operation is terminated at this point and no erasure (insertion of nulls) occurs.

When the stop address is lower than the current buffer address, the EUA operation wraps from the bottom row of the buffer to the top row. When the stop address equals the current address, all unprotected character locations in the buffer are erased.

Attribute characters are not affected by the EUA order.

The 3272 can attach to a selector channel, a byte multiplexer channel, or a block multiplexer channel, each through the standard I/O interface (Figure 1). When attached to a byte multiplexer channel, operations can be in forced-burst mode or in single-byte-multiplex mode. The channel, in turn, is attached to main storage and to the central processing unit (CPU).

The channel program controls all 3272 operations by transmitting information across the I/O interface. This information consists of (1) an address byte, which selects one control unit (3272) and one device (display or printer) attached to the control unit; (2) command bytes, which specify the type of operation to be performed by the 3272 for that device; (3) data bytes, which are either stored in the 3272 buffer for ultimate use by the selected device as display or printout data or are decoded as orders and used by the 3272 for formatting the buffer; and (4) various control signals. Status bytes, which are automatically generated by the 3272, inform the channel program (1) of the general condition of the 3272 and selected device at various stages of command operations and (2) of unique conditions of the 3272 and any attached device when command operations are not in progress.

## INTERFACE OPERATIONS

Local interface operations are summarized in the following paragraphs and are described in detail in the *IBM System/370 Principles of Operations* manual, Form GA22-7000. The CPU program initiates 3272 operations with a Start I/O instruction. This instruction identifies the I/O control unit and device (in this case, the 3272 and a display or printer) and causes the channel to fetch a channel address word (CAW) from a fixed location in main storage. The CAW designates the storage protection key and the location in main storage from which the channel subsequently fetches the first channel control word (CCW). The CCW specifies the command to be executed and the number and address, in main storage, of any bytes to be transmitted.

### Selection

The channel attempts to select the 3272 and an attached device by sending a unique address byte to the 3272 (and to all other control units attached to the same channel or subchannel). When a 3272 has 16 or fewer devices attached,

the first four bits of the address byte specify the 3272 address, and the last four bits of the address byte specify the device address (Table 11). Up to 32 devices can attach to 3272's that have even-numbered addresses; these addresses are coded as shown in Table 12. Note that no more than 16 devices can be attached to a 3272 that has an odd-numbered address. Device address must always be assigned sequentially, starting with address 0. However, no priority is given to any particular device address.

When a 3272 recognizes both addresses, it logically connects to the channel and responds to the selection by returning the address byte to the channel.

Table 11. 3272 and Device Addressing - 16 or Fewer Devices Per 3272

3272 No.	8-bit Local Address Byte		Device No.	4 5 6 7 (XXXX)
	3272	Device		
	0 1 2 3	4 5 6 7		
0	0 0 0 0	XXXX	0	0 0 0 0
1	0 0 0 1	XXXX	1	0 0 0 1
2	0 0 1 0	XXXX	2	0 0 1 0
3	0 0 1 1	XXXX	3	0 0 1 1
4	0 1 0 0	XXXX	4	0 1 0 0
5	0 1 0 1	XXXX	5	0 1 0 1
6	0 1 1 0	XXXX	6	0 1 1 0
7	0 1 1 1	XXXX	7	0 1 1 1
8	1 0 0 0	XXXX	8	1 0 0 0
9	1 0 0 1	XXXX	9	1 0 0 1
10	1 0 1 0	XXXX	10	1 0 1 0
11	1 0 1 1	XXXX	11	1 0 1 1
12	1 1 0 0	XXXX	12	1 1 0 0
13	1 1 0 1	XXXX	13	1 1 0 1
14	1 1 1 0	XXXX	14	1 1 1 0
15	1 1 1 1	XXXX	15	1 1 1 1

### Command Initiation

Command operations by the 3272 start when the 3272 and a device are successfully selected. When a command is to be executed by the 3272 (not by the channel alone), the channel sends the command code (CCW bits 0–7) to the 3272.

When execution of the command involves a transfer of data (such as Write or Read Modified), the 3272 responds to the command with a status byte (called "initial" status)

Table 12. 3272 and Device Addressing - 17 or More Devices per 3272

3272 No.	8-bit Local Address Byte	
	3272	Device
	0 1 2	3 4 5 6 7
0	0 0 0	XXXXXX
2	0 0 1	XXXXXX
4	0 1 0	XXXXXX
6	0 1 1	XXXXXX
8	1 0 0	XXXXXX
10	1 0 1	XXXXXX
12	1 1 0	XXXXXX
14	1 1 1	XXXXXX

Device No.	3 4 5 6 7 (XXXXXX)
0	0 0 0 0 0
1	0 0 0 0 1
2	0 0 0 1 0
3	0 0 0 1 1
4	0 0 1 0 0
5	0 0 1 0 1
6	0 0 1 1 0
7	0 0 1 1 1
8	0 1 0 0 0
9	0 1 0 0 1
10	0 1 0 1 0
11	0 1 0 1 1
12	0 1 1 0 0
13	0 1 1 0 1
14	0 1 1 1 0
15	0 1 1 1 1

Device No.	3 4 5 6 7 (XXXXXX)
16	1 0 0 0 0
17	1 0 0 0 1
18	1 0 0 1 0
19	1 0 0 1 1
20	1 0 1 0 0
21	1 0 1 0 1
22	1 0 1 1 0
23	1 0 1 1 1
24	1 1 0 0 0
25	1 1 0 0 1
26	1 1 0 1 0
27	1 1 0 1 1
28	1 1 1 0 0
29	1 1 1 0 1
30	1 1 1 1 0
31	1 1 1 1 1

Note: 3272 CU Nos. 1, 3, 5, 7, 9, 11, 13, and 15 cannot be assigned when attached devices are assigned Device No. 16 or greater.

indicating whether it can execute the command. If the command can be executed, the channel is set up to respond automatically to service requests from the 3272, and the 3272 assumes further control of the operation. Command operation can be terminated by the control unit or when the channel byte count reaches 0. At this time, the 3272 sends the channel a second status byte (called "ending" status) which indicates whether the command operation was successfully performed.

When the function of the 3270 command does not involve the transfer of data (such as EAU), it is called an "immediate" command. The resulting 3272 operation depends on the particular command, as follows. If the command is No Operation, ending status and initial status are combined to indicate to the channel that the 3272 has completed execution of the command. If the command is Select or Erase All Unprotected, which initiate certain 3272 and device operations, the initial status from the 3272 is such that block and byte multiplexer channels are released to perform other operations (selector channels remain logically connected to the 3272). When command execution is completed by the 3272 and selected device (and regains selection if attached to a multiplexer channel), the 3272 sends ending status to the channel, indicating whether the command was successfully performed.

### Chaining

When the channel has completed the operations specified by a CCW, it can continue the activity initiated by the

previous Start I/O by fetching a new CCW, thereby restarting the cycle. The fetching of this new CCW is called "command chaining", and the CCWs belonging to such a sequence are said to be chained. All CCWs in a chain apply to the control unit (3272) and device specified by the original Start I/O instruction.

Either of two types of chaining can be specified by the current CCW (bits 32 and 33): data-byte chaining or command chaining. During data chaining (current CCW bits 32=1), the new CCW fetched by the channel defines a new main storage area (data address) for the current command. During command chaining (current CCW bits 33=1), the new CCW specifies a new command and a data address for that new command.

Thus, when command chaining is used, the 3272 is selected following the Start I/O instruction when the channel receives the first CCW in the chain that involves operations with the 3272. The 3272 is totally dedicated to one CCW string until final Channel End time or until operations are abnormally terminated. Programming restrictions that must be observed when command chaining is used are described under "Commands and Orders".

### Status

The 3272 generates a status byte to inform the channel of certain 3272 and device conditions. This status byte can be generated synchronously (while the 3272 is selected and performing a command operation with the channel) or asynchronously (while the 3272 is not selected).



Synchronous status is passed to the channel as both “initial” and “ending” status to a command. Initial status reflects the condition of the selected device and/or 3272 upon receipt of a command, and indicates to the channel whether the command can be executed. Ending status reflects the condition of the 3272 and selected device after all channel/3270 interface operations of a non-immediate command are completed. Asynchronous status reflects: (1)

ending status for an immediate command other than No Operation; (2) a second ending status for a Write or Erase Write command, indicating that the 3272-to-device buffer transfer is completed; or (3) an equipment condition or operator action not associated with command execution (an attention).

Table 13 describes each bit of the status byte. Status is reset by the 3272 once it has been accepted by the channel.

**Table 13. Status Byte Bit Assignments**

Bit	Name	Condition
0	Attention (A)	Indicates a request for service from a 3277 attached to 3272. Set as result of certain keyboard, selector pen, or card reader activity at 3277 (see Table 6). Program should respond by issuing a Read Modified command (chained from a Select command if multiplexer channel) to the 3277 requesting attention. Attention bit is also set with Unit Check bit as result of asynchronously detected equipment malfunction; in this case, program should respond by issuing a Sense command.
1	Status Modifier (SM)	Is set, with Busy bit, in initial status byte to indicate that there is pending status for a device other than the one selected.
2	Control Unit End (CUE)	Is set following a busy condition, after pending status is cleared or when control unit is no longer busy, to indicate that 3272 is now not busy and is free to accept a new command.
3	Busy (B)	Is set alone in initial status byte when addressed device is busy because it is performing a print operation or an Erase All Unprotected command. Set with SM when addressed 3272 is busy. When the channel addresses a device other than the one that is busy and control unit is not busy, addressed device becomes selected and the command is honored. Busy bit is also set with pending status if addressed device has such status; if pending status is for a device other than the one addressed, Status Modifier bit is also set.
4	Channel End (CE)	Indicates 3272/channel data transfer operations are completed. Is set alone (1) in initial status for Select or Erase All Unprotected command, or (2) as ending status for Write or Erase/Write command; in both cases, Device End status is sent asynchronously when device operations (command execution or 3272-to-device buffer transfer) are completed. Is set with Device End, to indicate that 3272 and device operations (except printing) are completed (1) in initial status for No Operation command, (2) in ending status for Read Buffer, Read Modified, or Sense command, or (3) asynchronously if only Channel End status was pending and the device operation is completed before the channel accepts status. Is set with Device End and Unit Exception in initial status for Read or Write command if addressed device is busy executing another command.
5	Device End (DE)	Indicates that 3272 and device have completed all command operations and are free to execute another command. Is set (1) in initial status for No Operation command, (2) in ending status for Read Buffer, Read Modified, or Sense command, and (3) in asynchronous status for Write, Erase/Write, Select, or Erase All Unprotected command.
6	Unit Check (UC)	Is set when an irregular program or equipment condition is detected by 3272 or the device. Program should always respond to Unit Check status by issuing a Sense command for further definition of condition.
7	Unit Exception (UE)	Is set in ending status (synchronous or asynchronous) when 3272 has attempted to execute a command but has found, after initial status was returned, that addressed device was busy.

### Initial Status

Initial status is generated by the 3272 in response to initial selection, by the channel, of the 3272 and an attached device. During the initial selection sequence, the status byte is sent to the channel after the 3272 receives a command.

Table 14 shows the possible initial status bit configurations. An all-zero status byte is sent when a non-immediate command is accepted for execution by the 3272; it is also sent in response to Test I/O if other status is not pending. The Unit Check bit is set if the command is not accepted by the 3272 because of a program or equipment error.

Initial status to immediate commands is as follows. For No Operation, Channel End and Device End are both set to indicate completion of the command. For Select and Erase All Unprotected, which do not involve data transfer between the channel and the 3272, Channel End is set. This frees a multiplexer channel for other operations while the command is being executed. When command execution is completed, ending status is presented asynchronously.

If a Start I/O Fast Release (SIOF) is executed by the channel, then unchained initial status becomes ending status. (See *System/370 Principles of Operation*, GA22-7000.)

When status is pending (a previous status byte is awaiting transfer to the channel), the waiting status byte, with the Busy bit set, is sent to the channel in response to any command (not to a Test I/O instruction), and that command is not accepted by the 3272. For Test I/O, the waiting status byte is presented without the Busy bit set. If the waiting status is for a device other than the one selected during the initial command sequence, the Status Modifier bit is also set.

### Ending Status

When the 3272 completes channel operations for a non-immediate command, it sends an ending status byte to the channel, freeing the channel for other operations. This status byte always relates to the command operation that has been executed. The normal ending status byte for a Read Buffer, Read Modified, or Sense command will have only the Channel End and Device End bits set, indicating that the command has been executed. Normal ending status for a Write or Erase/Write command is Channel End alone. When the 3272-to-device buffer transfer is completed, ending the command operation, Device End status is sent to the channel as asynchronous status. Any error condition

**Table 14. Initial Status and Sense Conditions - Local**

Status <sup>1</sup> (Hex)	Sense (Hex)	Display	Printer	Error Recovery Procedure	Condition
All Zeros (00)		X	X		Normal status for any command other than No Operation, Select, or Erase All Unprotected.
CE (08)		X	X		Normal status for a Select or Erase All Unprotected command.
CE, DE (0C)		X	X		Normal status for a No Operation command.
UC (02)	BOC (20)	X	X	1	A parity check was detected on the command byte.
UC (02)	IR (40)	X	X	2	A command other than Sense was addressed to a device that the 3272 has recorded as "unavailable" or "not ready".
UC (02)	CR (80)	X	X	3	An invalid command was issued to 3272.
B (10)		X	X		Response to a command addressed to a device which is being serviced by 3272 or which is completing a previously issued command.
B, SM (50)		X	X		Response to a command addressed to a device other than device whose status is pending or device being serviced by 3272.

**Note 1.** If a SIOF is executed by the channel, unchained initial status becomes ending status.

associated with the operation just executed will cause additional status bits to be set. Table 15 shows the possible ending status bit configurations. Ending status causes an I/O interruption unless chaining is specified.

When the 3272 has pending status, it attempts to gain selection of the channel asynchronously to pass this status. It is passed to the channel either when selection is

accomplished or as initial status for the next command (with the Busy bit set), whichever occurs first.

#### Asynchronous Status

Asynchronous status reflects (1) the ending status of an "immediate" command other than No Operation, (2) the second ending status for a Write or Erase/Write command,

**Table 15. Ending Status and Sense Conditions - Local**

Status (Hex)	Sense (Hex)	Display	Printer	Error Recovery Procedure	Condition
CE <sup>2</sup> (08)		X	X		Sent at end of data stream on a Write or Erase/Write command.
CE, DE <sup>1,2</sup> (0C)		X	X		Sent at end of data stream on a Read Buffer, Read Modified, or Sense command or when channel byte count goes to zero on a Read Modified or Read Buffer command.
CE, DE, UC <sup>1</sup> (0E)	BOC (20)	X	X	10	The 3272 detected a parity error on a character in data stream of a Write or Erase/Write command.
CE, DE, UC <sup>1,2</sup> (0E)	DC, US (0C)	X	X	1	Addressed device detected a parity or cursor check during a Write, Read Buffer, or Read Modified command.
CE, DE, UC <sup>1,2</sup> (0E)	DC (08)	X	X	1	The 3272 detected a cursor or parity check during receipt of data stream on a Write or Erase/Write command.
CE, DE, UC <sup>1,2</sup> (0E)	DC (08)	X	X	10	The 3272 detected a cursor or parity check during transmission of data stream on a Read Buffer or Read Modified command.
CE, DE, UC <sup>1,2</sup> (0E)	CC (02)	X	X	10	Addressed device failed to respond in a specified period of time to an Erase/Write command or an unchained Read Buffer, Read Modified, or Write command.
CE, DE, UC <sup>1</sup> (0E)	OC (01)	X	X	3	The 3272 received an illegal buffer address in data stream of a Write or Erase/Write command, or data stream ended before providing all characters required for an SBA, RA, SF, or EUA order on a Write or Erase/Write command.
CE, DE, UE <sup>1,2</sup> (0D)		X	X	9	The 3272 attempted to perform a Read Buffer, Read Modified, Write or Erase/Write command but found, after returning initial status, that the addressed device was "busy".

**Notes:** 1: If this status is stacked by the channel, CUE could be generated and combined with it before the stacked status is accepted by the channel.

2: Occurs if a Start IO Fast Release (SIOF) is executed by the channel for Select, Erase All Unprotected, or No Operation.

indicating that all command-initiated operations are completed, (3) an action by the device operator that requires program intervention (attention status), or (4) a 3272 or attached device equipment malfunction. Table 16 shows the possible asynchronous status bit configurations.

When an asynchronous status condition occurs, the 3272 attempts to gain selection by the channel (this is a hardware function), and passes this status to the channel when

selection is accomplished. This status is called "pending" status until selection is accomplished. If the channel issues a command before retrieving this pending status, the pending status is returned, with the Busy bit set, in place of initial status for the command; in this case, the command is not executed.

When an asynchronous condition occurs at a device while the 3272 is performing command operations with

**Table 16. Asynchronous Status and Sense Conditions - Local**

Status <sup>1</sup> (Hex)	Sense (Hex)	Display	Printer	Error Recovery Procedure	Condition
A (80)		X			An attention-generating action (e.g., program access key has been depressed) was performed by the operator.
DE (04)		X	X		<p>The 3272-to-device buffer transfer is completed on a Write or Erase/Write command which did not start a printer.</p> <p>The device becomes "not busy" after completing an Erase All Unprotected command or the printer becomes "not busy" after completing a printout.</p> <p>The device-to-3272 buffer transfer is completed on a Select command.</p> <p>A device changes from "not available" to "available" or from "not ready" to "ready".</p> <p>A device becomes "not busy" after having previously sent Unit Exception when the 3272 attempted to execute a command with the device when it was "busy".</p> <p>The 3272 ONLINE/OFFLINE switch is thrown from OFFLINE to ONLINE. This causes each "available" device to present a Device End to the channel.</p>
A, DE (84)		X			The 3272 is thrown from OFFLINE to ONLINE and an attention-generating action (e.g., program access key has been depressed) was performed by the operator.
A, UC (82)	EC (10)	X	X	5	An idle 3272 polled a device twice and detected a "transmit" parity check each time on the data in the device reply.
A, UC (82)	DC, US (0C)	X	X	1	An idle device detected a parity check or cursor check in its buffer.
A, DE, UC (86)	DC, US (0C)	X	X	4 or 8	A device changes from "not available" to "available" or from "not ready" to "ready" and has detected a parity check or cursor check in its buffer or a printer detected parity check while printing.

Table 16. Asynchronous Status and Sense Conditions - Local (Cont)

Status <sup>1</sup> (Hex)	Sense (Hex)	Display	Printer	Error Recovery Procedure	Condition
A, DE, UC (86)	IR (40)		X	6	The addressed printer became Not Ready (out of paper or cover open) before completion of a print operation.
DE, UC (06)	IR (40)		X	6	A command attempting to start a printer found it Not Ready.
A, DE, UC (86)	IR, EC, US (54)		X	6	A printer became mechanically disabled during a printout and an automatic recovery was not successful, the printer CARRIAGE MOTOR POWER switch was off, or the switch fuse was blown.
DE, UC (06)	IR, EC, US (54)		X	6	A command attempted to start a print operation, but the printer CARRIAGE MOTOR POWER switch is turned off.
A, DE, UC (86)	EC, US (14)		X	7	A printer character generator or sync check error occurred or the printer became mechanically disabled during printout, but restored itself.
DE, UC (06)	DC (08)	X	X	10	During a Select or Erase/Write command the 3272 (1) detected a parity or cursor error, or (2) detected a parity check on data received from the addressed device in response to an internal poll during a command.
DE, UC (06)	DC (08)	X	X	1	During a Write command, the 3272 (1) detected a parity or cursor error, or (2) detected a parity check on data received from the addressed device in response to an internal poll during a command.
DE, UC (06)	DC, US (0C)	X	X	1	The addressed device detected a parity or cursor check while executing a Select, Write, Erase/Write, or Erase All Unprotected command.
DE, UC (06)	OC (01)	X	X	3	A Write or Erase/Write command, containing a WCC with a Start Print bit, is chained to a subsequent command.
DE, UC (06)	CC (02)	X	X	10	The addressed device failed to respond in a specified period of time to a Select, Write, Erase/Write, or Erase All Unprotected command.
DE, UE (05)		X		9	The 3272 attempted to perform a Select or Erase All Unprotected command, but found, after returning initial status, that the addressed device was busy.
CUE (20)		X	X		The 3272 had been addressed while busy, but is now not busy and is free to accept a new command.

Note 1: If this asynchronous status is stacked by the channel, an asynchronous CUE could be generated and combined with it before the stacked status is accepted by the channel.

another device, the asynchronous status remains pending until the 3272 completes the current command operation, returns ending status to the channel, and becomes not busy. The 3272 then retrieves the pending status from the device and attempts to present it to the channel in the same manner as other asynchronous statuses.

There are other conditions of multiple status that can occur which are not covered here. These conditions can be caused by multiple error conditions occurring simultaneously.

## ERROR RECOVERY PROCEDURES

### 3272/Device Detected Errors

Error conditions detected by the 3272 or an attached device are indicated to the program by Unit Check status. The program must respond to this status by using a Sense command for further definition of the condition. If a sense command is not performed and the sense conditions still exist, the 3272 will not honor any other interrupts from the devices. Subsequent recovery operations are then determined by the combined configuration of Unit Check status bits and associated sense bits.

Tables 14, 15, and 16 list the initial, ending, and asynchronous status and sense bit combinations, respectively. The abbreviations used in these tables are as follows:

- Status Bits
  - B - Busy
  - CE - Channel End
  - DE - Device End
  - SM - Status Modifier
  - UE - Unit Exception
  - UC - Unit Check
- Sense Bits
  - BOC - Bus Out Check
  - CC - Control Check
  - CR - Command Reject
  - DC - Data Check
  - EC - Equipment Check
  - IR - Intervention Required
  - OC - Operation Check
  - US - Unit Specify

### Referenced Error Recovery Procedures

The recovery procedures referenced in the Error Recovery Procedure column of Tables 14, 15, and 16 are as follows:

1. Reconstruct the entire buffer image and retry the failing chain of commands. The sequence of commands used to reconstruct this image should start with an Erase/Write command. If, after two retries, the problem is not corrected, follow procedure 4.
2. The error indicates the device is "unavailable". Request and wait for operator intervention to "ready" the

device; then, upon receipt of DE status, retry the chain of commands.

3. A nonrecoverable program error has occurred. Examine the data stream to locate the problem.
4. Request maintenance for the device that is giving trouble. After the repair, reconstruct the buffer image, starting with an Erase/Write command.
5. Record the error for future reference and continue with the program. This error occurred while the 3272 was "idle" and is not indicative of a data error.
6. The error indicates the printer is out of paper, has the cover open, or has a disabled print mechanism. Request operator intervention to "ready" the printer; then, upon receipt of DE status, retry the print operation by issuing a Write command with the proper WCC and no data stream. (There is no data error; the data is still intact in the device buffer and can be reused.) If this procedure is unsuccessful, follow procedure 1.
7. The error occurred during a printout and indicates either a character generator or sync check error or a disabled print mechanism. There is no buffer data error. The proper error recovery procedure is application-dependent since the user may or may not want a new printout. Because the buffer contents are still good, procedure 6 may be followed.
8. A data error occurred at the device during a printout. This indicates a data error at the device; procedure 1 should be followed.
9. A device is busy but the 3272 was not informed of this in time to respond with Busy status in the Initial Status byte. A DE status will be generated asynchronously when the device becomes not busy. After the DE is received, retry the chain of commands that was being executed when the Unit Exception (UE) status was received.
10. Retry the failing chain of commands. If, after two retries, the problem is not corrected, follow procedure 4.

### Channel-Detected Errors

Errors detected by the channel are indicated to the program by the channel status byte in the CSW. If the channel status byte indicates a Channel Control Check, an Interface Control Check, or a Channel Data Check, the recommended error recovery procedure is: Retry the chain of commands. If the problem is not corrected after three retries, request maintenance for the channel that is giving trouble.

**PROGRAMMING NOTE:** System/370 Models 155 and 158 may also present a machine check interrupt prior to the CSW store. When an IBM operating system is used, this machine check interrupt (HIR) is not seen by the I/O Supervisor (IOS) or the device-dependent error recovery procedures.

## INTRODUCTION

When using Binary Synchronous Communications (BSC) operating mode, the 3271 and 3275 communicate with the program via an IBM 2701, 2703, 3704, 3705, or an equivalent Integrated Communication Adapter (hereafter called TCU) and appropriate data sets. The type of TCU's and data sets are described in the first section of this publication.

*Note:* In the following paragraphs, the term “3270 CU” is used in statements that apply to both a 3271 and a 3275. If a statement applies to only one 3270 unit, the appropriate unit number is used.

The 3270 CU uses BSC procedures over duplex facilities (non-switched or privately owned); these communications use the Multipoint Data Link mode of operation only. A 3275 with the Dial feature uses the BSC Point-to-Point Data Link procedure over a switched line.

### Code Structures

Each 3270 CU can operate with one of two code structures: EBCDIC (Extended Binary-Coded-Decimal Interchange Code) or ASCII (American National Standard Code for Information Interchange). The choice of code depends on the application. However, for system compatibility, the same code must be chosen for all units on a particular communications line. Tables 1 and 2 respectively show the EBCDIC and ASCII character codes.

### Channel Program Concepts

In remote configurations, the TCU becomes the intermediary between the 3270 CU and the channel program. As such, the TCU, not the 3270 CU, executes channel commands and initiates I/O interrupts. At the start of each I/O operation involving the TCU, the Start I/O instruction addresses the TCU and a communication line attached to that TCU; it does not address an individual remote control unit on that line. Subsequent CCWs in the channel program initiate TCU operations; they specify TCU commands, not 3270 commands.

Selection of a 3270 CU and all subsequent command operations are specified by character sequences in TCU Write CCW data streams. Write CCW data to the TCU communications line selected by Start I/O can contain (1) address bytes to select a control unit on that line, (2) the code of a command (such as Erase/Write or Write) to initiate a control unit operation, or (3) orders and/or display/print data for the control unit buffer. In addition,

this write data will contain the appropriate data-link control characters. Thus, all characters sent by the TCU to a 3271 or 3275, with the exception of SYN, pad, and BCC characters, originate from the data stream of a Write CCW addressed to the TCU.

**PROGRAMMING NOTE:** All Write commands should be set for CCW chaining to a Read command when a response is expected. (This prevents a loss of data received by the TCU in response to Write command operations.) An exception to this requirement is when the Write command is used to issue EOT to the 3270.

### Text Blocking

The 3270 CU performs text blocking. Each block of data can contain a maximum of 256 text characters. Of that total, each block contains the STX and ETB (or ETX) data link control characters. Two address bytes (CU poll address and device address) precede the read heading in the first block only, and are included in the 256 character total. The last block of a message is terminated with ETX, which is also included in the 256 character total.

**PROGRAMMING NOTE:** If the automatic polling facility (Auto Poll) is used by the TCU, the Auto Poll index byte will add one byte to the text block created by the 3270 CU.

Block check characters (BCC) are transmitted as the last characters of a data stream. (See “Redundancy Checking”.) BCC is not counted as text because it follows the ETX and ETB data link characters. Upon successful comparison of the received BCC with the accumulated BCC, the program should respond with ACK to read the next block of text; each subsequent block is preceded by STX to initiate BCC accumulation by the TCU.

Text blocking does not disjoin the three-byte SBA order sequence (SBA code and two-byte field address) generated during the execution of a Read Modified command. Therefore, the last characters of a block ending with an SBA sequence would be . . . SBA, Address, Address, ETB (or ETX).

### Related Publications

Readers who are unfamiliar with the binary synchronous method of communications should review the following publications, as applicable:

- *General Information - Binary Synchronous Communications*, Form GA27-3004
- *IBM 2701 Data Adapter Unit Component Description*, Form GA22-6864 (especially the section that describes the Synchronous Data Adapter - Type II)

- *IBM 2703 Transmission Control Component Description*, Form A27-2703 (especially the section on BSC capabilities)
- *Introduction to the IBM 3704 and 3705 Communications Controller*, GA27-3051

## MULTIPOINT (NON-SWITCHED LINE) DATA LINK CONTROL

Each 3270 CU can operate on a nonswitched communications line with multiple stations. Time-sharing of the line is accomplished by interleaving transmissions between the TCU and all units on the line. A 3271 or 3275 (without the Dial feature) operates multidropped on the same line with other properly featured units, such as other 3270 units, IBM 2770's, and IBM 2780's. [Differences for a 3275 with the Dial feature are discussed under "Point-to-point (Switched Line) Data Link Control".]

The TCU is the *control station* of the multipoint, centralized network. All units attached by communications lines to the TCU are called *tributary stations*. The control station is the focal point of the network and maintains, under program control, an orderly flow of network traffic by initiating all data transfers. The control station is either the transmitter or receiver of every communication.

### 3270 Modes of Operation

In the multipoint environment, the 3270 CU is always in one of three modes of operation: Control mode, Text mode, or Transparent Monitor mode.

#### Control Mode

The 3270 CU enters Control mode whenever it transmits or receives a valid EOT sequence. While in Control mode, the unselected 3270 CU monitors the communications line for the following:

1. A valid selection or poll addressing sequence, by which the 3270 CU will become selected for entry into Text mode.
2. A DLE-STX sequence, placing the 3270 CU in Transparent Monitor mode.

#### Text Mode

Once a 3270 CU is successfully selected, it enters Text mode. In Text mode, the 3270 CU is either a master station or a slave station, as is the TCU. This status depends on the operation being performed. The station that is transmitting a message is called the *master station*, whereas the station that is receiving and acknowledging the message is called the *slave station*.

The 3270 CU becomes the *master station* (and the TCU the slave station) once it sends STX to the TCU while executing a Read command or a poll operation. As the master station, it can (1) transmit text messages and (2)

transmit ENQ to request a reply or retransmission from the TCU. After transmission of the message is completed, the 3270 CU returns to Control mode.

The 3270 CU becomes the *slave station* (and the TCU the master station) when executing a write-type command. As a slave station, it responds appropriately to master-station (TCU) transmissions.

#### Transparent Monitor Mode

The 3270 CU cannot operate in Transparent mode, but it can operate on a communications line with other types of terminals that can operate in Transparent mode.

Transparent Monitor mode is provided with EBCDIC 3270 CUs only. It permits the transmission of data in any of the 256 possible EBCDIC bit patterns between the TCU and another unit on the same communications line with the 3270 CU. This data may be independent of the selected transmission code (EBCDIC). Examples of such format-independent data are packed-decimal data, programs (both source and object), core images, and other binary data. Thus, link control characters within this data will not inadvertently initiate a 3270 CU operation.

When an EBCDIC 3270 CU decodes a DLE STX sequence while in Control mode, it enters Transparent Monitor mode. While in this mode, the 3270 CU disregards *all* data configurations that may appear on the communications line except for (1) a transparent text sync sequence (DLE SYN) or (2) a transparent text terminating sequence (DLE ITB, DLE ETX, DLE ETB, or DLE ENQ). The 3270 CU leaves Transparent Monitor mode and returns to Control mode (1) if a transparent text sync sequence is not received within any 3-second period or (2) if a transparent text terminating sequence is decoded.

#### Redundancy Checking

A redundancy check is performed on the following communications line data:

1. 3270 CU command-sequence characters (including the write data of a Write or Erase/Write command).
2. Data transmitted to the TCU in response to a read-type command or to a polling sequence.

A block check character (BCC) is accumulated for each block of data at both the TCU and the 3271 or 3275. If EBCDIC code is used, a two-byte BCC is generated (cyclic redundancy check accumulation); if ASCII code is used, a one-byte BCC is generated (longitudinal redundancy check accumulation).

BCC accumulation is initiated by, but does not include, the first STX or SOH framing character. All characters following this STX or SOH, up to and including the end-of-block character (ETB or ETX), are part of the accumulation. Following the ETB or ETX character, the transmitting unit transmits its BCC character. The receiving



unit then compares this character with the BCC it has accumulated. If the redundancy accumulations are different, a transmission error has occurred.

When the 3270 CU is the receiving unit and detects a BCC error, it responds to the transmission by sending EOT (3275) or NAK (3271) to the TCU. When the TCU is the receiving unit, it will set Unit Check in the ending status for the TCU command being executed when the BCC error was detected; also, it will set Data Check in the sense byte.

*Note:* BCC characters are removed from the data stream when received for comparison by the TCU or by the 3270 CU; they are not stored in main storage or in the 3270 CU buffer.

In both EBCDIC and ASCII, transmission formats (data link controls) are rigidly screened so that communication is orderly and accurate. Improper transmissions are ignored or rejected to avoid the acceptance of faulty messages. Received or transmitted data blocks are counted odd-even-odd-even, etc., by both the transmitter and receiver (by means of ACK 0's and ACK 1's), and their counts must agree at each block-check point.

#### **Data-Link Control Characters**

Two types of characters are transmitted between the TCU and the 3270: CU data-link control characters, and 3270 message data. Data-link control characters are used for such purposes as message framing, acknowledgment that received message data was valid or invalid, and identification of the start- or end-of-text transmission. Data link control characters are used (singly or in sequences) by the TCU (under program control) and by the 3271 or 3275 to establish and control all data link operations in an orderly fashion. The 3270 message data consists of all address, command, order, and display/print characters sent to the 3270 CU and of all buffer data, AID bytes, and status/sense bytes read from the 3270 CU. Data-link control characters are described individually in the following paragraphs and are described with 3270 message data later in this section (under "Operational Sequences").

The data-link control characters, with their EBCDIC and ASCII codes, are listed in Tables 1 and 2. All control characters transmitted by the TCU (except pad and SYN) are issued by the channel program as part of a TCU Write CCW data stream. All control characters transmitted by the 3270 to the TCU are generated by hardware; a Read command to the TCU is used to store these characters (except pad and SYN) into main storage for subsequent analysis by the access method.

#### ***Pad***

Pad characters, leading and trailing, are generated by TCU or 3270 CU hardware to ensure complete transmission or reception of the first and last significant character of each transmission.

#### ***SYN (Synchronous Idle)***

Two consecutive SYN characters are generated by TCU or 3270 CU hardware to establish character synchronism. The TCU can also embed SYN characters in text for time-fill to maintain synchronization; the 3270 CU discards these SYN characters (does not store them in the buffer).

#### ***DLE (Data Link Escape)***

DLE is always the first byte in the following two-byte control characters: ACK 0, ACK 1, WACK, and RVI. DLE is also used as the first character in several two-character sequences that are used in Transparent Monitor mode (described earlier in this section under "Transparent Monitor Mode").

#### ***ACK 0 (Even Acknowledge)***

ACK 0 is a two-byte character, as follows:

- EBCDIC: 10 70 (Hex)
- ASCII: 10 30 (Hex)

ACK 0 is transmitted by the 3270 CU after a successful selection addressing (not poll) sequence to indicate to the TCU that the 3270 CU is ready to accept transmission. ACK 0 is also transmitted by the 3270 CU or by the TCU upon receipt and validation of an even-numbered (second, fourth, etc.) text block.

#### ***ACK 1 (Odd Acknowledge)***

ACK 1 is a two-byte character, as follows:

- EBCDIC: 10 61 (Hex)
- ASCII: 10 31 (Hex)

ACK 1 is transmitted by the 3270 CU or TCU upon receipt and validation of an odd-numbered (first, third, etc.) text block.

#### ***NAK (Negative Acknowledgment)***

NAK is transmitted by the 3270 CU in response to a TCU text transmission that (1) terminates with ENQ, (2) has ENQ embedded in text, (3) has invalid BCC (3271 only), (4) contains a TTD sequence (STX ENQ), or (5) has ETX missing (3271 only). (The 3275 responds with EOT to a TCU text transmission that has invalid BCC or missing ETX.)

When NAK is received by the 3270 CU in response to a text transmission, the 3270 CU retransmits the last block of text.

**PROGRAMMING NOTE:** The TCU should be programmed to respond with NAK to an ENQ (that ends a text block) from the 3270 CU; this NAK causes the 3270 CU to send EOT and retain the status for error recovery.

#### *ENQ (Enquiry)*

The 3270 CU transmits ENQ (1) to request a reply from the TCU following a 3-second timeout, (2) to request retransmission of the previous reply from the TCU, or (3) as the last character of a text message in which a data check was detected by the 3270 CU. (See "Programming Note" above.)

When the 3270 CU receives ENQ in response to a transmission, the last 3270 CU transmission to the TCU is repeated. The 3270 CU responds with NAK when ENQ is received (1) as the last character of a TCU-aborted text transmission, (2) embedded in text, or (3) as part of a TTD sequence (STX ENQ).

To be addressed successfully, the 3270 CU must receive ENQ as the last character of a polling or selection addressing sequence.

#### *WACK (Wait before Transmit)*

WACK is a two-byte character, as follows:

- EBCDIC: 10 6B (Hex)
- ASCII: 10 3B (Hex)

WACK is generated by the 3270 CU (1) in response to a selection addressing (not poll) sequence when a printer (attached to a 3271 or 3275) or a 3277 (attached to a 3271) is busy, and (2) in response to a Write or Copy (3271 only) command text transmission when the Start Printer bit is set in the WCC or CCC. The 3270 CU responds with ENQ to a WACK from the TCU.

#### *RVI (Reverse Interrupt)*

RVI is a two-byte character, as follows:

- EBCDIC: 10 7C (Hex)
- ASCII: 10 3C (Hex)

RVI is generated by the 3270 CU in response to an attempted selection (not poll) by the TCU when the 3270 CU has a status and sense message to be transmitted. Whenever the 3270 CU receives RVI from the TCU, the CU responds with EOT and resets all pending status and sense information.

#### *STX (Start of Text)*

The 3270 CU receives STX as the first character of a command or TTD sequence. The STX causes the 3270 CU

to clear its BCC accumulation circuits and start accumulating a new BCC (STX is not included in the accumulation). Subsequent STX (and SOH) characters are included in the BCC accumulation. STX is transmitted by the 3270 CU to the TCU as the first character of a read-data text block except in a status or test-request message; this STX causes the TCU to start accumulating a new BCC (STX is not included in the accumulation).

The first character in status and test-request messages is SOH, with STX following two header characters. With a message of this type, the TCU starts BCC accumulation upon receipt of the first SOH; the subsequent STX character is included in the BCC accumulation.

#### *SOH (Start of Heading)*

The 3270 CU generates SOH in a three-character heading sequence that identifies the accompanying data as a status message (SOH, %, R, STX, - - -) or as a test-request message (SOH, %, /, STX, data - - -). The TCU starts BCC accumulation upon receipt of SOH (SOH is not included in the accumulation).

#### *ETB (End of Transmission Block)*

During a message transfer operation, ETB informs the receiving unit that BCC follows. The 3270 CU treats ETB as though it were ETX by checking BCC and then generating the appropriate response; the 3270 CU does not accept conventionally blocked text.

#### *ETX (End of Text)*

During a message transfer operation, ETX informs the receiving unit that BCC follows. The 3270 CU transmits ETX at the end of the last (or only) block of a text message. Then, upon successful comparison of the received BCC with the accumulated BCC, the program should respond with ACK to the 3270 CU. If the BCC comparison is unsuccessful, the TCU interrupts the program (Channel End, Device End, and Unit Check status, with Data Check set in the sense byte); the program should respond with NAK to the 3270 CU.

Receipt of ETX by the 3270 CU initiates a BCC comparison, causes a line turnaround, and causes generation of an appropriate response to the TCU.

#### *EOT (End of Transmission)*

EOT is transmitted by the 3270 CU (1) when the 3270 CU is a slave station and is unable to perform an operation requested by the TCU, (2) when the 3270 CU is a master station, as normal termination of a read operation, (3) when the 3271 has completed General Poll operations with each attached device, or (4) as an answer to RVI sent by the TCU. Line synchronization is dropped, and the 3270 CU is returned to Control mode. Note that the program can also issue EOT to the 3270 CU in order to drop line

synchronization and return the 3270 CU to Control mode. EOT does not reset status and sense in the 3270 CU; therefore it should not be sent as a response to a status message.

#### *ITB (End of Intermediate Transmission Block)*

The 3270 CU does not accept conventionally blocked text. However, to coexist on a BSC multipoint line on which ITB may be used, the 3270 CU includes the ITB and associated BCC in its own BCC accumulation but then removes them from the data stream so that they are not stored in the buffer. The 3270 CU does not perform a BCC comparison at that time, but continues the receive operations until ETB or ETX is decoded.

#### *ESC (Escape)*

ESC must precede the command code in each command-sequence data stream transmitted to the 3270 CU, as follows: STX, ESC, CMD,----. The 3270 CU does not generate ESC.

#### *TTD (Temporary Text Delay)*

TTD is a two-character sequence: STX ENQ. The 3270 CU responds to TTD by transmitting NAK to the TCU. The 3270 CU does not generate TTD. TTD may also be used by the master station to terminate an operation (i.e., initiate a forward abort). The 3270 CU (slave station) will always respond with a NAK, expecting the master station to transmit EOT. In this case, the slave station interprets this sequence as a controlled forward abort rather than an end of transmission.

### **OPERATIONAL SEQUENCES (LEASED LINE)**

The following paragraphs describe the various data and control sequences that can be performed with the 3270 operating on a leased line. Differences for a 3275 with a Dial feature are discussed under "Operational Sequences (Switched Line)". These sequences are divided into four categories:

1. Specific and general poll.
2. Selection addressing.
3. Write and control-type commands.
4. Read-type commands.

The description of each category is associated with a Sequence/Response Diagram, which shows (1) all 3270 CU responses to program-generated transmissions by the TCU and (2) normal program-handling of 3270 CU transmissions. These diagrams show the I/O supervisor/access method as examining each 3270 response to determine which operation to initiate next; however, for specific applications, additional usage of command-chaining in the channel programs may be desirable.

A selection addressing sequence selects a 3270 CU and an attached device for subsequent command operations. Polling sequences are selection sequences used specifically to obtain pending status at a device. Either a Specific Poll sequence requesting status from a particular device or a General Poll sequence sent to all devices may be executed.

#### **Remote-Chaining of 3270 Commands**

For remote operations, 3270 command codes are included in the data stream of a Write CCW to the TCU. Remote-chaining of 3270 commands is defined as the transmission of more than one command sequence to a 3270 CU following a single selection addressing or poll sequence. This chaining normally is accomplished with separate Write CCWs in the channel program. For example; the channel program could (1) write a selection addressing sequence and read the response for evaluation by the I/O supervisor/access method, (2) write a 3270 Write command and text block and read the 3270 response for evaluation, and then (3) write a 3270 Write command followed by a second text block and read the 3270 response for evaluation.

The program may chain 3270 commands following a selection addressing sequence, provided that the BSC rules governing Limited Conversational mode are observed. (Refer to *General Information - Binary Synchronous Communications*, Form GA27-3004.) The 3270 CU hardware permits any valid command to be chained following a poll sequence; however, Read Buffer or Read Modified should not be chained because the BSC rules for Limited Conversational mode (a maximum of two consecutive data transfers without an intervening ACK) will be violated.

Any 3270 command (except Erase All Unprotected) may be chained from a Write, Erase/Write, or Copy command. However, if the Write, Erase/Write, or Copy command has started a print operation, the 3270 CU will abort the subsequent chained command (the print operation is completed normally).

#### **General and Specific Poll Sequences**

When a General or Specific Poll sequence is issued (Figure 12), one of three possible results occurs:

1. If status and sense information is pending with or without an AID present, a status and sense message is generated.
2. If status and sense information is not pending and an AID is present, a Read Modified command is executed.
3. If there is no status or sense information or no AID pending, an EOT response is generated.

Table 20 lists the conditions under which status and sense messages are transmitted.

*Note:* When a program attention key is pressed at a 3275 Display Station, and status is not to be sent, the display

station screen will momentarily go blank, while the AID character is accepted during the polling cycle and a read or write type command reply is sent.

Control unit and device address bytes transmitted for the General and Specific Poll sequences are as follows:

1. General Poll address byte sequence:

3270 CU Poll Address	
3270 CU Poll Address	See Table 17
7F (EBCDIC) or 22 (ASCII)	Used in place of the
7F (EBCDIC) or 22 (ASCII)	two device-address bytes

2. Specific Poll address byte sequence:

3270 CU Poll Address	
3270 CU Poll Address	See Table 17
Device Address*	
Device Address*	

\*For the 3275, this is always the address of device 0.

The selected 3270 CU remains selected at the completion of a poll operation so that the program can issue a Write, Erase/Write, Copy, or EAU command without reselecting the 3270 CU and the device; command operations will be with (1) the device that was selected by Specific Poll or (2) the device from which a response was last received during the General Poll operation. Selection is dropped when the 3270 CU transmits EOT; the 3270 CU transmits EOT when the 3270 CU has no pending status or messages or after it receives NAK from the TCU in response to a message that ends with ENQ.

Specific Poll addresses the 3270 CU and one device to determine if status and sense information or a manually entered message is awaiting transfer to the TCU. The pending status and sense information or message is transferred automatically by the 3270 CU upon receipt of the Specific Poll addressing sequence.

General Poll addresses the 3270 CU and examines each attached device in sequence (starting at a random device address) to determine if a status and sense or a manually entered message is awaiting transfer to the TCU. If a message is present, it is transferred to the TCU. Each message is accompanied by the address of the device from which it originated. The 3275 responds to a General Poll the same as a 3271 with one device attached.

Upon completion of this transfer, an ACK response from the program causes the 3271 to continue the General Poll operation, either by transferring another block of a text message or by examining other attached devices for pending messages. (The program could issue a command, rather than ACK, to the device from which the message was just received.) Once the 3271 has examined all attached devices and has successfully transferred all pending messages, it generates EOT and returns to Control mode. If the program wishes to terminate the General Poll, an RVI must be issued to the 3270, forcing an EOT response.

Figure 13 shows the message formats. The Test Request, Read Modified, and Short Read operations and the resulting data are described under "Read Modified Command" in the section entitled "Commands and Orders". Note that a device address is not provided in the heading of a Test Request message. An address must be manually entered by the operator as part of the text; this is because the operator may specify the address of another device for test operations with the program.

The status and sense bits are described later in this section under "Status and Sense (S/S) Bytes".

### Selection Addressing Sequence

The selection addressing sequence (Figure 14) specifies a 3275 or 3271 and an attached device in preparation for write-, control-, or read-type command sequences. It is similar in format to a Specific Poll sequence in that a CU address is sent, followed by a device address, but different I/O characters and hex codes are used to represent the CU address bytes. Column 1 in Table 17 lists the characters and hex codes used to complete the selection addressing sequence. Comparative examples showing CU and device address codes for General Poll, Specific Poll, and selection addressing sequences are given at the bottom of Table 17.

For the 3271, the selection addressing sequence performs a function similar to a local Select command, in that it causes a device-to-3271 buffer transfer. The 3271 returns ACK 0 if the selection and buffer transfer were completed successfully.

When a 3275 is to be selected, note that device number 0 is always addressed (Table 17, Note 1).

### Write-Type and Control-Type Command Sequences

The program initiates a Write, Erase/Write, Copy, or EAU operation (Figure 15) by first writing a command and, except for EAU, a data sequence to the selected 3270 CU and then reading the response. All write-type commands and Copy commands must be followed by a minimum of one data byte (the WCC or CCC byte). If the program reads a positive response (ACK) from the 3270 CU, it can terminate the operation or continue with another command. The program can write blocks of text to the 3270 CU by initiating, after receipt of each ACK, a Write command sequence for each block to be written.

The blocking of write data is accomplished as follows: After each block is written and the 3271 has successfully completed execution of the Write command, the entire 3271 buffer contents are transferred to the device buffer. Each time the 3271 receives a Write command, it transfers the entire device buffer contents into the 3271 buffer before any write data is received. Thus, if the transfer of a block of write data to the 3271 buffer is unsuccessful (NAK reply), 3271-to-device buffer transfer is not performed. However, the 3271 can receive retransmission of

Table 17. Remote Control Unit and Device Addressing

Column 1 Use this column for: • Device Selection, • Specific Poll, • General Poll, and • Fixed Return Addresses					Column 2 Use this column for: • 3270 CU Selection Addresses • Test Requests				
CU or Device Number	EBCDIC I/O Char.	EBCDIC Hex (Note 3)	ASCII I/O Char.	ASCII Hex	CU Number	EBCDIC I/O Char.	EBCDIC Hex (Note 3)	ASCII I/O Char.	ASCII Hex
0	SP (Note 1)	40	SP	20	0	-	60	-	2D
1	A	C1	A	41	1	/	61	/	2F
2	B	C2	B	42	2	S	E2	S	53
3	C	C3	C	43	3	T	E3	T	54
4	D	C4	D	44	4	U	E4	U	55
5	E	C5	E	45	5	V	E5	V	56
6	F	C6	F	46	6	W	E6	W	57
7	G	C7	G	47	7	X	E7	X	58
8	H	C8	H	48	8	Y	E8	Y	59
9	I	C9	I	49	9	Z	E9	Z	5A
10	␣	4A	[	5B	10		6A	,	7C
11	.	4B	.	2E	11	,	6B	,	2C
12	<	4C	<	3C	12	%	6C	%	25
13	(	4D	(	28	13	—	6D	—	5F
14	+	4E	+	2B	14	>	6E	>	3E
15		4F	or !	21	15	?	6F	?	3F
16	&	50	&	26	16	0	F0	0	30
17	J	D1	J	4A	17	1	F1	1	31
18	K	D2	K	4B	18	2	F2	2	32
19	L	D3	L	4C	19	3	F3	3	33
20	M	D4	M	4D	20	4	F4	4	34
21	N	D5	N	4E	21	5	F5	5	35
22	O	D6	O	4F	22	6	F6	6	36
23	P	D7	P	50	23	7	F7	7	37
24	Q	D8	Q	51	24	8	F8	8	38
25	R	D9	R	52	25	9	F9	9	39
26		5A		5D	26	:	7A	:	3A
27	\$	5B	\$	24	27	#	7B	#	23
28	*	5C	*	2A	28	@	7C	@	40
29	)	5D	)	29	29	'	7D	'	27
30	;	5E	;	3B	30	=	7E	=	3D
31	␣	5F	␣ or ^	5E	31	" (Note 2)	7F	"	22

Examples:

3271 Addressing				3275 Addressing			
General Poll CU5	CU Address	EBCDIC	ASCII	General Poll CU5	CU Address	EBCDIC	ASCII
		{ C5	45			{ C5	45
	Device Address	{ 7F	22		Device Address	{ 7F	22
Specific Poll Device 4 on CU5	CU Address	{ C5	45	Specific Poll CU5	CU Address	{ C5	45
		{ C5	45			{ C5	45
	Device Address	{ C4	44		Device Address	{ 40	20
Select Device 4 on CU5	CU Address	{ E5	56	Select CU5	CU Address	{ E5	56
		{ E5	56			{ E5	56
	Device Address	{ C4	44		Device Address	{ 40	20
		{ C4	44			{ 40	20

## Notes:

1. I/O character address (SP) is always used as the device address when selecting a 3275.
2. I/O character address (") is used as the device address to specify a General Poll operation.
3. Graphic characters for the United States I/O interface codes are shown. Graphic characters for EBCDIC 4A, 5A, 5B, 7B, 7C, and 7F might differ for particular World Trade I/O interface codes. Refer to the applicable table in Appendix D for possible graphic differences when these codes are used.

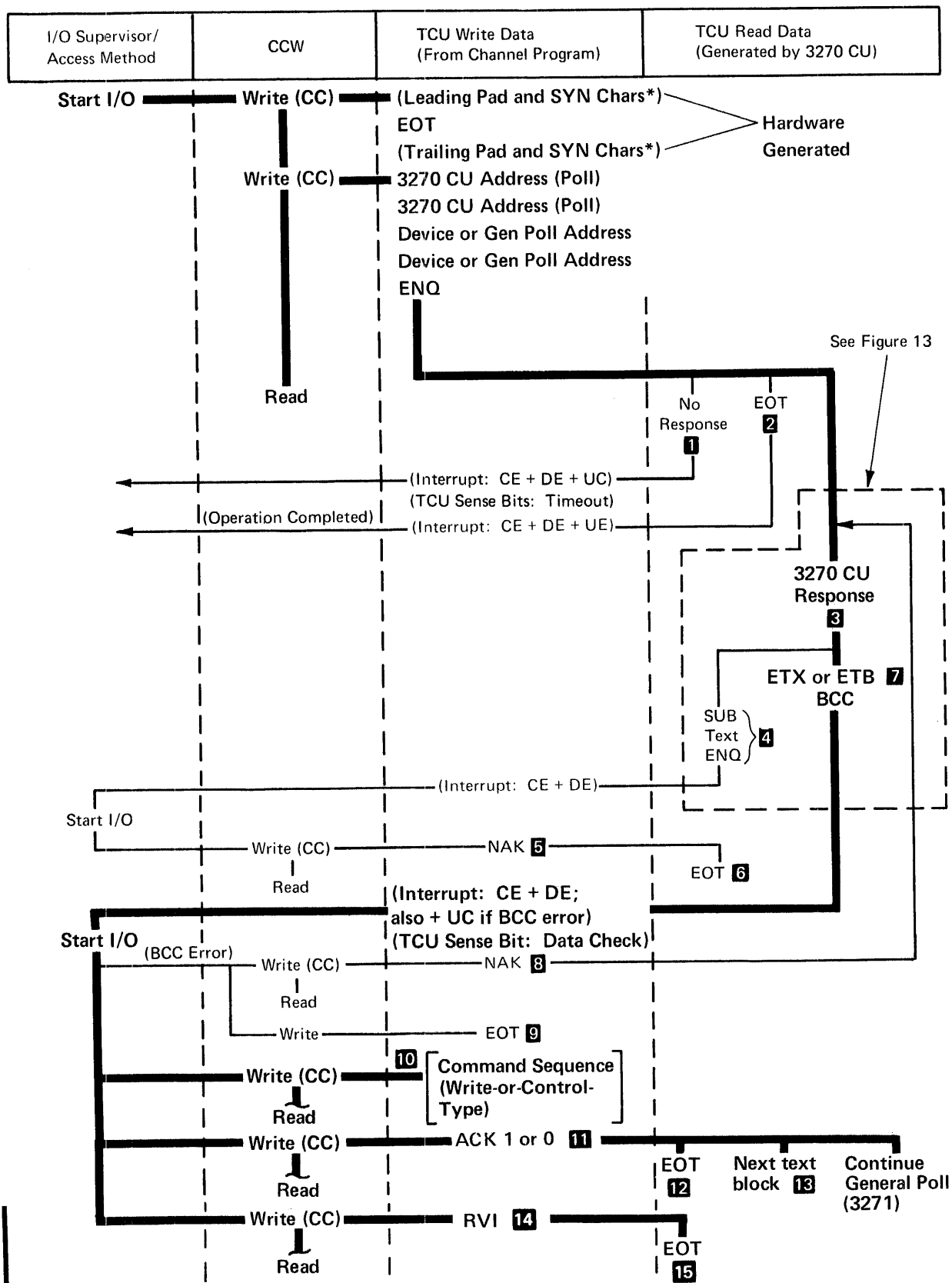


Figure 12. General Poll and Specific poll, Sequence/ Response Diagram (sheet 1 of 2)

*Notes:*

- 1** The 3270 CU will fail to respond to the addressing or polling sequence, causing a TCU timeout, for any of the following reasons:
  - The 3270 CU is “unavailable” (has power off, is “offline”, or is not attached).
  - The 3275 is “unavailable” to a Specific Poll sequence because the Security Lock is in the “off” position.
  - Any character in the polling sequence is invalid.
  - The characters in the polling sequence are out of order.
  - The polling sequence is incomplete (less than seven characters).
  - The 3270 CU address is incorrect in the write data stream.
  - The addressed 3270 CU was left selected from the previous transmission.
- 2** There is no I/O pending nor pending status. For General Poll, the CU sends EOT only after polling all devices.
- 3** The device response is a function of the kind of device and its status. Types of responses include: Text, Status, and Test Request messages. (Refer to Figure 13.)

3271: For General Poll, the search for a response starts at some random device address and continues sequentially (as long as ACKs are received in response to text transmissions) until all devices are given the opportunity to respond.
- 4** Upon detection of an internal parity check or a cursor check, the 3270 CU (1) substitutes the SUB character for the character in error, (2) records Data Check status, and (3) transmits an ENQ in place of ETX (or ETB) and BCC at the end of the text block. The internal 3271/device polling is stopped.
- 5** Mandatory program response to a text block terminated in ENQ.
- 6** Terminates the operation. The nature of the error (parity or cursor check) does not warrant a retry. This response indicates that status and sense information is stored and that internal 3271/device polling is stopped. The status retrieval information included in Figure 16, Note 2, applies.
- 7** ETB is used to frame each block of a blocked text message, except the last block. ETX is used to frame the last block of a blocked text message.
- 8** BCC error has been detected. The program issues NAK to cause the 3270 CU to repeat its last transmission.
- 9** Response issued by the program to terminate the operation if the TCU is unsuccessful in receiving a valid BCC following “n” attempts by the 3270 CU to transmit the message. This response does not cause the 3270 CU to reset its sense/status information. Therefore, the same status message will be transmitted if a Specific Poll is immediately issued to the same device.
- 10** This transmission must be a write or control-type command sequence (described in Figure 15). A read-type command would violate BSC standards on Limited Conversational mode.

3271: For General Poll, this transmission stops the 3271/device polling operation. The General Poll must be reinitiated to ensure receipt of all pending device messages.
- 11** Positive acknowledgment. The text block has been successfully received by the TCU. The program issues ACK 1 in response to the first and all odd-numbered text blocks and issues ACK 0 in response to the second and all even-numbered text blocks. This response to a text block terminated in ETX turns on the 3275 SYSTEM AVAILABLE indicator.
- 12** Normal termination of a Specific Poll

3271: Normal termination of a General Poll.

3275: No additional response is generated by the 3275 at the end of a General Poll.
- 13** The second and all succeeding text blocks are framed as the first except they do not include the 3270 CU/device address sequence.
- 14** RVI to terminate polling sequence.
- 15** Termination of polling sequence on receipt of RVI.

**LEGEND:**

(CC) = Chain Command (CC) Flag in CCW is set to 1.

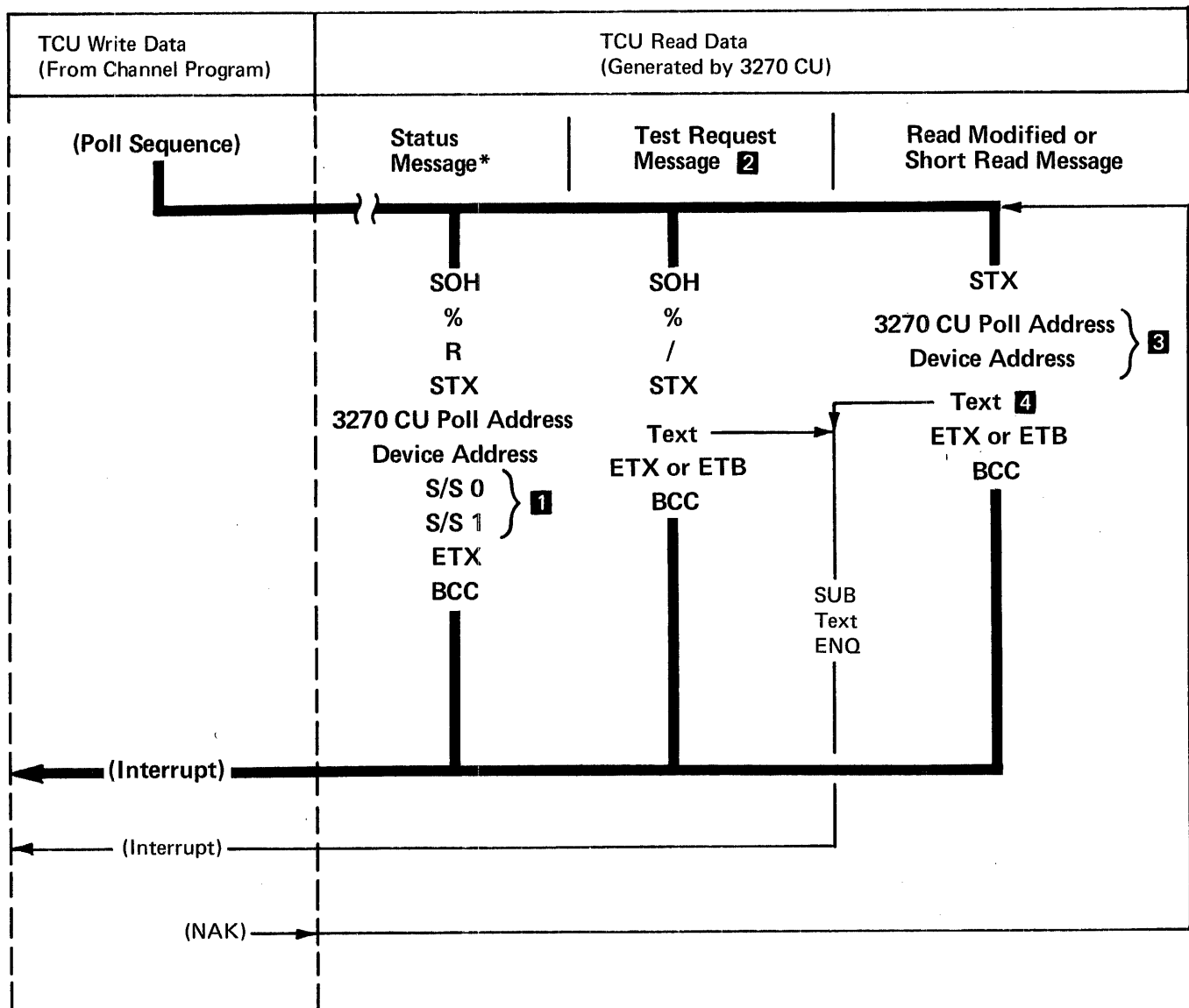
(Interrupt) = TCU-generated interrupt (CE = Channel End, DE = Device End, UE = Unit Exception, UC = Unit Check).

- 1** Reversed numbers refer to notes.

\*Only the critical framing characters (sync pattern and pad) are shown. All other framing characters are also hardware-generated as required. See *SL General Information - Binary Synchronous Communications*, GA27-3004, for a complete description.

**Figure 12. General Poll and Specific Poll, Sequence/Response Diagram (Sheet 2 of 2)**

(Note: This figure is referenced in Figures 12 and 16.)



\*Response to General Poll or Specific Poll only (not program-generated Read Modified command)

Figure 13. 3270 CU Message Response to Polling or Read Modified Command (Sheet 1 of 2)



**Notes:**

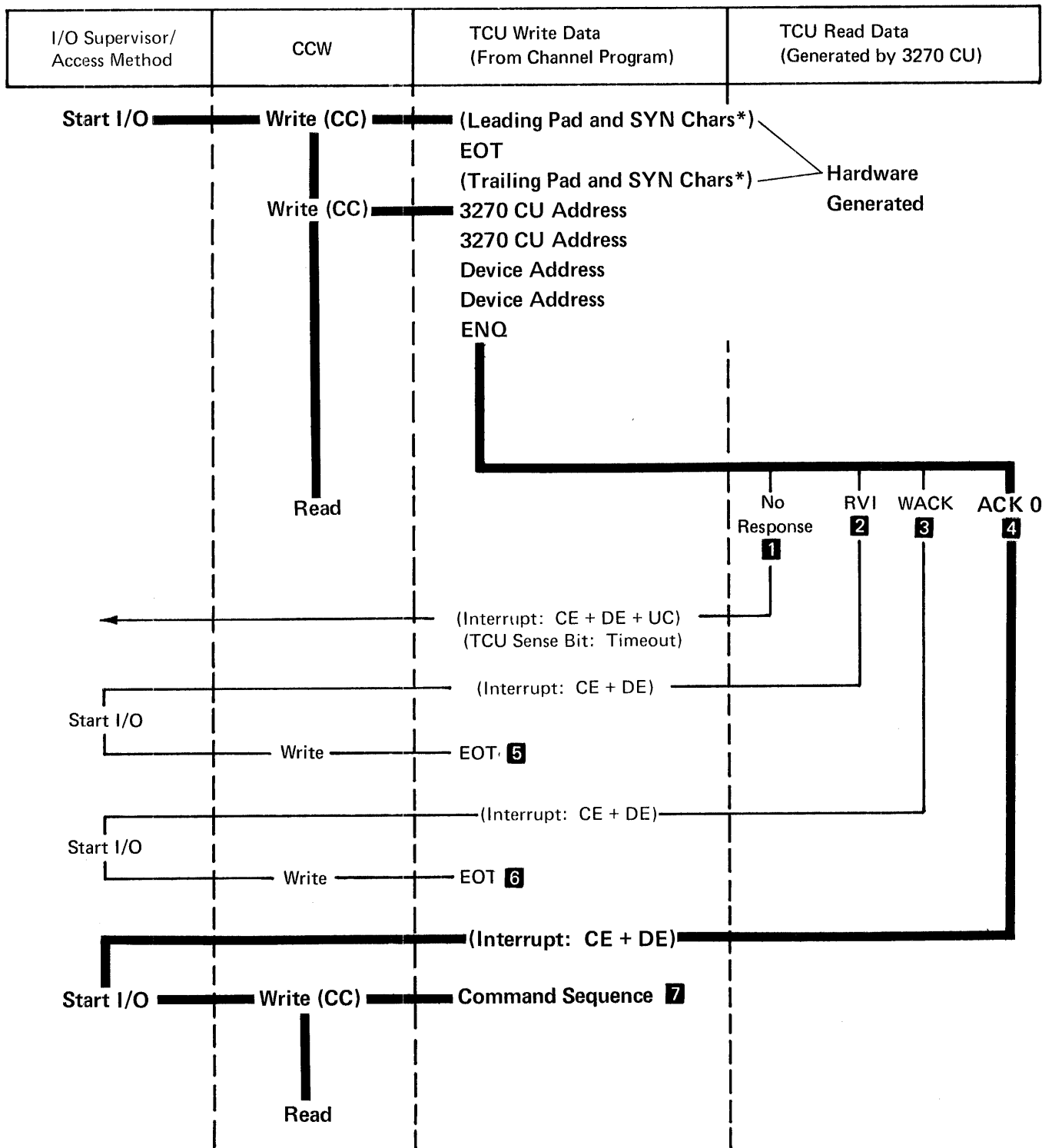
- 1** A status message response is issued to a General or Specific Poll if (1) the 3270 CU has pending status (General Poll ignores Device Busy and device "unavailable" and, if 3271, continues polling of next device), or (2) if error status develops during execution of the poll. Status and Sense bit assignments are described in Table 18.
- 2** A Test Request Message response is issued to a General or Specific Poll if a TEST REQ key is pressed at the keyboard of a polled 3275 or 3277.
- 3** This address is included only in the first block of a blocked text message.
- 4** The text portion of this message is the result of either a read-modified or short-read operation by the 3270 CU. Table 6 lists each operator action and the resulting read operation that will be performed. The read operations and the resulting data are described under "Read Modified Command" in the section entitled "Commands and Orders".

**LEGEND:**

(Interrupt) = TCU-generated interrupt.

- 1** Reversed numbers refer to notes.

**Figure 13. 3270 CU Message Response to Polling or Read Modified Command (Sheet 2 of 2)**



\*Only the critical framing characters (sync pattern and pad) are shown. All other framing characters are also hardware-generated as required. See *SL General Information – Binary Synchronous Communications*, GA27-3004, for a complete description.

Figure 14. Selection Addressing, Sequence/Response Diagram (Sheet 1 of 2)

*Notes:*

- 1** The 3270 CU will fail to respond to the addressing or polling sequence causing a TCU timeout, for any of the following reasons:
  - The 3271 is "unavailable" (has power off, is "offline", or is not attached).
  - The 3275 is "unavailable" (is not attached, has power down, or has the Security Lock in the "off" position).
  - Any character in the polling sequence is invalid.
  - The characters in the polling sequence are out of order.
  - The polling sequence is incomplete (less than seven characters).
  - The 3270 CU address is incorrect in the write data stream.
  - The addressed 3270 CU was left selected from the previous transmission.
- 2** 3271: The addressed device has pending status (excluding Device Busy and Device End) or is unavailable, the device-to-3271 buffer transfer was unsuccessful, the 3271 detected an internal parity or cursor check, or the addressed printer became "not ready" (out of paper, unrecoverable "hang", power off, or cover open). The S/S information is stored in the 3271, and the internal 3271/device polling is stopped.  
3275: The 3275 has pending status, excluding Device Busy and Device End.
- 3** The addressed 3271 device or the 3275, including the 3284-3 Printer, is busy. No S/S information is stored. An RVI response takes precedence over a WACK response.
- 4** The address has been successfully received, no status is pending, and, in the case of the 3271, the device-to-3271 buffer transfer is successfully completed.
- 5** Termination of attempted addressing sequence:  
3271: Availability of valid status and sense information cannot be ensured unless a Specific Poll is issued to the responding device as the next addressing sequence issued to this 3271. Successful completion of a Specific Poll addressed to the responding device, a device selection addressed to any other device on the same 3271, or a General Poll addressed to the same 3271, is required to start the internal 3271 device polling operation.  
3275: A Specific Poll to the 3275 retrieves the status existing at the time the RVI response was made.
- 6** Termination of attempted addressing sequence.
- 7** Refer to Figure 15 or 16 for the desired command sequence.

**LEGEND:**

(CC) = Chain Command (CC) Flag in CCW is set to 1.

(Interrupt) = TCU-Generated interrupt (CE = Channel End, DE = Device End, and UC = Unit Check)

- 1** Reversed numbers refer to notes.

**Figure 14. Selection Addressing, Sequence/Response Diagram (Sheet 2 of 2)**

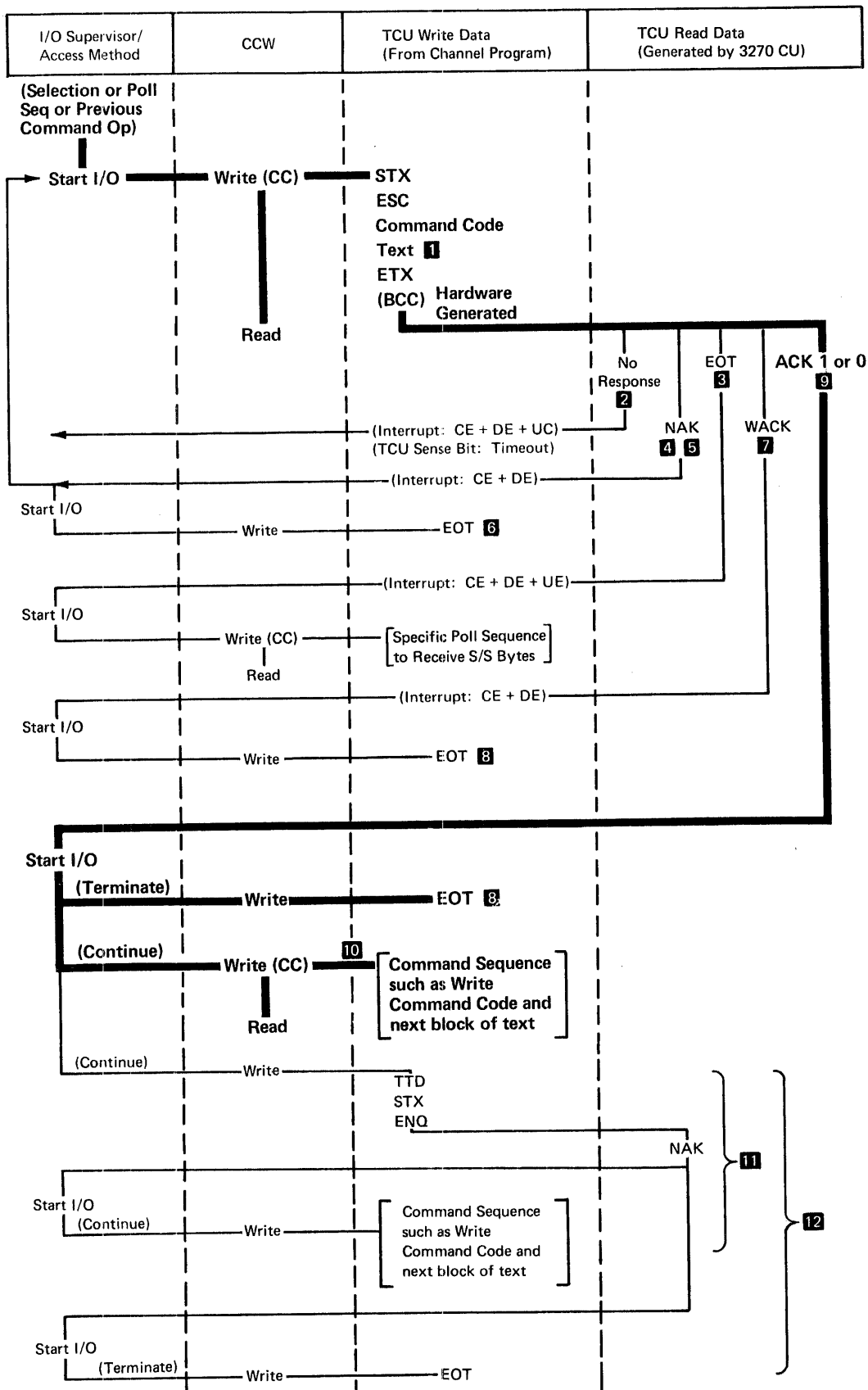


Figure 15. Write-Type and Control-Type Commands, Sequence/Response Diagram (Sheet 1 of 2)

*Notes:*

- 1** No text is transmitted on an EAU command transmission.
- 2** Command transmission was not successfully received because of invalid framing (STX missing). Causes timeout at TCU.
- 3** 3271: The 3271 is unable to perform the operation indicated in the command transmission because of a busy/unavailable/not ready device or one of the following 3271-detected check conditions:
  - a. receipt of an illegal command/order sequence,
  - b. failure to decode a valid command.
  - c. an I/O interface "overrun",
  - d. a parity/cursor check,
  - e. an illegal buffer address, or
  - f. a locked buffer.

In the case of the Copy command: Copy feature is not installed, "from" device is busy or has locked buffer, or CCC is missing.

The EOT response to a command transmission indicates that status information is stored in the 3271 and that internal 3271/device polling is stopped. To ensure retrieval of valid status, the program must issue a Specific Poll (addressing the device that was selected when EOT was generated) as the next addressing sequence to this 3271. Successful completion of a Specific Poll addressed to the responding device, a device selection addressed to any other device on the same 3271, or a General Poll addressed to the same 3271, is required to restart the internal 3271/device polling operation.

- 3275:** The 3275 is unable to perform the operation indicated in the command transmission because of (1) a BCC error, (2) a busy 3275 (including the attached 3284-3 Printer), or (3) a 3275-detected check condition (receipt of an illegal command/order sequence, failure to decode a valid command, an I/O interface "overrun", a parity/cursor check, or missing ETX). A Specific Poll to the 3275 retrieves the status existing at the time the EOT response was made.
- 4** 3271: If a transmission problem causes both a 3271-detected check condition and a BCC error, the BCC error takes precedence over all other check conditions, and a NAK is transmitted to the TCU.
- 5** 3271: BCC error or missing ETX has been detected. The NAK response requests the program to repeat its last transmission.

*Note:* The 3275 responds with EOT if it detects a BCC error or a missing ETX.

- 6** Response issued by the program to terminate the operation if the 3271 is unsuccessful in receiving a valid BCC following "n" attempts by the program to transmit the message.
- 7** If the Start Printer bit is set in the WCC or CCC, a WACK response indicates that the text transmission was successfully received (and, if 3271, that the 3271-to-device buffer transfer was successfully completed) but that the printer is now busy and an additional chained command cannot be accepted.

If any of the conditions cited in Note 3 prevail, the EOT response takes precedence over the WACK response.

- 8** Normal termination of the operation by the program.
- 9** Command execution has been successfully completed and, in the case of the 3271, the 3271-to-device buffer transfer is successfully completed.
- 10** Repeat the operation shown in this figure or in Figure 16 for the next command sequence.
- 11** Example of a Temporary Text Delay (TTD) sequence.
- 12** Example of terminating an operation using TTD (a forward abort sequence).

**LEGEND:**

(CC) = Chain Command (CC) Flag in CCW is set to 1.

(Interrupt) = TCU-generated interruption (CE = Channel End, DE = Device End, UE = Unit Exception, UC = Unit Check).

**1** = Number in parentheses refers to note.

**Figure 15. Write-Type and Control-Type Commands, Sequence/Response Diagram (Sheet 2 of 2)**

that block; upon receipt of the command, the 3271 retrieves the device buffer contents (these contents include any previous text blocks that were written successfully) before any write data is received.

The blocking of write data is of less value with a 3275 since the 3275 buffer is also the device buffer. Thus, if text-blocking is used and the 3275 fails to successfully receive the block, the buffer should be entirely written because orders within the unsuccessful data block may have affected data in any area of the buffer, possibly destroying the integrity of the buffer.

### Read-Type Command Sequences

**PROGRAMMING NOTE:** Read Buffer is used primarily for diagnostic purposes, and Poll (General and Specific) is normally used in place of Read Modified for remote read operations.

The program initiates a read operation (Figure 16) by first writing a command sequence to the selected 3270 CU and then reading the response. If the 3270 CU responds with text followed by ETB, and BCC comparison at the TCU is successful, the program should write ACK to retrieve the next text block. This should continue until an error is detected or until a text block is followed by ETX. After ETX is received, the program should write ACK to the 3270 CU and then read the EOT reply. The three types of Read Modified message responses are shown in Figure 13.

### Status and Sense (S/S) Bytes

All remote status and sense conditions are combined into two bytes. These two bytes are always sent in a status message. In EBCDIC code, the bits are transmitted as indicated in Table 18. If the sense bytes are transmitted in ASCII code, the EBCDIC code defined below is translated to ASCII before transmission.

Status and Sense conditions are recorded by the 3270 for each device. These conditions may include busy or ready status or detected errors. Table 19 shows how these Status and Sense conditions are interpreted for each error response transmitted by the 3270 in response to a poll sequence from the TCU.

### ERROR RECOVERY PROCEDURES

Errors detected at the 3270 system are indicated to the system processor by the following responses: RVI, NAK, EOT, or sense/status information. The meaning of the responses depends upon their sequences, as defined in Figures 12 through 16.

Table 20 lists the various error combinations of sense/status bits (with the exception of Device Busy (DB), which is not an error), and the recommended error recovery procedure for each combination. Although there are 256 possible combinations of status and sense bits, only a

portion of this total is normally used. Combinations other than those listed may occur. For example, an unpredictable catastrophic hardware failure could induce an undefined combination of status and sense bits. Errors that occur at the “from” device during a Copy command are identified by an Operation Check (OC) sense bit in addition to the sense bit representing the detected error.

The error recovery procedures recommended in Table 20 are as follows:

1. Execute a new address selection addressing sequence and retransmit the message, starting with the command sequence that was being executed when the error occurred. If, after two retries, the operation is not successful, this should be considered as a non-recoverable error. Follow supplementary procedure B after two retries.
2. Reconstruct the entire device buffer if possible, and retry the failing chain of commands (within the BSC sequence of operations). The sequence of commands used to reconstruct the buffer should start with an Erase/Write command. If the information in the screen buffer is such that it cannot, or need not, be reconstructed, the operation may still be retried. If, after three retries, the operation is not successful, this should be considered as a nonrecoverable error. Follow supplementary procedure A.

**PROGRAMMING NOTE:** A cursor check in the 3284 is indistinguishable from a data check that occurred in the 3271 or from a second selection to a 3277 with a cursor check. A selection addressing sequence or poll sequence to another device on the same control unit should be attempted before flagging the control unit as inoperative. A successful sequence indicates that the CU is probably okay, and the device requires manual intervention to reset it (e.g., a 3277 with a nonrecoverable data check). An unsuccessful sequence indicates that the CU may be at fault and requires manual intervention to reset it.

3. The error occurred during execution of a Copy command. Execute procedure 2, except that it is the buffer of the “from” device specified by the Copy command that should be reconstructed. After three retries, follow supplementary procedure B.
4. The error indicates that: the printer is out of paper, has its cover open, or has a disabled print mechanism; or that the device is unavailable. Request (or wait for) either the display or system operator to ready the device. Then retry the printout by issuing a Write command with the proper WCC and no data stream. (There is no data error, and the data is still intact in the device buffer and can be reused.) Or, follow procedure 2.
5. The error indicates that the “from” device specified by a Copy command is unavailable. Note that the device address associated with the error status and sense information does not indicate the device that actually

required “readying”. The device that requires the corrective action is the device specified by the “from” address in the Copy command. When this device is determined and made “ready”, follow procedure 1.

6. The operation should be tried up to six times. Continued failure implies an application programming problem, which can be detected by analyzing the failing write data stream.
7. The error occurred during a printout operation and indicates either a character-generator error or a disabled print mechanism. There is no data error. The proper error recovery procedure is application-dependent since the user may or may not want a new printout. If a new printout is required, follow procedure 4.
8. A data error occurred in the device buffer during a printout, and procedure 2 should be followed.
9. A Specific Poll detected that the addressed device is busy. Periodically issue a Specific Poll to pick up the Device End sense/status bit sent by the device when it becomes not ready (unless this status change is detected on a selection addressing sequence).
10. Indicates that a command was erroneously addressed to a busy device. Periodically issue a General or Specific Poll to pick up the Device End sense/status bit sent by the device when it becomes not busy. Then follow procedure 1.
11. Indicates that, in attempting to execute a Copy command, the “from” device was found to be busy. Follow procedure 1 when the “from” device becomes not busy. Note that the device address associated with the status and sense message is the address of the “to” device and not that of the busy “from” device. The “from” device will transmit Device End via a Specific or General Poll when it becomes not busy.
12. Indicates that the 3275 detected a BCC error during text transmission from the TCU. Follow procedure 2 if the failing command is a Write command with a data stream of more than one byte or if it is in a chain of commands and one of the previous commands in the chain is a Write command without an SBA order immediately following the WCC character. In all other cases, follow supplementary procedure D.  
If, after the recommended procedure has been tried six times, the problem is not corrected, follow supplementary procedure A.
13. An attempt was made to execute a Copy command, but access to the “from” device data was not authorized. The device address associated with the error sense/status bits is that of the Copy “to” device.

#### Supplementary Procedures

- A. Request maintenance for the device that is giving trouble. After repair, reconstruct the screen buffer image. The sequence of commands used to reconstruct this image should start with an Erase/Write command.

Retry the failing chain of commands according to the procedure that referred you to this supplementary procedure.

- B. The “from” device specified by the Copy command in the failing chain of commands (CCWs) is malfunctioning. The “from” device should be determined from the data-stream information, and maintenance should be requested for the device. After the repair, reconstruct the buffer image. The sequence of commands used to reconstruct this image should start with an Erase/Write command. Retry the failing chain of commands according to the procedure that referred you to this supplementary procedure.
- C. Same as procedure 1, except a new selection addressing sequence is not performed, and this message is transmitted as part of the present device selection.
- D. Same as procedure 1, except retransmit the entire failing chain of commands.

#### NAK to a Text Block

When the 3271 detects a BCC error at the end of a text transmission, it transmits a NAK. The following recovery action should be taken:

If the text is a Write command sequence chained from a previous Write or Erase/Write command and the failing Write command data stream contains more than one byte but does not contain an SBA Order sequence immediately following the WCC, then procedure 2 (above) should be executed.

In all other cases, supplementary procedure C (above) should be executed, except the number of retries should be six. If after these six retries the problem is not corrected, the program should issue an EOT and follow supplementary procedure A (above).

#### Notes:

1. When the 3275 detects a BCC error, it will set the Transmission Check (TC) sense/status bit and respond EOT.
2. An FF (hex) character in a data field will cause a BCC error.

#### EOT to a Text Block

The recommended recovery procedure depends upon the type of detected error. A Specific Poll must be issued immediately following the EOT to obtain the error sense/status information. (If the Dial feature is installed, a Specific Poll is not needed because the 3275 automatically bids for the line to present sense/status information.) Then the recovery procedures referenced in Table 20 should be executed.

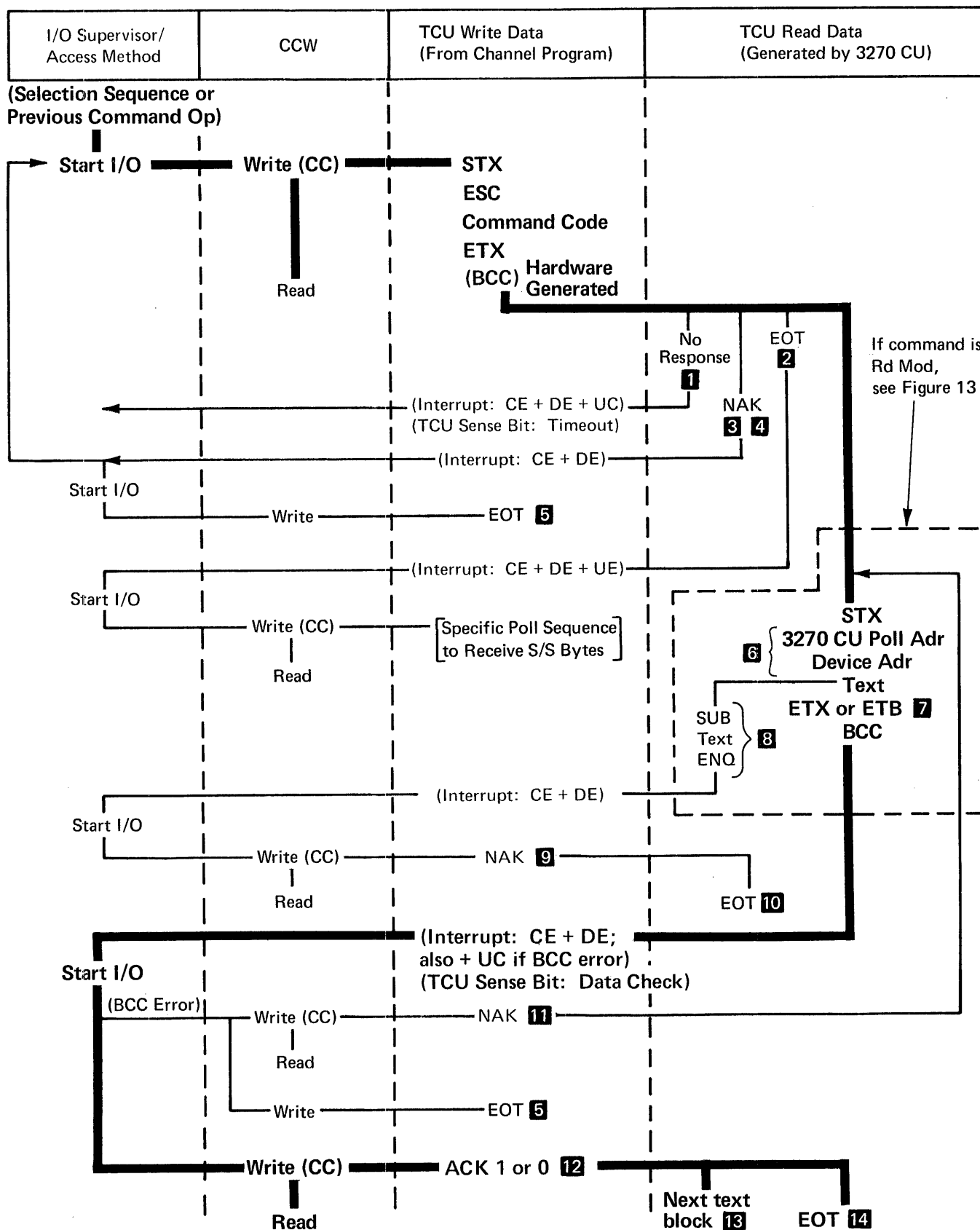


Figure 16. Read-Type Command, Sequence/Response Diagram (Sheet 1 of 2)



**Notes:**

- 1** Command transmission was not successfully received because of invalid framing (STX missing). Causes timeout at TCU.
- 2** 3271: The 3271 is unable to perform the operation indicated in the command transmission because of a busy/unavailable/not ready device or a 3271-detected check condition (receipt of an illegal command/order sequence, failure to decode a valid command, or an I/O interface "overrun"). The EOT response to a command transmission indicates that status information is stored in the 3271 and that internal 3271/device polling is stopped. To ensure retrieval of valid status, a Specific Poll must be issued to the device-responding EOT as the next addressing sequence issued to this 3271. Restarting of the internal 3271 polling operation requires the successful completion of a Specific Poll addressed to the responding device, a device selection addressed to any other device on the same 3271, or a General Poll addressed to the same 3271.  
  
3275: The 3275 is unable to perform the operation indicated in the command transmission because it (1) has detected a BCC error, (2) is busy (includes an attached 3284-3 Printer), (3) has detected a check condition (has received an illegal command/order sequence, has failed to decode a valid command, or has detected an I/O interface "overrun" or a missing ETX). A Specific Poll to the 3275 retrieves the status existing at the time the EOT response was made.
- 3** 3271: If a transmission problem causes both a 3271-detected check condition and a BCC error, the BCC error takes precedence over all other check conditions, and a NAK is transmitted to the TCU.
- 4** 3271: BCC error or missing ETX has been detected. The NAK response requests the program to repeat its last transmission.  
  
*Note:* The 3275 responds with EOT if it detects a BCC error or a missing ETX.
- 5** Response issued by the program to terminate the operation if the 3271 is unsuccessful in receiving a valid BCC following "n" attempts by the program to transmit the message.
- 6** This address sequence is included only in the first block of a blocked text message.
- 7** ETB is used to frame each block of a blocked text message, except for the last block. ETX is used to frame the last block of a blocked text message.
- 8** Upon detection of an internal parity check, the 3270 CU automatically substitutes the SUB character for the character in error. If a parity or cursor check is detected, ENQ is transmitted in place of ETX (or ETB) and BCC at the end of the text block and appropriate status and sense information is stored; also, internal 3271/device polling is stopped.
- 9** Mandatory program response to a text block terminated in ENQ.
- 10** Response to terminate the operation. The nature of the error (parity or cursor check) does not warrant a retry. This response indicates that appropriate status and sense information is stored and that internal 3271/device polling is stopped. The status retrieval information included in Note 2 applies.
- 11** BCC error has been detected. The program issues NAK to cause the 3270 CU to repeat its last transmission.
- 12** Positive acknowledgment. The text block has been successfully received by the TCU. The program issues ACK 1 in response to the first and all odd-numbered text blocks and issues ACK 0 in response to the second and all even-numbered text blocks. This response to a text block terminated in ETX turns on the device SYSTEM AVAILABLE indicator.
- 13** The second and all succeeding text blocks are framed as the first except that they do not include the 3270 CU/device address sequence.
- 14** Normal termination of the operation following transmission of the last text block.

**LEGEND:**

(CC) = Chain Command (CC) Flag in CCW is set to 1.

(Interrupt) = TCU-generated interrupt (CE = Channel End, DE = Device End, UE = Unit Exception, UC = Unit Check)

- 1** Reversed numbers refer to notes.

**Figure 16. Read-Type Command, Sequence/Response Diagram (Sheet 2 of 2)**

Table 18. Remote Status and Sense Byte Definition

Bit No.	Bit Definition
	S/S Byte 0:
0	Use bits 2 through 7 and Table 3 to determine translation.
1	Always a 1.
2	Reserved.
3	Reserved.
4	<p><b>Device Busy (DB)</b> - This bit indicates that the addressed device is busy executing an operation or that a busy detection was previously made by a command or Specific Poll. The device is busy when it is executing an Erase All Unprotected command or a print operation, accepting data from the Operator Identification Card Reader, or performing various keyboard operations (Erase Input, Backtab, and Clear).</p> <p>This bit is set with Operation Check when a Copy command is received which specifies a "busy" device with its "from" address.</p> <p>This bit is set with Unit Specify when a command is addressed to a busy device. This can occur by chaining a command to a Write, Erase/Write, or Copy command which started a Printer or by chaining a command to a Specific Poll addressed to a busy device.</p>
5	<b>Unit Specify (US)</b> - This bit is set if any S/S bit is set as a result of a device-detected error or if a command is addressed to a busy device.
6	<p><b>Device End (DE)</b> - This bit indicates that the addressed device has changed from unavailable to available and not ready to ready, or busy to not busy. This bit is included during a Specific or General Poll but is not considered pending status by a Selection Addressing sequence.</p> <p>If a Selection Addressing sequence detects that the addressed device has pending status and also detects one of the above status changes that warrants a Device End, then the Device End bit is set and preserved along with the other pending status, and an RVI response is made.</p>
7	<b>Transmission Check (TC)</b> - Not used by the 3271. This bit is set when the 3275 detects a BCC error on the TCU transmission.
	S/S Byte 1:
0	Use bits 2 through 7 and Table 3 to determine translation.
1	Always a 1.
2	<b>Command Reject (CR)</b> - This bit is set upon receipt of an invalid 3270 command (or Copy command if this feature is not installed).
3	<p><b>Intervention Required (IR)</b> - This bit is set if:</p> <ul style="list-style-type: none"> <li>• A Copy command contains a "from" address in its data stream which specifies an unavailable device.</li> <li>• A command attempted to start a printer but found it not ready. The printout is suppressed.</li> <li>• The 3271 receives a Selection Addressing sequence or a Specific Poll sequence for a device which is unavailable or which became not ready during a printout. A General Poll sequence does not respond to the unavailable/not ready indication and proceeds to determine the state of the next device.</li> <li>• The 3271 receives a command for a device which the 3271 has logged as unavailable or not ready.</li> </ul>
4	<b>Equipment Check (EC)</b> - This bit indicates a printer character generator or sync check error occurred, the printer became mechanically disabled, or 3271 detected bad parity from the device.
5	<b>Data Check (DC)</b> - This bit indicates the detection of a parity or Cursor check in either the 3271 or a device buffer or in the 3275 buffer, or 3271 detected bad parity from the device.
6	<b>Control Check (CC)</b> - This bit is not used by the 3275. For the 3271, this bit indicates a timeout check. A timeout check occurs when a device fails to respond to 3271 communications within a specified time period or when a device fails to complete an operation within a specified time period.
7	<p><b>Operation Check (OC)</b> - This bit, when set alone, indicates one of the following:</p> <ul style="list-style-type: none"> <li>• Receipt of an illegal buffer address or of an incomplete order sequence on a Write or Erase/Write command.</li> <li>• The device did not receive a CCC or a "from" address on a Copy command.</li> <li>• Receipt of an invalid command sequence. (ESC is not received in the second data character position of the sequence.)</li> <li>• An I/O Interface "overrun" is detected. This occurs during a command when a data byte (Character or Order) is presented to the device by the TCU before the operation required by the previous data byte has been completed.</li> </ul> <p>This bit is set with Control Check, Intervention Required, Data Check, Device Busy, or Data Check with Unit Specify to indicate that the errors that set these sense bits were detected while the 3271 was executing an operation with the "from" device during a Copy command. This bit is set with Unit Specify to indicate that the "from" address on a Copy command specified a device with a "locked" buffer (the device data is secure).</p>

Table 19. Remote Error Status and Sense Responses

Device Response	Command	S/S Explanation
RVI	Selection	<p>Outstanding Status - Pending information from a previous operation with the same device. (If the addressed device is busy, WACK is sent to the TCU instead of RVI, and no S/S bit is set.) <i>Note:</i> A Selection Addressing sequence does not recognize a Device End as pending status. If there is no other pending status, it resets this bit and proceeds with the selection. If the addressed device has other pending status, Device End remains set with it, and the RVI response is made as usual.</p> <p>CC - A timeout check is caused by the addressed device. The operation is tried twice before this bit is set.</p> <p>IR - The addressed device is unavailable.</p> <p>DC, EC (either or both) - The 3271 detects bad parity on data received from the addressed device.</p> <p>DE, EC, US - A character generator or sync check error has occurred, or the printer was mechanically disabled but the condition has been corrected.</p> <p>DE, IR - The addressed printer is out of paper, its power has been turned off, or its cover is open.</p> <p>DE, IR, EC, US - The addressed printer is mechanically disabled and cannot recover.</p> <p>DE, DC, US - A parity error is detected at the printer.</p> <p>DC, US - A parity check or cursor check is detected by the addressed device on the data it is sending to the control unit.</p>
EOT	Read Commands	<p>CR - Invalid or illegal 3270 command is received at the 3271 or 3275.</p> <p>OC - Invalid command sequence (ESC is not in the second data character position), or data follows the command in the data stream received at the device.</p> <p>DB, US - The addressed device is busy. The command was chained to a Write, Erase/Write, or Copy command which started a print, or it was chained to a Specific Poll.</p> <p>DB, US, DE - The addressed device becomes not busy before a Specific Poll is issued to retrieve the DB, US status.</p> <p>IR - A command is addressed to an unavailable device. (This is not applicable to the 3275.)</p> <p>DC - (1) A cursor check is detected at the 3271 before data transmission starts. The 3271 detects bad parity on data received from the addressed device. The operation is tried twice before this bit is set. No data is transmitted. (2) A parity check is detected by the 3271 before it is transferred to the TCU. A SUB character is substituted for the error character during transmission. When the transmission is completed, the 3271 sends ENQ to indicate an error. When the TCU responds NAK, the 3271 responds EOT. (3) A cursor check is detected by the 3271 during transmission to the TCU. When the transmission is completed, the 3271 sends ENQ to indicate an error. When the TCU responds NAK, the 3271 responds EOT.</p> <p>DC, US - A parity check or cursor check is detected by the addressed device on the data it is sending to the control unit.</p> <p>TC - A BCC error is detected at the 3275.</p>
EOT	Write Commands	<p>CR - An invalid or illegal 3270 command is received.</p> <p>OC - An invalid command sequence (ESC is not in the second data position), an illegal buffer address or an incomplete order sequence is received, or a data byte was sent to the device during the Write command before the operation required by the previous data byte was completed.</p> <p>TC - A BCC error is detected at the 3275.</p> <p>DC - The 3271 detects a parity or cursor check on its buffer during command operation. The 3271 detects bad parity on data received from the addressed device. The operation is tried twice before this bit is set.</p> <p>DC, US - The device detects a parity or cursor check on its buffer during the command operation.</p> <p>CC - The device fails to complete an operation or respond to the 3271 in a certain time (timeout check).</p> <p>DB, US - The addressed device is busy. The message is accepted but not stored in the 3271 or 3275 buffer. The command is aborted.</p> <p>DE, DB, US - The addressed device becomes not busy before a specific poll is issued to retrieve the DB, US status (described above).</p>
EOT	Copy Command	<p>CC, OC - The "from" device fails to complete an operation or respond to the 3271 in a certain time (timeout check).</p>

Table 19. Remote Error Status and Sense Responses (Cont)

Device Response	Command	S/S Explanation
EOT	Copy Command	<p>DB, OC - The "from" device is busy. (The device is busy executing an operation, a printout, reading data from the Operator Identification Card Reader, or performing a keyboard operation.) The Copy command is aborted.</p> <p>IR, OC - The device is not available.</p> <p>OC, US - The device has a locked buffer.</p> <p>OC - The data stream contains other than two bytes (the CCC and the "from" address). The command is aborted.</p> <p>DC, OC - The 3271 detects a parity check on the data transferred from the "from" device.</p> <p>DC, OC, US - Set when "from" device detects an internal parity or cursor check.</p> <p>DB, US - The addressed "to" device is busy.</p> <p>DB, US, OC - The addressed "to" device is also specified as the "from" device and is busy.</p> <p>DB, US, OC, DE - The addressed device becomes not busy before a specific poll is issued to retrieve the DB, US, OC status (described above).</p>
EOT	Write, Erase/Write, Copy Commands	<p>IR - Addressed device is not available, or addressed printer is not ready.</p> <p>IR, EC, US - A command attempted to start a print operation, but the printer CARRIAGE MOTOR POWER switch (a CE service switch) is turned off.</p>
EOT	Erase All Unprotected Command  Specific and General Poll	<p>OC - One or more data bytes followed the command (buffer overrun).</p> <p>DE, IR, EC, US - An unrecoverable mechanical failure is detected at the printer.</p> <p>DE, EC, US - A character generator or sync check error or a mechanical failure is detected at the printer but then recovered from.</p> <p>DC, US - A parity check or cursor check is detected by the addressed device on the data it is sending to the control unit.</p> <p>DC - (1) A parity error is detected by the 3271 on data to be transferred to the TCU. A SUB character is substituted for the error character during transmission. The transmission is completed, and ENQ is sent by the 3271. When the TCU responds NAK, the 3271 responds EOT. (2) A cursor check is detected at the 3271 before data transmission starts. (No data is transmitted.) (3) A cursor check is detected by the 3271 during transmission to the TCU. The transmission is completed, and the 3271 sends ENQ. When the TCU responds NAK, the 3271 responds EOT.</p> <p>DC, EC (either or both) - The 3271 detects a parity check on data received from the device.</p> <p>DE - The poll finds a device (1), previously recorded as busy, now not busy or, (2), previously recorded as unavailable or not ready, now available and ready. (The 3271 record is updated.) <i>Note:</i> When 3271 power is turned on, the DE bit is set for every available and ready device that is attached.</p> <p>IR, DE - The poll finds a device, previously recorded as ready, available, and busy, now not ready and not busy, or the printer went not ready during a printout. (The 3271 record is updated.)</p> <p>DC, US, DE - A parity error is detected at printer.</p> <p>CC (Specific Poll only) - The poll finds a device, previously recorded as unavailable, still unavailable (timeout check).</p> <p>DC, DE - 3275 (only) detects an internal parity or cursor check on its buffer when the printer goes "Not Busy".</p> <p>IR, EC, DE (3275 only) - The printer CARRIAGE MOTOR POWER switch (a CE service switch) is turned off, or a mechanical "hang" condition is detected.</p> <p>EC, DE (3275 only) - Character generator readout error.</p>
	Specific Poll	<p>CC - The poll finds a device, previously recorded as available and ready, now unavailable (timeout check). (The 3271 record is updated.)</p> <p>DB - The addressed device is busy.</p>
NAK	Read and Write Commands	<p>NAK is transmitted by the 3271 when it detects a Block Control Character (BCC) error on the TCU transmission. A BCC error has priority over all other detectable error conditions. If, for example, a BCC error and a parity error are detected during the same command transmission, the parity error condition is reset, and a NAK response is set by the 3271.</p>

Table 20. Remote Status and Sense Conditions

Sense/ Status Bits	Detected during 3270 Operation						Transmitted in Response to:		Error Recovery Procedure	
	Hex		Selection Addressing Sequence	Specific Poll Sequence	General Poll Sequence	A 3270 Command	Specific Poll	General Poll	3271	3275
	EBCDIC	ASCII								
CR	40 60	20 2D				D, P	D, P		6	6
OC	40 C1	20 41				D, P	D, P		6	6
OC, US	C4 C1	44 41				D, P	D, P		13	NA
CC	40 C2	20 42	D, P	D, P		D, P	D, P		1	NA
CC, OC	40 C3	20 43				D, P	D, P		1	NA
IR	40 50	20 26	D, P	D, P		D, P	D, P		4	4
IR, OC	40 D1	20 4A				D, P	D, P		5	NA
DC	40 C4	20 44	D, P	D, P	D, P	D, P	D, P	D, P	1, 2	2
EC	40 C8	20 48	D, P	D, P	D, P	D, P	D, P	D, P	1, 2†	2
DC, EC	40 4C	20 3C	D, P	D, P	D, P	D, P	D, P	D, P	1, 2†	2
DC, OC	40 C5	20 45				D, P	D, P		1	NA
DC, US	C4 C4	44 44	D, P	D, P	D, P	D, P	D, P	D, P	2	NA
DC, OC, US	C4 C5	44 45				D, P	D, P		3	NA
DC, DE	C2 C4	42 44		P	P			P	NA	8
DC, US, DE	C6 C4	46 44		P	P			P	8	NA
IR, DE	C2 50	42 26		P	P			P	4	4
IR, EC, DE	C2 D8	42 51		P	P			P	NA	7
EC, DE	C2 C8	42 48		P	P			P	NA	7
EC, US, DE	C6 C8	46 48		P	P			P	7	NA
IR, EC, US, DE	C6 D8	46 51		P	P			P	7	NA
DB	C8 40	48 20	D, P	D, P			D, P		9	9
DB, DE**	4A 40	54 20					D		9	NA
DB, US*	4C 40	3C 20				D, P	D, P		10	10
DB, US, DE	4E 40	2B 20				D, P	D, P		1	1
OC, DB*	C8 C1	48 41				D, P	D, P		11	NA
TC	C1 40	41 20				D	D		NA	12
TC, OC	C1 C1	41 41				D	D		NA	12
TC, CR	C1 60	41 2D				D	D		NA	12
TC, DC	C1 C4	41 44				D	D		NA	12
DE	C2 40	42 20		D, P	D, P		D, P	D, P	None	None
IR, EC, US	C4 D8	44 51				P	P		7	NA

*Note:* The 3271-attached device errors that are detected asynchronously do not cause a 3271 Sense bit to set until the device is polled for status during a Selection Addressing, Specific Poll, or General Poll sequence. Those error S/S bit combinations that contain DE were detected during a printout.

\*The DB, US, and OC S/S bits will be combined if a Copy command is addressed to a busy "to" device and the command also specifies the "from" device the same as the "to" device.

\*\*The DB and DE S/S bits can occur together in response to a Specific Poll to a formatted 3277 if the operator has performed Backtab or Erase Input operations in rapid succession. Ignore Device End and treat as Device Busy only.

†Perform error recovery procedure 1 if the error occurred during a Read operation. Perform error recovery 2 if the error occurred during a Write operation.

#### Legend

NA - Not Applicable  
D - Display (3277 or 3275)  
P - Printer

### **Errors Detected during a Specific or General Poll Sequence**

Any errors that result from execution of the Poll sequence itself are contained in Table 20, and those recovery procedures apply. The detected error bits are transmitted to the TCU in a Status Message during the Poll sequence.

### **RVI to Selection Addressing Sequence**

A Specific Poll must be issued immediately following the RVI to a selection addressing sequence to obtain the error sense/status information. Then the recovery procedures defined in Table 20 should be followed.

### **POINT-TO-POINT (SWITCHED LINE) DATA LINK CONTROL**

A 3275 with the Dial feature operates on a point-to-point, switched communications line. Data exchange takes place between a 3275 and a TCU, but not between 3275's.

#### **Terminal Identification**

Four terminal ID characters (4 bytes) are wired into each 3275 with the Dial feature. Only graphic characters can be assigned. The first character for 3270 devices is always f (for EBCDIC units) or F (for ASCII units). The remaining three characters can be assigned by IBM or by the customer at the customer's location. The non-IBM-assigned terminal ID characters consist of numbers and uppercase letters only. IBM-assigned terminal ID characters consist of lowercase letters and special graphics.

#### **Contention Line Discipline**

##### *Bid Sequence*

In switched line operation, the stations are normally disconnected. When the TCU is dialed from a 3275 or a 3275 is dialed by the TCU and a connection is successfully made (with both stations in data mode), the data link is in point-to-point contention. Once a connection is made, either station can bid to become the control station by sending a terminal identification sequence. Normally the control station would be the station that initiated the connection. The initial 3275 bid sequence is made up of the four terminal ID characters, followed by the character ENQ. Subsequent bids by the 3275 transmit only the ENQ character. The TCU bids for the line by sending the computer ID-ENQ sequence only during the first transmission and ENQ on the following bids. The bid sequence is used to maintain line discipline.

*Note:* In the switched line environment, the 3275 does not operate in Transparent Monitor mode.

### **3275-Initiated Call**

The telephone number of the desired computer system is dialed by the 3275 operator. Upon recognition of the answer tone from the called station, the modem (or line adapter) is automatically or manually switched into data mode. The 3275 operator then depresses an attention ID (AID) key, usually ENTER, which causes the following actions:

1. Disables the keyboard (except for the RESET key).
2. Turns on the INPUT INHIBITED indicator.
3. Initiates a bid for the line which, when successful, transfers a text message. The form of the message depends upon the key depressed (see Table 6).

The SYSTEM AVAILABLE indicator coming back on indicated to the operator that the 3275's message has been successfully transmitted. The operator can then depress the RESET key, enabling the keyboard for transmitting another message, or disconnect, as desired. The keyboard can also be enabled by the computer responding with a Write, Erase Write, or EAU command and the appropriate WCC.

### **Computer-Initiated Call**

A 3275 with the Dial feature can be called from the computer. If an external modem, wired for auto answer, or the IBM Line Adapter with the Auto Answer feature is used, the 3275 can answer a call unattended. This is of use when the 3275 is unattended and a printer is attached.

An external modem or the IBM Line Adapter with Auto Answer will, upon recognizing the ringing signal, initiate off hook, send an answer tone to the TCU, and automatically switch into data mode. The computer then begins transmission by sending a bid sequence.

In manual operation, the 3275 operator recognizes the ringing signal, lifts the telephone receiver (goes off hook), and activates the exclusion key on the hand set.

In all cases, data mode is indicated to the 3275 operator. In the manual case, data mode is implied by the hand set being out of the cradle. In the automatic case, an OFF HOOK indicator on the 3275 implies data mode.

### **Disconnection**

Disconnection is the process of terminating a call. During this action, both stations should perform the disconnection. If only one station disconnects, the other station can stay connected and appear busy to incoming calls.

*Manual Disconnection.* To manually disconnect a 3275, the operator must:

1. Raise and release the DISCONNECT switch on the 3275. This causes the 3275 to send the disconnect sequence

line control characters, namely, DLE EOT. If the 3275 has an external modem wired for auto answer or an IBM Line Adapter with Auto Answer, the connection is automatically terminated.

2. On a 3275 without Auto Answer, the 3275 operator must replace the hand set on hook to achieve disconnection at the 3275. Replacing the hand set restores the exclusion key to the talk position and disconnects the call. The hand set should only be cradled following activation of the DISCONNECT switch, as confirmed by the SYSTEM READY indicator turning off.

**Automatic Disconnection.** There are two ways to automatically disconnect. Both ways require Auto Answer, either in an external modem or as part of the IBM Line Adapter, and are as follows:

1. By receipt of the disconnect sequence line control characters, DLE EOT.
2. By a 20-second timeout which is enabled when a ring signal is received by the 3275 from the CPU. The 20-second timeout is initiated each time a station transmits a valid header, text, response, or control transmission. It is reset each time a station receives two SYN characters from the line. Failing to reset the timer within 20 seconds causes the disconnect sequence of DLE EOT to be transmitted and causes the telephone to be hung up.

#### **Data Line Control Characters**

The use of some line control characters in the 3275 with the Dial feature differs from the use of those in the basic 3275, as follows.

##### **ACK 0 and ACK 1 (Positive Acknowledgment)**

When the 3275 responds to an initial bid for the line, ACK 0 is preceded with the terminal ID. When an initial bid has been successfully completed, subsequent bids use only ACK 0.

The use of ACK 0 and ACK 1 to positively acknowledge data blocks is the same as the basic 3275.

##### **NAK (Negative Acknowledgment)**

When the 3275 is called by the computer but has pending status other than printer busy, the 3275 responds to the initial bid for the line with the terminal ID preceding NAK. NAK alone precedes all further bids for the line when status is pending. NAK is transmitted by the 3270 CU in response to a text transmission that contains a TTD sequence (STX ENQ). When the NAK is received by the 3275 in response to a text transmission, the 3275 retransmits the last block of text.

##### **ENQ (Enquiry)**

This character is transmitted by either station to bid for the line any time after it has transmitted or received EOT.

However, ENQ is preceded by the terminal ID when the 3275 is making an initial bid for the line, and the last character of a text message in which data check was detected by the 3275.

When the 3275 receives ENQ in response to a transmission, the last 3275 transmission to the TCU is repeated. The 3275 responds with NAK when ENQ is received (1) as the last character of a TCU-aborted text transmission, (2) embedded in text, or (3) as part of a TTD sequence (STX ENQ).

##### **RVI (Reverse Interrupt)**

Upon receipt of the RVI character, the 3275 with the Dial feature completes its buffer transfer before sending EOT.

##### **EOT (End of Transmission)**

EOT is transmitted by the master station (usually the caller) to indicate end of transmission. Either station is free to bid for the line following the EOT character.

When used as a response to a text block, EOT indicates that status is pending.

##### **DLE EOT (Disconnect)**

The DLE EOT is the disconnect signal. Any 3275 with the Dial feature can transmit DLE-EOT (initiated by activating the DISCONNECT switch). However, only units that are equipped with Auto Answer have the ability to disconnect automatically.

#### **OPERATIONAL SEQUENCES (SWITCHED LINE)**

The following paragraphs describe the various data and control sequences that are unique to the 3275 with Dial feature operating on a switched line. Because operation is initiated differently from that of the basic 3275 operating on a leased line, neither Selection nor Polling applies to point-to-point contention operation. 3270 commands can be chained as described under "Remote Chaining of 3270 Commands".

##### **3275-Initiated Sequences**

The 3275 with the Dial feature does not need a read-type command, including a Poll, to start transmission of text entered into the buffer or a status message. Normally, a 3275 operator who intends to transmit a text message to the computer enters this message by keyboard into the buffer. After correction of keying errors, the computer is dialed. After the connection has been made, the operator depresses an attention key (Table 6). This causes the 3275 to bid for the line by sending its four assigned terminal ID characters and ENQ.

Receiving a positive acknowledgment ends the identification phase and allows the 3275 to enter the data exchange phase. In the latter phase, assuming no status is pending,

the 3275 transmits a text message that is identical with messages generated by the Read Modified operation in the basic 3275 (see Figure 17). If status is pending, the 3275 transmits a status message (see Figure 20).

#### **TCU-Initiated Sequences**

The 3275 with the Dial feature can be called by the computer. The computer bids for the line with a computer ID-ENQ sequence or by sending ENQ only. (The computer ID of up to 15 characters is not decoded by the 3275.) When the 3275 responds with an ACK 0 or NAK to the initial line bid, the response character is prefaced by the four terminal ID characters. The program can then continue, as appropriate. Refer to Figure 18.

#### **Maintained Connection Sequences**

Once either station has signalled EOT, either station can bid for the line with ENQ without further use of a computer ID

or terminal ID. The response to the bid need not be preceded by the ID either. See Figure 19 for an example.

#### **Device Busy and Device End**

It is possible for a TCU line bid to find the terminal busy because of a printer, keyboard, or operator identification card reader operation. To an initial bid for the line, the busy 3275 responds WACK. The TCU might then either respond with a disconnection sequence DLE EOT or enter an ENQ/WACK loop, waiting for the busy-causing operation to end as indicated by a terminal ID-ACK response.

To a TCU line bid during a maintained connection, the busy 3275 also sends WACK. In this case, the program has a third choice of responding with just EOT. With EOT, the 3275 will bid for the line and send the device end status when the busy-causing operation ends.



**Intentionally Left Blank**

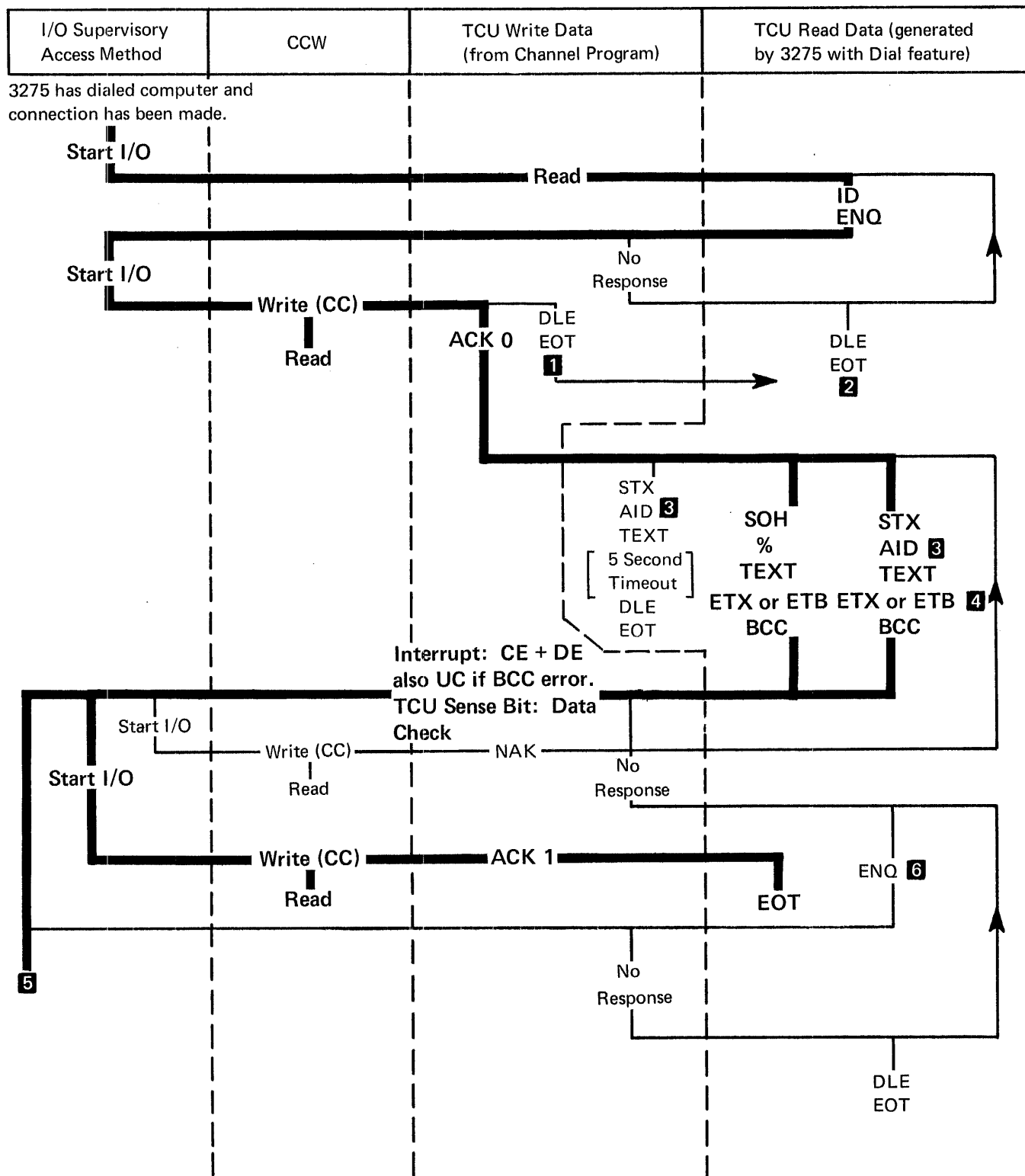


Figure 17. 3275-Initiated Transmission, Sequence/Response Diagram (Sheet 1 of 2)

**Notes:**

- 1** Upon correct reception of an invalid terminal ID, the computer disconnects. The TCU may optionally send DLE EOT before disconnecting. This is defined in the BSC rules as an "unusual termination".
- 2** The 3275 retries three times. When the number of retries is exhausted, the 3275 sends DLE EOT.
- 3** AID indicates which situation caused attention.
- 4** ETB is used to frame each block of a blocked text message, except the last block. ETX is used to frame the last block of a blocked text message.
- 5** The remainder of this sequence/response diagram is the same as that for a General or Specific Poll, as shown in Figure 12.
- 6** The 3275 as the master station solicits a response by sending ENQ. After the number of retries is exhausted, the 3275 acts as described in note 2.

**LEGEND:**

- 1** Reversed numbers refer to notes.

**Figure 17. 3275-Initiated Transmission, Sequence/Response Diagram (Sheet 2 of 2)**

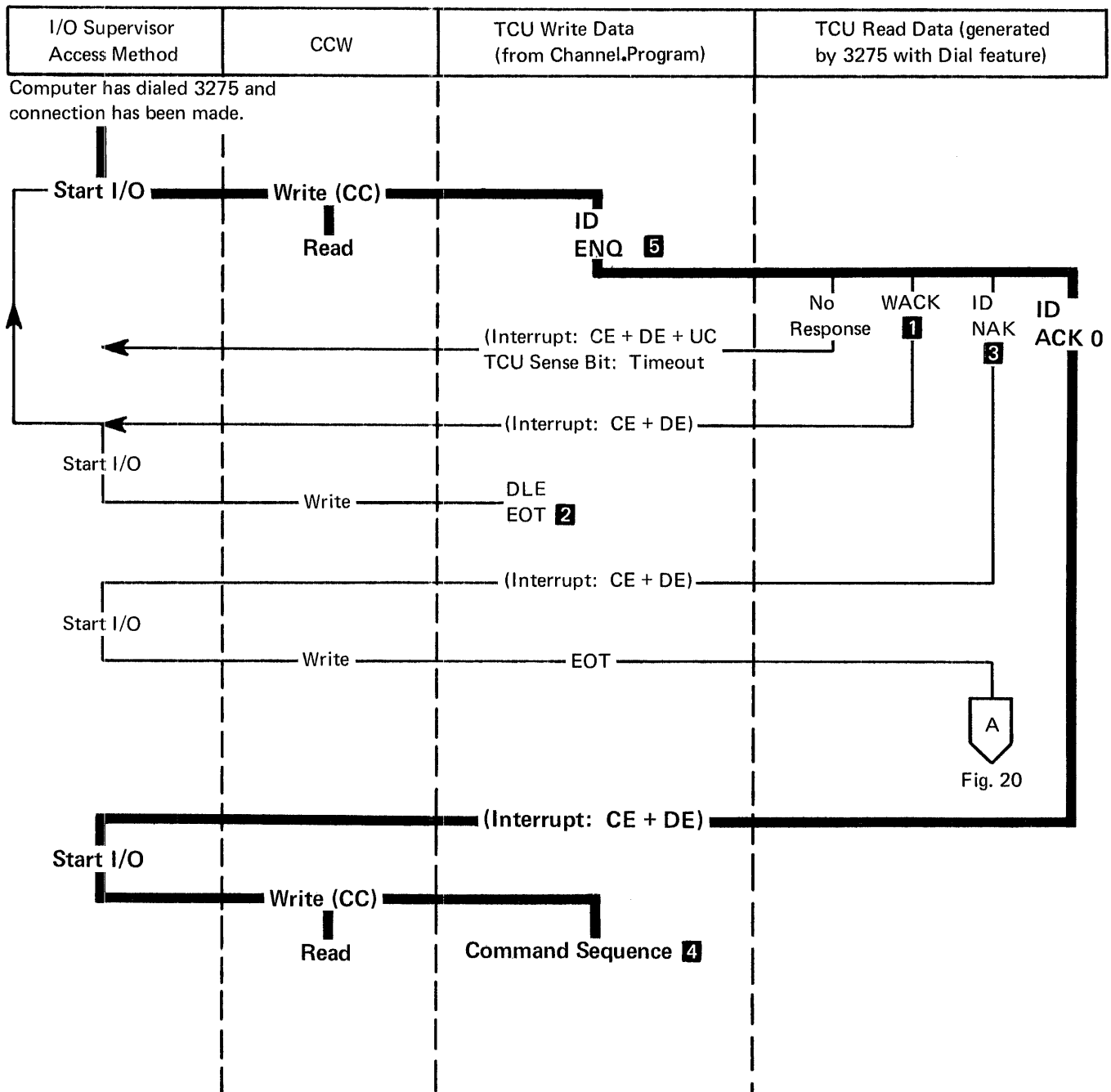


Figure 18. TCU-Initiated Transmission, Sequence/Response Diagram (Sheet 1 of 2)

*Notes:*

- 1** The 3275 is not ready to receive due to a printer, keyboard, or card reader operation.
- 2** The TCU should transmit DLE EOT before disconnecting. The 3275 with the Auto Answer feature will recognize DLE EOT and automatically disconnect.
- 3** The 3275 has status pending other than a busy printer and is not ready to receive. The 3275 monitors for EOT and prepares transmission of a status message.
- 4** Refer to Figure 15 or 16 for the desired command sequence.
- 5** Not decoded or used by the 3275.

LEGEND:

- 1** Reversed numbers refer to notes.

Figure 18. TCU-Initiated Transmission, Sequence/Response Diagram (Sheet 2 of 2)

**Figure 19. Example of Maintained Connection, Sequence/Response Diagram (Sheet 1 of 2)**

**Notes:**

- 1** Positive acknowledgment, when the printer bit has been set in the Write Control Word (WCC) included with the Write command issued to a 3275 with attached printer. The printer is now busy.
- 2** The 3275 as the master station solicits a response by sending ENQ. After three retries, the 3275 that is equipped with the Auto Answer feature sends DLE EOT and disconnects automatically. The 3275 that is not so equipped sends DLE EOT. The operator should then manually disconnect.
- 3** The 3275 aborts because it is unable to receive or to execute the command. This condition causes status to be set and the transmission of a status message to be prepared. This situation could have been caused as the result of a command in a chain following a start-print operation or as the result of a BCC error.
- 4** The connection is still maintained. The 3275 has prepared another text message and bids for the line.
- 5** Here, it is assumed that the 3275 cannot complete transmission because of a malfunction other than an internal parity check. A 5-second transmission timeout becomes effective, the uncompleted text transmission is terminated by DLE EOT, and, with Auto Answer installed, the telephone is automatically hung up.
- 6** Here, it is assumed that an internal parity error has been detected and the SUB character has been substituted for the character in error. The text block is terminated by ENQ. The mandatory response is NAK. In this situation, the 3275 is preparing for the transmission of a status message.

**LEGEND:**

- 1** Reversed numbers refer to notes.

**Figure 19. Example of Maintained Connection, Sequence/Response Diagram (Sheet 2 of 2)**

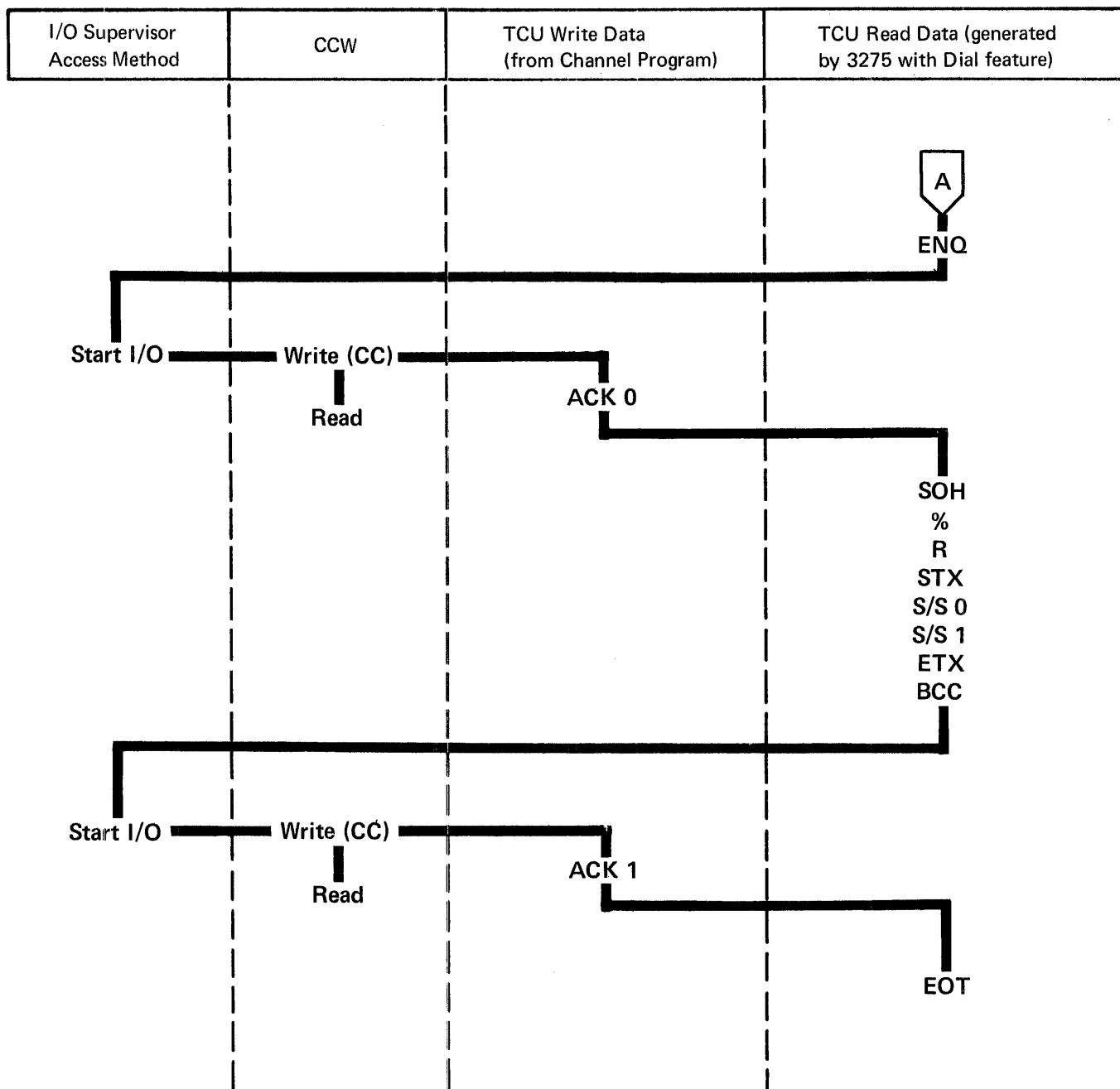


Figure 20. Status Message Transmission with Dial Feature, Sequence Response Diagram



## INTRODUCTION

The 3271 Control Unit Models 11 and 12 and the 3275 Display Station Models 11 and 12 use Synchronous Data Link Control (SDLC) mode of operation and communicate, as terminal modes, with the program via an IBM 3704 or 3705 Communication Controller and appropriate modems. The type of modems available are described in the first section of this publication.

*Note:* In the following paragraphs, the term “3270 CU” is used in statements that apply to both a 3271 and 3275. If a statement applies to only one 3270 unit, the appropriate unit number is used.

The 3270 CU that uses SDLC procedures provides half-duplex transmission over duplex or half-duplex facilities (non-switched or privately owned). These communications use the Multipoint Data Link Mode of operation only.

When employing SDLC line discipline, the 3270 CU operates in EBCDIC (External Binary-Coded-Decimal Interchange Code) or ASCII (American National Standard Code for Information Interchange).

## RELATED PUBLICATIONS

Synchronous Data Link Control (SDLC), the line discipline for management of information transfer between the 3704 or 3705 communications controller and the 3270 CU, is one of several logical elements which comprise the total communication system network. The remainder of the communication system network consists of the 3704 or 3705 and the host System/370. The operation of the total communication system network is governed by an overall group of procedures and protocols, referred to as Systems Network Architecture (SNA).

This chapter makes use of SDLC terms and a limited number of SNA terms. Only a few SDLC terms are defined herein. Readers who are unfamiliar with SDLC concepts and terminology should review the *IBM Synchronous Data Link Control General Information* manual, Form No. GA27-3093. Readers who require an understanding of SNA should refer to the *IBM Systems Network Architecture General Information* manual, Form No. GA27-3102. A functional description of the 3704 and 3705 units is contained in the *Introduction to the IBM 3704 and 3705 Communications Controller*, Form No. GA27-3051.

A description of VTAM support and related VTAM publications is contained in *Virtual Storage Supplement*, GC20-0001, for IBM System/360 and System/370 Bibliography, GA22-6822.

## MULTIPOINT (NON-SWITCHED LINE) DATA LINK CONTROL

Each 3270 CU can operate on a nonswitched communications line with multiple stations. Time sharing of the line is accomplished by interleaving transmissions between the 3704 or 3705 and all units on the line. A 3271 model 11 or 12, or 3275 model 11 or 12 operate multidropped on the same line with properly featured units, such as other 3270 units employing SDLC, IBM 3601 Finance Communication Controllers, and IBM 3791 Controllers.

The 3704 or 3705 is called the primary station of the multipoint network and controls operation of the communications link. All units attached by communications line to the 3704 or 3705 are called secondary stations. The primary station is the focal point of the network and maintains, under program control, an orderly flow of network traffic by initiating all data transfers. The primary station is either the transmitter or receiver of every communication. Secondary stations receive primary station controls and information and, as a result, initiate transmissions (responses and information) depending upon the specific command.

## SDLC TRANSMISSION BLOCKS

SDLC transmission blocks are called frames. Frames, as defined for 3270 application, consist of a series of eight-bit, binary-coded bytes which contain data and control information transmitted between the 3704 or 3705 communications controller and the 3270 CU. Frames are subdivided into the following types of information which is transmitted in the sequence listed.

- Flag (F) Sequence — 1 byte
- Control Unit Address (A) — 1 byte
- Control (C) Field — 1 byte
- Information (I) Field — up to 256 bytes of message data preceded by header information
- Frame Check Sequence (FCS) — 2 bytes
- Flag (F) Sequence — 1 byte

An information field is required within the frame only when message data is to be transmitted. The descriptions of the components of the SDLC frame, as given in *IBM Synchronous Data Link Control General Information*, Form No. GA27-3093, are applicable to the 3270 system, with the following qualifications:

1. The 3270 system makes use of the receive ready (RR) and receive not ready (RNR) supervisory commands and responses only. RR and RNR responses are always sent by the 3270 CU with the final bit set to 1.

The C-field byte formats for RR and RNR are as follows:

RR	<table><tr><td>N<sub>r</sub></td><td>P/F</td><td>0 0</td><td>0 1</td></tr><tr><td>012</td><td>3</td><td>4 5</td><td>6 7</td></tr></table>	N <sub>r</sub>	P/F	0 0	0 1	012	3	4 5	6 7
N <sub>r</sub>	P/F	0 0	0 1						
012	3	4 5	6 7						
RNR	<table><tr><td>N<sub>r</sub></td><td>P/F</td><td>0 1</td><td>0 1</td></tr><tr><td>012</td><td>3</td><td>4 5</td><td>6 7</td></tr></table>	N <sub>r</sub>	P/F	0 1	0 1	012	3	4 5	6 7
N <sub>r</sub>	P/F	0 1	0 1						
012	3	4 5	6 7						

2. The non-sequenced commands and responses that are employed by the 3270 system are limited to the following:

<u>Command/Response</u>	<u>C-Field</u>	<u>Hex Code</u>								
Set Normal Response Mode (SNRM) command	<table><tr><td>1</td><td>0</td><td>0</td><td>P</td><td>0</td><td>0</td><td>1</td><td>1</td></tr></table> 0 1 2 3 4 5 6 7	1	0	0	P	0	0	1	1	93
1	0	0	P	0	0	1	1			
Disconnect (DISC) command	<table><tr><td>0</td><td>1</td><td>0</td><td>P</td><td>0</td><td>0</td><td>1</td><td>1</td></tr></table> 0 1 2 3 4 5 6 7	0	1	0	P	0	0	1	1	53
0	1	0	P	0	0	1	1			
Nonsequenced Acknowledgement (NSA) response	<table><tr><td>0</td><td>1</td><td>1</td><td>F</td><td>0</td><td>0</td><td>1</td><td>1</td></tr></table> 0 1 2 3 4 5 6 7	0	1	1	F	0	0	1	1	73
0	1	1	F	0	0	1	1			
Request Online (ROL) response	<table><tr><td>0</td><td>0</td><td>0</td><td>F</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> 0 1 2 3 4 5 6 7	0	0	0	F	1	1	1	1	1F
0	0	0	F	1	1	1	1			
Command Reject (CMDR) response	<table><tr><td>1</td><td>0</td><td>0</td><td>F</td><td>0</td><td>1</td><td>1</td><td>1</td></tr></table> 0 1 2 3 4 5 6 7	1	0	0	F	0	1	1	1	97
1	0	0	F	0	1	1	1			
Link Test	<table><tr><td>1</td><td>1</td><td>1</td><td>P/F</td><td>0</td><td>0</td><td>1</td><td>1</td></tr></table> 0 1 2 3 4 5 6 7	1	1	1	P/F	0	0	1	1	F3
1	1	1	P/F	0	0	1	1			

\* Described in the *IBM Synchronous Data Link Control, General Information* manual, Form No. GA27-3093.

\*\* Described in this section.

## Link Test Command/Response

The Link Test command/response is a basic test of the data link between the controller and the 3270 CU. When the controller sends the Link Test command, the 3270 CU checks that the FCS field is valid and that the C-field poll bit is set to 1. Data may be sent to the 3270 CU that is included in the non-sequenced frame. If the command is received correctly, the 3270 CU sends the Link Test response to the controller. Data is not sent by the 3270 CU.

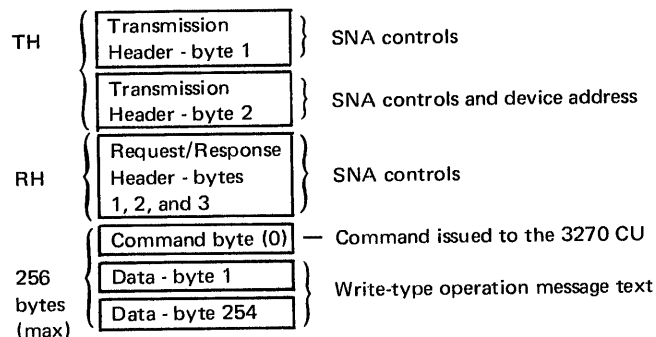
### Information (I) Field

An information (I) field is required when message text is transmitted in either direction between the controller and the 3270 CU. The C-field format which indicates that an I field is being sent is:

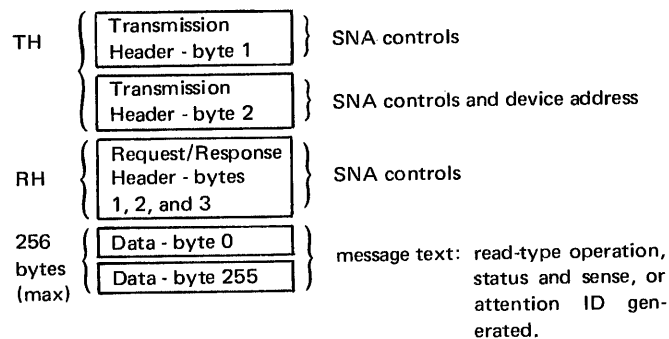
N <sub>r</sub>	P/F	N <sub>s</sub>	0
012	3	456	7

The I field is transmitted as a series of 8-bit bytes in the following format:

#### I field sent from the controller to the 3270 CU

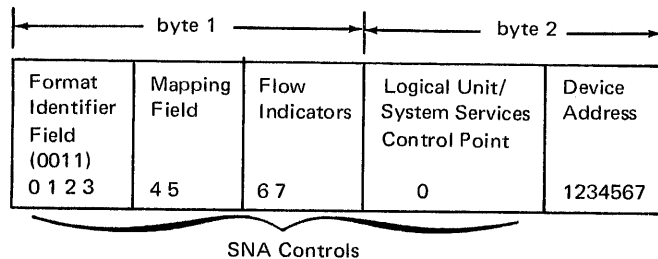


#### I field sent from the 3270 CU to the controller



### Transmission Header (TH)

A transmission header is always included in an I field. The two bytes of the transmission header contain four SNA fields in the following format:



The SNA controls are employed by higher level network management and may be modified by the application program. A description of these controls, as implemented by the 3270 system, is provided in this section.

Byte 1, bits 0, 1, 2, and 3 comprise the format identifier (FID) field. The configuration of FID bits defines the number of transmission headers (TH) and request/response (RH) headers that are required. The 3270 CU does not check these bits when they are received from the controller. When a TH is sent by the 3270 CU, FID 3 (0011) is used.

Bits 4 and 5 of byte 1 are the mapping field, which records the text blocking format that is used when read or write type operations are performed. Text blocks contain a maximum of 256 bytes. Bit assignments for the mapping field are as follows:

#### bits 4 and 5:

- 11 — indicates a complete basic information unit (BIU); i.e., the I field associated with the TH is a complete unit.
- 10 — indicates that the I field associated with the TH is the first I field in the BIU.
- 01 — indicates that the I field associated with the TH is the last I field in the BIU.
- 00 — indicates that the I field associated with the TH is an intermediate I field within the BIU.

Bits 6 and 7 of byte 1 are flow indicator bits. Bit 6 is the primary to secondary indicator (PSI), and is not checked by the 3270 CU when it is received from the controller. Bit 6 is sent as a 1 when the 3270 CU sends a response, and is sent as a 0 when the 3270 CU sends a request. Bit 6 is set in conjunction with the request/response (RR) bit in the request/response header (described in the paragraph titled "Request/Response Header (RH)").

Bit 7 is the expedited flow indicator (EFI), and is not checked by the 3270 CU when it is received from the controller. The 3270 CU sends the EFI as 0 in all cases except when sending a clear response, in which case the EFI is sent as 1. The clear command and response are described in the paragraph titled "Control Functions".

Byte 2, bit 0, is the logical unit/system services control point (LU/SSCP). The 3270 CU stores this bit when it is received from the controller. When sending a response to the controller in reply to a request, the 3270 CU returns this bit as it was received. When an attention AID is generated, except when caused by a test request message, the 3270 CU sets this bit to 1, indicating LU. A test request message results in setting this bit to 0, which indicates SSCP.

The device address is contained in bits 1 through 7 of byte 2. When received by the 3270 CU, the device address is decoded as the destination address for which the transmission is intended. When transmitted by the 3270 CU, the address indicates the device that initiated the transmission. Bit 1 is always set to 1, and bit 2 is always a 0. Up to 32 addresses, designated 0 through 31, are available for attachment of display station or printers to a 3271 control unit (Table 21). Device address 0 is used when communicating with a 3275 display station.

Table 21. Device Addressing for 3271 Control Unit, Models 11 and 12

Device Number	TH Address Field Bits: 1 2 3 4 5 6 7
0	1 0 0 0 0 0 0
1	1 0 0 0 0 0 1
2	1 0 0 0 0 1 0
3	1 0 0 0 0 1 1
4	1 0 0 0 1 0 0
5	1 0 0 0 1 0 1
6	1 0 0 0 1 1 0
7	1 0 0 0 1 1 1
8	1 0 0 1 0 0 0
9	1 0 0 1 0 0 1
10	1 0 0 1 0 1 0
11	1 0 0 1 0 1 1
12	1 0 0 1 1 0 0
13	1 0 0 1 1 0 1
14	1 0 0 1 1 1 0
15	1 0 0 1 1 1 1
16	1 0 1 0 0 0 0
17	1 0 1 0 0 0 1
18	1 0 1 0 0 1 0
19	1 0 1 0 0 1 1
20	1 0 1 0 1 0 0
21	1 0 1 0 1 0 1
22	1 0 1 0 1 1 0
23	1 0 1 0 1 1 1
24	1 0 1 1 0 0 0
25	1 0 1 1 0 0 1
26	1 0 1 1 0 1 0
27	1 0 1 1 0 1 1
28	1 0 1 1 1 0 0
29	1 0 1 1 1 0 1
30	1 0 1 1 1 1 0
31	1 0 1 1 1 1 1

### Request/Response Header (RH)

The request/response header contains 24 bits of SNA control information used by higher level network controls for routing and sequencing of transmissions and to indicate to the 3270 CU the form of response required. The RH and the message text contained in the I field comprise the basic exchange unit of control and data across the data link, called the request/response unit (RU).

Each I field may contain up to 256 bytes of message data. When the text of message exceeds 256 bytes, the message is segmented into a series of I formatted frames. The first and all intermediate frames within the segmented group contain 256 bytes of message text. The last frame contains the remainder of the text being transmitted, up to 256 bytes. A request/response header is required when the message contains one I frame (up to 256 bytes of message text) or, within the initial I frame of a segmented message.

The request/response header consists of 3 bytes which have the following format:

byte 1	R/R	RU	Subsystem Control Indicator	0	Format Indicator	Sense Data Included Indicator	1	1
	0	1	2	3	4	5	6	7
byte 2	DR*	0	0	EX*	0	0	0	P*
	0	1	2	3	4	5	6	7
byte 3	BB	EB	0	0	Code Selection Indicator*	0	0	0
	0	1	2	3	4	5	6	7

R/R = Request/Response

RU = Request/Response Unit

\*DR = Definite Response 1

\*EX = Exception Response

\*P = Pacing

BB = Begin Brackets

EB = End Brackets

\*Only DR, EX, P, and code selection indicator bits are significant to the application program.

Higher level network controls determine the implementation and bit assignments within the RH. Except for three bits, which indicate to the 3270 CU the form of response required, the remaining 21 RH bits are not significant to the application program. The response indicating bits are definite response 1 (DR), exception response (EX), and pacing (P). A detailed description of the response indicating bits is given in this section, followed by a general description of the remaining RH bits.

The 3270 CU responds to combinations of response indicating bits, specified in the RH received from the controller. The response generated by the 3270 CU consists of a frame containing the appropriate RH response bit(s) set to 1. (As explained in the paragraph titled "3270 CU Responses".) Receipt of an RH by the 3270 CU with the DR bits set to 1 (byte 2, bit 0) indicates to the 3270 CU that a response must be sent when the specified command operation has been completed. A definite response (DR) is called a positive response. An exception response (EX) is requested when RH byte 2 bit 3 and the DR bit are set to 1. An EX response is generated by the 3270 CU if an error condition (other than an SDLC error) is detected while executing a command. Error conditions are reported by the 3270 CU in the form of sense bytes contained within an I field. Pacing (P) is a response which allows the 3270 CU to indicate to the controller when message data can be sent for a device. Pacing control (byte 2, bit 7) is used when a command is being executed at a printer, and, at this time, pacing control is also used when a command operation is being performed at a display station.

The function of the remaining 21 bits contained in the RH is summarized as follows:

*Byte 1, Bit 0* is the request/response (RR) bit. The RR bit is not checked by the 3270 CU when it is received from the controller. The 3270 CU sends the RR bit to the controller as a 0 to indicate a request. This occurs when sending message text as part of a read-type command, read-by-poll operation, or when transmitting asynchronous status or sense information. The RR bit is sent by the 3270 CU as a 1 to indicate a response in reply to a definite or exception response (with or without pacing) which has been requested by the controller.

*Byte 1, Bits 1 and 2* are the request/response unit (RU) type, and subsystem control indicator bits, respectively. They are stored, but not checked by the 3270 CU, when they are received from the controller. These bits are set, depending upon the contents of the RU, as follows:

RU	Bit 1 (RU Type)	Bit 2 (SCI)
Function Management (FM) Data	0	0
Network Control	0	1
Data Flow Control	1	0
Session Control	1	1

The 3270 CU sends FM data, except when sending a clear or pseudo bid response, in which case bits 1 and 2 are sent in the same form in which they are received from the controller.

*Byte 1, Bit 3* (always 0) is not used by the 3270 CU.

*Byte 1, Bit 4* is the format indicator. The 3270 CU stores, but does not check, this bit when it is received from the controller. When the 3270 CU generates a request, the format indicator bit is sent as a 0; when sending a response, the 3270 CU sends this bit as it was received from the controller.

*Byte 1, Bit 5* is the sense data included indicator. The 3270 CU does not check this bit when it is received from the controller. The 3270 CU sends this bit as a 1 when sense data is transmitted, and as a 0 when sense information is not sent to the controller.

*Byte 1, Bits 6 and 7* (always 1) are not used by the 3270 CU.

*Byte 2, Bits 1, 2, 4, 5, and 6* (always 0) are not used by the 3270 CU.

*Byte 3, Bit 0* is the begin bracket (BB) bit, and is used by the 3270 CU in conjunction with the pseudo bid command (described in the paragraph titled "Control Functions"). Receipt of the BB bit set decrements the poll counter in the 3270 CU.

*Byte 3, Bit 1 (end brackets), Bits 2, 3, 5, 6, and 7* are always 0 and are not used by the 3270 CU.

*Byte 3, Bit 4* is the code selection indicator. This bit identifies the transmission code as EBCDIC (0), or ASCII (1).

#### *Command Byte*

The command contained in the command byte is sent after the RH by the controller for execution by the 3275 or by a device attached to the 3271. A list of command codes and a description of 3270 command operations is given in the Chapter titled "Commands and Orders". Order codes, when employed, are transmitted within the message text following a Write or Erase/Write command.

The following conditions must be met to allow command execution:

1. The frame must have a valid FCS character.
2. The I field must be the initial I field of a segmented message, or contain the entire text of the message.
3. The addressed device must be in a ready state (not busy).

#### *3270 CU Responses*

The 3270 CU responds to combinations of DR, EX and P bit settings received from the controller in byte 2 of the RH. Valid request and response formats are listed in Table 22.

#### *Positive Response with Pacing*

1. *Write and Erase/Write Commands for Display Stations and Printer.* When a write type operation is successfully completed, the 3270 CU responds with a frame containing byte sequence F, A, C, TH, RH, FCS, F, with

DR=1, EX=0 and P=1. Successful completion of a write operation to a printer occurs when the printout is completed. If an error is detected (other than an SDLC error) during command execution, the 3270 CU sends a response frame with DR=1, EX=1, and P=1 within the RH, and inserts an I field containing a 4 byte sense RU to report the error condition. Sense RU format is defined in the paragraph titled "Error Responses and Error Recovery".

2. *Read Modified and Read Buffer Commands for Display Stations.* Successful completion of a read type command occurs when the data has been sent and acknowledged at link level by the controller. The 3270 CU then replies with a frame containing DR=1, EX=0, and P=1 within the RH. If an error is detected, other than an SDLC error, while obtaining the device buffer, the 3270 CU sends a response frame containing DR=1, EX=1, and P=1, and includes a sense RU I frame. If an error is detected during transmission of the message data to the controller, the 3270 sends a sense RU request to the controller with an abort segment indication, (as described in the paragraph titled "Error Responses and Error Recovery"). Following the sense RU request, a frame is sent containing DR=1, EX=0, and P=1. In this case, the read operation is considered complete but unsuccessful.

3. *Copy Command for Display Stations and Printers.* When buffer data has been transferred from the "from" device to the "to" device without detection of an error, the operation is considered complete. The 3270 CU then sends a response frame with DR=1, EX=0, and P=1. If the "to" device is a printer the response is delayed until the printout is complete. If an error is detected while obtaining the "from" device buffer, the 3270 CU sends a sense RU response with DR=1, EX=1, and P=1. The address in the TH is the address of the "to" device but the sense RU indicates that the error is in the "from" device or in the 3270 CU. If an error is detected during the transfer of data to the "to" device, the 3270 CU responds with a sense RU containing DR=1, EX=1 and P=1.

#### *Exception Responses with Pacing*

1. *Write and Erase/Write Commands for Display Stations and Printers.* During execution of a write type command to a printer, when the transfer of message text from the 3270 CU to the printer has begun, the CU may begin servicing other attached devices. When the printer operation has been completed, the form of the response requested within the RH for the printer message is no longer present in the 3270 CU. In this situation, the 3270 CU replies by sending a positive response with pacing (DR=1, EX=0, P=1).

When the addressed device is a display station, the operation is the same as described previously for write

and erase write commands in the paragraph titled “Exception Response with Pacing”, except that successful command execution results in the 3270 CU sending an isolated pacing response i.e., DR=0, EX=0, P=1.

2. *Read Modified and Read Buffer Commands for Display Stations.* The operation is the same as described previously for read modified and read buffer commands

in the paragraph titled “Positive Response with Pacing”, except that the 3270 CU sends DR=0, EX=0, P=1 when the command has been successfully completed.

3. *Copy Command for Display Stations and Printers.* Since the printer must operate in positive response with pacing mode, the 3270 CU treats a request on copy command operations to a printer as though positive response with pacing had been specified regardless of the actual setting

Table 22. Request and Response Format

Response	Request format— sent by the controller:			Response format— sent in reply by the 3270 CU:			Explanation
	DR	EX	P	DR	EX	P	
Definite response with pacing	1	0	1	1	0	1	<p>Indicates successful completion of a read or write type or copy command by a display station; or a write type or copy command by a printer.</p> <ol style="list-style-type: none"> <li>1. Indicates that an error occurred during transmission of read data. In this case, the response may be preceded by a sense RU request containing an abort indication.</li> <li>2. Indicates that an error was detected while obtaining a device buffer.</li> </ol> <p><i>Note: The printer operates in positive response with pacing mode only. Therefore, when a command has been executed by a printer the 3270 CU always responds with positive response with pacing (101, or 111) regardless of the request received.</i></p>
				1	1	1	
Exception response with pacing	1	1	1	0	0	1	<p>Indicates successful completion of a read or write type or copy command by a display station.</p> <ol style="list-style-type: none"> <li>1. Indicates that an error was detected while obtaining a device buffer.</li> <li>2. Indicates that an error occurred during transmission of read data. In this case a sense RU request with an abort segment indication is transmitted before the response.</li> </ol>
				1	1	1	
No response with pacing	0	0	1	0	0	1	Applicable to commands executed by display stations only. An error response (EX = 1) is not sent regardless of how the operation ends. The 3270 CU transmits only an isolated pacing response.
Definite response no pacing	1	0	0	1	0	0	Applicable to display station command operations only. The response description is the same as described above for positive response with pacing, except that the pacing bit is always set to 0.
				1	1	0	
Exception response, no pacing	1	1	0	0	0	0*	Applicable to display station command operations only. The response format is the same as explained above for exception response with pacing, except that the pacing bit is always set to 0.
				1	1	0	
No response no pacing	0	0	0	0	0	0*	Applicable to display station command operations only. The 3270 CU does not send a response.

\*A response format 000 indicates that no response is sent.

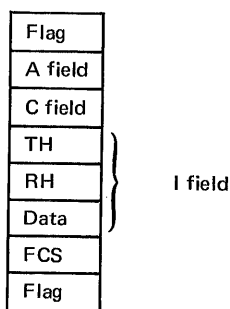
of the DR, EX and P bits. The operation is the same as is described previously for the copy command in the paragraph titled "Positive Response with Pacing".

When the "to" device is a display station the operation is same as described previously except that successful completion causes the 3270 CU to reply with an isolated pacing response, DR=0, EX=0, P=1.

*Positive or Exception Responses without Pacing; No Responses with or without Pacing.* Positive or exception response without pacing, and no response with or without pacing are four variations of responses based on the positive or exception response with pacing. The response formats and a description of the response operations are given in Table 22.

#### Data Transmissions by the 3270 CU

Data transmitted by the 3270 CU can be message text, test request data, or status and sense information. Data is transmitted to the controller in the same SDLC frame format used by the controller except that a command code is not present within the I field. The frame format is as follows:



*Message Text.* Message text can be transmitted following:

1. receipt of a read buffer or read modified command with a poll bit set to 1 in the C field, or when an RR command with the poll bit set to 1 is received after the frame containing the read type command.
2. receipt of an RR command with the poll bit set to 1 when an attention key is depressed (except the TEST REQ key).

The address contained in the TH is the address of the device which received the read type command or the address of the device which had an attention key depressed when an RR command was received.

When more than 256 bytes of message text are transmitted, the data stream is segmented into 256 byte blocks (as described previously for data transmissions to the 3270 CU in the paragraph titled "Request/Response Header (RH)").

*Test Request Messages.* Test request messages can be entered from a display station keyboard when the operator has depressed the TEST REQ key and a read modified command is issued to the device. For a description of the

test request operation, refer to the paragraph titled "Test Request Read" in the "Commands and Orders" chapter.

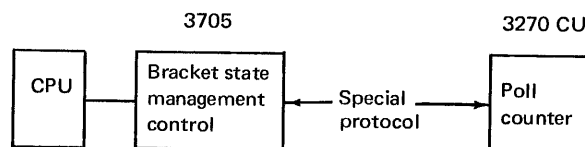
#### Control Functions

The Clear and Pseudo Bid control functions take the form of control commands issued by the controller in information format. The 3270 CU sends a Clear response when replying to the Clear command.

*Clear Command/Response.* The Clear command is sent by the controller to cancel pending DR and (or) pacing responses from the 3270 CU. The Clear command format consists of a one byte I field (hex A1), with the DR request bit set in the RH. The 3270 CU replies with a response frame in the same format received from the controller.

*Pseudo Bid Command.* The Pseudo Bid command is sent by the controller to cause the 3270 CU to do a specific poll to a specific device, and, if no attention ID is pending, to execute a write type command at the selected device. The Pseudo Bid command is sent in information format as one byte of data (hex F8) with or without request bits set in the RH. If an attention ID is not present at the addressed display station or printer and a request was sent by the controller, the 3270 CU replies with a response frame. The controller then sends an information frame containing a write type command and the B/B bit set in the RH. Request bits are set in the RH if a 3270 CU response is desired. The operation then proceeds as a write type command. Bracket protocol for the application program and the terminal operator are given in *Programming the IBM 3270*, GC27-6999.

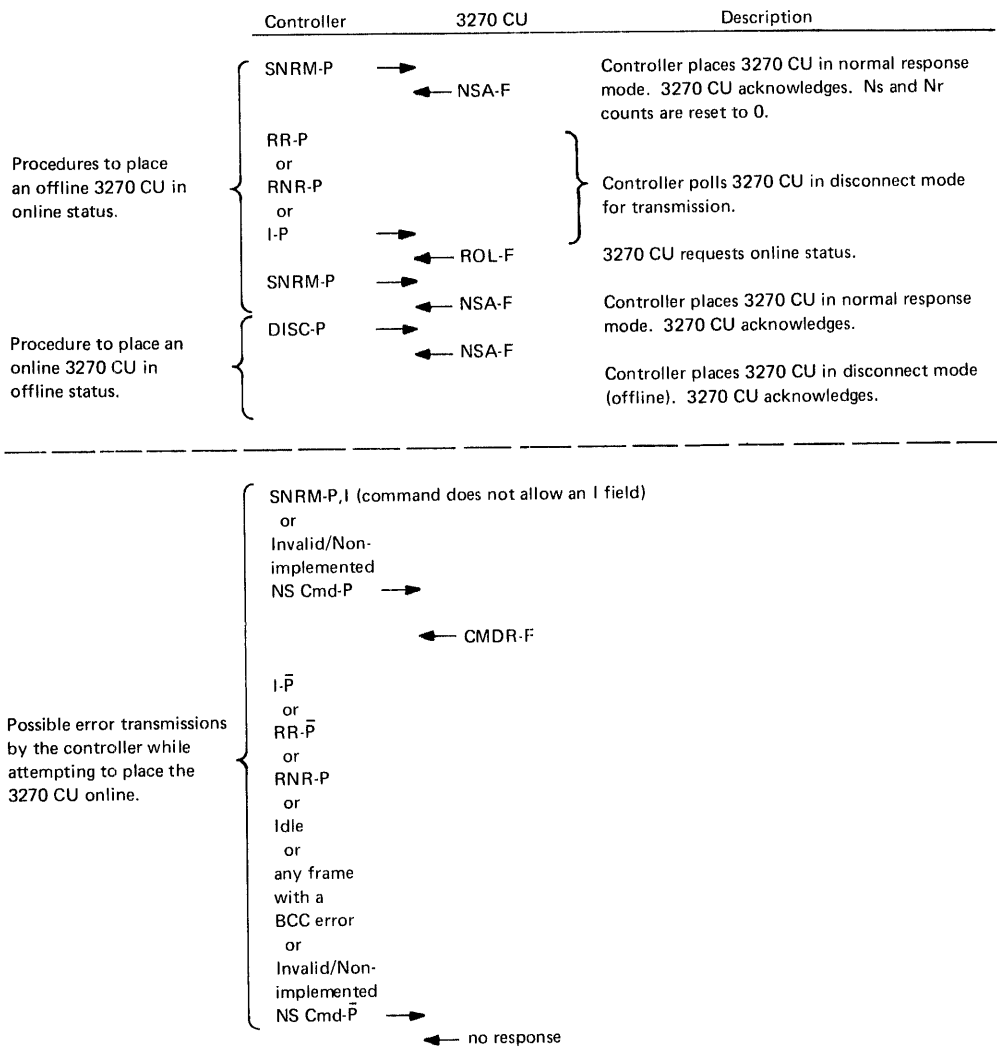
Generally the bracket state management function resides within the CU. However, in the 3270 system employing SNA, the 3705 controller provides bracket state management control for the 3270 CU. As a result, the 3705 controls the operation of the poll counter in the 3270 CU and generates the pseudo bid command.



The poll counter is used for bracket state management. A successful pseudo bid command operation at the 3270 CU (i.e., no attention ID pending) increments the poll counter. Receipt of the B/B bit set, with no attention ID pending, decrements the poll counter. The poll counter must be equal to zero to allow the 3270 CU to present attention-generated information to the controller. When the poll counter is not equal to zero, communication with the devices is inhibited.

SDLC Sequence Response Diagrams

Figures 21, 22, and 23 are sequence/response diagrams which show, respectively, online/offline procedures, read type command, and write type command operations. Only portions of the SDLC frames that are essential to the operation are shown in the diagrams. The descriptive text given on each diagram summarizes the flow of information between the controller and the 3270 CU.



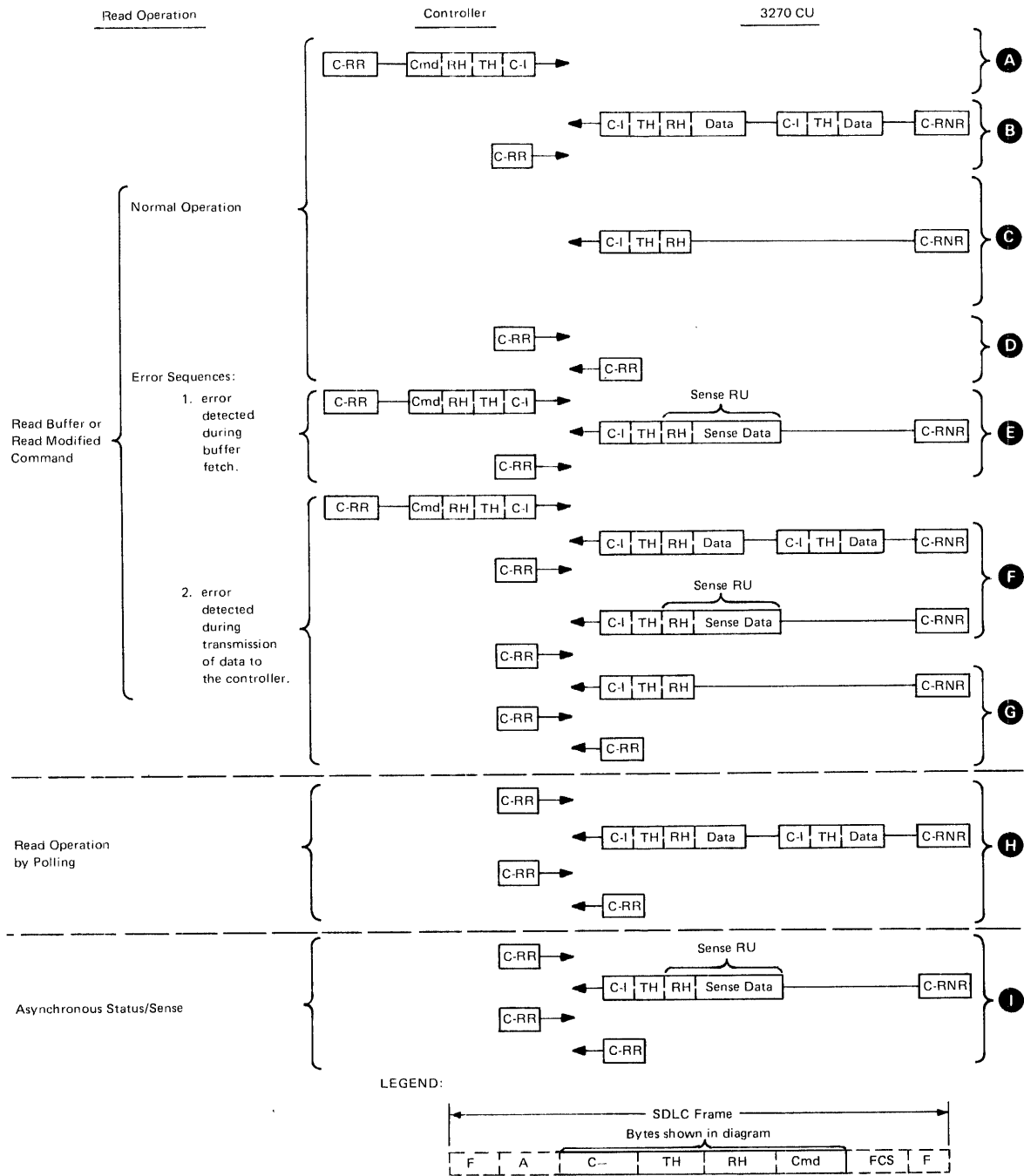
Note: Only SDLC bytes that are significant for the sequence being illustrated are shown in the diagram.

P/F=poll/final bit  
I = information frame  
dash (—) above a letter = not set to 1.

Figure 21. Online and Offline Sequence/Response Diagram

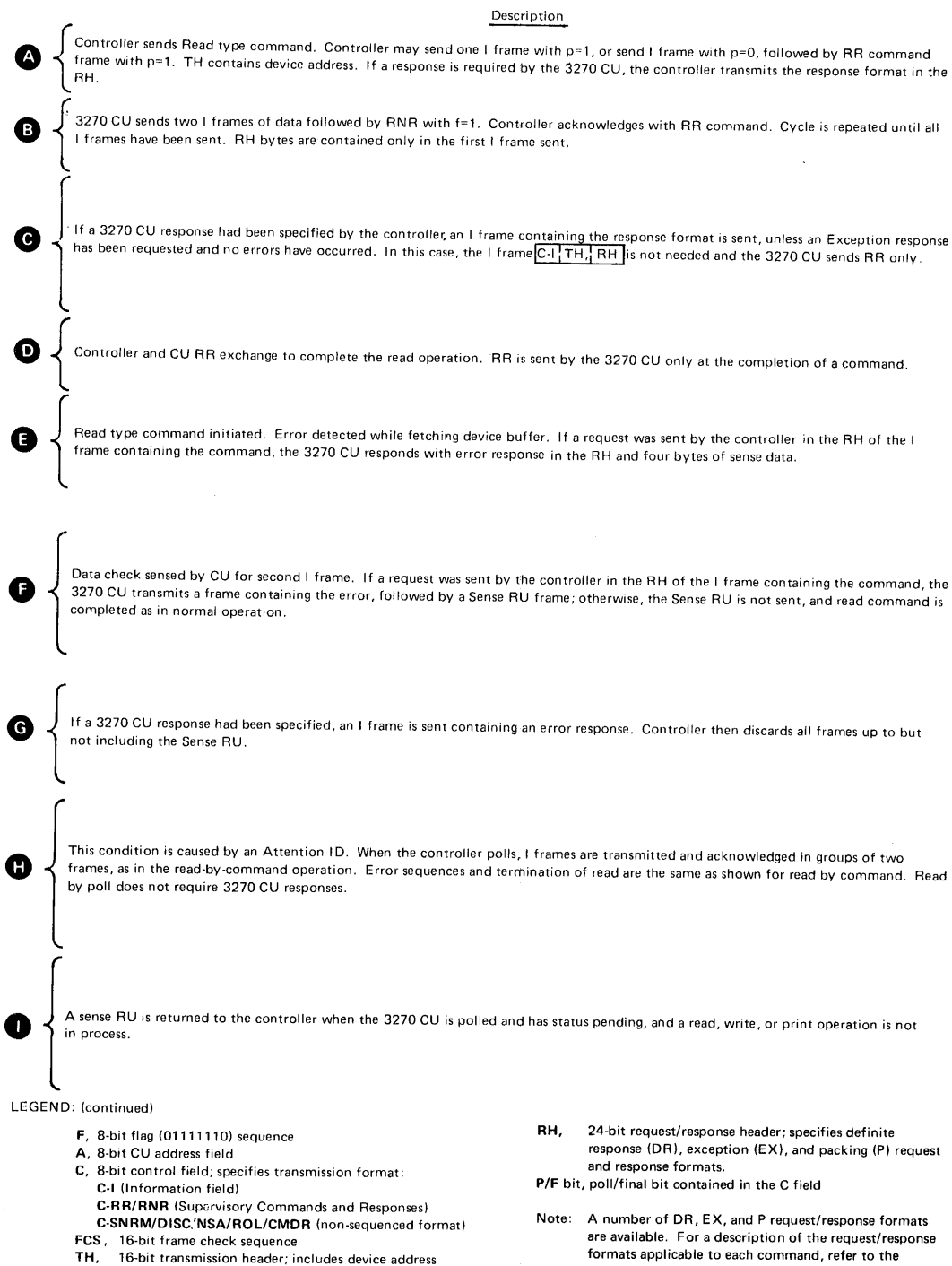


**Intentionally Left Blank**

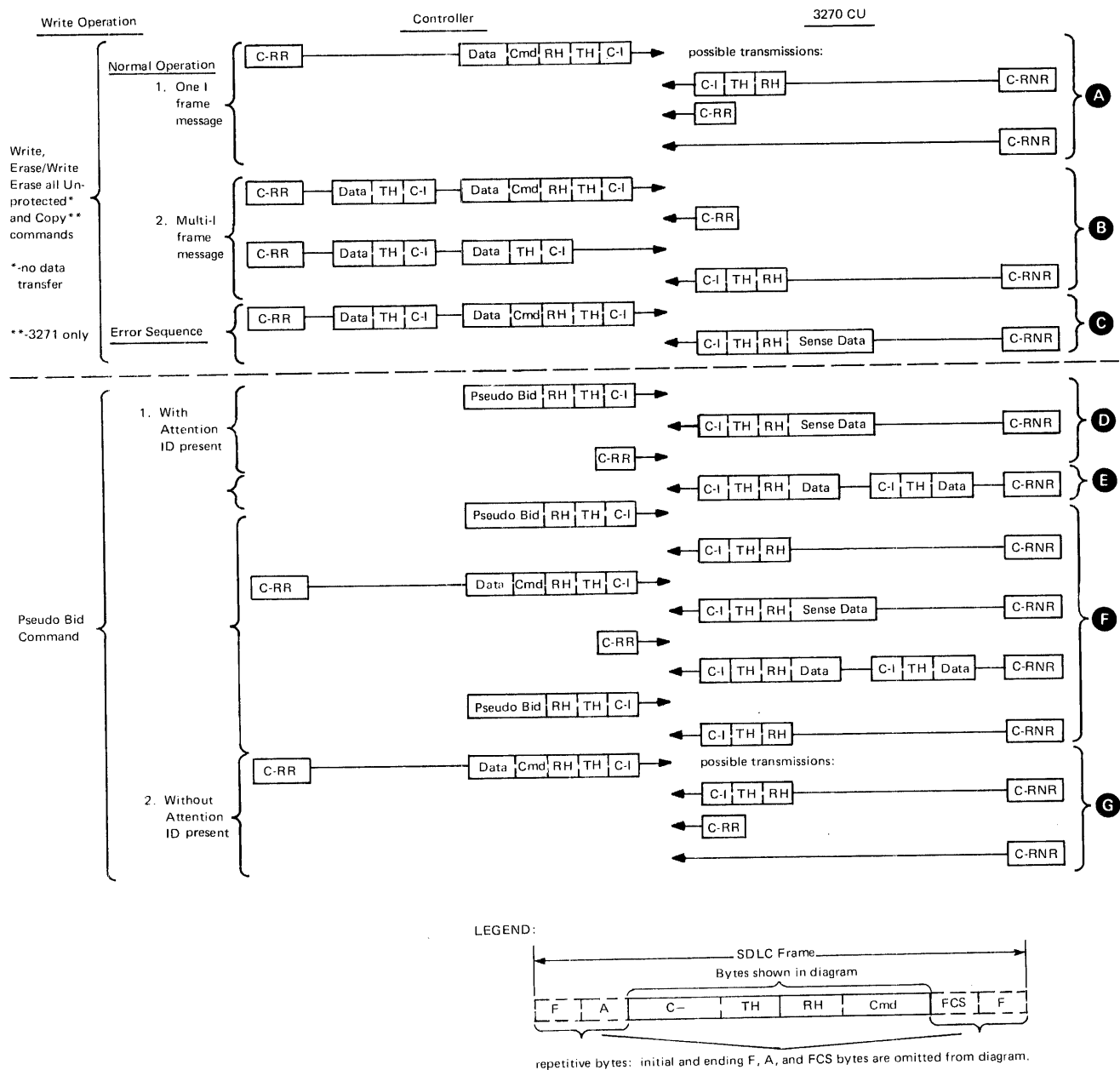


repetitive bytes: initial and ending F, A, and FCS bytes are omitted from diagram.

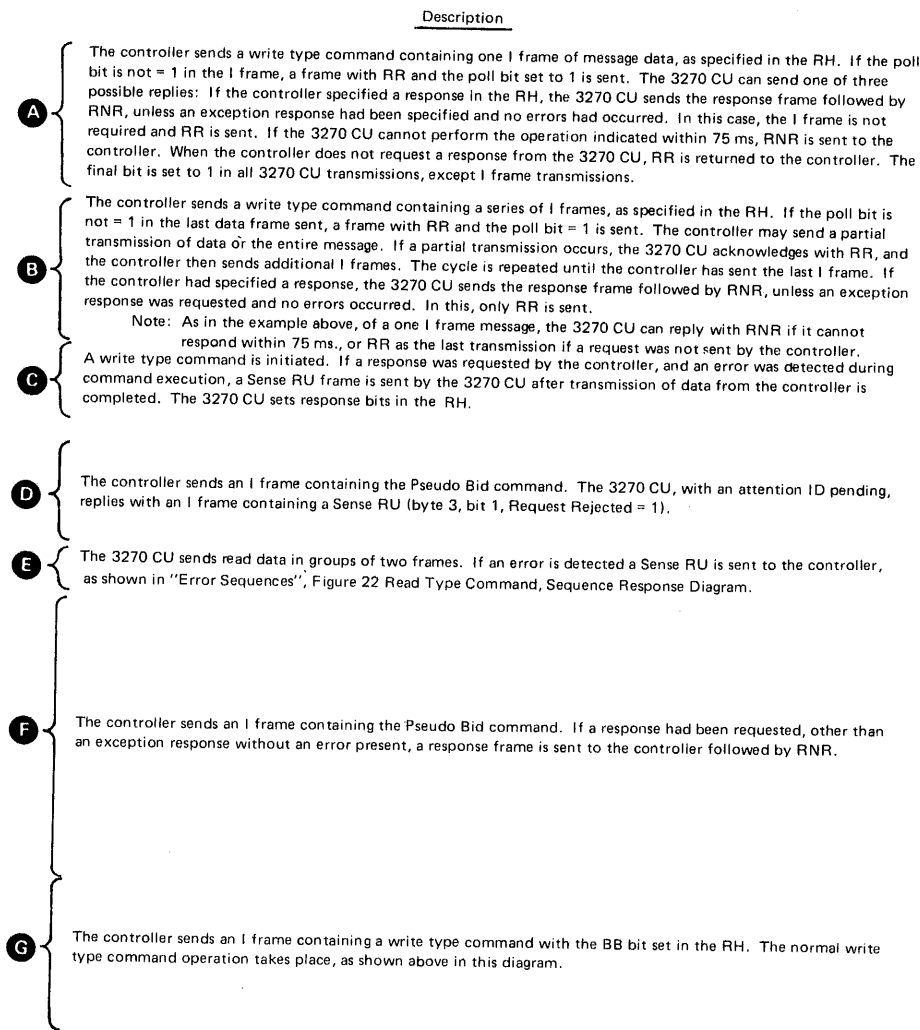
Figure 22. Read Type Command Sequence/Response Diagram



**Figure 22. Read Type Command Sequence/Response Diagram (cont)**



**Figure 23. Write Type Command Sequence/Response Diagram**



LEGEND: (continued)

F, 8-bit flag (01111110) sequence.

A, 8-bit CU address field.

C, 8-bit control field; specifies transmission format:

C-I (Information field)

C-RR/RNR (Supervisory Commands and Responses)

C-SNRM/DISC/NSA/ROL/CMDR (non-sequenced format)

FCS, 16-bit frame check sequence

TH, 16-bit transmission header; includes device address

RH, 24-bit request/response header; specifies definite response (DR), exception (EX), and pacing (P) request and response formats.

P/F bit, poll/final bit contained in the C field

Note: A number of DR, EX, and P request/response formats are available. For a description of the request/response formats applicable to each command, refer to the paragraph titled "3270 CU Responses".

**Figure 23. Write Type Command Sequence/Response Diagram (cont)**

## Status and Sense (S/S) Bytes

The 3270 CU records SNA status, and status and sense (S/S) conditions for each attached device. All remote status and sense conditions are contained in four bytes which are sent to the controller as a sense RU status and sense message. Bytes 0 and 1 contain SNA S/S information and bytes 2 and 3 contain device S/S information in the same format used for remotely attached BSC devices. A sense RU is returned to the controller when the 3270 CU has status pending and receives an RR command or I formatted frame with the poll bit set to 1.

The status and sense message contains nine bytes in the I field in the following sequence:

TH — byte 1	{	Address of the device for which the transmission is intended, or the address of the device which originated the transmission
TH — byte 2		
RH — 3 bytes		
S/S — byte 0	{	SNA status/sense
S/S — byte 1		
S/S — byte 2	{	device status/sense
S/S — byte 3		

The definition of each S/S bit is listed in Table 23.

Table 24 shows how these status and sense conditions are interpreted for each error response or request transmitted by the 3270 CU.

Table 23. Remote Status and Sense Byte Definition

Bit No.	Bit Definition	Bit No.	Bit Definition
	S/S Byte 0:		S/S Byte 1:
0	<i>Path Error</i> — For the 3271, this bit is set if the device address received (bits 1 through 7 of TH byte 2) is invalid, or if the device adapter card for the indicated address is not installed.  For the 3275, this bit is set if the device address is not 100000 (bits 1 through 7 of TH byte 2).  Intervention Required (IR), S/S byte 3, bit 3, may also be set with this bit.	0,1,2,4,5	Reserved.
1,2	Reserved	3,6,7	These bits are set with <i>request reject</i> (bit 4, byte 0)
3	<i>Request Error</i> — This bit is set if the first byte of the RU is not recognized as a valid command or command function. Command Reject (CR), S/S byte 3, bit 2, is set when Request Error is set.		S/S Byte 2:
4	<i>Request Reject</i> — The bit is set if a pseudo bid command or begin bracket bit (set in the RH) is sent to a device that has an attention pending.	0,1,2,3	Reserved.
5,6,7	Reserved.	4	<i>Device Busy (DB)</i> — This bit indicates that the addressed device is busy executing an operation. The device is busy when executing an erase all unprotected command, or a print operation, accepting data from the Operator Identification Card Reader, or performing various keyboard operations (Erase Input, Backtab and Clear).
		5	<i>Unit Specify (US)</i> — This bit is set if any S/S bit is set as a result of a device-detected error.
		6	<i>Device End (DE)</i> — This bit indicates that the addressed device has changed from unavailable to available and not ready to ready, or busy to not busy. When a printer goes from busy to not busy, a positive response with pacing is generated instead of DE.
		7	Reserved.

Table 23. Remote Status and Sense Byte Definition (Cont)

Bit No.	Bit Definition	Bit No.	Bit Definition
	S/S Byte 3:		
0,1	Reserved.	6	<i>Control Check (CC)</i> – This bit is not used for the 3275. For the 3271, this bit indicates a timeout check. A timeout check occurs when a device fails to respond to 3271 communications within a specified time period or when a device fails to complete an operation within a specified time period.
2	<i>Command Reject (CR)</i> – This bit is set upon receipt of an invalid or illegal 3270 command.	7	<i>Operation Check (OC)</i> – This bit, when set alone, indicates one of the following: <ul style="list-style-type: none"> <li>• Receipt of an illegal buffer address or of an incomplete order sequence on a write or erase/write command.</li> <li>• The device did not receive a CCC or a “from” address on a copy command.</li> <li>• Receipt of a read, read modified, copy, or erase all unprotected command with TH mapping field bits not equal to 11 (i.e., a complete BIU).</li> <li>• An I/O interface “overrun” is detected. This occurs if a data byte follows a read buffer, read modified, or erase all unprotected command, or if more than two data bytes follow a copy command.</li> </ul> <p>This bit is set with Control Check, Intervention Required, Data Check, or Data Check with Unit Specify, to indicate that the errors that set these sense bits were detected while the 3270 CU was executing an operation with the “from” device during a copy command.</p>
3	<i>Intervention Required (IR)</i> – This bit is set if: <ul style="list-style-type: none"> <li>• A copy command contains a “from” device address in its data stream which specifies an unavailable device.</li> <li>• A command attempted to start a printer but found it not ready. The printout is suppressed.</li> <li>• The 3271 receives a Pseudo Bid sequence for a device which is unavailable or which became not ready during a printout.</li> <li>• The 3270 CU receives a command for a device which the 3271 has logged as unavailable and not ready.</li> </ul>		
4	<i>Equipment Check (EC)</i> – This bit is set if: <ul style="list-style-type: none"> <li>• A printer character generator error occurred, or the printer became mechanically disabled.</li> <li>• The 3270 CU detected bad parity from the device, or data transmitted in a device reply.</li> </ul> <p><b>Note:</b> <i>The data check (DC) bit may also be set.</i></p>		
5	<i>Data Check (DC)</i> – This bit indicates detection of a parity or cursor check in either the 3271 or a device buffer, or in the 3275 buffer, or that the 3271 detected bad parity from the device.		

Table 24. Remote Error Status and Sense Responses and Requests

Status/Sense Bits	Explanation	
	Response	Request
PE (Address not available)	Bits 1 through 7 of TH byte 2 are not a valid device address or the device adapter card is not installed in the 3271.	NA
CC	A timeout check is caused by the addressed device. The operation is tried twice before the CC bit is set.	NA
CC, OC	The "from" device fails to complete an operation or to respond to the 3271 within a specified time period (timeout check) during a copy command operation.	NA
DC	<ol style="list-style-type: none"> <li>1. The 3271 or 3275 detects a parity or cursor check in its buffer during a command operation.</li> <li>2. The 3271 detects bad parity on data received from the addressed device. The operation is attempted twice before the DC bit is set.</li> </ol>	A parity error is detected by the 3271 on a data transfer to the NCP as a result of a poll or a parity error detected in the 3275.
DC, US (3271 only)	<ol style="list-style-type: none"> <li>1. A parity check or cursor check is detected by the addressed device on the data it is sending to the 3270 CU.</li> <li>2. The device detects a parity or cursor check in its buffer during a command operation.</li> </ol>	A parity check or cursor check is detected by the polled device on the data it is sending to the 3271 CU.
DC, OC (3271 only)	The 3271 detects a parity check on the data transferred from the "from" device during a copy command operation.	NA
DC, OC, US	Sent when the "from" device detects an internal parity or cursor check while performing the copy command.	NA
IR	The addressed device is not available or the addressed printer is not ready.	NA
IR, OC (3271 only)	The from device is not available on a copy command.	NA
IR, EC, US	The addressed printer is mechanically disabled and cannot recover.	NA
OC	1. The copy command data stream contains more or less than two bytes (the CCC and the "from" device address). The copy command is aborted.	NA
	2. One or more data bytes followed an erase all unprotected command (buffer overrun).	NA
	3. A data byte followed a read type command in the data stream received at the device.	NA
OC, US (3271 only)	The device has a locked buffer during a copy command operation. (Refer to paragraph titled "Copy Command" in the section on Commands and Orders).	NA
EC, US (3271 only)	A character generator error or a mechanical failure is detected at the printer but recovery occurs.	NA
FIE, CR	An invalid command is detected (first byte of data). For example, a copy command is sent to the 3275.	NA
EC	Character generator error (3275 only) in printer.	Bad parity from a device (3271 only).



**Table 24. Remote Error Status and Sense Responses and Requests (Cont)**

Status/Sense Bits	Explanation	
	Response	Request
EC, DC	Transmit parity error has occurred. If a buffer was obtained during the operation, the data check bit is also set.	NA
DE	The poll bit finds a device which was previously recorded as busy, as not busy. Transmission of an I frame with read or write type data resets this bit.	The poll bit finds a device which was previously recorded as unavailable or not ready, as available and ready.
IR	The addressed printer is out of paper, power has been turned off, or the printer cover is open.	NA
IR, EC (3275 only)	Power is off at the 3284 model 3 printer or a malfunction is detected.	NA
OC, DB	The "from" device receiving a copy command is busy. The device is busy performing an operation, a printout, reading data from the Operator Identification Card header, or performing a keyboard operation.	NA
DB	The addressed device is busy.	NA

**Notes:**

1. There are other conditions of multiple status that can occur which are not included here; for example, an unpredictable catastrophic card failure or multiple error conditions occurring simultaneously could cause an undefined combination of status and sense bits. If a multiple status condition occurs, each bit must be checked separately to determine the cause(s) of the failure.
2. Refer to Table 25 for error-recovery procedures that are applicable for certain combinations of status/sense bits.

**ERROR RECOVERY PROCEDURES**

Errors detected by the 3270 CU are indicated to the system by a timeout, a CMDR response, or a sense RU message.

Table 25 lists the various error combinations of sense/status bits (described in Table 24) and refers to error recovery procedures. The error recovery procedures recommended in Table 25 are as follows:

1. (a) Any response other than NSA to a set mode command is discarded and results in "N" retries of the particular set mode command being attempted. If the timeout response persists, the system operator should take action to verify the link.
- (b) Execute a new command sequence starting with the command that was being executed when the error occurred. Executing a new command is a function of the access method or the application program, and is the responsibility of the customer written application program. If, after two retries, the operation is not successful, inform the system operator of the problem and follow procedure 4a.
- (c) Perform procedure 1b, except, if operation is not successful, follow procedure 4b instead of 4a.
2. Notify the responsible application programmer that a nonrecoverable program error was detected.
3. (a) Reconstruct the entire device buffer image starting with the first segment if a multi-segmented transmission occurred, and retry the failing sequence of commands. The sequence of commands used to reconstruct the image should start with an erase/write command to correct a possible missing or multiple cursor condition in the device buffer. This procedure is the responsibility of the customer written application program. If, after a series of retries the problem is not corrected, inform the system operator of the problem and follow procedure 4a.
- (b) The error occurred during execution of a copy command. Follow procedure 3a, and reconstruct the entire image of the device buffer of the "from" device specified by the copy command. If, after a series of retries, the operation is not successful, follow procedure 4b.
4. (a) Request the system operator to request maintenance support. Following repair, reconstruct the buffer image. The sequence of commands used to reconstruct the image should start with an erase/write command to correct a possible missing of multiple cursor condition in the device buffer.

Table 25. Remote Status and Sense Conditions

Sense/ Status Bit	Detected during 3270 Operation		Error Recovery Procedure:	
	Transmitted as:		3271	3275
	Response	Request		
PE (Address not available)	D, P		2	2
CC	D, P		1b	NA
CC, OC	D, P		1c	NA
DC	D, P	D, P	1b, 3a†	3a
DC, US	D, P	D, P	3a	NA
DC, OC	D, P		1c	NA
DC, OC, US	D, P		3b	NA
IR	D, P		6a	6a
IR, OC	D, P			NA
IR, EC, US	P		5	NA
OC	D, P		2	2
OC, US	D, P		7	NA
EC, US	P		5	NA
FIE, CR	D, P		2	2
EC	D, P	D, P	1b	5
DC, US, DE	D, P		3a	NA
IR, EC	D		NA	5
DE	D, P	D, P	None	None
OC, DB	D, P		8a	NA
RR	D, P		None	None
DB	D, P		8b	8b

**Note:**

†Perform error recovery procedure 1b if error occurred during a read operation.

Perform error recovery procedure 3a if error occurred during a write operation.

**Legend:**

- NA — Not applicable
- D — Display (3277 or 3275)
- P — Printer

(b) The “from” device specified by the copy command in the failing chain of commands is malfunctioning. The device should be identified from the customer written application program, and the system operator should be requested to have this device repaired. After repair, reconstruct the device buffer image. The sequence of commands used to reconstruct the image should start with an erase/write command to correct a possible missing or multiple cursor condition in the device buffer.

5. The error occurred during a printout operation and indicates either a character-generator error or a disabled print mechanism. There is no data error. The proper error recovery procedure is application-dependent since the user may not want a new printout. In this case, the

appropriate recovery procedure is the responsibility of the customer written application program. If a new printout is required, follow procedure 6a.

6. (a) The error indicates that: the printer is out of paper, has its cover open, or has a disabled print mechanism, or that the device is unavailable. Request (or wait for) either the display or system operator to ready the device. Then retry the printout by issuing a write command with the proper WCC and no data stream. (There is no data error, and the data is still intact in the device buffer and can be reused.) Or, follow procedure 3a.
- (b) The error indicates that the “from” device specified by a copy command is unavailable. The device address associated with the error status and sense information is not the device that requires reading. The device that requires reading is the “from” address specified in a Copy command. The responsible customer application programmer should determine the “from” device address and inform the system operator.
7. An attempt was made to execute a copy command in which access to the “from” device data was not authorized. Determine the appropriate customer written application program and notify the customer. The device address associated with the error status/sense bits in the sense RU is that of the copy command “to” device.
8. (a) This indicates that, in attempting to execute a copy command, the “from” device was found to be busy. Follow procedure 1b when the from device becomes not busy. Note that the device address associated with the S/S bits in the sense RU is the address of the “to” device and not that of the busy “from” device. The “from” device will transmit device end when it becomes not busy.
- (b) This indicates that the addressed device is busy. If the device is a display station it will transmit device end when it becomes not busy. If the device is a printer, a positive response with pacing is sent.

**Timeout to a Poll**

When the 3270 CU detects a FCS check, it initiates a timeout and does not respond to the Controller. The Controller retransmits the message several times if necessary in an attempt to correct the error.

**CMDR Response to Invalid Nonsequenced Commands and I Field Formats**

The 3270 sends the CMDR response for invalid non-sequenced command formats and I formats. The recovery action for CMDR response is the responsibility of the NCP.

**ROL Response to a Poll**

The 3270 CU sends a ROL response upon receipt of an RR or RNR command with the poll bit set to 1, when it is in disconnect response mode. Disconnect response mode is a result of a DISC command issued previously by the Controller, or because power had been removed from the 3270 CU and then applied. The Controller must issue a SNRM command to return the 3270 CU to on line status.

**Aborting an I Frame**

Data checks are sensed by the 3270 CU before a segment of message data is transmitted to the Controller. If the

segment assembled for transmission was the first or the only segment of the message (indicated by the mapping bits in the TH), then a sense RU is transmitted with the mapping bits set to indicate one segment (whole) in place of the segment of message data which contained the error. If the segment assembled for transmission was an intermediate or the last segment, and contained an error, a sense RU is transmitted with mapping bits indicating one segment. As a result, the Controller discards all segments received up to and including the segment containing the sense RU.

## Appendix A. Indicators and Controls

The indicators and controls associated with each 3270 unit are listed in Table 26 and are described below:

**OFF-PUSH:** This triple-function concentric switch/control is used to control the application of power to the unit, and also to control the brightness (outer knob) and contrast (inner knob) of the displayed image.

**BIT RATE:** This two-position toggle switch, added by the Dial feature, allows the 3275 model 1 or 2 operator to select a transmission rate of 600 or 1200 bps.

**DISCONNECT:** This momentary-contact toggle switch, added to the 3275 model 1 or 2 by the Dial feature, is used by the 3275 operator when terminating a call.

**INSERT MODE:** This indicator is turned on by the keyboard INS MODE key to show that the unit is in Insert Mode of operation. It is turned off by the keyboard RESET key.

**INPUT INHIBITED:** When lighted, this indicator shows that manual input to the unit from the keyboard, Selector Pen, or Operator Identification Card Reader is inhibited.

Table 26. Indicators and Controls

Indicator or Control	3270 Unit					
	3277	3275	3272	3271	3284, 3286	3288
OFF-PUSH (Sw, Ctl)	X	X				
BIT RATE (Sw)		D				
DISCONNECT (Sw)		D				
INSERT MODE (Ind)	X	X				
INPUT INHIBITED (Ind)	X	X				
SYSTEM AVAILABLE (Ind)	X	X				X
Sys Avl (Ind)						X
SYSTEM READY (Ind)		X		X		
SYNC SEARCH (Ind)		X		X		
SELECTED (Ind)		X		X		
FLAG DETECT		S		S		
CU ACTIVE		S		S		
OFF HOOK (Ind)		D				
TRANSMIT (Ind)		X		X		
STATUS (Ind)		X		X		
POWER ON LOCAL MODE (Sw)			X			
POWER OFF LOCAL MODE (Sw)			X			
MAIN LINE ON/OFF (Sw)			X			
LOC/REM (Sw)			X			
ON LINE/OFF LINE (Sw)			X			
I/O INTF DSBLD (Sw)			X			
POWER ON/OFF (Sw)				X	X	X
Power On (1)/Power Off (O) (Sw)						X
Carriage Restore (Pb)						X
Start Test (Sw)						X
VFC Selector (Sw)						X
POWER ON (Ind)			X			
Ready (Ind)						X
Ops Chk (Ind)						X
Address I.D. (Label)	X	X			X	X

Key: Sw - Switch  
 Ctl - Control  
 Ind - Indicator  
 X - Basic  
 D - Dial Feature  
 S - SDLC

It is turned on by:

1. Operation of any program attention key.
2. A selector-pen-attention operation that caused an I/O interruption to occur.
3. An operator-identification-card-reader operation that caused an I/O interruption to occur.
4. Turning the Security Key Lock to the OFF position if the Security Key Lock feature is installed.
5. Initiation of a printout at an unbuffered printer attached to the 3275 Display Station.
6. A system-initiated I/O operation addressed to that unit.
7. Operation of any alphameric key, the DUP, FIELD MARK, ERASE EOF, or DEL keys when the cursor is in a protected field.
8. Operation of any alphameric key not included in the numeric key grouping when the cursor is in a numeric field, without simultaneously operating either the ALPHA or NUMERIC shift key, when the Numeric Lock special feature is installed.
9. Detection of a parity or Cursor Check in the device buffer.

It is turned off by:

1. Receipt and execution of a WCC with the Keyboard Restore bit set.
2. Receipt and execution of an Erase All Unprotected command.
3. Turning the Security Key Lock to the On position (if it was turned on because the Security Key Lock was in the Off position).
4. Operation of the keyboard RESET key, with the following exceptions;
  - a. The device is selected and executing a command from the control unit.
  - b. The display station is in the process of reading a magnetic card from the Operator Identification Card Reader.
  - c. A printout is in process at the attached 3284 Printer Model 3.
  - d. A parity or Cursor Check has been detected.
5. Termination of an unbuffered printer printout (if it was turned on because an unbuffered printer printout was initiated).
6. Correction of a parity or Cursor Check condition and resetting of the error status by a Write or Erase/Write command addressed to that device.

**SYSTEM AVAILABLE (3275, models 1 and 2, 3277), Sys Avl (3288):** When lighted, this indicator shows that the unit has had successful communication with the system and is available to accept an operator-initiated transmission to the system.

It is turned on by:

1. Successful completion of a Write, Erase/Write, Erase All Unprotected, Copy, Read Modified, or Read Buffer command, in local or remote operation.
2. On a 3275 (models 1 and 2), receipt of an ACK from the TCU in response to an ETX at the completion of a General or Specific Poll sequence.

It is turned off by:

1. Any operator-generated I/O interrupt.
2. A parity or cursor check and resulting I/O interrupt.
3. Turning the Security Key Lock to the Off position.

**SYSTEM READY:** When lighted, this indicator shows that the Data Set carrier is on and that the TCU is online. With the Dial feature installed, this indicator lights when a transmission is first sent or received and extinguishes when a disconnect sequence is sent or received.

**SYNC SEARCH (3271 and 3275 models 1 and 2 only):** When lighted, this indicator shows that the unit is attempting to establish line synchronization.

**SELECTED (3271 and 3275 models 1 and 2 only):** When lighted, this indicator shows that the unit has been selected; i.e., it is in the process of executing a command or a chain of commands.

**CU ACTIVE (3271 and 3275 models 11 and 12 only):** This indicator lights after selection, and remains set until the operation is complete.

**FLAG DETECT (3271 and 3275 models 11 and 12 only):** This indicator lights when a valid flag character (7E) is received.

**OFF HOOK/AUTO ANSWER:** This indicator replaces the SELECTED indicator when the IBM Line Adapter or external modem with Auto Answer feature is installed. When lit, it indicates that a communications link to the 3275 (models 1 and 2) is active (that is, the data access arrangement is "off hook"). When the Auto Answer feature is not installed, the OFF HOOK/AUTO ANSWER indicator is always lit during unit operation.

**TRANSMIT:** When lighted, this indicator shows that the unit is transmitting to the TCU.

**STATUS:** When lighted, this indicator shows that an error status condition exists within the unit.

**POWER ON LOCAL MODE:** This momentary-contact switch is used to turn on dc power for a 3272.

**POWER OFF LOCAL MODE:** This momentary-contact switch is used to turn off dc power for a 3272.

**MAIN LINE ON/OFF:** This two-position toggle switch is used to turn on and turn off ac power for the 3272.

**LOC/REM:** This two-position rotary switch on the 3272, when placed in the REM (remote) position, gives control of the power supply activation to the CPU to which the control unit is attached. When placed in the LOC (local) position, power is controlled at the 3272 by using the **POWER ON LOCAL MODE** and **POWER OFF LOCAL MODE** switches.

**ON LINE/OFF LINE:** This two-position toggle switch, when placed in the ON LINE position (the operating position) connects the 3272 to the channel interface.

**I/O INTF DSBLD:** This indicator lights when the ON LINE/OFF LINE switch on the 3272 is in the OFF LINE position.

**POWER ON:** When lighted, this indicator shows that power has been turned on for a 3272.

**POWER ON/OFF:** This two-position toggle switch is used to turn on and turn off power for 3271 control units and all printers.

**Ready:** When lighted, this indicator shows that the 3288 Line Printer is ready to receive transmissions from the control unit. It is turned on after a successful power-on sequence, when the belt is up to speed and the printer is ready to print data.

It is turned off by:

1. Open machine covers.
2. Open print unit.
3. Running out of forms.
4. A paper motion failure (forms jam, torn forms, or missing feed holes).
5. An overheated printer mechanism.
6. A hardware failure requiring a repair action.

**Ops Chk:** When blinking, this indicator shows that the 3288 Line Printer Not Ready condition (shown by the Ready indicator being off) can be corrected by the operator.

It is turned on by:

1. Open machine covers.
2. Open print unit.
3. Running out of forms.
4. A paper motion failure.
5. The TEST switch (on test switch panel) in other than the ON LN (On Line) position.

It is turned off when the condition that caused it to light is corrected.

**Address Identification:** Provision is made on each display station and printer to identify both the physical (hexadecimal) and symbolic addresses assigned to that unit at installation time.

**VFC Selector:** The VFC Selector switches on the 3288 Line Printer are set (00–99) by the operator to determine the number of lines skipped in a VFC operation.

**Carriage Restore:** The Carriage Restore pushbutton on the 3288 Line Printer advances the forms to a predetermined print line established by the initial forms positioning and the settings of the VFC selector switches.

**Power On/Power Off (Coded I and O):** This two-position rocker switch is used to control power to the 3288 Line Printer.

**Start Test:** This switch on the 3288 is used in conjunction with the test switches located on the test switch panel under the top cover to initiate offline test printouts.

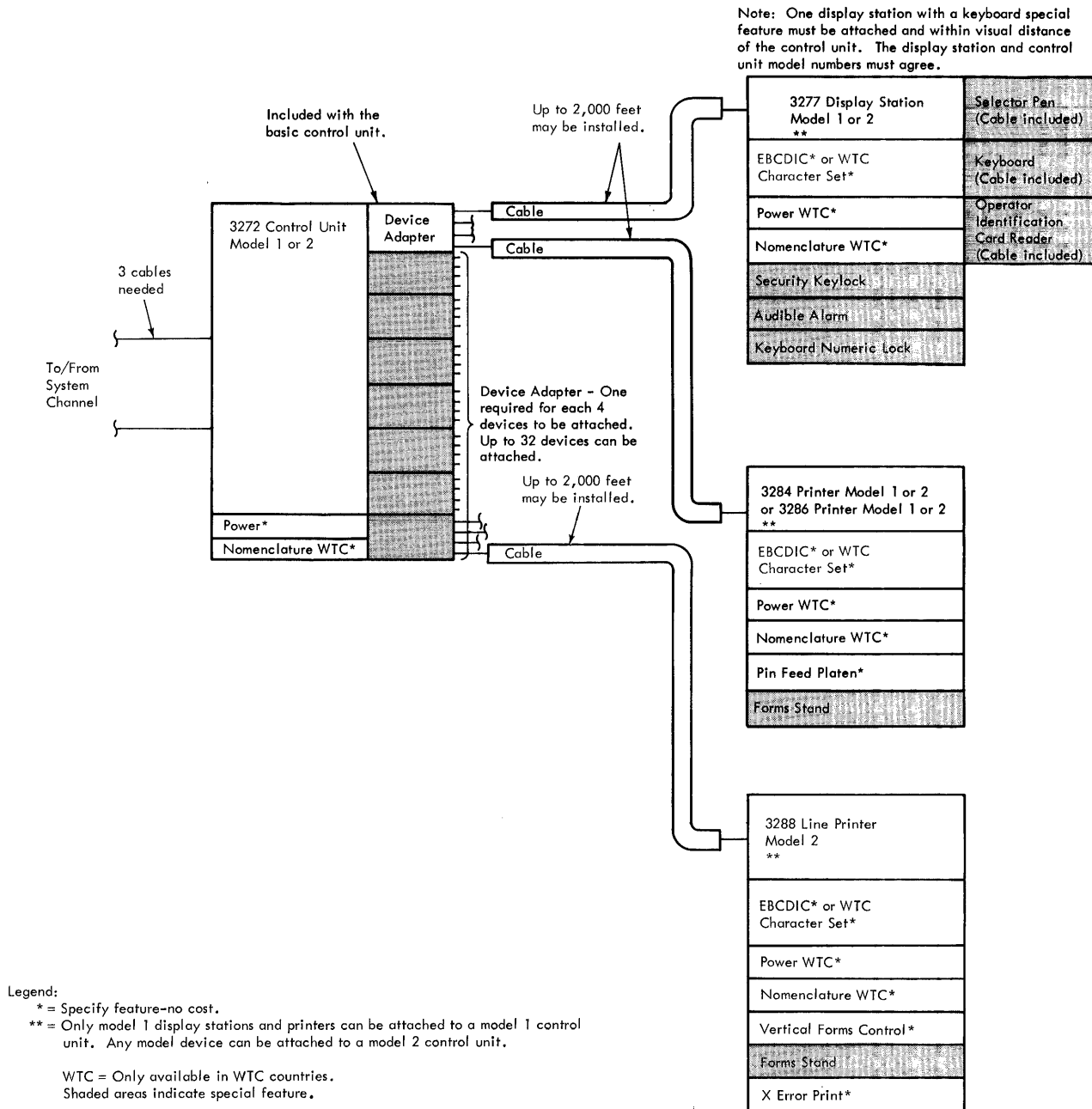


Figure 24. 3270 Display System, Local Configurator (3272 and Attached Devices)

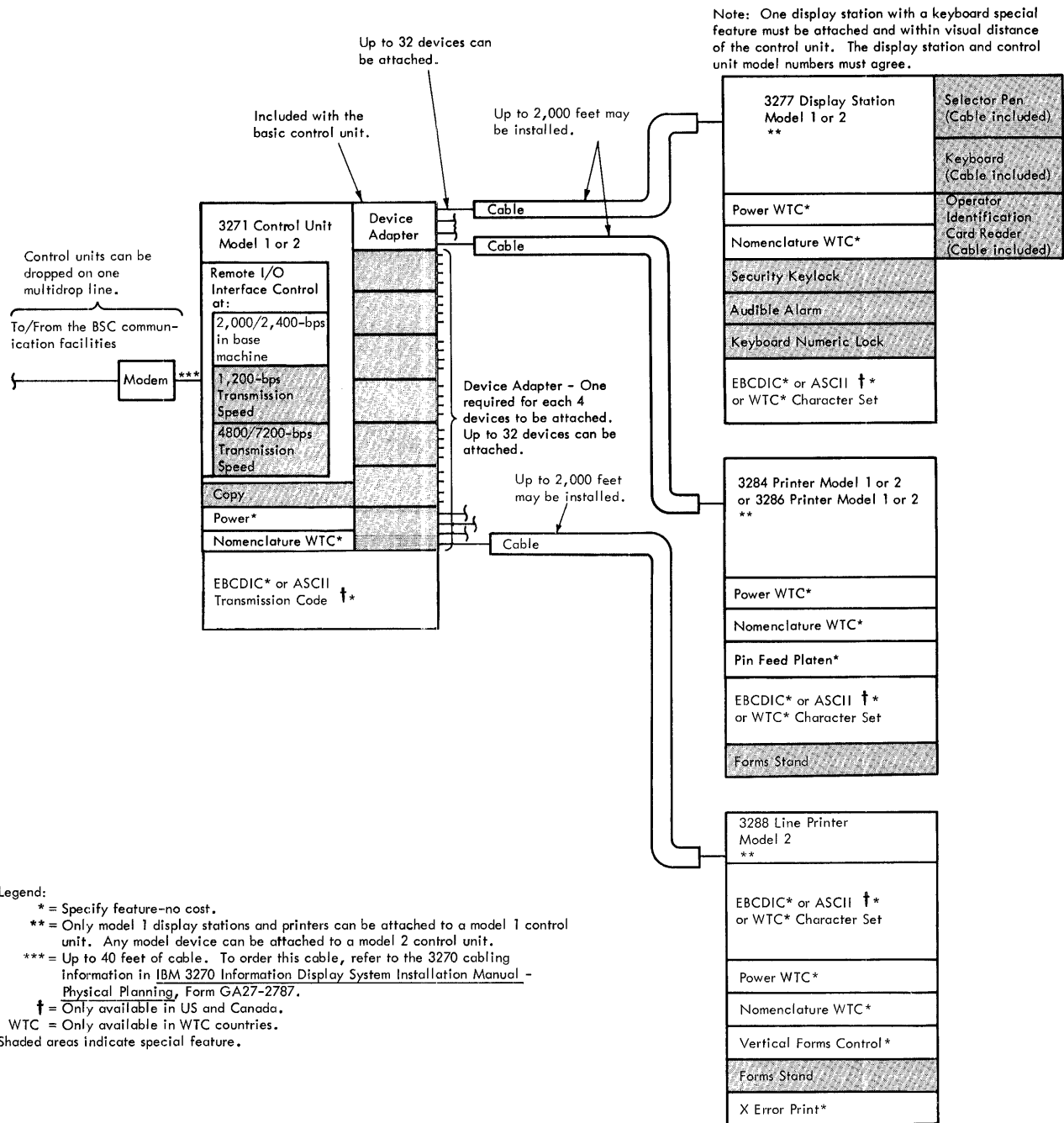


Figure 25. 3270 Display System, Remote Configurator, 3271 Control Unit, Model 1 or 2 (BSC Attachment)



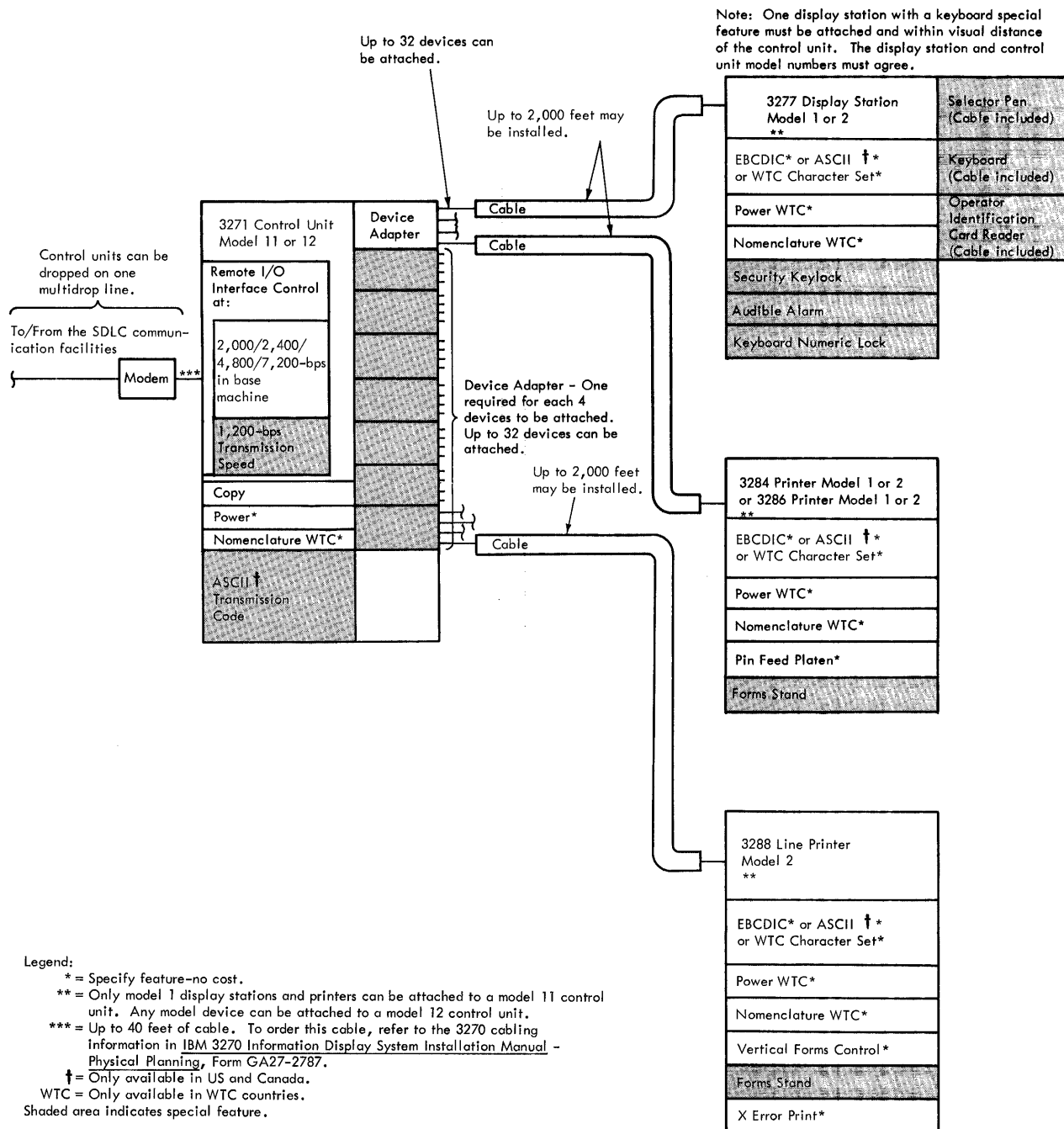


Figure 26. 3270 Display System, Remote Configurator, 3271 Control Unit, Model 11 or 12 (SDLC Attachment)

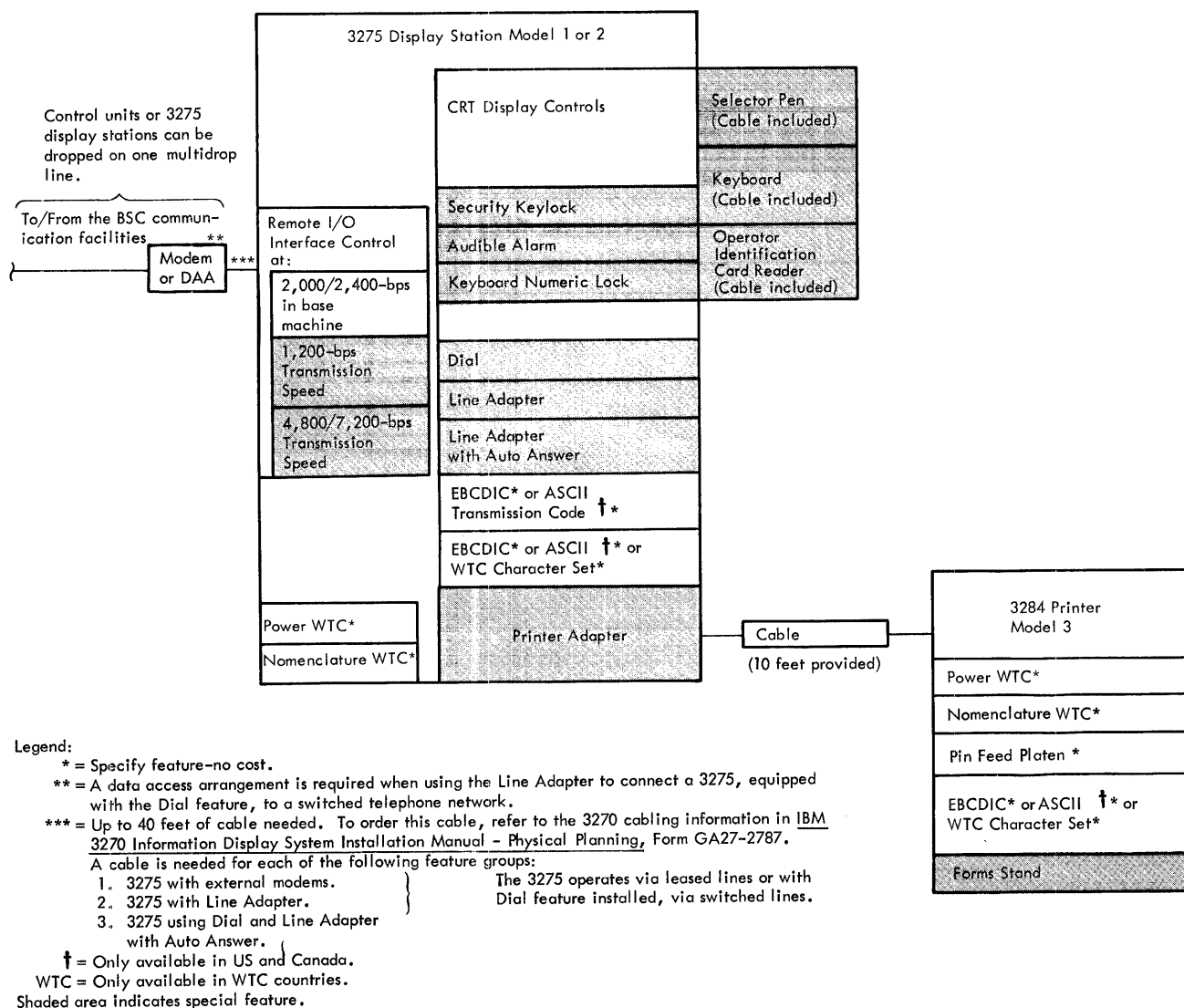


Figure 27. 3270 Display System, Remote Configurator, 3275 Display Station, Model 1 or 2 (BSC Attachment)

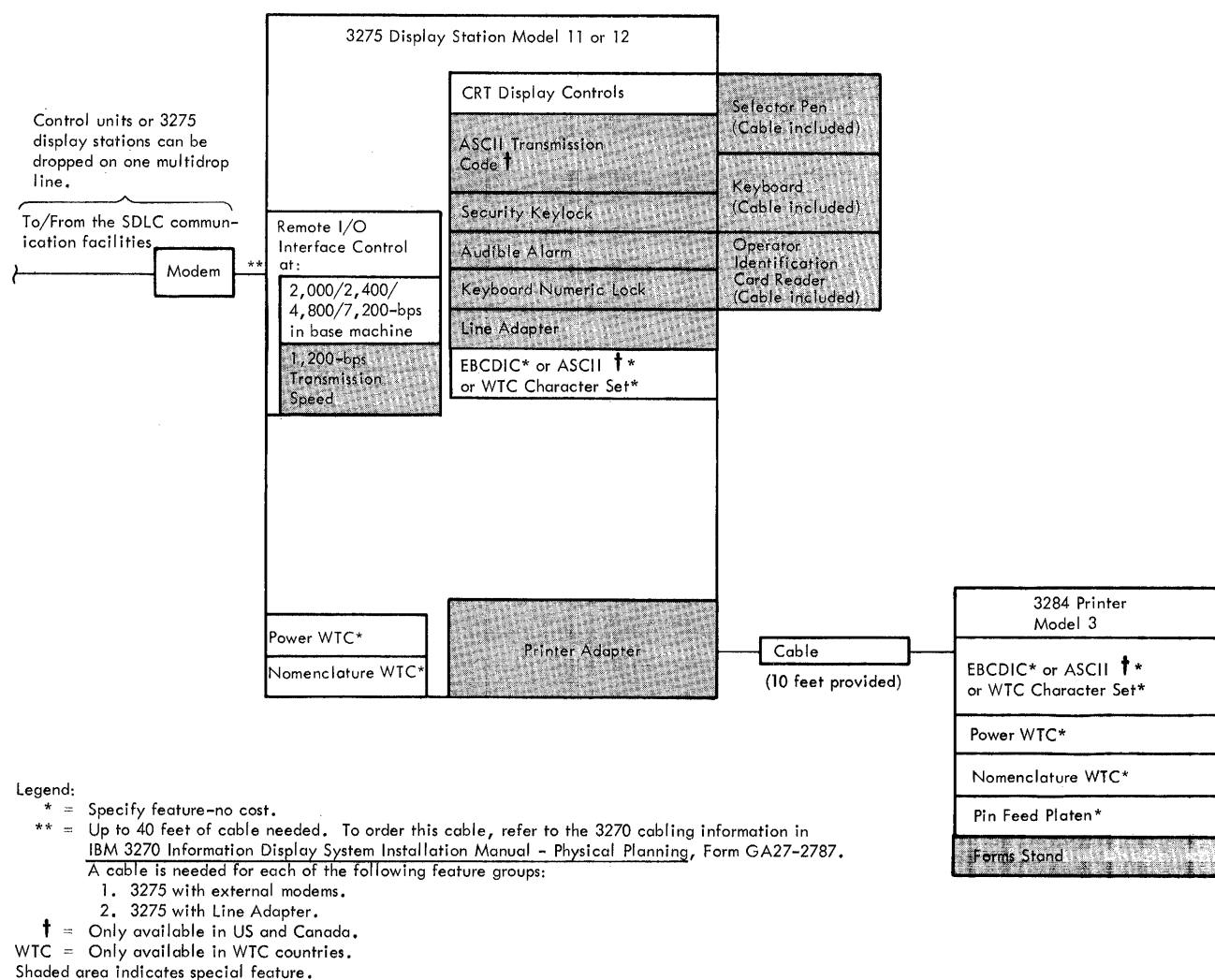


Figure 28. 3270 Display System, Remote Configurator, 3275 Display Station, Model 11 or 12 (SDLC Attachment)

## Appendix C. Buffer Address I/O Interface Codes

Mod 1		Mod 2		Position		Buffer Address (Hex)				Mod 1		Mod 2		Position		Buffer Address (Hex)			
R	C	R	C	Dec	Hex	EBCDIC	ASCII			R	C	R	C	Dec	Hex	EBCDIC	ASCII		
01	01	01	01	0000	0000	40	40	20	20	02	23	01	63	0062	003E	40	7E	20	3D
01	02	01	02	0001	0001	40	C1	20	41	02	24	01	64	0063	003F	40	7F	20	22
01	03	01	03	0002	0002	40	C2	20	42	02	25	01	65	0064	0040	C1	40	41	20
01	04	01	04	0003	0003	40	C3	20	43	02	26	01	66	0065	0041	C1	C1	41	41
01	05	01	05	0004	0004	40	C4	20	44	02	27	01	67	0066	0042	C1	C2	41	42
01	06	01	06	0005	0005	40	C5	20	45	02	28	01	68	0067	0043	C1	C3	41	43
01	07	01	07	0006	0006	40	C6	20	46	02	29	01	69	0068	0044	C1	C4	41	44
01	08	01	08	0007	0007	40	C7	20	47	02	30	01	70	0069	0045	C1	C5	41	45
01	09	01	09	0008	0008	40	C8	20	48	02	31	01	71	0070	0046	C1	C6	41	46
01	10	01	10	0009	0009	40	C9	20	49	02	32	01	72	0071	0047	C1	C7	41	47
01	11	01	11	0010	000A	40	4A	20	5B	02	33	01	73	0072	0048	C1	C8	41	48
01	12	01	12	0011	000B	40	4B	20	2E	02	34	01	74	0073	0049	C1	C9	41	49
01	13	01	13	0012	000C	40	4C	20	3C	02	35	01	75	0074	004A	C1	4A	41	5B
01	14	01	14	0013	000D	40	4D	20	28	02	36	01	76	0075	004B	C1	4B	41	2E
01	15	01	15	0014	000E	40	4E	20	2B	02	37	01	77	0076	004C	C1	4C	41	3C
01	16	01	16	0015	000F	40	4F	20	21	02	38	01	78	0077	004D	C1	4D	41	28
01	17	01	17	0016	0010	40	50	20	26	02	39	01	79	0078	004E	C1	4E	41	2B
01	18	01	18	0017	0011	40	D1	20	4A	02	40	01	80	0079	004F	C1	4F	41	21
01	19	01	19	0018	0012	40	D2	20	4B	03	01	02	01	0080	0050	C1	50	41	26
01	20	01	20	0019	0013	40	D3	20	4C	03	02	02	02	0081	0051	C1	D1	41	4A
01	21	01	21	0020	0014	40	D4	20	4D	03	03	02	03	0082	0052	C1	D2	41	4B
01	22	01	22	0021	0015	40	D5	20	4E	03	04	02	04	0083	0053	C1	D3	41	4C
01	23	01	23	0022	0016	40	D6	20	4F	03	05	02	05	0084	0054	C1	D4	41	4D
01	24	01	24	0023	0017	40	D7	20	50	03	06	02	06	0085	0055	C1	D5	41	4E
01	25	01	25	0024	0018	40	D8	20	51	03	07	02	07	0086	0056	C1	D6	41	4F
01	26	01	26	0025	0019	40	D9	20	52	03	08	02	08	0087	0057	C1	D7	41	50
01	27	01	27	0026	001A	40	5A	20	5D	03	09	02	09	0088	0058	C1	D8	41	51
01	28	01	28	0027	001B	40	5B	20	24	03	10	02	10	0089	0059	C1	D9	41	52
01	29	01	29	0028	001C	40	5C	20	2A	03	11	02	11	0090	005A	C1	5A	41	5D
01	30	01	30	0029	001D	40	5D	20	29	03	12	02	12	0091	005B	C1	5B	41	24
01	31	01	31	0030	001E	40	5E	20	3B	03	13	02	13	0092	005C	C1	5C	41	2A
01	32	01	32	0031	001F	40	5F	20	5E	03	14	02	14	0093	005D	C1	5D	41	29
01	33	01	33	0032	0020	40	60	20	2D	03	15	02	15	0094	005E	C1	5E	41	3B
01	34	01	34	0033	0021	40	61	20	2F	03	16	02	16	0095	005F	C1	5F	41	5E
01	35	01	35	0034	0022	40	E2	20	53	03	17	02	17	0096	0060	C1	60	41	2D
01	36	01	36	0035	0023	40	E3	20	54	03	18	02	18	0097	0061	C1	61	41	2F
01	37	01	37	0036	0024	40	E4	20	55	03	19	02	19	0098	0062	C1	E2	41	53
01	38	01	38	0037	0025	40	E5	20	56	03	20	02	20	0099	0063	C1	E3	41	54
01	39	01	39	0038	0026	40	E6	20	57	03	21	02	21	0100	0064	C1	E4	41	55
01	40	01	40	0039	0027	40	E7	20	58	03	22	02	22	0101	0065	C1	E5	41	56
02	01	01	41	0040	0028	40	E8	20	59	03	23	02	23	0102	0066	C1	E6	41	57
02	02	01	42	0041	0029	40	E9	20	5A	03	24	02	24	0103	0067	C1	E7	41	58
02	03	01	43	0042	002A	40	6A	20	7C	03	25	02	25	0104	0068	C1	E8	41	59
02	04	01	44	0043	002B	40	6B	20	2C	03	26	02	26	0105	0069	C1	E9	41	5A
02	05	01	45	0044	002C	40	6C	20	25	03	27	02	27	0106	006A	C1	6A	41	7C
02	06	01	46	0045	002D	40	6D	20	5F	03	28	02	28	0107	006B	C1	6B	41	2C
02	07	01	47	0046	002E	40	6E	20	3E	03	29	02	29	0108	006C	C1	6C	41	25
02	08	01	48	0047	002F	40	6F	20	3F	03	30	02	30	0109	006D	C1	6D	41	5F
02	09	01	49	0048	0030	40	F0	20	30	03	31	02	31	0110	006E	C1	6E	41	3E
02	10	01	50	0049	0031	40	F1	20	31	03	32	02	32	0111	006F	C1	6F	41	3F
02	11	01	51	0050	0032	40	F2	20	32	03	33	02	33	0112	0070	C1	F0	41	30
02	12	01	52	0051	0033	40	F3	20	33	03	34	02	34	0113	0071	C1	F1	41	31
02	13	01	53	0052	0034	40	F4	20	34	03	35	02	35	0114	0072	C1	F2	41	32
02	14	01	54	0053	0035	40	F5	20	35	03	36	02	36	0115	0073	C1	F3	41	33
02	15	01	55	0054	0036	40	F6	20	36	03	37	02	37	0116	0074	C1	F4	41	34
02	16	01	56	0055	0037	40	F7	20	37	03	38	02	38	0117	0075	C1	F5	41	35
02	17	01	57	0056	0038	40	F8	20	38	03	39	02	39	0118	0076	C1	F6	41	36
02	18	01	58	0057	0039	40	F9	20	39	03	40	02	40	0119	0077	C1	F7	41	37
02	19	01	59	0058	003A	40	7A	20	3A	04	01	02	41	0120	0078	C1	F8	41	38
02	20	01	60	0059	003B	40	7B	20	23	04	02	02	42	0121	0079	C1	F9	41	39
02	21	01	61	0060	003C	40	7C	20	40	04	03	02	43	0122	007A	C1	7A	41	3A
02	22	01	62	0061	003D	40	7D	20	27	04	04	02	44	0123	007B	C1	7B	41	23

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)				Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII					Dec	Hex	EBCDIC	ASCII		
04 05	02 45	0124	007C	C1	7C	41	40	05 27	03 27	0186	00BA	C2	7A	42	3A
04 06	02 46	0125	007D	C1	7D	41	27	05 28	03 28	0187	00BB	C2	7B	42	23
04 07	02 47	0126	007E	C1	7E	41	3D	05 29	03 29	0188	00BC	C2	7C	42	40
04 08	02 48	0127	007F	C1	7F	41	22	05 30	03 30	0189	00BD	C2	7D	42	27
04 09	02 49	0128	0080	C2	40	42	20	05 31	03 31	0190	00BE	C2	7E	42	3D
04 10	02 50	0129	0081	C2	C1	42	41	05 32	03 32	0191	00BF	C2	7F	42	22
04 11	02 51	0130	0082	C2	C2	42	42	05 33	03 33	0192	00C0	C3	40	43	20
04 12	02 52	0131	0083	C2	C3	42	43	05 34	03 34	0193	00C1	C3	C1	43	41
04 13	02 53	0132	0084	C2	C4	42	44	05 35	03 35	0194	00C2	C3	C2	43	42
04 14	02 54	0133	0085	C2	C5	42	45	05 36	03 36	0195	00C3	C3	C3	43	43
04 15	02 55	0134	0086	C2	C6	42	46	05 37	03 37	0196	00C4	C3	C4	43	44
04 16	02 56	0135	0087	C2	C7	42	47	05 38	03 38	0197	00C5	C3	C5	43	45
04 17	02 57	0136	0088	C2	C8	42	48	05 39	03 39	0198	00C6	C3	C6	43	46
04 18	02 58	0137	0089	C2	C9	42	49	05 40	03 40	0199	00C7	C3	C7	43	47
04 19	02 59	0138	008A	C2	4A	42	5B	06 01	03 41	0200	00C8	C3	C8	43	48
04 20	02 60	0139	008B	C2	4B	42	2E	06 02	03 42	0201	00C9	C3	C9	43	49
04 21	02 61	0140	008C	C2	4C	42	3C	06 03	03 43	0202	00CA	C3	4A	43	5B
04 22	02 62	0141	008D	C2	4D	42	28	06 04	03 44	0203	00CB	C3	4B	43	2F
04 23	02 63	0142	008E	C2	4E	42	2B	06 05	03 45	0204	00CC	C3	4C	43	3C
04 24	02 64	0143	008F	C2	4F	42	21	06 06	03 46	0205	00CD	C3	4D	43	28
04 25	02 65	0144	0090	C2	50	42	26	06 07	03 47	0206	00CE	C3	4E	43	2B
04 26	02 66	0145	0091	C2	D1	42	4A	06 08	03 48	0207	00CF	C3	4F	43	21
04 27	02 67	0146	0092	C2	D2	42	4B	06 09	03 49	0208	00D0	C3	50	43	26
04 28	02 68	0147	0093	C2	D3	42	4C	06 10	03 50	0209	00D1	C3	D1	43	4A
04 29	02 69	0148	0094	C2	D4	42	4D	06 11	03 51	0210	00D2	C3	D2	43	4B
04 30	02 70	0149	0095	C2	D5	42	4E	06 12	03 52	0211	00D3	C3	D3	43	4C
04 31	02 71	0150	0096	C2	D6	42	4F	06 13	03 53	0212	00D4	C3	D4	43	4D
04 32	02 72	0151	0097	C2	D7	42	50	06 14	03 54	0213	00D5	C3	D5	43	4E
04 33	02 73	0152	0098	C2	D8	42	51	06 15	03 55	0214	00D6	C3	D6	43	4F
04 34	02 74	0153	0099	C2	D9	42	52	06 16	03 56	0215	00D7	C3	D7	43	50
04 35	02 75	0154	009A	C2	5A	42	5D	06 17	03 57	0216	00D8	C3	D8	43	51
04 36	02 76	0155	009B	C2	5B	42	24	06 18	03 58	0217	00D9	C3	D9	43	52
04 37	02 77	0156	009C	C2	5C	42	2A	06 19	03 59	0218	00DA	C3	5A	43	5D
04 38	02 78	0157	009D	C2	5D	42	29	06 20	03 60	0219	00DB	C3	5B	43	24
04 39	02 79	0158	009E	C2	5E	42	3B	06 21	03 61	0220	00DC	C3	5C	43	2A
04 40	02 80	0159	009F	C2	5F	42	5E	06 22	03 62	0221	00DD	C3	5D	43	29
05 01	03 01	0160	00A0	C2	60	42	2D	06 23	03 63	0222	00DE	C3	5E	43	3B
05 02	03 02	0161	00A1	C2	61	42	2F	06 24	03 64	0223	00DF	C3	5F	43	5E
05 03	03 03	0162	00A2	C2	E2	42	53	06 25	03 65	0224	00E0	C3	60	43	2D
05 04	03 04	0163	00A3	C2	E3	42	54	06 26	03 66	0225	00E1	C3	61	43	2F
05 05	03 05	0164	00A4	C2	E4	42	55	06 27	03 67	0226	00E2	C3	E2	43	53
05 06	03 06	0165	00A5	C2	E5	42	56	06 28	03 68	0227	00E3	C3	E3	43	54
05 07	03 07	0166	00A6	C2	E6	42	57	06 29	03 69	0228	00E4	C3	E4	43	55
05 08	03 08	0167	00A7	C2	E7	42	58	06 30	03 70	0229	00E5	C3	E5	43	56
05 09	03 09	0168	00A8	C2	E8	42	59	06 31	03 71	0230	00E6	C3	E6	43	57
05 10	03 10	0169	00A9	C2	E9	42	5A	06 32	03 72	0231	00E7	C3	E7	43	58
05 11	03 11	0170	00AA	C2	6A	42	7C	06 33	03 73	0232	00E8	C3	E8	43	59
05 12	03 12	0171	00AB	C2	6B	42	2C	06 34	03 74	0233	00E9	C3	E9	43	5A
05 13	03 13	0172	00AC	C2	6C	42	25	06 35	03 75	0234	00EA	C3	6A	43	7C
05 14	03 14	0173	00AD	C2	6D	42	5F	06 36	03 76	0235	00EB	C3	6B	43	2C
05 15	03 15	0174	00AE	C2	6E	42	3E	06 37	03 77	0236	00EC	C3	6C	43	25
05 16	03 16	0175	00AF	C2	6F	42	3F	06 38	03 78	0237	00ED	C3	6D	43	5F
05 17	03 17	0176	00B0	C2	F0	42	30	06 39	03 79	0238	00EE	C3	6E	43	3E
05 18	03 18	0177	00B1	C2	F1	42	31	06 40	03 80	0239	00EF	C3	6F	43	3F
05 19	03 19	0178	00B2	C2	F2	42	32	07 01	04 01	0240	00F0	C3	F0	43	30
05 20	03 20	0179	00B3	C2	F3	42	33	07 02	04 02	0241	00F1	C3	F1	43	31
05 21	03 21	0180	00B4	C2	F4	42	34	07 03	04 03	0242	00F2	C3	F2	43	32
05 22	03 22	0181	00B5	C2	F5	42	35	07 04	04 04	0243	00F3	C3	F3	43	33
05 23	03 23	0182	00B6	C2	F6	42	36	07 05	04 05	0244	00F4	C3	F4	43	34
05 24	03 24	0183	00B7	C2	F7	42	37	07 06	04 06	0245	00F5	C3	F5	43	35
05 25	03 25	0184	00B8	C2	F8	42	38	07 07	04 07	0246	00F6	C3	F6	43	36
05 26	03 26	0185	00B9	C2	F9	42	39	07 08	04 08	0247	00F7	C3	F7	43	37

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)				Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII					Dec	Hex	EBCDIC	ASCII		
07 09	04 09	0248	00F8	C3	F8	43	38	08 31	04 71	0310	0136	C4	F6	44	36
07 10	04 10	0249	00F9	C3	F9	43	39	08 32	04 72	0311	0137	C4	F7	44	37
07 11	04 11	0250	00FA	C3	7A	43	3A	08 33	04 73	0312	0138	C4	F8	44	38
07 12	04 12	0251	00FB	C3	7B	43	23	08 34	04 74	0313	0139	C4	F9	44	39
07 13	04 13	0252	00FC	C3	7C	43	40	08 35	04 75	0314	013A	C4	7A	44	3A
07 14	04 14	0253	00FD	C3	7D	43	27	08 36	04 76	0315	013B	C4	7B	44	23
07 15	04 15	0254	00FE	C3	7E	43	3D	08 37	04 77	0316	013C	C4	7C	44	40
07 16	04 16	0255	00FF	C3	7F	43	22	08 38	04 78	0317	013D	C4	7D	44	27
07 17	04 17	0256	0100	C4	40	44	20	08 39	04 79	0318	013E	C4	7E	44	3D
07 18	04 18	0257	0101	C4	C1	44	41	08 40	04 80	0319	013F	C4	7F	44	22
07 19	04 19	0258	0102	C4	C2	44	42	09 01	05 01	0320	0140	C5	40	45	20
07 20	04 20	0259	0103	C4	C3	44	43	09 02	05 02	0321	0141	C5	C1	45	41
07 21	04 21	0260	0104	C4	C4	44	44	09 03	05 03	0322	0142	C5	C2	45	42
07 22	04 22	0261	0105	C4	C5	44	45	09 04	05 04	0323	0143	C5	C3	45	43
07 23	04 23	0262	0106	C4	C6	44	46	09 05	05 05	0324	0144	C5	C4	45	44
07 24	04 24	0263	0107	C4	C7	44	47	09 06	05 06	0325	0145	C5	C5	45	45
07 25	04 25	0264	0108	C4	C8	44	48	09 07	05 07	0326	0146	C5	C6	45	46
07 26	04 26	0265	0109	C4	C9	44	49	09 08	05 08	0327	0147	C5	C7	45	47
07 27	04 27	0266	010A	C4	4A	44	5B	09 09	05 09	0328	0148	C5	C8	45	48
07 28	04 28	0267	010B	C4	4B	44	2E	09 10	05 10	0329	0149	C5	C9	45	49
07 29	04 29	0268	010C	C4	4C	44	3C	09 11	05 11	0330	014A	C5	4A	45	5B
07 30	04 30	0269	010D	C4	4D	44	28	09 12	05 12	0331	014B	C5	4B	45	2E
07 31	04 31	0270	010E	C4	4E	44	2B	09 13	05 13	0332	014C	C5	4C	45	3C
07 32	04 32	0271	010F	C4	4F	44	21	09 14	05 14	0333	014D	C5	4D	45	28
07 33	04 33	0272	0110	C4	50	44	26	09 15	05 15	0334	014E	C5	4E	45	2B
07 34	04 34	0273	0111	C4	D1	44	4A	09 16	05 16	0335	014F	C5	4F	45	21
07 35	04 35	0274	0112	C4	D2	44	4B	09 17	05 17	0336	0150	C5	50	45	26
07 36	04 36	0275	0113	C4	D3	44	4C	09 18	05 18	0337	0151	C5	D1	45	4A
07 37	04 37	0276	0114	C4	D4	44	4D	09 19	05 19	0338	0152	C5	D2	45	4B
07 38	04 38	0277	0115	C4	D5	44	4E	09 20	05 20	0339	0153	C5	D3	45	4C
07 39	04 39	0278	0116	C4	D6	44	4F	09 21	05 21	0340	0154	C5	D4	45	4D
07 40	04 40	0279	0117	C4	D7	44	50	09 22	05 22	0341	0155	C5	D5	45	4E
08 01	04 41	0280	0118	C4	D8	44	51	09 23	05 23	0342	0156	C5	D6	45	4F
08 02	04 42	0281	0119	C4	D9	44	52	09 24	05 24	0343	0157	C5	D7	45	50
08 03	04 43	0282	011A	C4	5A	44	5D	09 25	05 25	0344	0158	C5	D8	45	51
08 04	04 44	0283	011B	C4	5B	44	24	09 26	05 26	0345	0159	C5	D9	45	52
08 05	04 45	0284	011C	C4	5C	44	2A	09 27	05 27	0346	015A	C5	5A	45	5D
08 06	04 46	0285	011D	C4	5D	44	29	09 28	05 28	0347	015B	C5	5B	45	24
08 07	04 47	0286	011E	C4	5E	44	3B	09 29	05 29	0348	015C	C5	5C	45	2A
08 08	04 48	0287	011F	C4	5F	44	5E	09 30	05 30	0349	015D	C5	5D	45	29
08 09	04 49	0288	0120	C4	60	44	2D	09 31	05 31	0350	015E	C5	5E	45	3B
08 10	04 50	0289	0121	C4	61	44	2F	09 32	05 32	0351	015F	C5	5F	45	5E
08 11	04 51	0290	0122	C4	E2	44	53	09 33	05 33	0352	0160	C5	60	45	2D
08 12	04 52	0291	0123	C4	E3	44	54	09 34	05 34	0353	0161	C5	61	45	2F
08 13	04 53	0292	0124	C4	E4	44	55	09 35	05 35	0354	0162	C5	E2	45	53
08 14	04 54	0293	0125	C4	E5	44	56	09 36	05 36	0355	0163	C5	E3	45	54
08 15	04 55	0294	0126	C4	E6	44	57	09 37	05 37	0356	0164	C5	E4	45	55
08 16	04 56	0295	0127	C4	E7	44	58	09 38	05 38	0357	0165	C5	E5	45	56
08 17	04 57	0296	0128	C4	E8	44	59	09 39	05 39	0358	0166	C5	E6	45	57
08 18	04 58	0297	0129	C4	E9	44	5A	09 40	05 40	0359	0167	C5	E7	45	58
08 19	04 59	0298	012A	C4	6A	44	7C	10 01	05 41	0360	0168	C5	E8	45	59
08 20	04 60	0299	012B	C4	6B	44	2C	10 02	05 42	0361	0169	C5	E9	45	5A
08 21	04 61	0300	012C	C4	6C	44	25	10 03	05 43	0362	016A	C5	6A	45	7C
08 22	04 62	0301	012D	C4	6D	44	5F	10 04	05 44	0363	016B	C5	6B	45	2C
08 23	04 63	0302	012E	C4	6E	44	3E	10 05	05 45	0364	016C	C5	6C	45	25
08 24	04 64	0303	012F	C4	6F	44	3F	10 06	05 46	0365	016D	C5	6D	45	5F
08 25	04 65	0304	0130	C4	F0	44	30	10 07	05 47	0366	016E	C5	6E	45	3E
08 26	04 66	0305	0131	C4	F1	44	31	10 08	05 48	0367	016F	C5	6F	45	3F
08 27	04 67	0306	0132	C4	F2	44	32	10 09	05 49	0368	0170	C5	F0	45	30
08 28	04 68	0307	0133	C4	F3	44	33	10 10	05 50	0369	0171	C5	F1	45	31
08 29	04 69	0308	0134	C4	F4	44	34	10 11	05 51	0370	0172	C5	F2	45	32
08 30	04 70	0309	0135	C4	F5	44	35	10 12	05 52	0371	0173	C5	F3	45	33

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)				Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII					Dec	Hex	EBCDIC	ASCII		
10 13	05 53	0372	0174	C5	F4	45	34	11 35	06 35	0434	01B2	C6	F2	46	32
10 14	05 54	0373	0175	C5	F5	45	35	11 36	06 36	0435	01B3	C6	F3	46	33
10 15	05 55	0374	0176	C5	F6	45	36	11 37	06 37	0436	01B4	C6	F4	46	34
10 16	05 56	0375	0177	C5	F7	45	37	11 38	06 38	0437	01B5	C6	F5	46	35
10 17	05 57	0376	0178	C5	F8	45	38	11 39	06 39	0438	01B6	C6	F6	46	36
10 18	05 58	0377	0179	C5	F9	45	39	11 40	06 40	0439	01B7	C6	F7	46	37
10 19	05 59	0378	017A	C5	7A	45	3A	12 01	06 41	0440	01B8	C6	F8	46	38
10 20	05 60	0379	017B	C5	7B	45	23	12 02	06 42	0441	01B9	C6	F9	46	39
10 21	05 61	0380	017C	C5	7C	45	40	12 03	06 43	0442	01BA	C6	7A	46	3A
10 22	05 62	0381	017D	C5	7D	45	27	12 04	06 44	0443	01BB	C6	7B	46	23
10 23	05 63	0382	017E	C5	7E	45	3D	12 05	06 45	0444	01BC	C6	7C	46	40
10 24	05 64	0383	017F	C5	7F	45	22	12 06	06 46	0445	01BD	C6	7D	46	27
10 25	05 65	0384	0180	C6	40	46	20	12 07	06 47	0446	01BE	C6	7E	46	3D
10 26	05 66	0385	0181	C6	C1	46	41	12 08	06 48	0447	01BF	C6	7F	46	22
10 27	05 67	0386	0182	C6	C2	46	42	12 09	06 49	0448	01C0	C7	40	47	20
10 28	05 68	0387	0183	C6	C3	46	43	12 10	06 50	0449	01C1	C7	C1	47	41
10 29	05 69	0388	0184	C6	C4	46	44	12 11	06 51	0450	01C2	C7	C2	47	42
10 30	05 70	0389	0185	C6	C5	46	45	12 12	06 52	0451	01C3	C7	C3	47	43
10 31	05 71	0390	0186	C6	C6	46	46	12 13	06 53	0452	01C4	C7	C4	47	44
10 32	05 72	0391	0187	C6	C7	46	47	12 14	06 54	0453	01C5	C7	C5	47	45
10 33	05 73	0392	0188	C6	C8	46	48	12 15	06 55	0454	01C6	C7	C6	47	46
10 34	05 74	0393	0189	C6	C9	46	49	12 16	06 56	0455	01C7	C7	C7	47	47
10 35	05 75	0394	018A	C6	4A	46	5B	12 17	06 57	0456	01C8	C7	C8	47	48
10 36	05 76	0395	018B	C6	4B	46	2E	12 18	06 58	0457	01C9	C7	C9	47	49
10 37	05 77	0396	018C	C6	4C	46	3C	12 19	06 59	0458	01CA	C7	4A	47	5B
10 38	05 78	0397	018D	C6	4D	46	28	12 20	06 60	0459	01CB	C7	4B	47	2E
10 39	05 79	0398	018E	C6	4E	46	2B	12 21	06 61	0460	01CC	C7	4C	47	3C
10 40	05 80	0399	018F	C6	4F	46	21	12 22	06 62	0461	01CD	C7	4D	47	28
11 01	06 01	0400	0190	C6	50	46	26	12 23	06 63	0462	01CE	C7	4E	47	2B
11 02	06 02	0401	0191	C6	D1	46	4A	12 24	06 64	0463	01CF	C7	4F	47	21
11 03	06 03	0402	0192	C6	D2	46	4B	12 25	06 65	0464	01D0	C7	50	47	26
11 04	06 04	0403	0193	C6	D3	46	4C	12 26	06 66	0465	01D1	C7	D1	47	4A
11 05	06 05	0404	0194	C6	D4	46	4D	12 27	06 67	0466	01D2	C7	D2	47	4B
11 06	06 06	0405	0195	C6	D5	46	4E	12 28	06 68	0467	01D3	C7	D3	47	4C
11 07	06 07	0406	0196	C6	D6	46	4F	12 29	06 69	0468	01D4	C7	D4	47	4D
11 08	06 08	0407	0197	C6	D7	46	50	12 30	06 70	0469	01D5	C7	D5	47	4E
11 09	06 09	0408	0198	C6	D8	46	51	12 31	06 71	0470	01D6	C7	D6	47	4F
11 10	06 10	0409	0199	C6	D9	46	52	12 32	06 72	0471	01D7	C7	D7	47	50
11 11	06 11	0410	019A	C6	5A	46	5D	12 33	06 73	0472	01D8	C7	D8	47	51
11 12	06 12	0411	019B	C6	5B	46	24	12 34	06 74	0473	01D9	C7	D9	47	52
11 13	06 13	0412	019C	C6	5C	46	2A	12 35	06 75	0474	01DA	C7	5A	47	5D
11 14	06 14	0413	019D	C6	5D	46	29	12 36	06 76	0475	01DB	C7	5B	47	24
11 15	06 15	0414	019E	C6	5E	46	3B	12 37	06 77	0476	01DC	C7	5C	47	2A
11 16	06 16	0415	019F	C6	5F	46	5E	12 38	06 78	0477	01DD	C7	5D	47	29
11 17	06 17	0416	01A0	C6	60	46	2D	12 39	06 79	0478	01DE	C7	5E	47	3B
11 18	06 18	0417	01A1	C6	61	46	2F	12 40	06 80	0479	01DF	C7	5F	47	5E
11 19	06 19	0418	01A2	C6	E2	46	53		07 01	0480	01E0	C7	60	47	2D
11 20	06 20	0419	01A3	C6	E3	46	54		07 02	0481	01E1	C7	61	47	2F
11 21	06 21	0420	01A4	C6	E4	46	55		07 03	0482	01E2	C7	E2	47	53
11 22	06 22	0421	01A5	C6	E5	46	56		07 04	0483	01E3	C7	E3	47	54
11 23	06 23	0422	01A6	C6	E6	46	57		07 05	0484	01E4	C7	E4	47	55
11 24	06 24	0423	01A7	C6	E7	46	58		07 06	0485	01E5	C7	E5	47	56
11 25	06 25	0424	01A8	C6	E8	46	59		07 07	0486	01E6	C7	E6	47	57
11 26	06 26	0425	01A9	C6	E9	46	5A		07 08	0487	01E7	C7	E7	47	58
11 27	06 27	0426	01AA	C6	6A	46	7C		07 09	0488	01E8	C7	E8	47	59
11 28	06 28	0427	01AB	C6	6B	46	2C		07 10	0489	01E9	C7	E9	47	5A
11 29	06 29	0428	01AC	C6	6C	46	25		07 11	0490	01EA	C7	6A	47	7C
11 30	06 30	0429	01AD	C6	6D	46	5F		07 12	0491	01EB	C7	6B	47	2C
11 31	06 31	0430	01AE	C6	6E	46	3E		07 13	0492	01EC	C7	6C	47	25
11 32	06 32	0431	01AF	C6	6F	46	3F		07 14	0493	01ED	C7	6D	47	5F
11 33	06 33	0432	01B0	C6	F0	46	30		07 15	0494	01EE	C7	6E	47	3E
11 34	06 34	0433	01B1	C6	F1	46	31		07 16	0495	01EF	C7	6F	47	3F

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII		
	07 17	0496	01F0	C7	F0	47	30
	07 18	0497	01F1	C7	F1	47	31
	07 19	0498	01F2	C7	F2	47	32
	07 20	0499	01F3	C7	F3	47	33
	07 21	0500	01F4	C7	F4	47	34
	07 22	0501	01F5	C7	F5	47	35
	07 23	0502	01F6	C7	F6	47	36
	07 24	0503	01F7	C7	F7	47	37
	07 25	0504	01F8	C7	F8	47	38
	07 26	0505	01F9	C7	F9	47	39
	07 27	0506	01FA	C7	7A	47	3A
	07 28	0507	01FB	C7	7B	47	23
	07 29	0508	01FC	C7	7C	47	40
	07 30	0509	01FD	C7	7D	47	27
	07 31	0510	01FE	C7	7E	47	3D
	07 32	0511	01FF	C7	7F	47	22
	07 33	0512	0200	C8	40	48	20
	07 34	0513	0201	C8	C1	48	41
	07 35	0514	0202	C8	C2	48	42
	07 36	0515	0203	C8	C3	48	43
	07 37	0516	0204	C8	C4	48	44
	07 38	0517	0205	C8	C5	48	45
	07 39	0518	0206	C8	C6	48	46
	07 40	0519	0207	C8	C7	48	47
	07 41	0520	0208	C8	C8	48	48
	07 42	0521	0209	C8	C9	48	49
	07 43	0522	020A	C8	4A	48	5B
	07 44	0523	020B	C8	4B	48	2E
	07 45	0524	020C	C8	4C	48	3C
	07 46	0525	020D	C8	4D	48	28
	07 47	0526	020E	C8	4E	48	2B
	07 48	0527	020F	C8	4F	48	21
	07 49	0528	0210	C8	50	48	26
	07 50	0529	0211	C8	D1	48	4A
	07 51	0530	0212	C8	D2	48	4B
	07 52	0531	0213	C8	D3	48	4C
	07 53	0532	0214	C8	D4	48	4D
	07 54	0533	0215	C8	D5	48	4E
	07 55	0534	0216	C8	D6	48	4F
	07 56	0535	0217	C8	D7	48	50
	07 57	0536	0218	C8	D8	48	51
	07 58	0537	0219	C8	D9	48	52
	07 59	0538	021A	C8	5A	48	5D
	07 60	0539	021B	C8	5B	48	24
	07 61	0540	021C	C8	5C	48	2A
	07 62	0541	021D	C8	5D	48	29
	07 63	0542	021E	C8	5E	48	3B
	07 64	0543	021F	C8	5F	48	5E
	07 65	0544	0220	C8	60	48	2D
	07 66	0545	0221	C8	61	48	2F
	07 67	0546	0222	C8	E2	48	53
	07 68	0547	0223	C8	E3	48	54
	07 69	0548	0224	C8	E4	48	55
	07 70	0549	0225	C8	E5	48	56
	07 71	0550	0226	C8	E6	48	57
	07 72	0551	0227	C8	E7	48	58
	07 73	0552	0228	C8	E8	48	59
	07 74	0553	0229	C8	E9	48	5A
	07 75	0554	022A	C8	6A	48	7C
	07 76	0555	022B	C8	6B	48	2C
	07 77	0556	022C	C8	6C	48	25
	07 78	0557	022D	C8	6D	48	5F

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII		
	07 79	0558	022E	C8	6E	48	3E
	07 80	0559	022F	C8	6F	48	3F
	08 01	0560	0230	C8	F0	48	30
	08 02	0561	0231	C8	F1	48	31
	08 03	0562	0232	C8	F2	48	32
	08 04	0563	0233	C8	F3	48	33
	08 05	0564	0234	C8	F4	48	34
	08 06	0565	0235	C8	F5	48	35
	08 07	0566	0236	C8	F6	48	36
	08 08	0567	0237	C8	F7	48	37
	08 09	0568	0238	C8	F8	48	38
	08 10	0569	0239	C8	F9	48	39
	08 11	0570	023A	C8	7A	48	3A
	08 12	0571	023B	C8	7B	48	23
	08 13	0572	023C	C8	7C	48	40
	08 14	0573	023D	C8	7D	48	27
	08 15	0574	023E	C8	7E	48	3D
	08 16	0575	023F	C8	7F	48	22
	08 17	0576	0240	C9	40	49	20
	08 18	0577	0241	C9	C1	49	41
	08 19	0578	0242	C9	C2	49	42
	08 20	0579	0243	C9	C3	49	43
	08 21	0580	0244	C9	C4	49	44
	08 22	0581	0245	C9	C5	49	45
	08 23	0582	0246	C9	C6	49	46
	08 24	0583	0247	C9	C7	49	47
	08 25	0584	0248	C9	C8	49	48
	08 26	0585	0249	C9	C9	49	49
	08 27	0586	024A	C9	4A	49	5B
	08 28	0587	024B	C9	4B	49	2E
	08 29	0588	024C	C9	4C	49	3C
	08 30	0589	024D	C9	4D	49	28
	08 31	0590	024E	C9	4E	49	2B
	08 32	0591	024F	C9	4F	49	21
	08 33	0592	0250	C9	50	49	26
	08 34	0593	0251	C9	D1	49	4A
	08 35	0594	0252	C9	D2	49	4B
	08 36	0595	0253	C9	D3	49	4C
	08 37	0596	0254	C9	D4	49	4D
	08 38	0597	0255	C9	D5	49	4E
	08 39	0598	0256	C9	D6	49	4F
	08 40	0599	0257	C9	D7	49	50
	08 41	0600	0258	C9	D8	49	51
	08 42	0601	0259	C9	D9	49	52
	08 43	0602	025A	C9	5A	49	5D
	08 44	0603	025B	C9	5B	49	24
	08 45	0604	025C	C9	5C	49	2A
	08 46	0605	025D	C9	5D	49	29
	08 47	0606	025E	C9	5E	49	3B
	08 48	0607	025F	C9	5F	49	5E
	08 49	0608	0260	C9	60	49	2D
	08 50	0609	0261	C9	61	49	2F
	08 51	0610	0262	C9	E2	49	53
	08 52	0611	0263	C9	E3	49	54
	08 53	0612	0264	C9	E4	49	55
	08 54	0613	0265	C9	E5	49	56
	08 55	0614	0266	C9	E6	49	57
	08 56	0615	0267	C9	E7	49	58
	08 57	0616	0268	C9	E8	49	59
	08 58	0617	0269	C9	E9	49	5A
	08 59	0618	026A	C9	6A	49	7C
	08 60	0619	026B	C9	6B	49	2C



Mod 1		Mod 2		Position		Buffer Address (Hex)		Mod 1		Mod 2		Position		Buffer Address (Hex)	
R	C	R	C	Dec	Hex	EBCDIC	ASCII	R	C	R	C	Dec	Hex	EBCDIC	ASCII
		08 61		0620	026C	C9	6C	49	25			09 43	0682 02AA	4A	6A
		08 62		0621	026D	C9	6D	49	5F			09 44	0683 02AB	4A	6B
		08 63		0622	026E	C9	6E	49	3E			09 45	0684 02AC	4A	6C
		08 64		0623	026F	C9	6F	49	3F			09 46	0685 02AD	4A	6D
		08 65		0624	0270	C9	F0	49	30			09 47	0686 02AE	4A	6E
		08 66		0625	0271	C9	F1	49	31			09 48	0687 02AF	4A	6F
		08 67		0626	0272	C9	F2	49	32			09 49	0688 02B0	4A	F0
		08 68		0627	0273	C9	F3	49	33			09 50	0689 02B1	4A	F1
		08 69		0628	0274	C9	F4	49	34			09 51	0690 02B2	4A	F2
		08 70		0629	0275	C9	F5	49	35			09 52	0691 02B3	4A	F3
		08 71		0630	0276	C9	F6	49	36			09 53	0692 02B4	4A	F4
		08 72		0631	0277	C9	F7	49	37			09 54	0693 02B5	4A	F5
		08 73		0632	0278	C9	F8	49	38			09 55	0694 02B6	4A	F6
		08 74		0633	0279	C9	F9	49	39			09 56	0695 02B7	4A	F7
		08 75		0634	027A	C9	7A	49	3A			09 57	0696 02B8	4A	F8
		08 76		0635	027B	C9	7B	49	23			09 58	0697 02B9	4A	F9
		08 77		0636	027C	C9	7C	49	40			09 59	0698 02BA	4A	7A
		08 78		0637	027D	C9	7D	49	27			09 60	0699 02BB	4A	7B
		08 79		0638	027E	C9	7E	49	3D			09 61	0700 02BC	4A	7C
		08 80		0639	027F	C9	7F	49	22			09 62	0701 02BD	4A	7D
		09 01		0640	0280	4A	40	5B	20			09 63	0702 02BE	4A	7E
		09 02		0641	0281	4A	C1	5B	41			09 64	0703 02BF	4A	7F
		09 03		0642	0282	4A	C2	5B	42			09 65	0704 02C0	4B	40
		09 04		0643	0283	4A	C3	5B	43			09 66	0705 02C1	4B	C1
		09 05		0644	0284	4A	C4	5B	44			09 67	0706 02C2	4B	C2
		09 06		0645	0285	4A	C5	5B	45			09 68	0707 02C3	4B	C3
		09 07		0646	0286	4A	C6	5B	46			09 69	0708 02C4	4B	C4
		09 08		0647	0287	4A	C7	5B	47			09 70	0709 02C5	4B	C5
		09 09		0648	0288	4A	C8	5B	48			09 71	0710 02C6	4B	C6
		09 10		0649	0289	4A	C9	5B	49			09 72	0711 02C7	4B	C7
		09 11		0650	028A	4A	4A	5B	5B			09 73	0712 02C8	4B	C8
		09 12		0651	028B	4A	4B	5B	2E			09 74	0713 02C9	4B	C9
		09 13		0652	028C	4A	4C	5B	3C			09 75	0714 02CA	4B	4A
		09 14		0653	028D	4A	4D	5B	28			09 76	0715 02CB	4B	4B
		09 15		0654	028E	4A	4E	5B	2B			09 77	0716 02CC	4B	4C
		09 16		0655	028F	4A	4F	5B	21			09 78	0717 02CD	4B	4D
		09 17		0656	0290	4A	50	5B	26			09 79	0718 02CE	4B	4E
		09 18		0657	0291	4A	D1	5B	4A			09 80	0719 02CF	4B	4F
		09 19		0658	0292	4A	D2	5B	4B			10 01	0720 02D0	4B	50
		09 20		0659	0293	4A	D3	5B	4C			10 02	0721 02D1	4B	D1
		09 21		0660	0294	4A	D4	5B	4D			10 03	0722 02D2	4B	D2
		09 22		0661	0295	4A	D5	5B	4E			10 04	0723 02D3	4B	D3
		09 23		0662	0296	4A	D6	5B	4F			10 05	0724 02D4	4B	D4
		09 24		0663	0297	4A	D7	5B	50			10 06	0725 02D5	4B	D5
		09 25		0664	0298	4A	D8	5B	51			10 07	0726 02D6	4B	D6
		09 26		0665	0299	4A	D9	5B	52			10 08	0727 02D7	4B	D7
		09 27		0666	029A	4A	5A	5B	5D			10 09	0728 02D8	4B	D8
		09 28		0667	029B	4A	5B	5B	24			10 10	0729 02D9	4B	D9
		09 29		0668	029C	4A	5C	5B	2A			10 11	0730 02DA	4B	5A
		09 30		0669	029D	4A	5D	5B	29			10 12	0731 02DB	4B	5B
		09 31		0670	029E	4A	5E	5B	3B			10 13	0732 02DC	4B	5C
		09 32		0671	029F	4A	5F	5B	5E			10 14	0733 02DD	4B	5D
		09 33		0672	02A0	4A	60	5B	2D			10 15	0734 02DE	4B	5E
		09 34		0673	02A1	4A	61	5B	2F			10 16	0735 02DF	4B	5F
		09 35		0674	02A2	4A	E2	5B	53			10 17	0736 02E0	4B	60
		09 36		0675	02A3	4A	E3	5B	54			10 18	0737 02E1	4B	61
		09 37		0676	02A4	4A	E4	5B	55			10 19	0738 02E2	4B	E2
		09 38		0677	02A5	4A	E5	5B	56			10 20	0739 02E3	4B	E3
		09 39		0678	02A6	4A	E6	5B	57			10 21	0740 02E4	4B	E4
		09 40		0679	02A7	4A	E7	5B	58			10 22	0741 02E5	4B	E5
		09 41		0680	02A8	4A	E8	5B	59			10 23	0742 02E6	4B	E6
		09 42		0681	02A9	4A	E9	5B	5A			10 24	0743 02E7	4B	E7

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)				Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII					Dec	Hex	EBCDIC	ASCII		
	10 25	0744	02E8	4B	E8	2E	59		11 07	0806	0326	4C	E6	3C	57
	10 26	0745	02E9	4B	E9	2E	5A		11 08	0807	0327	4C	E7	3C	58
	10 27	0746	02EA	4B	6A	2E	7C		11 09	0808	0328	4C	E8	3C	59
	10 28	0747	02EB	4B	6B	2E	2C		11 10	0809	0329	4C	E9	3C	5A
	10 29	0748	02EC	4B	6C	2E	25		11 11	0810	032A	4C	6A	3C	7C
	10 30	0749	02ED	4B	6D	2E	5F		11 12	0811	032B	4C	6B	3C	2C
	10 31	0750	02EE	4B	6E	2E	3E		11 13	0812	032C	4C	6C	3C	25
	10 32	0751	02EF	4B	6F	2E	3F		11 14	0813	032D	4C	6D	3C	5F
	10 33	0752	02F0	4B	F0	2E	30		11 15	0814	032E	4C	6E	3C	3E
	10 34	0753	02F1	4B	F1	2E	31		11 16	0815	032F	4C	6F	3C	3F
	10 35	0754	02F2	4B	F2	2E	32		11 17	0816	0330	4C	F0	3C	30
	10 36	0755	02F3	4B	F3	2E	33		11 18	0817	0331	4C	F1	3C	31
	10 37	0756	02F4	4B	F4	2E	34		11 19	0818	0332	4C	F2	3C	32
	10 38	0757	02F5	4B	F5	2E	35		11 20	0819	0333	4C	F3	3C	33
	10 39	0758	02F6	4B	F6	2E	36		11 21	0820	0334	4C	F4	3C	34
	10 40	0759	02F7	4B	F7	2E	37		11 22	0821	0335	4C	F5	3C	35
	10 41	0760	02F8	4B	F8	2E	38		11 23	0822	0336	4C	F6	3C	36
	10 42	0761	02F9	4B	F9	2E	39		11 24	0823	0337	4C	F7	3C	37
	10 43	0762	02FA	4B	7A	2E	3A		11 25	0824	0338	4C	F8	3C	38
	10 44	0763	02FB	4B	7B	2E	23		11 26	0825	0339	4C	F9	3C	39
	10 45	0764	02FC	4B	7C	2E	40		11 27	0826	033A	4C	7A	3C	3A
	10 46	0765	02FD	4B	7D	2E	27		11 28	0827	033B	4C	7B	3C	23
	10 47	0766	02FE	4B	7E	2E	3D		11 29	0828	033C	4C	7C	3C	40
	10 48	0767	02FF	4B	7F	2E	22		11 30	0829	033D	4C	7D	3C	27
	10 49	0768	0300	4C	40	3C	20		11 31	0830	033E	4C	7E	3C	3D
	10 50	0769	0301	4C	C1	3C	41		11 32	0831	033F	4C	7F	3C	22
	10 51	0770	0302	4C	C2	3C	42		11 33	0832	0340	4D	40	28	20
	10 52	0771	0303	4C	C3	3C	43		11 34	0833	0341	4D	C1	28	41
	10 53	0772	0304	4C	C4	3C	44		11 35	0834	0342	4D	C2	28	42
	10 54	0773	0305	4C	C5	3C	45		11 36	0835	0343	4D	C3	28	43
	10 55	0774	0306	4C	C6	3C	46		11 37	0836	0344	4D	C4	28	44
	10 56	0775	0307	4C	C7	3C	47		11 38	0837	0345	4D	C5	28	45
	10 57	0776	0308	4C	C8	3C	48		11 39	0838	0346	4D	C6	28	46
	10 58	0777	0309	4C	C9	3C	49		11 40	0839	0347	4D	C7	28	47
	10 59	0778	030A	4C	4A	3C	5B		11 41	0840	0348	4D	C8	28	48
	10 60	0779	030B	4C	4B	3C	2E		11 42	0841	0349	4D	C9	28	49
	10 61	0780	030C	4C	4C	3C	3C		11 43	0842	034A	4D	4A	28	5B
	10 62	0781	030D	4C	4D	3C	28		11 44	0843	034B	4D	4B	28	2E
	10 63	0782	030E	4C	4E	3C	2B		11 45	0844	034C	4D	4C	28	3C
	10 64	0783	030F	4C	4F	3C	21		11 46	0845	034D	4D	4D	28	28
	10 65	0784	0310	4C	50	3C	26		11 47	0846	034E	4D	4E	28	2B
	10 66	0785	0311	4C	D1	3C	4A		11 48	0847	034F	4D	4F	28	21
	10 67	0786	0312	4C	D2	3C	4B		11 49	0848	0350	4D	50	28	26
	10 68	0787	0313	4C	D3	3C	4C		11 50	0849	0351	4D	D1	28	4A
	10 69	0788	0314	4C	D4	3C	4D		11 51	0850	0352	4D	D2	28	4B
	10 70	0789	0315	4C	D5	3C	4E		11 52	0851	0353	4D	D3	28	4C
	10 71	0790	0316	4C	D6	3C	4F		11 53	0852	0354	4D	D4	28	4D
	10 72	0791	0317	4C	D7	3C	50		11 54	0853	0355	4D	D5	28	4E
	10 73	0792	0318	4C	D8	3C	51		11 55	0854	0356	4D	D6	28	4F
	10 74	0793	0319	4C	D9	3C	52		11 56	0855	0357	4D	D7	28	50
	10 75	0794	031A	4C	5A	3C	5D		11 57	0856	0358	4D	D8	28	51
	10 76	0795	031B	4C	5B	3C	24		11 58	0857	0359	4D	D9	28	52
	10 77	0796	031C	4C	5C	3C	2A		11 59	0858	035A	4D	5A	28	5D
	10 78	0797	031D	4C	5D	3C	29		11 60	0859	035B	4D	5B	28	24
	10 79	0798	031E	4C	5E	3C	3B		11 61	0860	035C	4D	5C	28	2A
	10 80	0799	031F	4C	5F	3C	5E		11 62	0861	035D	4D	5D	28	29
	11 01	0800	0320	4C	60	3C	2D		11 63	0862	035E	4D	5E	28	3B
	11 02	0801	0321	4C	61	3C	2F		11 64	0863	035F	4D	5F	28	5E
	11 03	0802	0322	4C	E2	3C	53		11 65	0864	0360	4D	60	28	2D
	11 04	0803	0323	4C	E3	3C	54		11 66	0865	0361	4D	61	28	2F
	11 05	0804	0324	4C	E4	3C	55		11 67	0866	0362	4D	E2	28	53
	11 06	0805	0325	4C	E5	3C	56		11 68	0867	0363	4D	E3	28	54

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)				Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII					Dec	Hex	EBCDIC	ASCII		
	11 69	0868	0364	4D	E4	28	55		12 51	0930	03A2	4E	E2	2B	53
	11 70	0869	0365	4D	E5	28	56		12 52	0931	03A3	4E	E3	2B	54
	11 71	0870	0366	4D	E6	28	57		12 53	0932	03A4	4E	E4	2B	55
	11 72	0871	0367	4D	E7	28	58		12 54	0933	03A5	4E	E5	2B	56
	11 73	0872	0368	4D	E8	28	59		12 55	0934	03A6	4E	E6	2B	57
	11 74	0873	0369	4D	E9	28	5A		12 56	0935	03A7	4E	E7	2B	58
	11 75	0874	036A	4D	6A	28	7C		12 57	0936	03A8	4E	E8	2B	59
	11 76	0875	036B	4D	6B	28	2C		12 58	0937	03A9	4E	E9	2B	5A
	11 77	0876	036C	4D	6C	28	25		12 59	0938	03AA	4E	6A	2B	7C
	11 78	0877	036D	4D	6D	28	5F		12 60	0939	03AB	4E	6B	2B	2C
	11 79	0878	036E	4D	6E	28	3E		12 61	0940	03AC	4E	6C	2B	25
	11 80	0879	036F	4D	6F	28	3F		12 62	0941	03AD	4E	6D	2B	5F
	12 01	0880	0370	4D	F0	28	30		12 63	0942	03AE	4E	6E	2B	3E
	12 02	0881	0371	4D	F1	28	31		12 64	0943	03AF	4E	6F	2B	3F
	12 03	0882	0372	4D	F2	28	32		12 65	0944	03B0	4E	F0	2B	30
	12 04	0883	0373	4D	F3	28	33		12 66	0945	03B1	4E	F1	2B	31
	12 05	0884	0374	4D	F4	28	34		12 67	0946	03B2	4E	F2	2B	32
	12 06	0885	0375	4D	F5	28	35		12 68	0947	03B3	4E	F3	2B	33
	12 07	0886	0376	4D	F6	28	36		12 69	0948	03B4	4E	F4	2B	34
	12 08	0887	0377	4D	F7	28	37		12 70	0949	03B5	4E	F5	2B	35
	12 09	0888	0378	4D	F8	28	38		12 71	0950	03B6	4E	F6	2B	36
	12 10	0889	0379	4D	F9	28	39		12 72	0951	03B7	4E	F7	2B	37
	12 11	0890	037A	4D	7A	28	3A		12 73	0952	03B8	4E	F8	2B	38
	12 12	0891	037B	4D	7B	28	23		12 74	0953	03B9	4E	F9	2B	39
	12 13	0892	037C	4D	7C	28	40		12 75	0954	03BA	4E	7A	2B	3A
	12 14	0893	037D	4D	7D	28	27		12 76	0955	03BB	4E	7B	2B	23
	12 15	0894	037E	4D	7E	28	3D		12 77	0956	03BC	4E	7C	2B	40
	12 16	0895	037F	4D	7F	28	22		12 78	0957	03BD	4E	7D	2B	27
	12 17	0896	0380	4E	40	2B	20		12 79	0958	03BE	4E	7E	2B	3D
	12 18	0897	0381	4E	C1	2B	41		12 80	0959	03BF	4E	7F	2B	22
	12 19	0898	0382	4E	C2	2B	42		13 01	0960	03C0	4F	40	21	20
	12 20	0899	0383	4E	C3	2B	43		13 02	0961	03C1	4F	C1	21	41
	12 21	0900	0384	4E	C4	2B	44		13 03	0962	03C2	4F	C2	21	42
	12 22	0901	0385	4E	C5	2B	45		13 04	0963	03C3	4F	C3	21	43
	12 23	0902	0386	4E	C6	2B	46		13 05	0964	03C4	4F	C4	21	44
	12 24	0903	0387	4E	C7	2B	47		13 06	0965	03C5	4F	C5	21	45
	12 25	0904	0388	4E	C8	2B	48		13 07	0966	03C6	4F	C6	21	46
	12 26	0905	0389	4E	C9	2B	49		13 08	0967	03C7	4F	C7	21	47
	12 27	0906	038A	4E	4A	2B	5B		13 09	0968	03C8	4F	C8	21	48
	12 28	0907	038B	4E	4B	2B	2E		13 10	0969	03C9	4F	C9	21	49
	12 29	0908	038C	4E	4C	2B	3C		13 11	0970	03CA	4F	4A	21	5B
	12 30	0909	038D	4E	4D	2B	28		13 12	0971	03CB	4F	4B	21	2E
	12 31	0910	038E	4E	4E	2B	2B		13 13	0972	03CC	4F	4C	21	3C
	12 32	0911	038F	4E	4F	2B	21		13 14	0973	03CD	4F	4D	21	28
	12 33	0912	0390	4E	50	2B	26		13 15	0974	03CE	4F	4E	21	2B
	12 34	0913	0391	4E	D1	2B	4A		13 16	0975	03CF	4F	4F	21	21
	12 35	0914	0392	4E	D2	2B	4B		13 17	0976	03D0	4F	50	21	26
	12 36	0915	0393	4E	D3	2B	4C		13 18	0977	03D1	4F	D1	21	4A
	12 37	0916	0394	4E	D4	2B	4D		13 19	0978	03D2	4F	D2	21	4B
	12 38	0917	0395	4E	D5	2B	4E		13 20	0979	03D3	4F	D3	21	4C
	12 39	0918	0396	4E	D6	2B	4F		13 21	0980	03D4	4F	D4	21	4D
	12 40	0919	0397	4E	D7	2B	50		13 22	0981	03D5	4F	D5	21	4E
	12 41	0920	0398	4E	D8	2B	51		13 23	0982	03D6	4F	D6	21	4F
	12 42	0921	0399	4E	D9	2B	52		13 24	0983	03D7	4F	D7	21	50
	12 43	0922	039A	4E	5A	2B	5D		13 25	0984	03D8	4F	D8	21	51
	12 44	0923	039B	4E	5B	2B	24		13 26	0985	03D9	4F	D9	21	52
	12 45	0924	039C	4E	5C	2B	2A		13 27	0986	03DA	4F	5A	21	5D
	12 46	0925	039D	4E	5D	2B	29		13 28	0987	03DB	4F	5B	21	24
	12 47	0926	039E	4E	5E	2B	3B		13 29	0988	03DC	4F	5C	21	2A
	12 48	0927	039F	4E	5F	2B	5E		13 30	0989	03DD	4F	5D	21	29
	12 49	0928	03A0	4E	60	2B	2D		13 31	0990	03DE	4F	5E	21	3B
	12 50	0929	03A1	4E	61	2B	2F		13 32	0991	03DF	4F	5F	21	5E

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)				Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII					Dec	Hex	EBCDIC	ASCII		
	13 33	0992	03E0	4F	60	21	2D		14 15	1054	041E	50	5E	26	3B
	13 34	0993	03E1	4F	61	21	2F		14 16	1055	041F	50	5F	26	5E
	13 35	0994	03E2	4F	E2	21	53		14 17	1056	0420	50	60	26	2D
	13 36	0995	03E3	4F	E3	21	54		14 18	1057	0421	50	61	26	2F
	13 37	0996	03E4	4F	E4	21	55		14 19	1058	0422	50	E2	26	53
	13 38	0997	03E5	4F	E5	21	56		14 20	1059	0423	50	E3	26	54
	13 39	0998	03E6	4F	E6	21	57		14 21	1060	0424	50	E4	26	55
	13 40	0999	03E7	4F	E7	21	58		14 22	1061	0425	50	E5	26	56
	13 41	1000	03E8	4F	E8	21	59		14 23	1062	0426	50	E6	26	57
	13 42	1001	03E9	4F	E9	21	5A		14 24	1063	0427	50	E7	26	58
	13 43	1002	03EA	4F	6A	21	7C		14 25	1064	0428	50	E8	26	59
	13 44	1003	03EB	4F	6B	21	2C		14 26	1065	0429	50	E9	26	5A
	13 45	1004	03EC	4F	6C	21	25		14 27	1066	042A	50	6A	26	7C
	13 46	1005	03ED	4F	6D	21	5F		14 28	1067	042B	50	6B	26	2C
	13 47	1006	03EE	4F	6E	21	3E		14 29	1068	042C	50	6C	26	25
	13 48	1007	03EF	4F	6F	21	3F		14 30	1069	042D	50	6D	26	5F
	13 49	1008	03F0	4F	F0	21	30		14 31	1070	042E	50	6E	26	3E
	13 50	1009	03F1	4F	F1	21	31		14 32	1071	042F	50	6F	26	3F
	13 51	1010	03F2	4F	F2	21	32		14 33	1072	0430	50	F0	26	30
	13 52	1011	03F3	4F	F3	21	33		14 34	1073	0431	50	F1	26	31
	13 53	1012	03F4	4F	F4	21	34		14 35	1074	0432	50	F2	26	32
	13 54	1013	03F5	4F	F5	21	35		14 36	1075	0433	50	F3	26	33
	13 55	1014	03F6	4F	F6	21	36		14 37	1076	0434	50	F4	26	34
	13 56	1015	03F7	4F	F7	21	37		14 38	1077	0435	50	F5	26	35
	13 57	1016	03F8	4F	F8	21	38		14 39	1078	0436	50	F6	26	36
	13 58	1017	03F9	4F	F9	21	39		14 40	1079	0437	50	F7	26	37
	13 59	1018	03FA	4F	7A	21	3A		14 41	1080	0438	50	F8	26	38
	13 60	1019	03FB	4F	7B	21	23		14 42	1081	0439	50	F9	26	39
	13 61	1020	03FC	4F	7C	21	40		14 43	1082	043A	50	7A	26	3A
	13 62	1021	03FD	4F	7D	21	27		14 44	1083	043B	50	7B	26	23
	13 63	1022	03FE	4F	7E	21	3D		14 45	1084	043C	50	7C	26	40
	13 64	1023	03FF	4F	7F	21	22		14 46	1085	043D	50	7D	26	27
	13 65	1024	0400	50	40	26	20		14 47	1086	043E	50	7E	26	3D
	13 66	1025	0401	50	C1	26	41		14 48	1087	043F	50	7F	26	22
	13 67	1026	0402	50	C2	26	42		14 49	1088	0440	D1	40	4A	20
	13 68	1027	0403	50	C3	26	43		14 50	1089	0441	D1	C1	4A	41
	13 69	1028	0404	50	C4	26	44		14 51	1090	0442	D1	C2	4A	42
	13 70	1029	0405	50	C5	26	45		14 52	1091	0443	D1	C3	4A	43
	13 71	1030	0406	50	C6	26	46		14 53	1092	0444	D1	C4	4A	44
	13 72	1031	0407	50	C7	26	47		14 54	1093	0445	D1	C5	4A	45
	13 73	1032	0408	50	C8	26	48		14 55	1094	0446	D1	C6	4A	46
	13 74	1033	0409	50	C9	26	49		14 56	1095	0447	D1	C7	4A	47
	13 75	1034	040A	50	4A	26	5B		14 57	1096	0448	D1	C8	4A	48
	13 76	1035	040B	50	4B	26	2E		14 58	1097	0449	D1	C9	4A	49
	13 77	1036	040C	50	4C	26	3C		14 59	1098	044A	D1	4A	4A	5B
	13 78	1037	040D	50	4D	26	28		14 60	1099	044B	D1	4B	4A	2E
	13 79	1038	040E	50	4E	26	2B		14 61	1100	044C	D1	4C	4A	3C
	13 80	1039	040F	50	4F	26	21		14 62	1101	044D	D1	4D	4A	28
	14 01	1040	0410	50	50	26	26		14 63	1102	044E	D1	4E	4A	2B
	14 02	1041	0411	50	D1	26	4A		14 64	1103	044F	D1	4F	4A	21
	14 03	1042	0412	50	D2	26	4B		14 65	1104	0450	D1	50	4A	26
	14 04	1043	0413	50	D3	26	4C		14 66	1105	0451	D1	D1	4A	4A
	14 05	1044	0414	50	D4	26	4D		14 67	1106	0452	D1	D2	4A	4B
	14 06	1045	0415	50	D5	26	4E		14 68	1107	0453	D1	D3	4A	4C
	14 07	1046	0416	50	D6	26	4F		14 69	1108	0454	D1	D4	4A	4D
	14 08	1047	0417	50	D7	26	50		14 70	1109	0455	D1	D5	4A	4E
	14 09	1048	0418	50	D8	26	51		14 71	1110	0456	D1	D6	4A	4F
	14 10	1049	0419	50	D9	26	52		14 72	1111	0457	D1	D7	4A	50
	14 11	1050	041A	50	5A	26	5D		14 73	1112	0458	D1	D8	4A	51
	14 12	1051	041B	50	5B	26	24		14 74	1113	0459	D1	D9	4A	52
	14 13	1052	041C	50	5C	26	2A		14 75	1114	045A	D1	5A	4A	5D
	14 14	1053	041D	50	5D	26	29		14 76	1115	045B	D1	5B	4A	24

Mod 1	Mod 2	Position	Buffer Address (Hex)				Mod 1	Mod 2	Position	Buffer Address (Hex)			
R C	R C	Dec Hex	EBCDIC	ASCII			R C	R C	Dec Hex	EBCDIC	ASCII		
	14 77	1116 045C	D1	5C	4A	2A		15 59	1178 049A	D2	5A	4B	5D
	14 78	1117 045D	D1	5D	4A	29		15 60	1179 049B	D2	5B	4B	24
	14 79	1118 045E	D1	5E	4A	3B		15 61	1180 049C	D2	5C	4B	2A
	14 80	1119 045F	D1	5F	4A	5E		15 62	1181 049D	D2	5D	4B	29
	15 01	1120 0460	D1	60	4A	2D		15 63	1182 049E	D2	5E	4B	3B
	15 02	1121 0461	D1	61	4A	2F		15 64	1183 049F	D2	5F	4B	5E
	15 03	1122 0462	D1	E2	4A	53		15 65	1184 04A0	D2	60	4B	2D
	15 04	1123 0463	D1	E3	4A	54		15 66	1185 04A1	D2	61	4B	2F
	15 05	1124 0464	D1	E4	4A	55		15 67	1186 04A2	D2	E2	4B	53
	15 06	1125 0465	D1	E5	4A	56		15 68	1187 04A3	D2	E3	4B	54
	15 07	1126 0466	D1	E6	4A	57		15 69	1188 04A4	D2	E4	4B	55
	15 08	1127 0467	D1	E7	4A	58		15 70	1189 04A5	D2	E5	4B	56
	15 09	1128 0468	D1	E8	4A	59		15 71	1190 04A6	D2	E6	4B	57
	15 10	1129 0469	D1	E9	4A	5A		15 72	1191 04A7	D2	E7	4B	58
	15 11	1130 046A	D1	6A	4A	7C		15 73	1192 04A8	D2	E8	4B	59
	15 12	1131 046B	D1	6B	4A	2C		15 74	1193 04A9	D2	E9	4B	5A
	15 13	1132 046C	D1	6C	4A	25		15 75	1194 04AA	D2	6A	4B	7C
	15 14	1133 046D	D1	6D	4A	5F		15 76	1195 04AB	D2	6B	4B	2C
	15 15	1134 046E	D1	6E	4A	3E		15 77	1196 04AC	D2	6C	4B	25
	15 16	1135 046F	D1	6F	4A	3F		15 78	1197 04AD	D2	6D	4B	5F
	15 17	1136 0470	D1	F0	4A	30		15 79	1198 04AE	D2	6E	4B	3E
	15 18	1137 0471	D1	F1	4A	31		15 80	1199 04AF	D2	6F	4B	3F
	15 19	1138 0472	D1	F2	4A	32		16 01	1200 04B0	D2	F0	4B	30
	15 20	1139 0473	D1	F3	4A	33		16 02	1201 04B1	D2	F1	4B	31
	15 21	1140 0474	D1	F4	4A	34		16 03	1202 04B2	D2	F2	4B	32
	15 22	1141 0475	D1	F5	4A	35		16 04	1203 04B3	D2	F3	4B	33
	15 23	1142 0476	D1	F6	4A	36		16 05	1204 04B4	D2	F4	4B	34
	15 24	1143 0477	D1	F7	4A	37		16 06	1205 04B5	D2	F5	4B	35
	15 25	1144 0478	D1	F8	4A	38		16 07	1206 04B6	D2	F6	4B	36
	15 26	1145 0479	D1	F9	4A	39		16 08	1207 04B7	D2	F7	4B	37
	15 27	1146 047A	D1	7A	4A	3A		16 09	1208 04B8	D2	F8	4B	38
	15 28	1147 047B	D1	7B	4A	23		16 10	1209 04B9	D2	F9	4B	39
	15 29	1148 047C	D1	7C	4A	40		16 11	1210 04BA	D2	7A	4B	3A
	15 30	1149 047D	D1	7D	4A	27		16 12	1211 04BB	D2	7B	4B	23
	15 31	1150 047E	D1	7E	4A	3D		16 13	1212 04BC	D2	7C	4B	40
	15 32	1151 047F	D1	7F	4A	22		16 14	1213 04BD	D2	7D	4B	27
	15 33	1152 0480	D2	40	4B	20		16 15	1214 04BE	D2	7E	4B	3D
	15 34	1153 0481	D2	C1	4B	41		16 16	1215 04BF	D2	7F	4B	22
	15 35	1154 0482	D2	C2	4B	42		16 17	1216 04C0	D3	40	4C	20
	15 36	1155 0483	D2	C3	4B	43		16 18	1217 04C1	D3	C1	4C	41
	15 37	1156 0484	D2	C4	4B	44		16 19	1218 04C2	D3	C2	4C	42
	15 38	1157 0485	D2	C5	4B	45		16 20	1219 04C3	D3	C3	4C	43
	15 39	1158 0486	D2	C6	4B	46		16 21	1220 04C4	D3	C4	4C	44
	15 40	1159 0487	D2	C7	4B	47		16 22	1221 04C5	D3	C5	4C	45
	15 41	1160 0488	D2	C8	4B	48		16 23	1222 04C6	D3	C6	4C	46
	15 42	1161 0489	D2	C9	4B	49		16 24	1223 04C7	D3	C7	4C	47
	15 43	1162 048A	D2	4A	4B	5B		16 25	1224 04C8	D3	C8	4C	48
	15 44	1163 048B	D2	4B	4B	2E		16 26	1225 04C9	D3	C9	4C	49
	15 45	1164 048C	D2	4C	4B	3C		16 27	1226 04CA	D3	4A	4C	5B
	15 46	1165 048D	D2	4D	4B	28		16 28	1227 04CB	D3	4B	4C	2E
	15 47	1166 048E	D2	4E	4B	2B		16 29	1228 04CC	D3	4C	4C	3C
	15 48	1167 048F	D2	4F	4B	21		16 30	1229 04CD	D3	4D	4C	28
	15 49	1168 0490	D2	50	4B	26		16 31	1230 04CE	D3	4E	4C	2B
	15 50	1169 0491	D2	D1	4B	4A		16 32	1231 04CF	D3	4F	4C	21
	15 51	1170 0492	D2	D2	4B	4B		16 33	1232 04D0	D3	50	4C	26
	15 52	1171 0493	D2	D3	4B	4C		16 34	1233 04D1	D3	D1	4C	4A
	15 53	1172 0494	D2	D4	4B	4D		16 35	1234 04D2	D3	D2	4C	4B
	15 54	1173 0495	D2	D5	4B	4E		16 36	1235 04D3	D3	D3	4C	4C
	15 55	1174 0496	D2	D6	4B	4F		16 37	1236 04D4	D3	D4	4C	4D
	15 56	1175 0497	D2	D7	4B	50		16 38	1237 04D5	D3	D5	4C	4E
	15 57	1176 0498	D2	D8	4B	51		16 39	1238 04D6	D3	D6	4C	4F
	15 58	1177 0499	D2	D9	4B	52		16 40	1239 04D7	D3	D7	4C	50

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)				Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII					Dec	Hex	EBCDIC	ASCII		
	16 41	1240	04D8	D3	D8	4C	51		17 23	1302	0516	D4	D6	4D	4F
	16 42	1241	04D9	D3	D9	4C	52		17 24	1303	0517	D4	D7	4D	50
	16 43	1242	04DA	D3	5A	4C	5D		17 25	1304	0518	D4	D8	4D	51
	16 44	1243	04DB	D3	5B	4C	24		17 26	1305	0519	D4	D9	4D	52
	16 45	1244	04DC	D3	5C	4C	2A		17 27	1306	051A	D4	5A	4D	5D
	16 46	1245	04DD	D3	5D	4C	29		17 28	1307	051B	D4	5B	4D	24
	16 47	1246	04DE	D3	5E	4C	3B		17 29	1308	051C	D4	5C	4D	2A
	16 48	1247	04DF	D3	5F	4C	5E		17 30	1309	051D	D4	5D	4D	29
	16 49	1248	04E0	D3	60	4C	2D		17 31	1310	051E	D4	5E	4D	3B
	16 50	1249	04E1	D3	61	4C	2F		17 32	1311	051F	D4	5F	4D	5E
	16 51	1250	04E2	D3	E2	4C	53		17 33	1312	0520	D4	60	4D	2D
	16 52	1251	04E3	D3	E3	4C	54		17 34	1313	0521	D4	61	4D	2F
	16 53	1252	04E4	D3	E4	4C	55		17 35	1314	0522	D4	E2	4D	53
	16 54	1253	04E5	D3	E5	4C	56		17 36	1315	0523	D4	E3	4D	54
	16 55	1254	04E6	D3	E6	4C	57		17 37	1316	0524	D4	E4	4D	55
	16 56	1255	04E7	D3	E7	4C	58		17 38	1317	0525	D4	E5	4D	56
	16 57	1256	04E8	D3	E8	4C	59		17 39	1318	0526	D4	E6	4D	57
	16 58	1257	04E9	D3	E9	4C	5A		17 40	1319	0527	D4	E7	4D	58
	16 59	1258	04EA	D3	6A	4C	7C		17 41	1320	0528	D4	E8	4D	59
	16 60	1259	04EB	D3	6B	4C	2C		17 42	1321	0529	D4	E9	4D	5A
	16 61	1260	04EC	D3	6C	4C	25		17 43	1322	052A	D4	6A	4D	7C
	16 62	1261	04ED	D3	6D	4C	5F		17 44	1323	052B	D4	6B	4D	2C
	16 63	1262	04EE	D3	6E	4C	3E		17 45	1324	052C	D4	6C	4D	25
	16 64	1263	04EF	D3	6F	4C	3F		17 46	1325	052D	D4	6D	4D	5F
	16 65	1264	04F0	D3	F0	4C	30		17 47	1326	052E	D4	6E	4D	3E
	16 66	1265	04F1	D3	F1	4C	31		17 48	1327	052F	D4	6F	4D	3F
	16 67	1266	04F2	D3	F2	4C	32		17 49	1328	0530	D4	F0	4D	30
	16 68	1267	04F3	D3	F3	4C	33		17 50	1329	0531	D4	F1	4D	31
	16 69	1268	04F4	D3	F4	4C	34		17 51	1330	0532	D4	F2	4D	32
	16 70	1269	04F5	D3	F5	4C	35		17 52	1331	0533	D4	F3	4D	33
	16 71	1270	04F6	D3	F6	4C	36		17 53	1332	0534	D4	F4	4D	34
	16 72	1271	04F7	D3	F7	4C	37		17 54	1333	0535	D4	F5	4D	35
	16 73	1272	04F8	D3	F8	4C	38		17 55	1334	0536	D4	F6	4D	36
	16 74	1273	04F9	D3	F9	4C	39		17 56	1335	0537	D4	F7	4D	37
	16 75	1274	04FA	D3	7A	4C	3A		17 57	1336	0538	D4	F8	4D	38
	16 76	1275	04FB	D3	7B	4C	23		17 58	1337	0539	D4	F9	4D	39
	16 77	1276	04FC	D3	7C	4C	40		17 59	1338	053A	D4	7A	4D	3A
	16 78	1277	04FD	D3	7D	4C	27		17 60	1339	053B	D4	7B	4D	23
	16 79	1278	04FE	D3	7E	4C	3D		17 61	1340	053C	D4	7C	4D	40
	16 80	1279	04FF	D3	7F	4C	22		17 62	1341	053D	D4	7D	4D	27
	17 01	1280	0500	D4	40	4D	20		17 63	1342	053E	D4	7E	4D	3D
	17 02	1281	0501	D4	C1	4D	41		17 64	1343	053F	D4	7F	4D	22
	17 03	1282	0502	D4	C2	4D	42		17 65	1344	0540	D5	40	4E	20
	17 04	1283	0503	D4	C3	4D	43		17 66	1345	0541	D5	C1	4E	41
	17 05	1284	0504	D4	C4	4D	44		17 67	1346	0542	D5	C2	4E	42
	17 06	1285	0505	D4	C5	4D	45		17 68	1347	0543	D5	C3	4E	43
	17 07	1286	0506	D4	C6	4D	46		17 69	1348	0544	D5	C4	4E	44
	17 08	1287	0507	D4	C7	4D	47		17 70	1349	0545	D5	C5	4E	45
	17 09	1288	0508	D4	C8	4D	48		17 71	1350	0546	D5	C6	4E	46
	17 10	1289	0509	D4	C9	4D	49		17 72	1351	0547	D5	C7	4E	47
	17 11	1290	050A	D4	4A	4D	5B		17 73	1352	0548	D5	C8	4E	48
	17 12	1291	050B	D4	4B	4D	2E		17 74	1353	0549	D5	C9	4E	49
	17 13	1292	050C	D4	4C	4D	3C		17 75	1354	054A	D5	4A	4E	5B
	17 14	1293	050D	D4	4D	4D	28		17 76	1355	054B	D5	4B	4E	2E
	17 15	1294	050E	D4	4E	4D	2B		17 77	1356	054C	D5	4C	4E	3C
	17 16	1295	050F	D4	4F	4D	21		17 78	1357	054D	D5	4D	4E	28
	17 17	1296	0510	D4	50	4D	26		17 79	1358	054E	D5	4E	4E	2B
	17 18	1297	0511	D4	D1	4D	4A		17 80	1359	054F	D5	4F	4E	21
	17 19	1298	0512	D4	D2	4D	4B		18 01	1360	0550	D5	50	4E	26
	17 20	1299	0513	D4	D3	4D	4C		18 02	1361	0551	D5	D1	4E	4A
	17 21	1300	0514	D4	D4	4D	4D		18 03	1362	0552	D5	D2	4E	4B
	17 22	1301	0515	D4	D5	4D	4E		18 04	1363	0553	D5	D3	4E	4C

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)				Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII					Dec	Hex	EBCDIC	ASCII		
	18 05	1364	0554	D5	D4	4E	4D		18 67	1426	0592	D6	D2	4F	4B
	18 06	1365	0555	D5	D5	4E	4E		18 68	1427	0593	D6	D3	4F	4C
	18 07	1366	0556	D5	D6	4E	4F		18 69	1428	0594	D6	D4	4F	4D
	18 08	1367	0557	D5	D7	4E	50		18 70	1429	0595	D6	D5	4F	4E
	18 09	1368	0558	D5	D8	4E	51		18 71	1430	0596	D6	D6	4F	4F
	18 10	1369	0559	D5	D9	4E	52		18 72	1431	0597	D6	D7	4F	50
	18 11	1370	055A	D5	5A	4E	5D		18 73	1432	0598	D6	D8	4F	51
	18 12	1371	055B	D5	5B	4E	24		18 74	1433	0599	D6	D9	4F	52
	18 13	1372	055C	D5	5C	4E	2A		18 75	1434	059A	D6	5A	4F	5D
	18 14	1373	055D	D5	5D	4E	29		18 76	1435	059B	D6	5B	4F	24
	18 15	1374	055E	D5	5E	4E	3B		18 77	1436	059C	D6	5C	4F	2A
	18 16	1375	055F	D5	5F	4E	5E		18 78	1437	059D	D6	5D	4F	29
	18 17	1376	0560	D5	60	4E	2D		18 79	1438	059E	D6	5E	4F	3B
	18 18	1377	0561	D5	61	4E	2F		18 80	1439	059F	D6	5F	4F	5E
	18 19	1378	0562	D5	E2	4E	53		19 01	1440	05A0	D6	60	4F	2D
	18 20	1379	0563	D5	E3	4E	54		19 02	1441	05A1	D6	61	4F	2F
	18 21	1380	0564	D5	E4	4E	55		19 03	1442	05A2	D6	E2	4F	53
	18 22	1381	0565	D5	E5	4E	56		19 04	1443	05A3	D6	E3	4F	54
	18 23	1382	0566	D5	E6	4E	57		19 05	1444	05A4	D6	E4	4F	55
	18 24	1383	0567	D5	E7	4E	58		19 06	1445	05A5	D6	E5	4F	56
	18 25	1384	0568	D5	E8	4E	59		19 07	1446	05A6	D6	E6	4F	57
	18 26	1385	0569	D5	E9	4E	5A		19 08	1447	05A7	D6	E7	4F	58
	18 27	1386	056A	D5	6A	4E	7C		19 09	1448	05A8	D6	E8	4F	59
	18 28	1387	056B	D5	6B	4E	2C		19 10	1449	05A9	D6	E9	4F	5A
	18 29	1388	056C	D5	6C	4E	25		19 11	1450	05AA	D6	6A	4F	7C
	18 30	1389	056D	D5	6D	4E	5F		19 12	1451	05AB	D6	6B	4F	2C
	18 31	1390	056E	D5	6E	4E	3E		19 13	1452	05AC	D6	6C	4F	25
	18 32	1391	056F	D5	6F	4E	3F		19 14	1453	05AD	D6	6D	4F	5F
	18 33	1392	0570	D5	F0	4E	30		19 15	1454	05AE	D6	6E	4F	3E
	18 34	1393	0571	D5	F1	4E	31		19 16	1455	05AF	D6	6F	4F	3F
	18 35	1394	0572	D5	F2	4E	32		19 17	1456	05B0	D6	F0	4F	30
	18 36	1395	0573	D5	F3	4E	33		19 18	1457	05B1	D6	F1	4F	31
	18 37	1396	0574	D5	F4	4E	34		19 19	1458	05B2	D6	F2	4F	32
	18 38	1397	0575	D5	F5	4E	35		19 20	1459	05B3	D6	F3	4F	33
	18 39	1398	0576	D5	F6	4E	36		19 21	1460	05B4	D6	F4	4F	34
	18 40	1399	0577	D5	F7	4E	37		19 22	1461	05B5	D6	F5	4F	35
	18 41	1400	0578	D5	F8	4E	38		19 23	1462	05B6	D6	F6	4F	36
	18 42	1401	0579	D5	F9	4E	39		19 24	1463	05B7	D6	F7	4F	37
	18 43	1402	057A	D5	7A	4E	3A		19 25	1464	05B8	D6	F8	4F	38
	18 44	1403	057B	D5	7B	4E	23		19 26	1465	05B9	D6	F9	4F	39
	18 45	1404	057C	D5	7C	4E	40		19 27	1466	05BA	D6	7A	4F	3A
	18 46	1405	057D	D5	7D	4E	27		19 28	1467	05BB	D6	7B	4F	23
	18 47	1406	057E	D5	7E	4E	3D		19 29	1468	05BC	D6	7C	4F	40
	18 48	1407	057F	D5	7F	4E	22		19 30	1469	05BD	D6	7D	4F	27
	18 49	1408	0580	D6	40	4F	20		19 31	1470	05BE	D6	7E	4F	3D
	18 50	1409	0581	D6	C1	4F	41		19 32	1471	05BF	D6	7F	4F	22
	18 51	1410	0582	D6	C2	4F	42		19 33	1472	05C0	D7	40	50	20
	18 52	1411	0583	D6	C3	4F	43		19 34	1473	05C1	D7	C1	50	41
	18 53	1412	0584	D6	C4	4F	44		19 35	1474	05C2	D7	C2	50	42
	18 54	1413	0585	D6	C5	4F	45		19 36	1475	05C3	D7	C3	50	43
	18 55	1414	0586	D6	C6	4F	46		19 37	1476	05C4	D7	C4	50	44
	18 56	1415	0587	D6	C7	4F	47		19 38	1477	05C5	D7	C5	50	45
	18 57	1416	0588	D6	C8	4F	48		19 39	1478	05C6	D7	C6	50	46
	18 58	1417	0589	D6	C9	4F	49		19 40	1479	05C7	D7	C7	50	47
	18 59	1418	058A	D6	4A	4F	5B		19 41	1480	05C8	D7	C8	50	48
	18 60	1419	058B	D6	4B	4F	2E		19 42	1481	05C9	D7	C9	50	49
	18 61	1420	058C	D6	4C	4F	3C		19 43	1482	05CA	D7	4A	50	5B
	18 62	1421	058D	D6	4D	4F	28		19 44	1483	05CB	D7	4B	50	2E
	18 63	1422	058E	D6	4E	4F	2B		19 45	1484	05CC	D7	4C	50	3C
	18 64	1423	058F	D6	4F	4F	21		19 46	1485	05CD	D7	4D	50	28
	18 65	1424	0590	D6	50	4F	26		19 47	1486	05CE	D7	4E	50	2B
	18 66	1425	0591	D6	D1	4F	4A		19 48	1487	05CF	D7	4F	50	21

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)				Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII					Dec	Hex	EBCDIC	ASCII		
	19 49	1488	05D0	D7	50	50	26		20 31	1550	060E	D8	4E	51	2B
	19 50	1489	05D1	D7	D1	50	4A		20 32	1551	060F	D8	4F	51	21
	19 51	1490	05D2	D7	D2	50	4B		20 33	1552	0610	D8	50	51	26
	19 52	1491	05D3	D7	D3	50	4C		20 34	1553	0611	D8	D1	51	4A
	19 53	1492	05D4	D7	D4	50	4D		20 35	1554	0612	D8	D2	51	4B
	19 54	1493	05D5	D7	D5	50	4E		20 36	1555	0613	D8	D3	51	4C
	19 55	1494	05D6	D7	D6	50	4F		20 37	1556	0614	D8	D4	51	4D
	19 56	1495	05D7	D7	D7	50	50		20 38	1557	0615	D8	D5	51	4E
	19 57	1496	05D8	D7	D8	50	51		20 39	1558	0616	D8	D6	51	4F
	19 58	1497	05D9	D7	D9	50	52		20 40	1559	0617	D8	D7	51	50
	19 59	1498	05DA	D7	5A	50	5D		20 41	1560	0618	D8	D8	51	51
	19 60	1499	05DB	D7	5B	50	24		20 42	1561	0619	D8	D9	51	52
	19 61	1500	05DC	D7	5C	50	2A		20 43	1562	061A	D8	5A	51	5D
	19 62	1501	05DD	D7	5D	50	29		20 44	1563	061B	D8	5B	51	24
	19 63	1502	05DE	D7	5E	50	3B		20 45	1564	061C	D8	5C	51	2A
	19 64	1503	05DF	D7	5F	50	5E		20 46	1565	061D	D8	5D	51	29
	19 65	1504	05E0	D7	60	50	2D		20 47	1566	061E	D8	5E	51	3B
	19 66	1505	05E1	D7	61	50	2F		20 48	1567	061F	D8	5F	51	5E
	19 67	1506	05E2	D7	E2	50	53		20 49	1568	0620	D8	60	51	2D
	19 68	1507	05E3	D7	E3	50	54		20 50	1569	0621	D8	61	51	2F
	19 69	1508	05E4	D7	E4	50	55		20 51	1570	0622	D8	E2	51	53
	19 70	1509	05E5	D7	E5	50	56		20 52	1571	0623	D8	E3	51	54
	19 71	1510	05E6	D7	E6	50	57		20 53	1572	0624	D8	E4	51	55
	19 72	1511	05E7	D7	E7	50	58		20 54	1573	0625	D8	E5	51	56
	19 73	1512	05E8	D7	E8	50	59		20 55	1574	0626	D8	E6	51	57
	19 74	1513	05E9	D7	E9	50	5A		20 56	1575	0627	D8	E7	51	58
	19 75	1514	05EA	D7	6A	50	7C		20 57	1576	0628	D8	E8	51	59
	19 76	1515	05EB	D7	6B	50	2C		20 58	1577	0629	D8	E9	51	5A
	19 77	1516	05EC	D7	6C	50	25		20 59	1578	062A	D8	6A	51	7C
	19 78	1517	05ED	D7	6D	50	5F		20 60	1579	062B	D8	6B	51	2C
	19 79	1518	05EE	D7	6E	50	3E		20 61	1580	062C	D8	6C	51	25
	19 80	1519	05EF	D7	6F	50	3F		20 62	1581	062D	D8	6D	51	5F
	20 01	1520	05F0	D7	F0	50	30		20 63	1582	062E	D8	6E	51	3E
	20 02	1521	05F1	D7	F1	50	31		20 64	1583	062F	D8	6F	51	3F
	20 03	1522	05F2	D7	F2	50	32		20 65	1584	0630	D8	F0	51	30
	20 04	1523	05F3	D7	F3	50	33		20 66	1585	0631	D8	F1	51	31
	20 05	1524	05F4	D7	F4	50	34		20 67	1586	0632	D8	F2	51	32
	20 06	1525	05F5	D7	F5	50	35		20 68	1587	0633	D8	F3	51	33
	20 07	1526	05F6	D7	F6	50	36		20 69	1588	0634	D8	F4	51	34
	20 08	1527	05F7	D7	F7	50	37		20 70	1589	0635	D8	F5	51	35
	20 09	1528	05F8	D7	F8	50	38		20 71	1590	0636	D8	F6	51	36
	20 10	1529	05F9	D7	F9	50	39		20 72	1591	0637	D8	F7	51	37
	20 11	1530	05FA	D7	7A	50	3A		20 73	1592	0638	D8	F8	51	38
	20 12	1531	05FB	D7	7B	50	23		20 74	1593	0639	D8	F9	51	39
	20 13	1532	05FC	D7	7C	50	40		20 75	1594	063A	D8	7A	51	3A
	20 14	1533	05FD	D7	7D	50	27		20 76	1595	063B	D8	7B	51	23
	20 15	1534	05FE	D7	7E	50	3D		20 77	1596	063C	D8	7C	51	40
	20 16	1535	05FF	D7	7F	50	22		20 78	1597	063D	D8	7D	51	27
	20 17	1536	0600	D8	40	51	20		20 79	1598	063E	D8	7E	51	3D
	20 18	1537	0601	D8	C1	51	41		20 80	1599	063F	D8	7F	51	22
	20 19	1538	0602	D8	C2	51	42		21 01	1600	0640	D9	40	52	20
	20 20	1539	0603	D8	C3	51	43		21 02	1601	0641	D9	C1	52	41
	20 21	1540	0604	D8	C4	51	44		21 03	1602	0642	D9	C2	52	42
	20 22	1541	0605	D8	C5	51	45		21 04	1603	0643	D9	C3	52	43
	20 23	1542	0606	D8	C6	51	46		21 05	1604	0644	D9	C4	52	44
	20 24	1543	0607	D8	C7	51	47		21 06	1605	0645	D9	C5	52	45
	20 25	1544	0608	D8	C8	51	48		21 07	1606	0646	D9	C6	52	46
	20 26	1545	0609	D8	C9	51	49		21 08	1607	0647	D9	C7	52	47
	20 27	1546	060A	D8	4A	51	5B		21 09	1608	0648	D9	C8	52	48
	20 28	1547	060B	D8	4B	51	2E		21 10	1609	0649	D9	C9	52	49
	20 29	1548	060C	D8	4C	51	3C		21 11	1610	064A	D9	4A	52	5B
	20 30	1549	060D	D8	4D	51	28		21 12	1611	064B	D9	4B	52	2E



Mod 1	Mod 2	Position	Buffer Address (Hex)				Mod 1	Mod 2	Position	Buffer Address (Hex)			
R C	R C	Dec Hex	EBCDIC	ASCII			R C	R C	Dec Hex	EBCDIC	ASCII		
	21 13	1612 064C	D9	4C	52	3C		21 75	1674 068A	5A	4A	5D	5B
	21 14	1613 064D	D9	4D	52	28		21 76	1675 068B	5A	4B	5D	2E
	21 15	1614 064E	D9	4E	52	2B		21 77	1676 068C	5A	4C	5D	3C
	21 16	1615 064F	D9	4F	52	21		21 78	1677 068D	5A	4D	5D	28
	21 17	1616 0650	D9	50	52	26		21 79	1678 068E	5A	4E	5D	2B
	21 18	1617 0651	D9	D1	52	4A		21 80	1679 068F	5A	4F	5D	21
	21 19	1618 0652	D9	D2	52	4B		22 01	1680 0690	5A	50	5D	26
	21 20	1619 0653	D9	D3	52	4C		22 02	1681 0691	5A	D1	5D	4A
	21 21	1620 0654	D9	D4	52	4D		22 03	1682 0692	5A	D2	5D	4B
	21 22	1621 0655	D9	D5	52	4E		22 04	1683 0693	5A	D3	5D	4C
	21 23	1622 0656	D9	D6	52	4F		22 05	1684 0694	5A	D4	5D	4D
	21 24	1623 0657	D9	D7	52	50		22 06	1685 0695	5A	D5	5D	4E
	21 25	1624 0658	D9	D8	52	51		22 07	1686 0696	5A	D6	5D	4F
	21 26	1625 0659	D9	D9	52	52		22 08	1687 0697	5A	D7	5D	50
	21 27	1626 065A	D9	5A	52	5D		22 09	1688 0698	5A	D8	5D	51
	21 28	1627 065B	D9	5B	52	24		22 10	1689 0699	5A	D9	5D	52
	21 29	1628 065C	D9	5C	52	2A		22 11	1690 069A	5A	5A	5D	5D
	21 30	1629 065D	D9	5D	52	29		22 12	1691 069B	5A	5B	5D	24
	21 31	1630 065E	D9	5E	52	3B		22 13	1692 069C	5A	5C	5D	2A
	21 32	1631 065F	D9	5F	52	5E		22 14	1693 069D	5A	5D	5D	29
	21 33	1632 0660	D9	60	52	2D		22 15	1694 069E	5A	5E	5D	3B
	21 34	1633 0661	D9	61	52	2F		22 16	1695 069F	5A	5F	5D	5E
	21 35	1634 0662	D9	E2	52	53		22 17	1696 06A0	5A	60	5D	2D
	21 36	1635 0663	D9	E3	52	54		22 18	1697 06A1	5A	61	5D	2F
	21 37	1636 0664	D9	E4	52	55		22 19	1698 06A2	5A	E2	5D	53
	21 38	1637 0665	D9	E5	52	56		22 20	1699 06A3	5A	E3	5D	54
	21 39	1638 0666	D9	E6	52	57		22 21	1700 06A4	5A	E4	5D	55
	21 40	1639 0667	D9	E7	52	58		22 22	1701 06A5	5A	E5	5D	56
	21 41	1640 0668	D9	E8	52	59		22 23	1702 06A6	5A	E6	5D	57
	21 42	1641 0669	D9	E9	52	5A		22 24	1703 06A7	5A	E7	5D	58
	21 43	1642 066A	D9	6A	52	7C		22 25	1704 06A8	5A	E8	5D	59
	21 44	1643 066B	D9	6B	52	2C		22 26	1705 06A9	5A	E9	5D	5A
	21 45	1644 066C	D9	6C	52	25		22 27	1706 06AA	5A	6A	5D	7C
	21 46	1645 066D	D9	6D	52	5F		22 28	1707 06AB	5A	6B	5D	2C
	21 47	1646 066E	D9	6E	52	3E		22 29	1708 06AC	5A	6C	5D	25
	21 48	1647 066F	D9	6F	52	3F		22 30	1709 06AD	5A	6D	5D	5F
	21 49	1648 0670	D9	F0	52	30		22 31	1710 06AE	5A	6E	5D	3E
	21 50	1649 0671	D9	F1	52	31		22 32	1711 06AF	5A	6F	5D	3F
	21 51	1650 0672	D9	F2	52	32		22 33	1712 06B0	5A	F0	5D	30
	21 52	1651 0673	D9	F3	52	33		22 34	1713 06B1	5A	F1	5D	31
	21 53	1652 0674	D9	F4	52	34		22 35	1714 06B2	5A	F2	5D	32
	21 54	1653 0675	D9	F5	52	35		22 36	1715 06B3	5A	F3	5D	33
	21 55	1654 0676	D9	F6	52	36		22 37	1716 06B4	5A	F4	5D	34
	21 56	1655 0677	D9	F7	52	37		22 38	1717 06B5	5A	F5	5D	35
	21 57	1656 0678	D9	F8	52	38		22 39	1718 06B6	5A	F6	5D	36
	21 58	1657 0679	D9	F9	52	39		22 40	1719 06B7	5A	F7	5D	37
	21 59	1658 067A	D9	7A	52	3A		22 41	1720 06B8	5A	F8	5D	38
	21 60	1659 067B	D9	7B	52	23		22 42	1721 06B9	5A	F9	5D	39
	21 61	1660 067C	D9	7C	52	40		22 43	1722 06BA	5A	7A	5D	3A
	21 62	1661 067D	D9	7D	52	27		22 44	1723 06BB	5A	7B	5D	23
	21 63	1662 067E	D9	7E	52	3D		22 45	1724 06BC	5A	7C	5D	40
	21 64	1663 067F	D9	7F	52	22		22 46	1725 06BD	5A	7D	5D	27
	21 65	1664 0680	5A	40	5D	20		22 47	1726 06BE	5A	7E	5D	3D
	21 66	1665 0681	5A	C1	5D	41		22 48	1727 06BF	5A	7F	5D	22
	21 67	1666 0682	5A	C2	5D	42		22 49	1728 06C0	5B	40	24	20
	21 68	1667 0683	5A	C3	5D	43		22 50	1729 06C1	5B	C1	24	41
	21 69	1668 0684	5A	C4	5D	44		22 51	1730 06C2	5B	C2	24	42
	21 70	1669 0685	5A	C5	5D	45		22 52	1731 06C3	5B	C3	24	43
	21 71	1670 0686	5A	C6	5D	46		22 53	1732 06C4	5B	C4	24	44
	21 72	1671 0687	5A	C7	5D	47		22 54	1733 06C5	5B	C5	24	45
	21 73	1672 0688	5A	C8	5D	48		22 55	1734 06C6	5B	C6	24	46
	21 74	1673 0689	5A	C9	5D	49		22 56	1735 06C7	5B	C7	24	47

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)				Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII					Dec	Hex	EBCDIC	ASCII		
	22 57	1736	06C8	5B	C8	24	48		23 39	1798	0706	5C	C6	2A	46
	22 58	1737	06C9	5B	C9	24	49		23 40	1799	0707	5C	C7	2A	47
	22 59	1738	06CA	5B	4A	24	5B		23 41	1800	0708	5C	C8	2A	48
	22 60	1739	06CB	5B	4B	24	2E		23 42	1801	0709	5C	C9	2A	49
	22 61	1740	06CC	5B	4C	24	3C		23 43	1802	070A	5C	4A	2A	5B
	22 62	1741	06CD	5B	4D	24	28		23 44	1803	070B	5C	4B	2A	2E
	22 63	1742	06CE	5B	4E	24	2B		23 45	1804	070C	5C	4C	2A	3C
	22 64	1743	06CF	5B	4F	24	21		23 46	1805	070D	5C	4D	2A	28
	22 65	1744	06D0	5B	50	24	26		23 47	1806	070E	5C	4E	2A	2B
	22 66	1745	06D1	5B	D1	24	4A		23 48	1807	070F	5C	4F	2A	21
	22 67	1746	06D2	5B	D2	24	4B		23 49	1808	0710	5C	50	2A	26
	22 68	1747	06D3	5B	D3	24	4C		23 50	1809	0711	5C	D1	2A	4A
	22 69	1748	06D4	5B	D4	24	4D		23 51	1810	0712	5C	D2	2A	4B
	22 70	1749	06D5	5B	D5	24	4E		23 52	1811	0713	5C	D3	2A	4C
	22 71	1750	06D6	5B	D6	24	4F		23 53	1812	0714	5C	D4	2A	4D
	22 72	1751	06D7	5B	D7	24	50		23 54	1813	0715	5C	D5	2A	4E
	22 73	1752	06D8	5B	D8	24	51		23 55	1814	0716	5C	D6	2A	4F
	22 74	1753	06D9	5B	D9	24	52		23 56	1815	0717	5C	D7	2A	50
	22 75	1754	06DA	5B	5A	24	5D		23 57	1816	0718	5C	D8	2A	51
	22 67	1755	06DB	5B	5B	24	24		23 58	1817	0719	5C	D9	2A	52
	22 77	1756	06DC	5B	5C	24	2A		23 59	1818	071A	5C	5A	2A	5D
	22 78	1757	06DD	5B	5D	24	29		23 60	1819	071B	5C	5B	2A	24
	22 79	1758	06DE	5B	5E	24	3B		23 61	1820	071C	5C	5C	2A	2A
	22 80	1759	06DF	5B	5F	24	5E		23 62	1821	071D	5C	5D	2A	29
	23 01	1760	06E0	5B	60	24	2D		23 63	1822	071E	5C	5E	2A	3B
	23 02	1761	06E1	5B	61	24	2F		23 64	1823	071F	5C	5F	2A	5E
	23 03	1762	06E2	5B	E2	24	53		23 65	1824	0720	5C	60	2A	2D
	23 04	1763	06E3	5B	E3	24	54		23 66	1825	0721	5C	61	2A	2F
	23 05	1764	06E4	5B	E4	24	55		23 67	1826	0722	5C	E2	2A	53
	23 06	1765	06E5	5B	E5	24	56		23 68	1827	0723	5C	E3	2A	54
	23 07	1766	06E6	5B	E6	24	57		23 69	1828	0724	5C	E4	2A	55
	23 08	1767	06E7	5B	E7	24	58		23 70	1829	0725	5C	E5	2A	56
	23 09	1768	06E8	5B	E8	24	59		23 71	1830	0726	5C	E6	2A	57
	23 10	1769	06E9	5B	E9	24	5A		23 72	1831	0727	5C	E7	2A	58
	23 11	1770	06EA	5B	6A	24	7C		23 73	1832	0728	5C	E8	2A	59
	23 12	1771	06EB	5B	6B	24	2C		23 74	1833	0729	5C	E9	2A	5A
	23 13	1772	06EC	5B	6C	24	25		23 75	1834	072A	5C	6A	2A	7C
	23 14	1773	06ED	5B	6D	24	5F		23 76	1835	072B	5C	6B	2A	2C
	23 15	1774	06EE	5B	6E	24	3E		23 77	1836	072C	5C	6C	2A	25
	23 16	1775	06EF	5B	6F	24	3F		23 78	1837	072D	5C	6D	2A	5F
	23 17	1776	06F0	5B	F0	24	30		23 79	1838	072E	5C	6E	2A	3E
	23 18	1777	06F1	5B	F1	24	31		23 80	1839	072F	5C	6F	2A	3F
	23 19	1778	06F2	5B	F2	24	32		24 01	1840	0730	5C	F0	2A	30
	23 20	1779	06F3	5B	F3	24	33		24 02	1841	0731	5C	F1	2A	31
	23 21	1780	06F4	5B	F4	24	34		24 03	1842	0732	5C	F2	2A	32
	23 22	1781	06F5	5B	F5	24	35		24 04	1843	0733	5C	F3	2A	33
	23 23	1782	06F6	5B	F6	24	36		24 05	1844	0734	5C	F4	2A	34
	23 24	1783	06F7	5B	F7	24	37		24 06	1845	0735	5C	F5	2A	35
	23 25	1784	06F8	5B	F8	24	38		24 07	1846	0736	5C	F6	2A	36
	23 26	1785	06F9	5B	F9	24	39		24 08	1847	0737	5C	F7	2A	37
	23 27	1786	06FA	5B	7A	24	3A		24 09	1848	0738	5C	F8	2A	38
	23 28	1787	06FB	5B	7B	24	23		24 10	1849	0739	5C	F9	2A	39
	23 29	1788	06FC	5B	7C	24	40		24 11	1850	073A	5C	7A	2A	3A
	23 30	1789	06FD	5B	7D	24	27		24 12	1851	073B	5C	7B	2A	23
	23 31	1790	06FE	5B	7E	24	3D		24 13	1852	073C	5C	7C	2A	40
	23 32	1791	06FF	5B	7F	24	22		24 14	1853	073D	5C	7D	2A	27
	23 33	1792	0700	5C	40	2A	20		24 15	1854	073E	5C	7E	2A	3D
	23 34	1793	0701	5C	C1	2A	41		24 16	1855	073F	5C	7F	2A	22
	23 35	1794	0702	5C	C2	2A	42		24 17	1856	0740	5D	40	29	20
	23 36	1795	0703	5C	C3	2A	43		24 18	1857	0741	5D	C1	29	41
	23 37	1796	0704	5C	C4	2A	44		24 19	1858	0742	5D	C2	29	42
	23 38	1797	0705	5C	C5	2A	45		24 20	1859	0743	5D	C3	29	43

Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)				Mod 1 R C	Mod 2 R C	Position		Buffer Address (Hex)			
		Dec	Hex	EBCDIC	ASCII					Dec	Hex	EBCDIC	ASCII		
	24 21	1860	0744	5D	C4	29	44		24 51	1890	0762	5D	E2	29	53
	24 22	1861	0745	5D	C5	29	45		24 52	1891	0763	5D	E3	29	54
	24 23	1862	0746	5D	C6	29	46		24 53	1892	0764	5D	E4	29	55
	24 24	1863	0747	5D	C7	29	47		24 54	1893	0765	5D	E5	29	56
	24 25	1864	0748	5D	C8	29	48		24 55	1894	0766	5D	E6	29	57
	24 26	1865	0749	5D	C9	29	49		24 56	1895	0767	5D	E7	29	58
	24 27	1866	074A	5D	4A	29	5B		24 57	1896	0768	5D	E8	29	59
	24 28	1867	074B	5D	4B	29	2E		24 58	1897	0769	5D	E9	29	5A
	24 29	1868	074C	5D	4C	29	3C		24 59	1898	076A	5D	6A	29	7C
	24 30	1869	074D	5D	4D	29	28		24 60	1899	076B	5D	6B	29	2C
	24 31	1870	074E	5D	4E	29	2B		24 61	1900	076C	5D	6C	29	25
	24 32	1871	074F	5D	4F	29	21		24 62	1901	076D	5D	6D	29	5F
	24 33	1872	0750	5D	50	29	26		24 63	1902	076E	5D	6E	29	3E
	24 34	1873	0751	5D	D1	29	4A		24 64	1903	076F	5D	6F	29	3F
	24 35	1874	0752	5D	D2	29	4B		24 65	1904	0770	5D	F0	29	30
	24 36	1875	0753	5D	D3	29	4C		24 66	1905	0771	5D	F1	29	31
	24 37	1876	0754	5D	D4	29	4D		24 67	1906	0772	5D	F2	29	32
	24 38	1877	0755	5D	D5	29	4E		24 68	1907	0773	5D	F3	29	33
	24 39	1878	0756	5D	D6	29	4F		24 69	1908	0774	5D	F4	29	34
	24 40	1879	0757	5D	D7	29	50		24 70	1909	0775	5D	F5	29	35
	24 41	1880	0758	5D	D8	29	51		24 71	1910	0776	5D	F6	29	36
	24 42	1881	0759	5D	D9	29	52		24 72	1911	0777	5D	F7	29	37
	24 43	1882	075A	5D	5A	29	5D		24 73	1912	0778	5D	F8	29	38
	24 44	1883	075B	5D	5B	29	24		24 74	1913	0779	5D	F9	29	39
	24 45	1884	075C	5D	5C	29	2A		24 75	1914	077A	5D	7A	29	3A
	24 46	1885	075D	5D	5D	29	29		24 76	1915	077B	5D	7B	29	23
	24 47	1886	075E	5D	5E	29	3B		24 77	1916	077C	5D	7C	29	40
	24 48	1887	075F	5D	5F	29	5E		24 78	1917	077D	5D	7D	29	27
	24 49	1888	0760	5D	60	29	2D		24 79	1918	077E	5D	7E	29	3D
	24 50	1889	0761	5D	61	29	2F		24 80	1919	077F	5D	7F	29	22

Legend:

R = Row  
C = Column

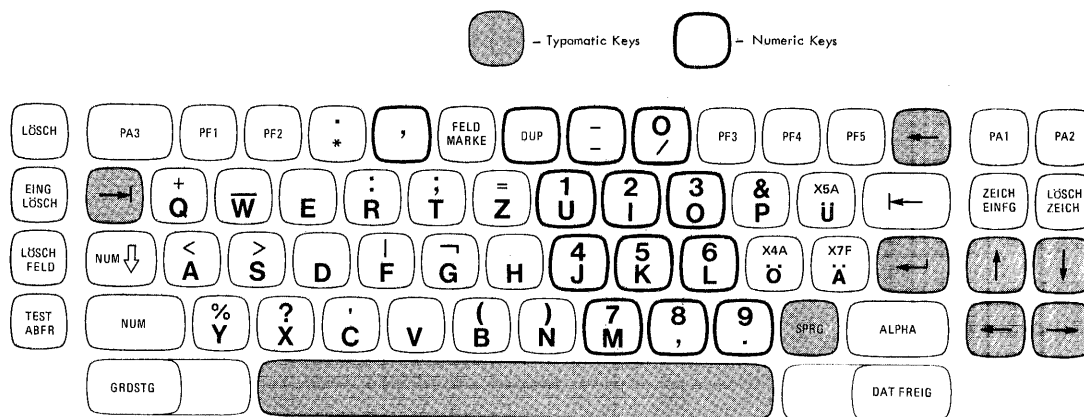
## Appendix D. World Trade Keyboards and I/O Interface Codes

Table 27. Austrian/German I/O Interface Codes

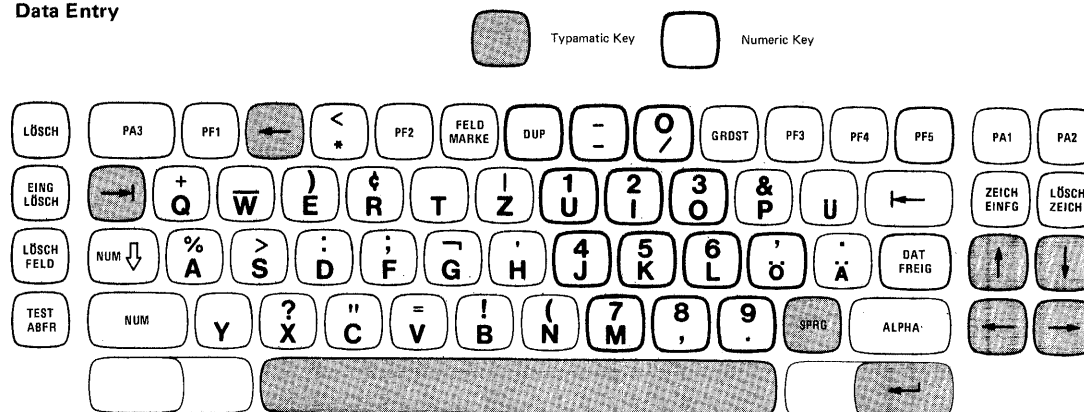
		00				01				10				11				Bits 0,1
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bits 2,3
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	Hex 0
Bits 4567	Hex 1																	
0000	0	NUL	DLE			SP	&	-									0	
0001	1	SOH	SBA					/		a	j			A	J		1	
0010	2	STX	EUA		SYN					b	k	s		B	K	S	2	
0011	3	ETX	IC							c	l	t		C	L	T	3	
0100	4									d	m	u		D	M	U	4	
0101	5	PT	NL							e	n	v		E	N	V	5	
0110	6			ETB						f	o	w		F	O	W	6	
0111	7			ESC	EOT					g	p	x		G	P	X	7	
1000	8									h	q	y		H	Q	Y	8	
1001	9		EM							i	r	z		I	R	Z	9	
1010	A					ø	ü	!	:									
1011	B					.	Ü	,	Ä									
1100	C	FF	DUP		RA	<	*	%	Ö									
1101	D		SF	ENQ	NAK	(	)	_	'									
1110	E		FM			+	;	>	=									
1111	F		ITB		SUB		⌞	?	ä									

### Notes:

- Character code assignments other than those shown within all outlined portions of this chart are undefined. If an undefined character code is programmed, the character that will be displayed is not specified. The character displayed by the 3277 or 3275 for a given undefined character code may be different for other devices. IBM reserves the right to change at any time the character displayed for an undefined character code.
- The 29 lowercase alphabet characters (within the dotted outlined area) are converted to uppercase by the display station or printer and are displayed or printed as uppercase characters.
- NL, EM, FF, DUP, and FM control characters are displayed or printed as 5, 9, <, \*, and ; characters, respectively, except by the printer under format control, in which case NL and EM do not result in a character being printed.
- Bit 0 is assigned and bit 1 is always a 1 for the following characters: attribute, write control (WCC), copy control (CCC), CU and device address, buffer address, sense, and status. Bit 0 is assigned so that each character can be represented by a graphic character within the solid-outlined portions of the chart. See Table 3.
- The | character (hex 6A) is not displayed and is printed by the 3288 only.



### Data Entry



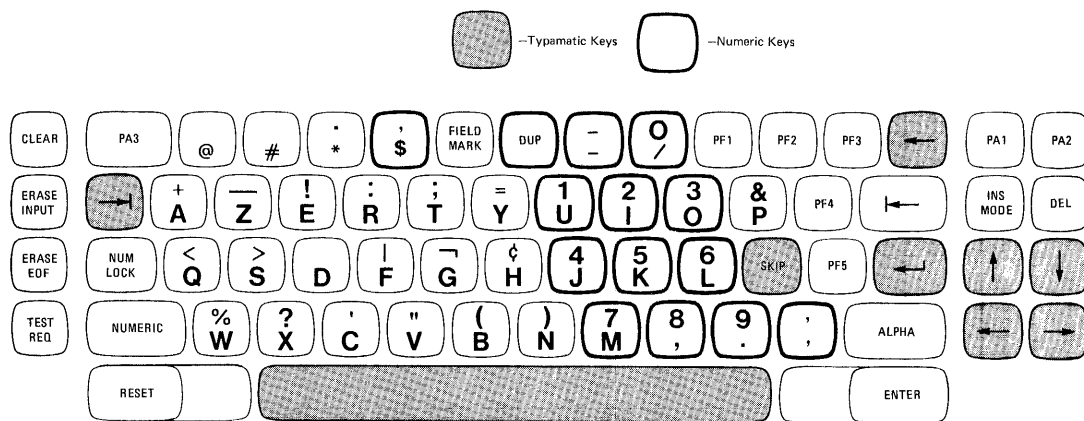
### Data Entry – Keypunch Layout



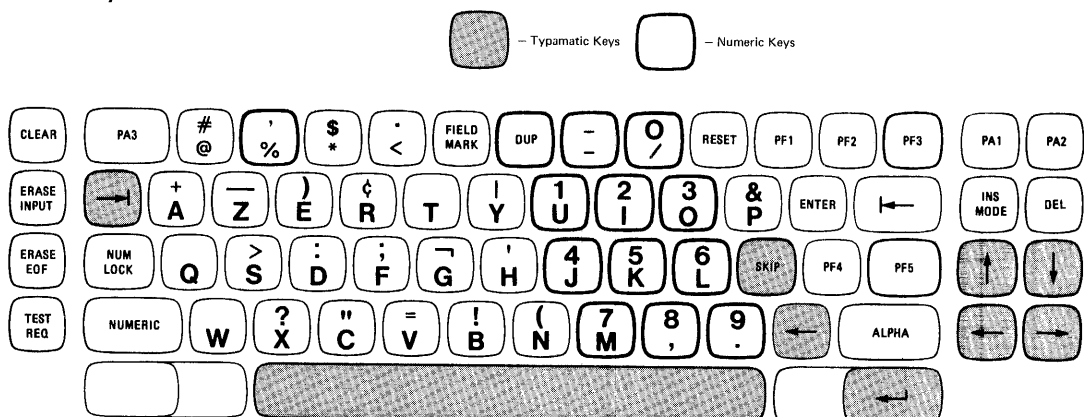
### Typewriter

Figure 29. Austrian/German Keyboards

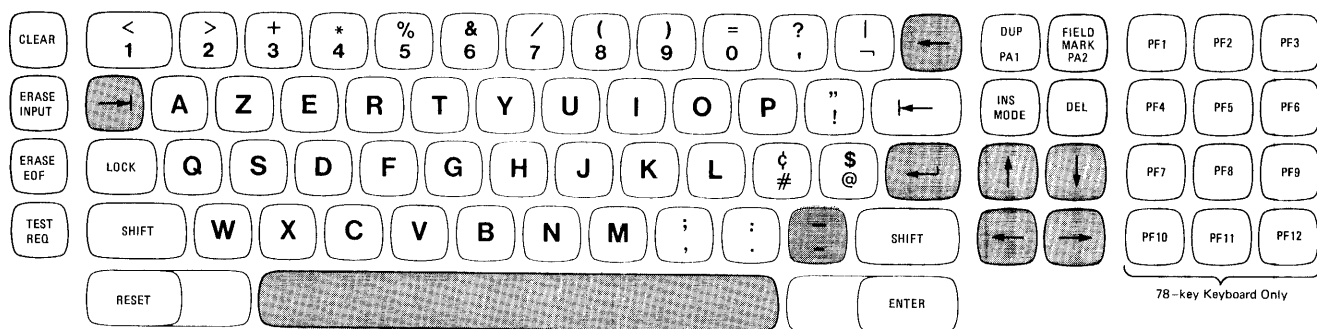
**Intentionally Left Blank**



#### Data Entry



#### Data Entry — Keypunch Layout



#### Typewriter

**Note:** Belgium uses the same I/O interface codes and graphics as used in United States EBCDIC. Refer to Table 1.

**Figure 30. Belgian Keyboards**

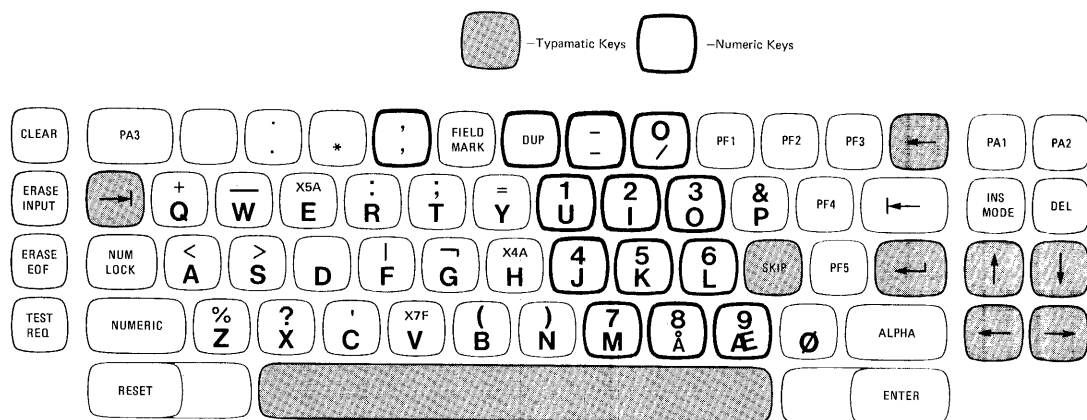
Table 28. Danish/Norwegian I/O Interface Code

		00				01				10				11				Bits 0,1
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bits 2,3
Hex 1		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	Hex 0
0000	0	NUL	DLE			SP	&	-									0	
0001	1	SOH	SBA					/		a	j			A	J		1	
0010	2	STX	EUA		SYN					b	k	s		B	K	S	2	
0011	3	ETX	IC							c	l	t		C	L	T	3	
0100	4									d	m	u		D	M	U	4	
0101	5	PT	NL							e	n	v		E	N	V	5	
0110	6				ETB					f	o	w		F	O	W	6	
0111	7				ESC	EOT				g	p	x		G	P	X	7	
1000	8									h	q	y		H	Q	Y	8	
1001	9		EM							i	r	z		I	R	Z	9	
1010	A					ø	å	ı	:									
1011	B					.	Ä	,	Æ									
1100	C	FF	DUP		RA	<	*	%	Ø									
1101	D		SF	ENQ	NAK	(	)	_	'									
1110	E		FM			+	;	>	=									
1111	F		ITB		SUB		¬	?	æ									

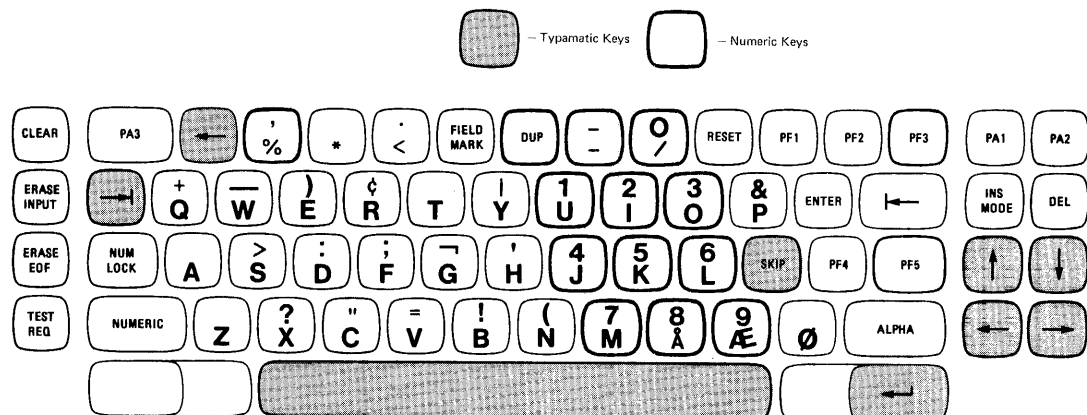
**Notes:**

1. Character code assignments other than those shown within all outlined portions of this chart are undefined. If an undefined character code is programmed, the character that will be displayed is not specified. The character displayed by the 3277 or 3275 for a given undefined character code may be different for other devices. IBM reserves the right to change at any time the character displayed for an undefined character code.
2. The 29 lowercase alphabet characters (within the dotted outlined area) are converted to uppercase by the display station or printer and are displayed or printed as uppercase characters.
3. NL, EM, FF, DUP, and FM control characters are displayed or printed as 5, 9, <, \*, and ; characters, respectively, except by the printer under format control, in which case NL and EM do not result in a character being printed.
4. Bit 0 is assigned and bit 1 is always a 1 for the following characters: attribute, write control (WCC), copy control (CCC), CU and device address, buffer address, sense, and status. Bit 0 is assigned so that each character can be represented by a graphic character within the solid-outlined portions of the chart. See Table 3.
5. The ı character (hex 6A) is not displayed and is printed by the 3288 only.

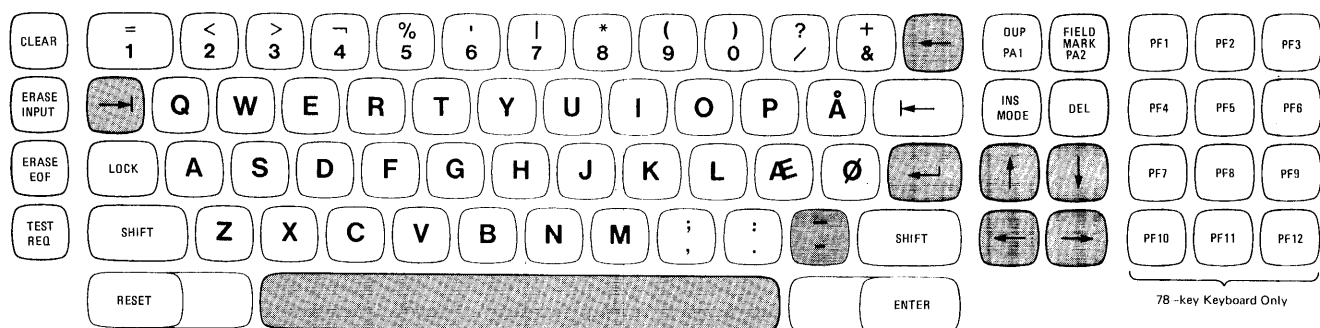




### Data Entry



### Data Entry — Keypunch Layout



### Typewriter

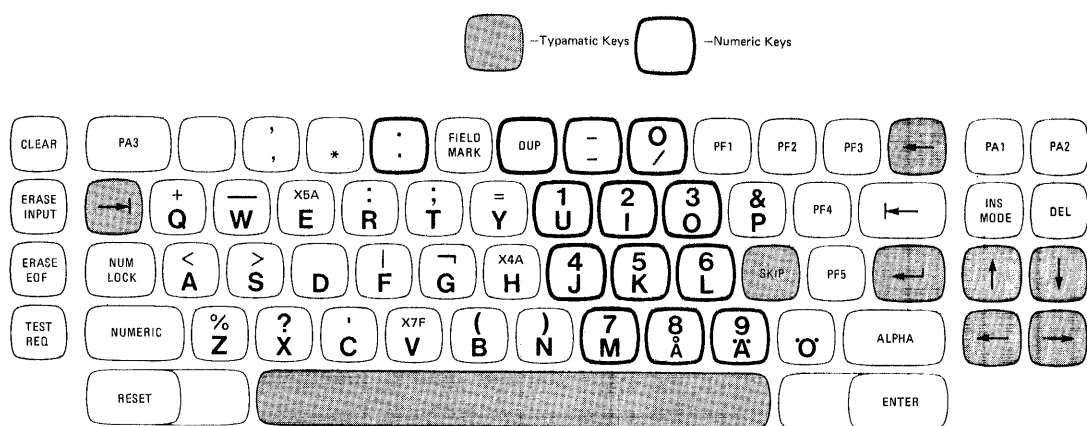
Figure 31. Danish Keyboards

Table 29. Finnish/Swedish I/O Interface Code

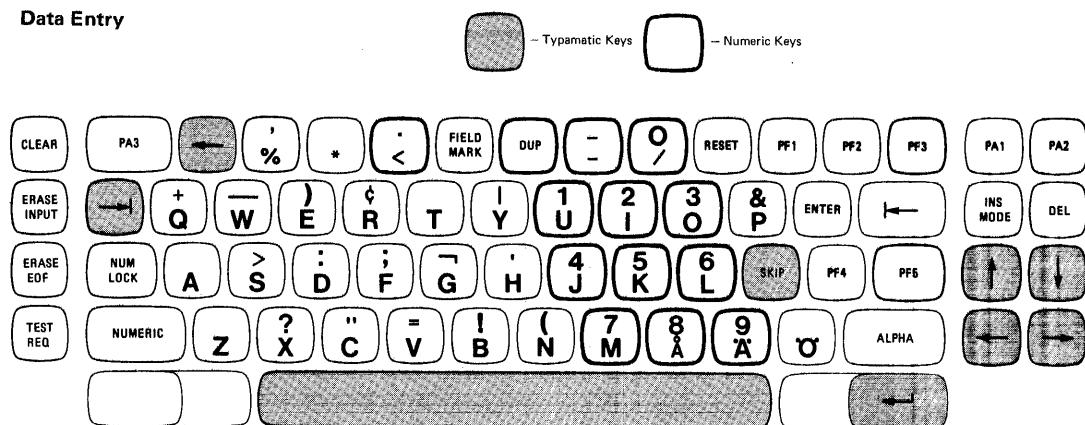
		00				01				10				11				Bits 0,1
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bits 2,3
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	Hex 0
0000	0	NUL	DLE			SP	&	-									0	
0001	1	SOH	SBA					/		a	j			A	J		1	
0010	2	STX	EUA		SYN					b	k	s		B	K	S	2	
0011	3	ETX	IC							c	l	t		C	L	T	3	
0100	4									d	m	u		D	M	U	4	
0101	5	PT	NL							e	n	v		E	N	V	5	
0110	6			ETB						f	o	w		F	O	W	6	
0111	7			ESC	EOT					g	p	x		G	P	X	7	
1000	8									h	q	y		H	Q	Y	8	
1001	9		EM							i	r	z		I	R	Z	9	
1010	A					ö	ä		:									
1011	B					.	Å	,	Ä									
1100	C	FF	DUP		RA	<	*	%	Ö									
1101	D		SF	ENQ	NAK	(	)	_	'									
1110	E		FM			+	;	>	=									
1111	F		ITB		SUB		⌋	?	ä									

**Notes:**

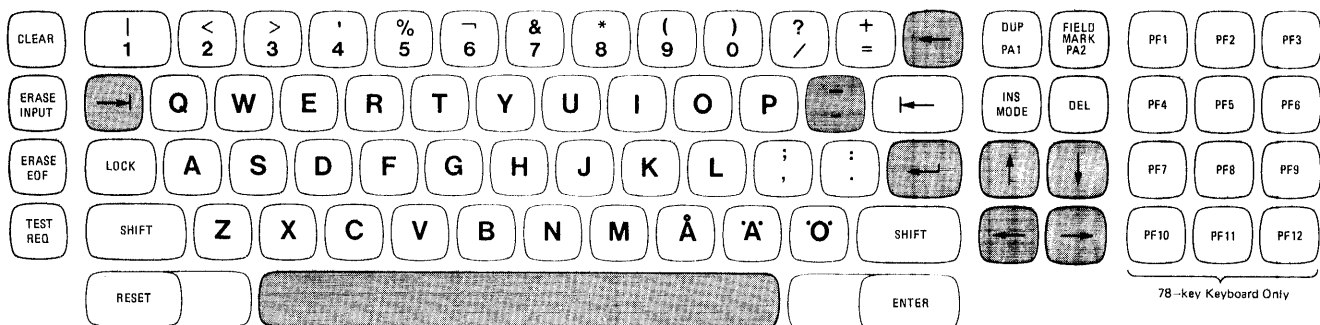
1. Character code assignments other than those shown within all outlined portions of this chart are undefined. If an undefined character code is programmed, the character that will be displayed is not specified. The character displayed by the 3277 or 3275 for a given undefined character code may be different for other devices. IBM reserves the right to change at any time the character displayed for an undefined character code.
2. The 29 lowercase alphabet characters (within the dotted outlined area) are converted to uppercase by the display station or printer and are displayed or printed as uppercase characters.
3. NL, EM, FF, DUP, and FM control characters are displayed or printed as 5, 9, <, \*, and ; characters, respectively, except by the printer under format control, in which case NL and EM do not result in a character being printed.
4. Bit 0 is assigned and bit 1 is always a 1 for the following characters: attribute, write control (WCC), copy control (CCC), CU and device address, buffer address, sense, and status. Bit 0 is assigned so that each character can be represented by a graphic character within the solid-outlined portions of the chart. See Table 3.
5. The | character (hex 6A) is not displayed and is printed by the 3288 only.



### Data Entry



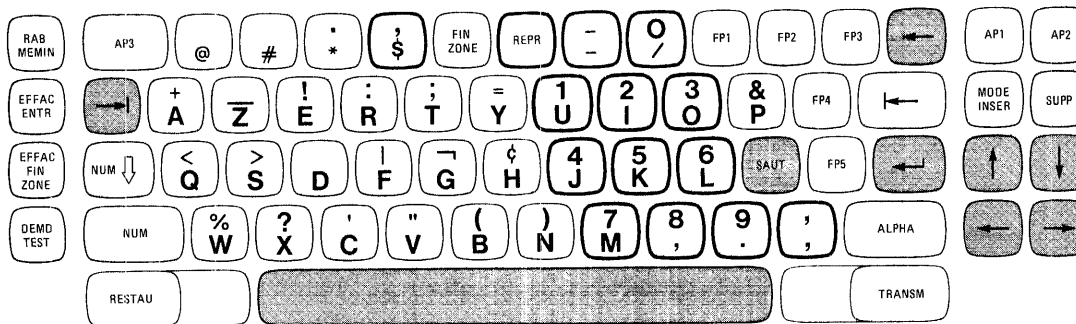
### Data Entry – Keypunch Layout



### Typewriter

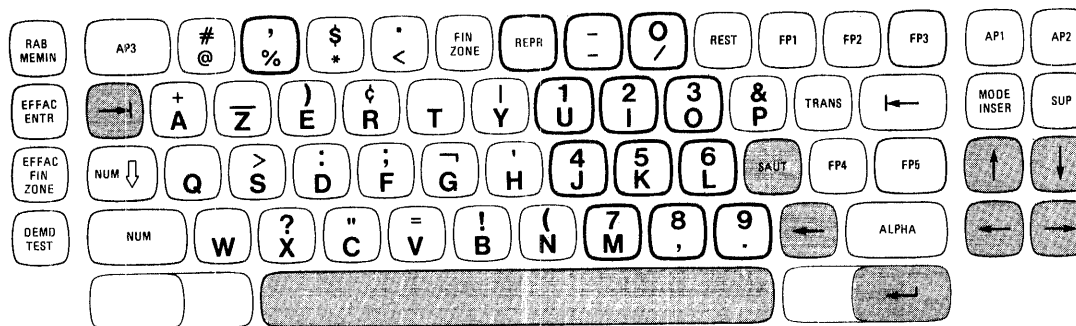
Figure 32. Finnish/Swedish Keyboards

 - Typematic Keys
  - Numeric Keys

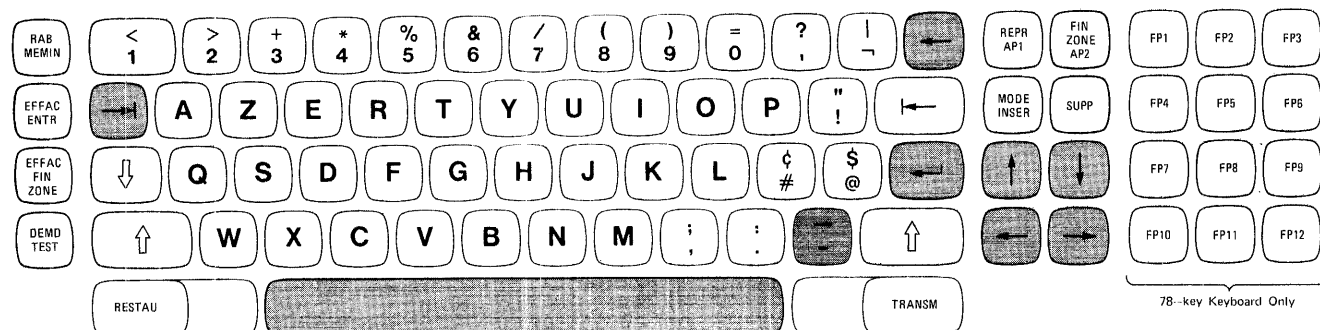


### Data Entry

 - Typematic Keys
  - Numeric Keys



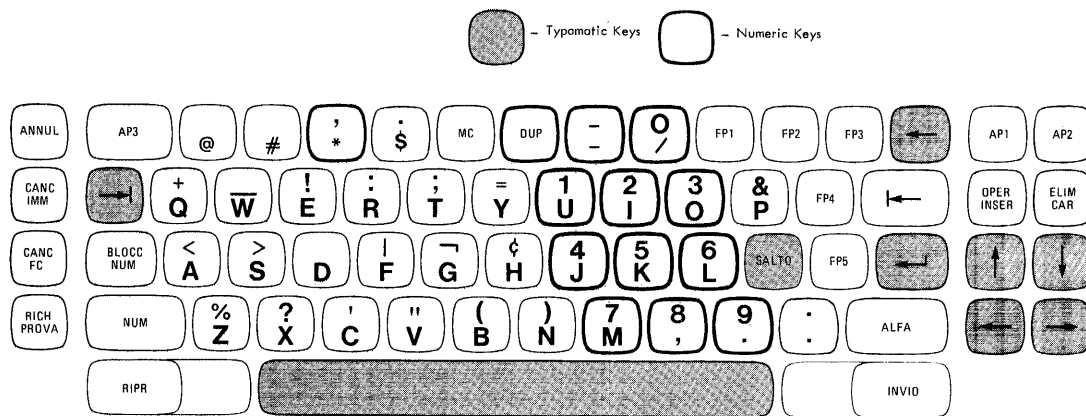
### Data Entry – Keypunch Layout



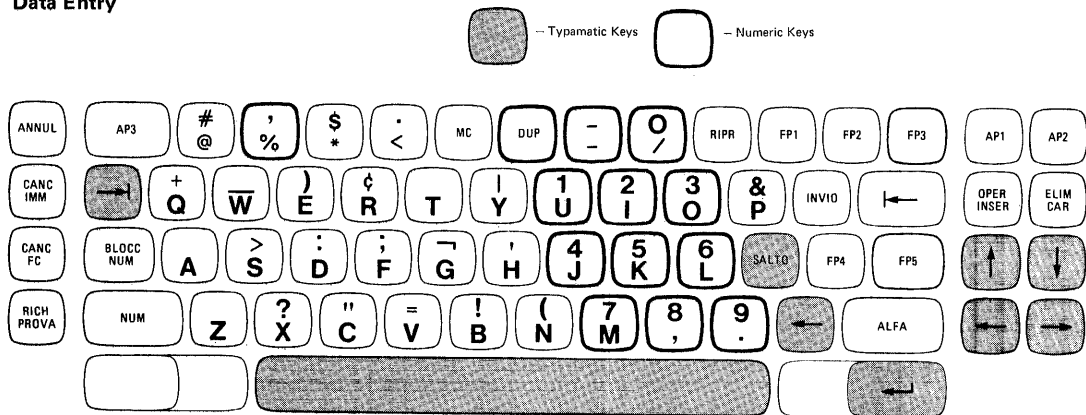
### Typewriter

**Note:** France uses the same I/O interface codes and graphics as used in United States EBCDIC. Refer to Table 1.

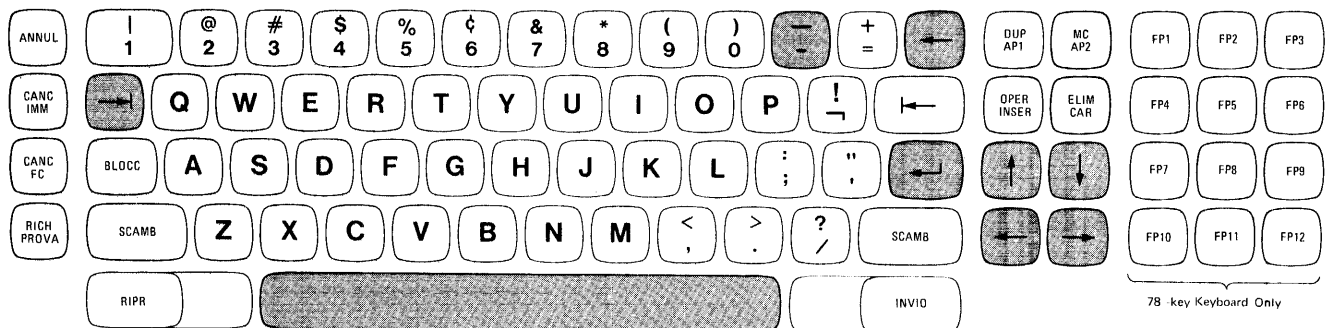
**Figure 33. French Keyboards**



#### Data Entry



#### Data Entry – Keypunch Layout

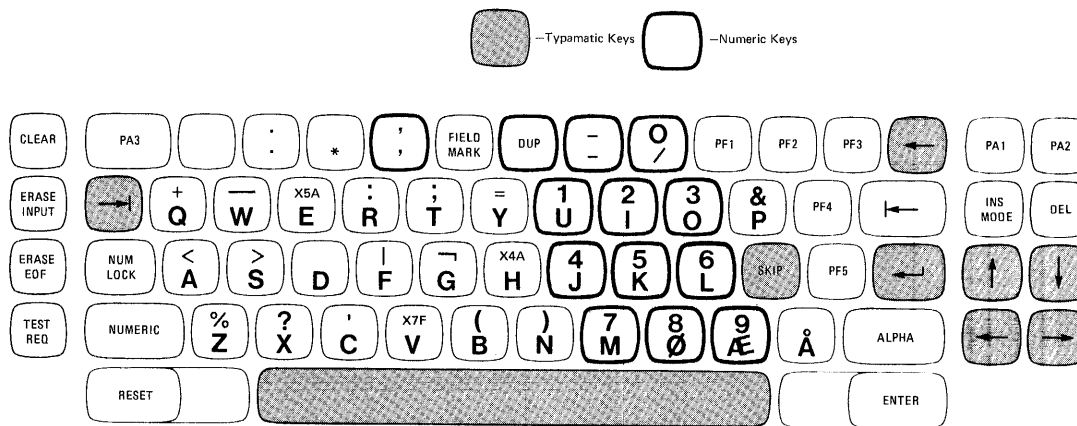


#### Typewriter

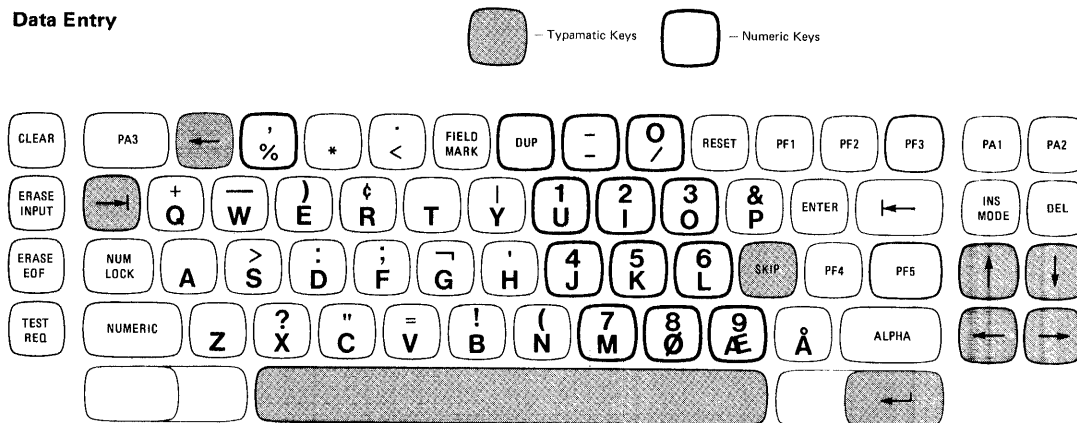
**Note:** Italy uses the same I/O interface codes and graphics as used in United States EBCDIC. Refer to Table 1.

**Figure 34. Italian Keyboards**

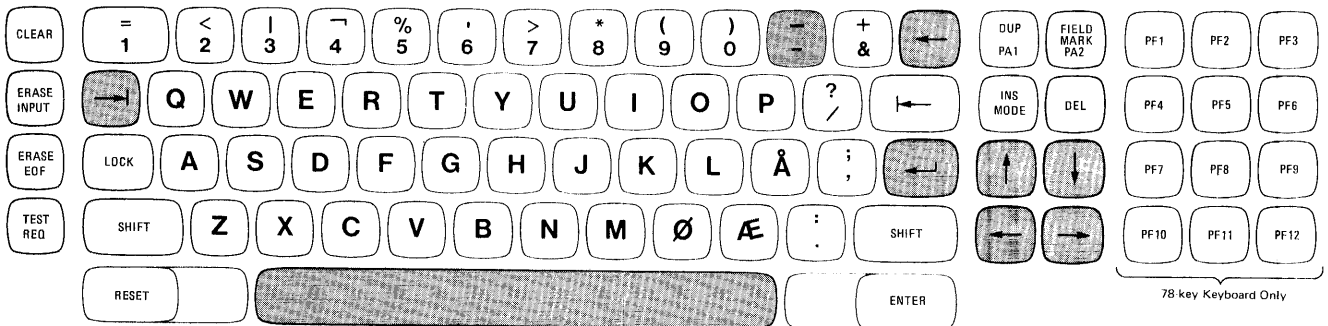
**Intentionally Left Blank**



#### Data Entry



#### Data Entry — Keypunch Layout



#### Typewriter

**Note:** Norway and Denmark use the same I/O interface codes and graphics. Refer to Table 28.

**Figure 35. Norwegian Keyboards**

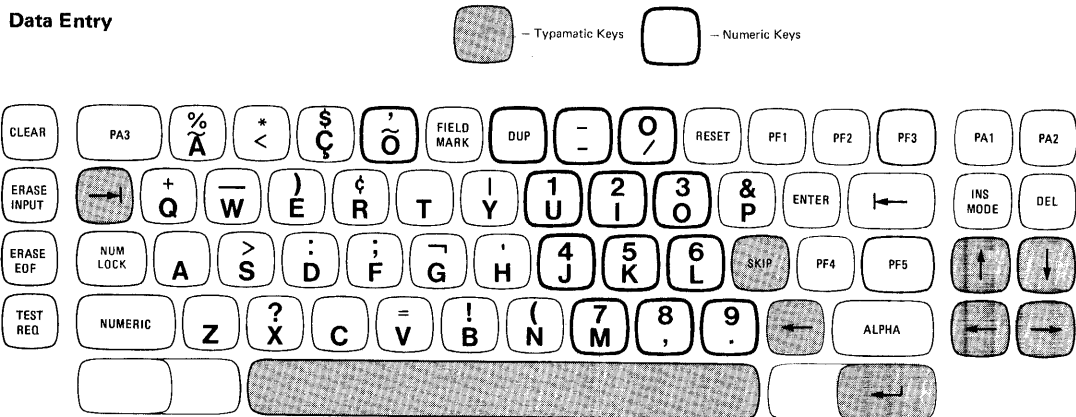
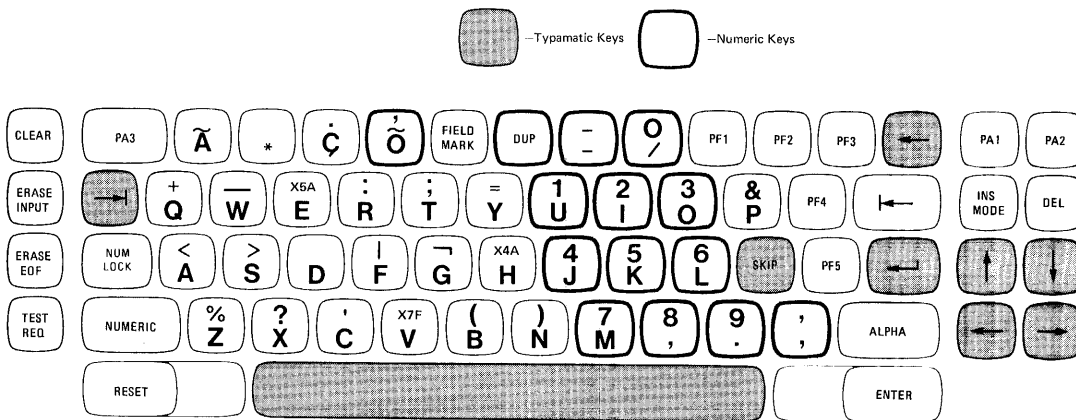
Table 30. Portuguese I/O Interface Code

		00				01				10				11				Bits 0,1
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	2,3
Bits 4567	Hex 1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	Hex 0
0000	0	NUL	DLE			SP	&	-									0	
0001	1	SOH	SBA					/		a	j			A	J		1	
0010	2	STX	EUA		SYN					b	k	s		B	K	S	2	
0011	3	ETX	IC							c	l	t		C	L	T	3	
0100	4									d	m	u		D	M	U	4	
0101	5	PT	NL							e	n	v		E	N	V	5	
0110	6			ETB						f	o	w		F	O	W	6	
0111	7			ESC	EOT					g	p	x		G	P	X	7	
1000	8									h	q	y		H	Q	Y	8	
1001	9		EM							i	r	z		I	R	Z	9	
1010	A					~	ç		:									
1011	B					.	ç	.	õ									
1100	C	FF	DUP		RA	<	*	%	Ã									
1101	D		SF	ENQ	NAK	(	)	_	'									
1110	E		FM			+	;	>	=									
1111	F		ITB		SUB		⌋	?	ø									

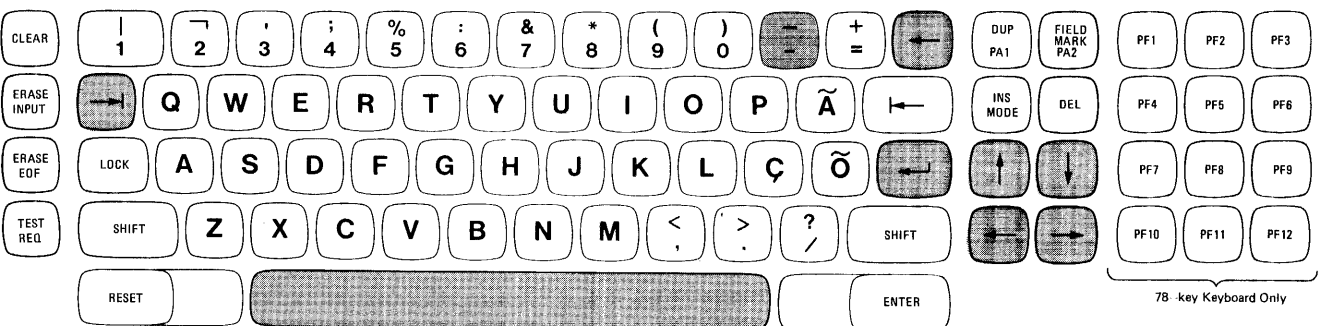
**Notes:**

1. Character code assignments other than those shown within all outlined portions of this chart are undefined. If an undefined character code is programmed, the character that will be displayed is not specified. The character displayed by the 3277 or 3275 for a given undefined character code may be different for other devices. IBM reserves the right to change at any time the character displayed for an undefined character code.
2. The 29 lowercase alphabet characters (within the dotted outlined area) are converted to uppercase by the display station or printer and are displayed or printed as uppercase characters.
3. NL, EM, FF, DUP, and FM control characters are displayed or printed as 5, 9, <, \*, and ; characters, respectively, except by the printer under format control, in which case NL and EM do not result in a character being printed.
4. Bit 0 is assigned and bit 1 is always a 1 for the following characters: attribute, write control (WCC), copy control (CCC), CU and device address, buffer address, sense, and status. Bit 0 is assigned so that each character can be represented by a graphic character within the solid-outlined portions of the chart. See Table 3.
5. The | character (hex 6A) is not displayed and is printed by the 3288 only.





**Data Entry — Keypunch Layout**



**Typewriter**

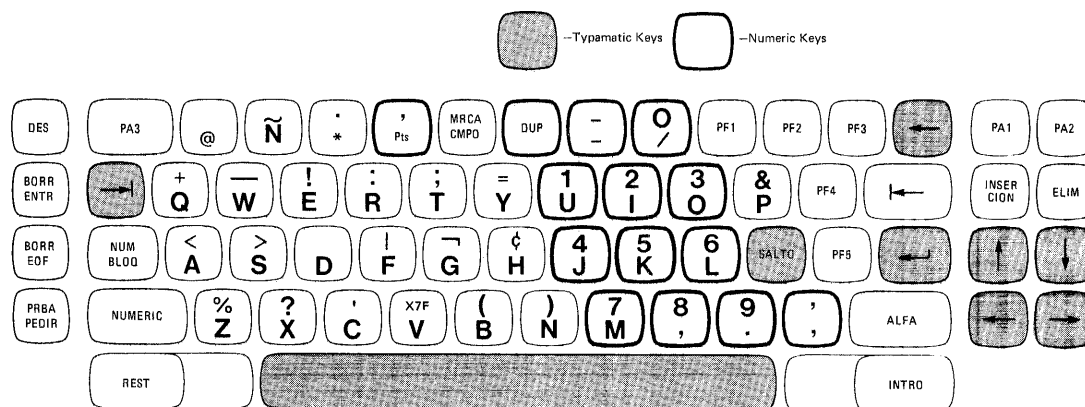
**Figure 36. Portuguese Keyboards**

Table 31. Spanish I/O Interface Code

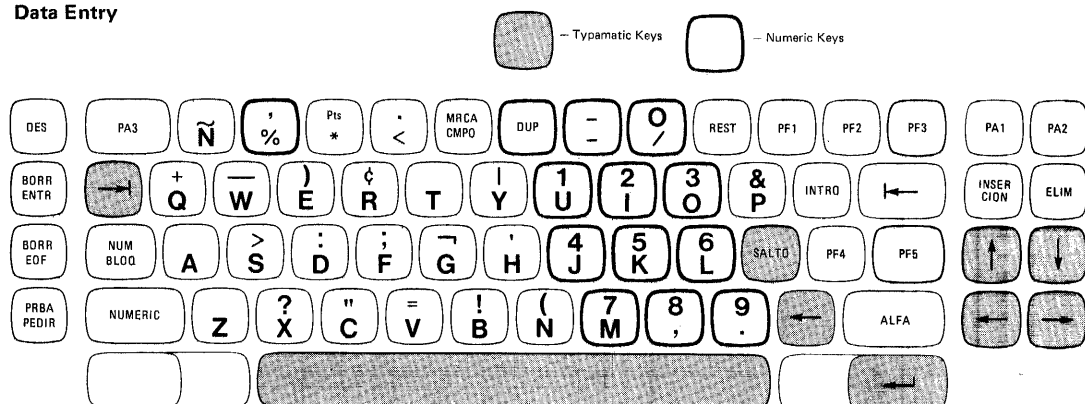
		00				01				10				11				Bits 0,1
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bits 2,3
Hex 1		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	Hex 0
0000	0	NUL	DLE			SP	&	-									0	
0001	1	SOH	SBA					/		a	j			A	J		1	
0010	2	STX	EUA		SYN					b	k	s		B	K	S	2	
0011	3	ETX	IC							c	l	t		C	L	T	3	
0100	4									d	m	u		D	M	U	4	
0101	5	PT	NL							e	n	v		E	N	V	5	
0110	6			ETB						f	o	w		F	O	W	6	
0111	7			ESC	EOT					g	p	x		G	P	X	7	
1000	8									h	q	y		H	Q	Y	8	
1001	9		EM							i	r	z		I	R	Z	9	
1010	A					¢	!		:									
1011	B					.	Pt	,	Ñ									
1100	C	FF	DUP		RA	<	*	%	@									
1101	D		SF	ENQ	NAK	(	)	_	'									
1110	E		FM			+	;	>	=									
1111	F		ITB		SUB		⌞	?	ˆ									

**Notes:**

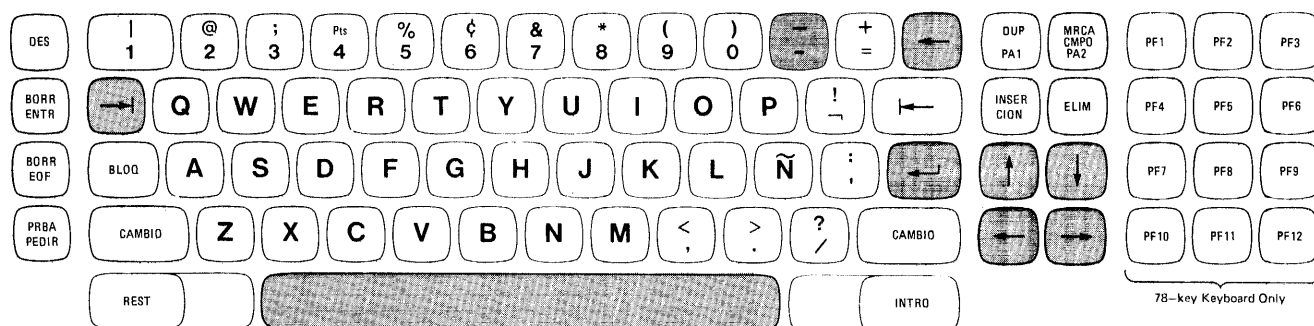
- Character code assignments other than those shown within all outlined portions of this chart are undefined. If an undefined character code is programmed, the character that will be displayed is not specified. The character displayed by the 3277 or 3275 for a given undefined character code may be different for other devices. IBM reserves the right to change at any time the character displayed for an undefined character code.
- The 27 lowercase alphabet characters (within the dotted outlined area) are converted to uppercase by the display station or printer and are displayed or printed as uppercase characters.
- NL, EM, FF, DUP, and FM control characters are displayed or printed as 5, 9, <, \*, and ; characters, respectively, except by the printer under format control, in which case NL and EM do not result in a character being printed.
- Bit 0 is assigned and bit 1 is always a 1 for the following characters: attribute, write control (WCC), copy control (CCC), CU and device address, buffer address, sense, and status. Bit 0 is assigned so that each character can be represented by a graphic character within the solid-outlined portions of the chart. See Table 3.
- The | character (hex 6A) is not displayed and is printed by the 3288 only.



### Data Entry



### Data Entry — Keypunch Layout



### Typewriter

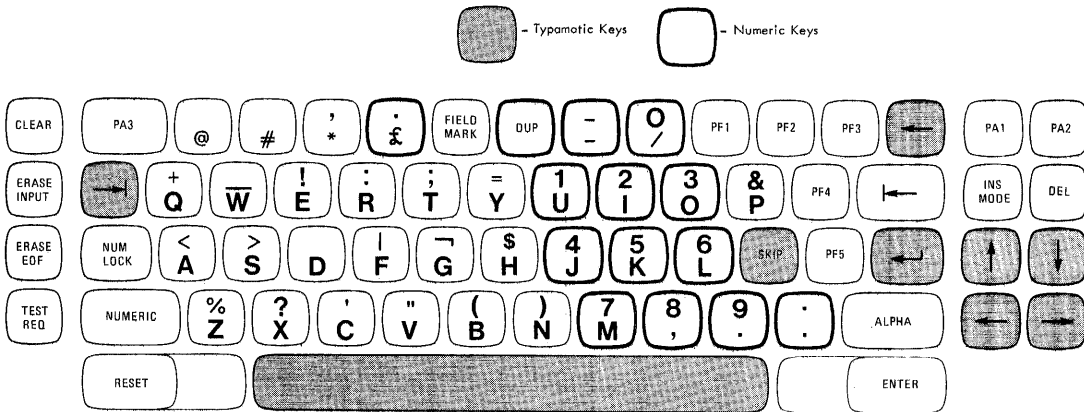
Figure 37. Spanish Keyboards

Table 32. United Kingdom I/O Interface Code

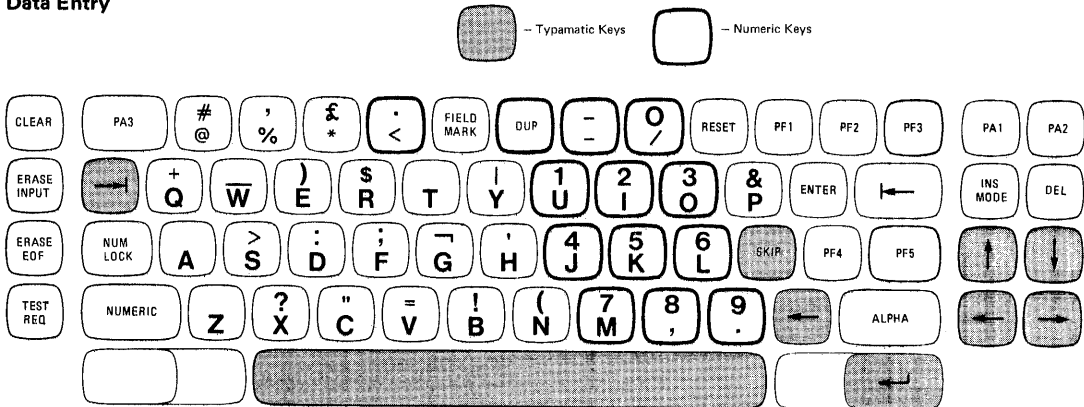
		00				01				10				11				Bits 0,1
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bits 2,3
Hex 1		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	Hex 0
Bits 4567																		
0000	0	NUL	DLE			SP	&	-										0
0001	1	SOH	SBA					/		a	j			A	J			1
0010	2	STX	EUA		SYN					b	k	s		B	K	S		2
0011	3	ETX	IC							c	l	t		C	L	T		3
0100	4									d	m	u		D	M	U		4
0101	5	PT	NL							e	n	v		E	N	V		5
0110	6			ETB						f	o	w		F	O	W		6
0111	7			ESC	EOT					g	p	x		G	P	X		7
1000	8									h	q	y		H	Q	Y		8
1001	9		EM							i	r	z		I	R	Z		9
1010	A			.		\$	!		:									
1011	B					.	£	,	#									
1100	C	FF	DUP		RA	<	*	%	@									
1101	D		SF	ENQ	NAK	(	)	_	'									
1110	E		FM			+	;	>	=									
1111	F		ITB		SUB		⌞	?	"									

**Notes:**

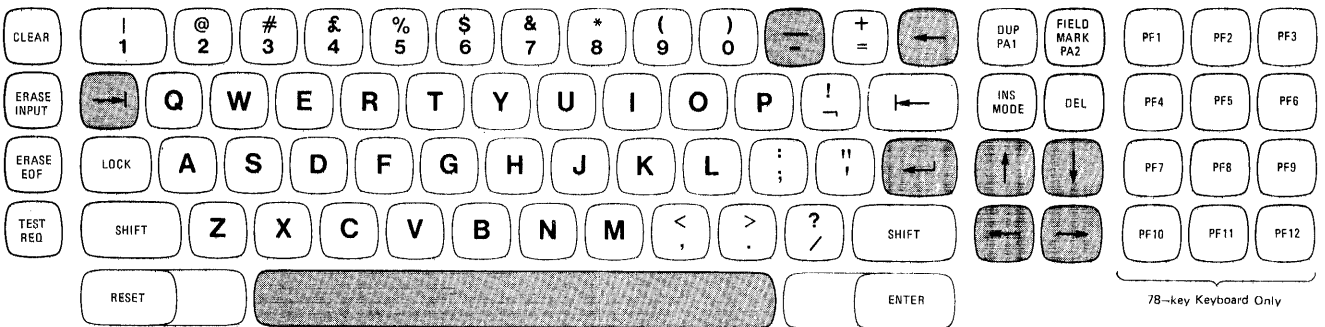
- Character code assignments other than those shown within all outlined portions of this chart are undefined. If an undefined character code is programmed, the character that will be displayed is not specified. The character displayed by the 3277 or 3275 for a given undefined character code may be different for other devices. IBM reserves the right to change at any time the character displayed for an undefined character code.
- The 27 lowercase alphabet characters (within the dotted outlined area) are converted to uppercase by the display station or printer and are displayed or printed as uppercase characters.
- NL, EM, FF, DUP, and FM control characters are displayed or printed as 5, 9, <, \*, and ; characters, respectively, except by the printer under format control, in which case NL and EM do not result in a character being printed.
- Bit 0 is assigned and bit 1 is always a 1 for the following characters: attribute, write control (WCC), copy control (CCC), CU and device address, buffer address, sense, and status. Bit 0 is assigned so that each character can be represented by a graphic character within the solid-outlined portions of the chart. See Table 3.
- The | character (hex 6A) is not displayed and is printed by the 3288 only.



#### Data Entry



#### Data Entry — Keypunch Layout



#### Typewriter

Figure 38. United Kingdom Keyboards

## Glossary

Terms in this glossary are defined here as they apply to the 3270 Display System.

***Alphanumeric Field:*** A field that may contain any alphabetic, numeric, or special character that is available on any of the 3270 keyboards.

***Alphanumeric Keyboard:*** A typewriter-like keyboard used to enter letters, numbers, and special characters into a display station buffer; also used to perform special functions (such as backspacing) and to produce special control signals.

***Attention:*** An I/O interruption generated asynchronously by a display station, usually as the result of an action taken by the operator of the device.

***Attention Identification (AID) Character:*** A code that is set in the display station when the operator takes an action that produces an I/O interruption. The character identifies the action or key that caused the condition to be generated. The AID is set when the display station operator presses a program access key, when a Selector Pen attention occurs, or when a successful operator identification card read-in occurs. It also identifies device addresses assigned to printers.

***Attribute:*** A characteristic of a display field. The attributes of a display field include: protected or unprotected (against manual input and copy operations); numeric-only or alphanumeric input control; displayed, nondisplayed, display-intensified; selector-pen-detectable or -nondetectable; and modified or not modified.

***Attribute Character:*** A code that defines the attributes of the display field that follows. An attribute character is the first character in a display field, but it is not a displayable character.

***Audible Alarm:*** A special feature that causes a short, audible tone to be sounded automatically when a character is entered from the keyboard into the next-to-last character position on the screen. It can also be sounded under program control.

***Automatic Skip:*** Automatic repositioning of the cursor, after entry of a character into the last character position of an unprotected display field, over a protected and numeric field to the first character position of the next unprotected display field.

***Automatic Upshift:*** Automatic shift of the data-entry keyboard, when the cursor enters an unprotected numeric field to allow entry of only the upper symbols on dual-character keys.

***Available/Unavailable:*** A device is available for CU-channel operation if (1) ac power is on at the device, (2) it is online, (3) it is physically attached to the CU, and (4) its security lock is turned on. The device is unavailable if any one of these conditions does not exist.

***Buffer:*** The hardware portion of a display station, control unit, or buffered printer in which display or print data is stored.

***Buffer Address:*** The address of a location in the buffer at which one character can be stored.

***Busy/Not Busy:*** The CU considers a device busy if (1) it is performing an operation that was initiated by the CU (namely, an erase-all-unprotected operation or a printing operation) or (2) if the CU attempted to perform a command with the device but found the device busy executing a manually initiated operation. A manual operation can be initiated at the keyboard, operator identification card reader, or selector pen.

***Cathode-Ray Tube (CRT):*** A vacuum tube in which a slender beam of electrons is projected upon a fluorescent screen to produce a luminous glow corresponding to the beam's path.

***Character Addressing:*** The capability of gaining access to any character position in the buffer by using an address.

***Character Generator:*** A hardware unit contained in each 3275, 3277, and printer. It converts the digital code for a character into signals that cause the character to be printed or displayed.

***Character Position:*** A location on the screen at which one character can be displayed; also, an addressed location in the buffer at which one character can be stored.

***Communication Facilities:*** Any media, such as a telephone circuit, that connects a remote 3270 unit (3271 or 3275) with a computer.

**Copy Control Character (CCC):** A character used in conjunction with the Copy command to specify that a particular operation, or combination of operations, is to be performed at a display station or printer in the data that is to be copied.

**Copy Operation:** An operation that copies the contents of the buffer from one display station or printer to another display station or printer attached to the same control unit.

**Cursor:** A unique symbol (an underscore) that identifies a character position in a screen display, usually the character position at which the next character to be entered from the keyboard will be displayed.

**Cursor Check:** An error condition that occurs when 3275 or 3277 circuitry detects no cursor or more than one cursor in the display buffer.

**Data-Entry Keyboard:** A standard typewriter keyboard on which the numeric keys are grouped in a format similar to the numeric keys on a card punch keyboard (to facilitate entry of numeric data). Other features include (1) automatic upshift of the keyboard when the cursor enters a numeric-only display field and (2) automatic prevention of entry of nonnumeric characters into a numeric-only display field, when the special Numeric Lock feature is installed.

**Data Set:** See *Modem*.

**Data Stream:** All data transmitted through a channel in a single read or write operation to a display station or printer.

**Designator Character:** A character that immediately follows the attribute character in a selector-pen-detectable field. The designator character controls whether a detect on the field will or will not cause an attention. For a nonattention-producing field, the designator character also determines whether the modified data tag for the field is to be set or reset as the result of a selector-pen detect.

**Detect:** See *Selector-Pen Detect*.

**Detectable:** An attribute of a display field; determines whether the field can be sensed by the selector pen.

**Display Field:** A group of consecutive characters (in the buffer) that starts with an attribute character (defining the characteristics of the field) and contains one or more alphanumeric characters. The field continues to, but does not include, the next attribute character.

**Display Operator:** A person who uses the keyboard to perform operations at a display station.

**Escape Command Sequence:** A two-character sequence used in remote operations that consists of ESC (27 hex in EBCDIC and 1B hex in ASCII) and the command character which follows and specifies the 3270 command.

**Field:** See *Display Field*.

**Formatted Display:** A screen display in which a display field, or fields, has been defined as a result of storing at least one attribute character in the display buffer.

**Input Field:** An unprotected field in which data can be entered, modified, or erased manually.

**Intensified Display:** An attribute of a display field; causes data in that field to be displayed at a brighter level than other data displayed on the screen.

**I/O Pending:** The condition that results in generation of the attention status in a locally attached display station and results in a response to a polling operation in a remotely attached display station.

**Keyboard Numeric Lock:** A special feature which allows entry of 0–9, minus (-), period (.), or DUP only; otherwise, the keyboard will be disabled.

**Leased Line:** See *Nonswitched Line*.

**Line Adapter:** 1200-bps Integrated Modem.

**Modem:** A device that modulates and demodulates signals transmitted over communication facilities.

**Modified Data Tag (MDT):** A bit in the attribute character of a display field, which, when set, causes that field to be transferred to the channel during a read-modified operation. The modified data tag may be set by (1) a keyboard input to the field, (2) a selector-pen detection in the field, (3) a card read-in operation, or (4) program control. The modified data tag may be reset by (1) a selector-pen detection in the field, (2) program control, or (3) ERASE INPUT key.

**Multidrop:** A line or circuit interconnecting several stations; synonymous with multipoint line.

**Nonswitched Line:** A connection between a remote 3270 unit (3271 or 3275) and a computer that does not have to be established by dialing.

***Null Character:*** An all-0 character that occupies a position in the storage buffer and is displayed as a blank.

***Null Suppression:*** In reading the contents of the buffer for a display or printer, the bypassing of all null characters in order to reduce the amount of data to be transmitted or printed.

***Order Code:*** A code that may be included in the write data stream transmitted for a display station or printer; provides additional formatting or definition of the write data.

***Order Sequence:*** A sequence in the data stream that starts with an order code and includes a character address and/or data characters related to the order code.

***Parity Check:*** An error condition that occurs when 3270 system circuitry detects one or more characters with bad parity in a 3270 unit buffer.

***Printer Hang (3284/3286 only):*** This condition exists when the print mechanism is unable to advance successfully. This condition can occur any time during a printout through to, and including, the carriage return and new line advance. The printer will try to recover, i.e., mechanically restore its print mechanism to the starting position. This hang condition may be caused by a mechanical malfunction or loss of ac power at the carriage motor.

***Program Access (PA) Key:*** A program attention key that may be defined to solicit program action that does not require data to be read from the buffer of the display station. If a Read Modified command is issued in response to the program attention key interruption, only the attention identification (AID) character is transferred to the program; no data from the buffer is transferred.

***Program Attention Key:*** Any key on the keyboard that solicits program action by generating an I/O interruption. The keys are the CLEAR key, ENTER key, TEST REQ key, CNCL key, program function keys, and program access keys. Each program attention key is associated with a unique attention identification (AID) character.

***Program Function (PF) Key:*** A program attention key that may be defined to solicit program action that usually requires data to be read from the buffer of the display station. If a Read Modified command is issued in response to the program function key interruption, the attention identification (AID) character and all display fields in which the modified data tags are set are transferred to the program.

***Protected Field:*** A display field for which the display operator cannot use the keyboard or operator identification card reader to enter, modify, or erase data.

***Read-Modified Operation:*** An operation in which only those display fields in which the modified data tag is set are read.

***Ready/Not Ready:*** The only devices that can be “not ready” are the attached printers. Thus, a printer is not ready to operate with the CU when (1) the printer’s cover is open, (2) it is out of paper, or (3) a “hang” condition exists in the printer. (See *Printer Hang*.)

***Security Key Lock:*** A special feature that disables all input functions and blanks the display, except when the key is inserted in the lock and turned.

***Selector Pen:*** A pen-like instrument which may be attached to the display station as a special feature. When pointed at a detectable portion of an image and then activated, the selector pen senses the presence of light at a display field and produces a selector-pen detect.

***Selector Pen Attention:*** An interruption generated when a selector-pen detect occurs on a display field that has a null or space designator character. The attention concludes the selector-pen operation.

***Selector-Pen Detect:*** The sensing by the selector pen of the presence of light from data in a display field that has the detectable attribute. Depending on the designator character of that display field, the detection and location information is identified on the screen (and stored in the buffer) or may produce an interrupt that is transmitted to the CPU.

***Short Read:*** A Read Modified command sent in reply to depression of the CLEAR CNCL, or a PA key at a display station. Only an AID byte is transferred to main storage.

***Structured Data 6-Bit:*** The low-order 6 bit binary coded characters used internally by the CU. The 6-bit code is applicable to all characters received by the CU: graphic, AID, attribute, write control (WCC), copy control (CCC), CU and device address, buffer address, status and sense.

***Test Request Read:*** A Read Modified command resulting from the operator pressing the TEST REQ key to allow entry of a predefined test request data format.

***Unformatted Display:*** A screen display in which no attribute character (and, therefore, no display field) has been defined.



*Unprotected Field:* A display field for which the display station operator can manually enter, modify, or erase data.

*Wraparound:* The continuation of an operation (for example, a read operation or a cursor movement operation) from the last character position in a buffer to the first character position in the buffer.

*Write Control Character (WCC):* A character used in conjunction with a Write command to specify that a particular operation, or combination of operations, is to be performed at a display station or printer.

*1200-bps Integrated Modem:* A feature for the 3275 that provides a modem capable of operating at a speed of 1200 bps over nonswitched communication facilities, or at speeds of 600/1200 bps over switched communication facilities via a similarly equipped 2701 or 3705.

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