GA27-2749-1

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 and 2
- IBM 3272 Control Unit, Models 1 and 2
- IBM 3275 Display Station, Models 1 and 2
- IBM 3277 Display Station, Models 1 and 2
- IBM 3284 Printer, Models 1, 2, and 3
- IBM 3286 Printer, Models 1 and 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" section discusses the unique operations of remotely attached 3270 systems. Described are Binary Synchronous Communications (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.

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.

### 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 2701 Data Adapter Unit Component Description,* GA22-6864
- *IBM 2703 Transmission Control Component Description,* GA27-2703
- *IBM System/3 Model 10 Components Reference Manual,* GA21-9103

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
- *Introduction to IBM 3705 Communications Controller,* GA27-3051

*Second Edition* (June 1972)

This major revision obsoletes GA27-2749-0. It adds: a new table (Table 3) to aid in determining high-order bit assignments and EBCDIC-ASCII code equivalency; programmer notes (especially those regarding selector-pen operation and the Operator Identification Card Reader); clarification of selector-pen operation; a description of the Numeric Lock Special Feature operation; ASCII characters to Table 6; and the World Trade keyboards and I/O interface code charts (Appendix D). Major changes have been made to: Table 17; Figures 12–16, and 20; and the error recovery procedures listing. Minor changes have also been made to the text and other tables and figures. 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 in connection with the operation of IBM systems, refer to the latest System/360 and System/370 SRL Newsletter, Order No. GN20-0360, 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.

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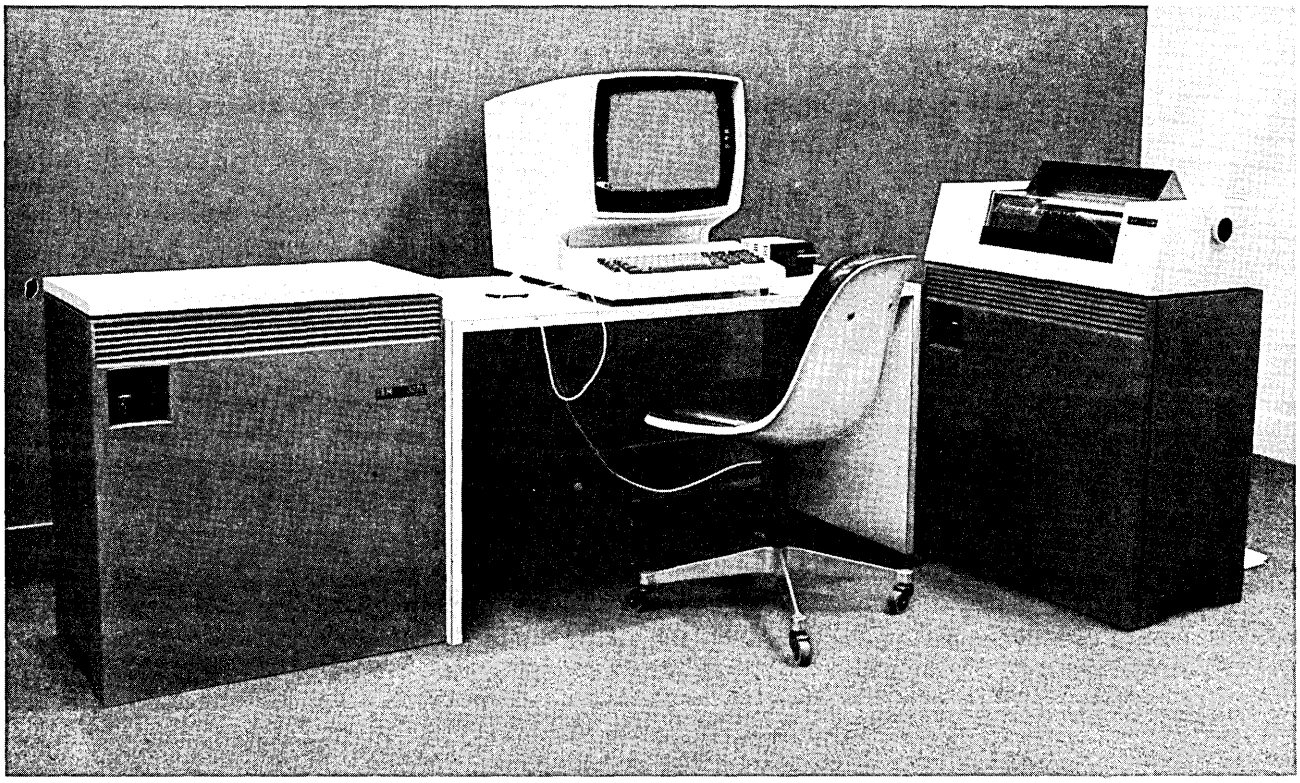
A form is provided at the back of this publication for reader's comments. If the form has been removed, comments may be addressed to IBM System Development Division, Product Publications, Dept. 520, Neighborhood Road, Kingston, N.Y. 12401.

## Illustrations



## Tables

| | |
|---|---|
| A | Attention |
| ACK | positive acknowledge |
| AID | Attention Identification |
| ALPHA | alphameric |
| A/N | alphameric/numeric |
| ASCII | American Standard Code for Information Interchange |
| Async | asynchronous |
| Atb | attribute |
| B | Busy |
| BCC | block check character |
| 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 |
| DB | Device Busy |
| DC | Data Check |
| DE | Device End |
| Dec | decimal |
| DEL | delete |
| DLE | data link escape |
| DUP | duplicate |
| EAU | Erase All Unprotected |
| EBCDIC | Extended Binary-Coded-Decimal Interchange Code |
| EC | Equipment Check |
| EM | end of message |
| ENQ | enquiry |
| EOF | end of field |
| EOI | end of inquiry |
| EOR | end of record |
| EOT | end of transmission |
| ESC | escape |
| ETB | end of transmission block |
| ETX | end of text |
| EUA | Erase Unprotected to Address |
| FM | field mark |
| GP | General Poll |
| Hex | hexadecimal |
| Hz | Hertz |
| IC | Insert Cursor |
| ident | identification |
| Ind | indicator |
| INS | insert |
| IR | Intervention Required |
| ITB | end of intermediate transmission block |
| Kbd | keyboard |
| LRC | longitudinal redundancy check |
| MDT | modified data tag |
| NA or N/A | not applicable |
| NAK | negative acknowledge |
| NL | New Line |
| NUL | null |
| OC | Operation Check |
| P | printer, protected |
| PA | program access |
| PF | program function |
| PT | Program Tab |
| R | row |
| RA | Repeat to Address |
| Rd Mod | Read Modified |
| Req | request |
| RVI | reverse interrupt |
| SA | selection addressing |
| SBA | Set Buffer Address |
| SF | Start Field |
| SM | Status Modifier |
| SOH | start of heading |
| SOR | start of record |
| SP | space, Specific Poll |
| SPD | selector pen detect |
| S/S | status and sense |
| STX | start of text |
| SUB | substitute |
| Sw | switch |
| SYN | synchronous idle |
| TC | Transmission Check |
| TCU | transmission control unit |
| TTD | temporary text delay |
| U | unprotected |
| UC | Unit Check |
| UE | Unit Exception |
| US | Unit Specify |
| V | volts |
| WACK | wait before transmit |
| WCC | write control character |



The IBM 3270 Information Display System (frontispiece) is a new family of display products that can be tailored to meet the needs of all alphameric 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.

Among the systems that can operate with the 3270 display system are:

System/360 Models 25, 30, 40, 50, 65, 67 (in 65 mode), 75, 85, and 195.
System/370 Models 135, 145, 155, 165, and 195.
System/3 Model 10

## DISPLAY SYSTEM COMPONENTS

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

### Control Unit

The control unit provides the external I/O interface 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:

- IBM 3272, for local applications.
  Model 1 - 480 character capacity.
  Model 2 - 1920 character capacity.
- IBM 3271, for remote applications.
  Model 1 - 480 character capacity.
  Model 2 - 1920 character capacity.

### 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:

- IBM 3277 - Attaches to a 3271 Control Unit for remote applications or to a 3272 Control Unit for local applications.
  Model 1 - 480 character capacity. For use with the 3271, Model 1 or 2, or 3272, Model 1 or 2.
  Model 2 - 1920 character capacity. For use with the 3271, Model 2, or 3272, Model 2.
- IBM 3275 - A standalone display station that contains its own interface control for remote applications.
  Model 1 - 480 character capacity.
  Model 2 - 1920 character capacity.

### 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:

- IBM 3284 - A buffered printer having a printout rate of 40 characters per second (cps); attaches to either the 3271 or 3272 Control Unit.
  Model 1 - 480 character capacity.
  Model 2 - 1920 character capacity.
- IBM 3284, Model 3 - An unbuffered printer having a printout rate of 40 cps; attaches singly to the standalone 3275 Display Station.
- IBM 3286 - Has a printout rate of 66 cps and attaches to either the 3271 or 3272 Control Unit.
  Model 1 - 480 character capacity.
  Model 2 - 1920 character capacity.

## DISPLAY SYSTEM CONFIGURATION

A 3271 or 3272 Control Unit, Model 1, can direct the operation of a combination of up to 32 attached:

- 3277 Display Stations, Model 1
- 3284 Printers, Model 1
- 3286 Printers, Model 1

A 3271 or 3272 Control Unit, Model 2, can direct the operation of a combination of up to 32 attached:

- 3277 Display Stations, Model 1 or 2
- 3284 Printers, Model 1 or 2
- 3286 Printers, Model 1 or 2

At least one display station with a keyboard must be attached to each control unit. The display station must be of the same model number as that of the control unit.

### Local Attachment

Locally attached 3270 display systems (Figure 1) use a 3272 Control Unit, Model 1 or 2. The 3272 is attached to a System/360 or System/370 through a block multiplexer,

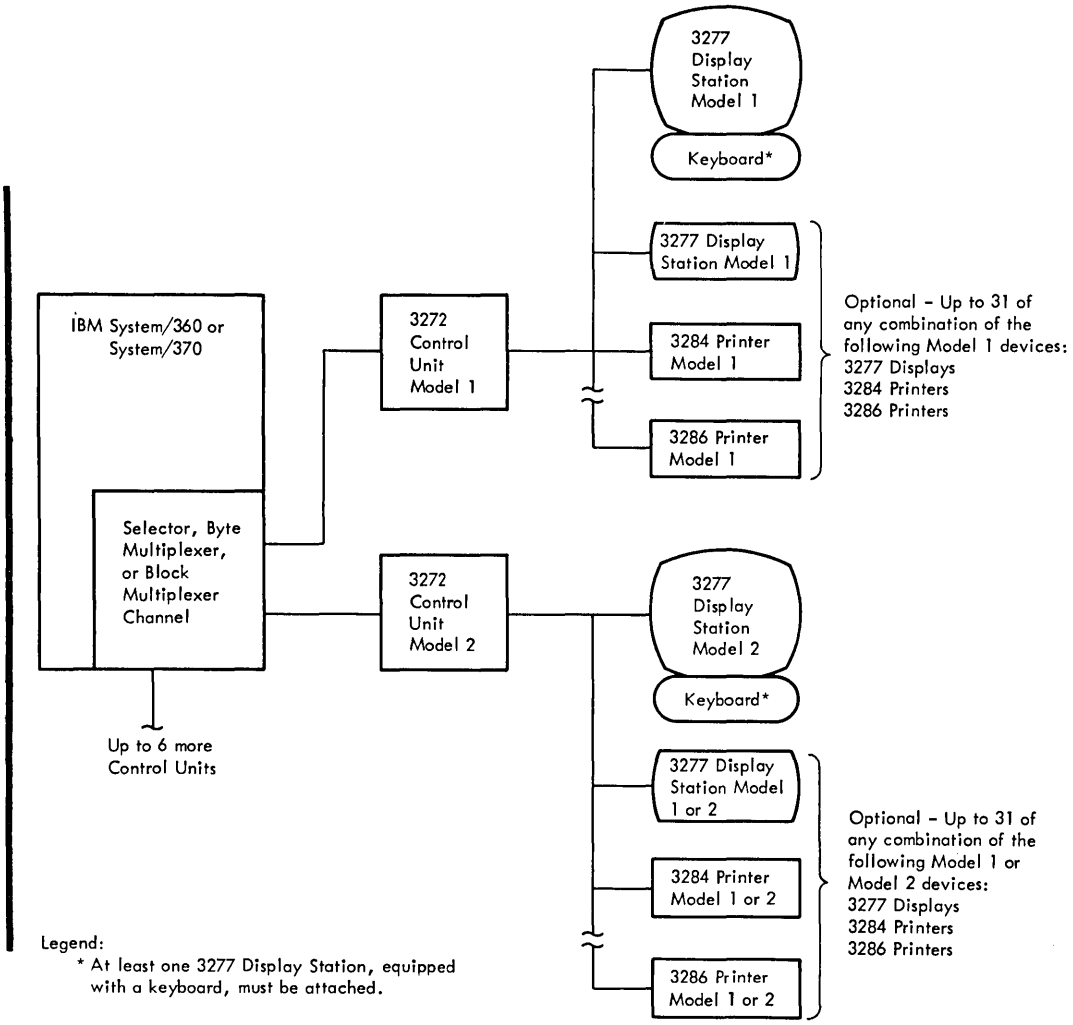



**Figure 1. Locally Attached 3270 Display System**

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

Remotely attached 3270 display systems (Figure 2) use a 3271 Control Unit, Model 1 or 2, or 3275 Display Station, Model 1 or 2. 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 a remote configuration, a transmission control unit (TCU) is cabled locally to the system channel. The TCU relays display data and control information from the system channel to the 3271 or 3275 in a binary synchronous communications (BSC) multipoint data link mode of operation via data sets and common carrier leased network voice grade channels or via the customer's own equivalent communication facilities (telephone lines, microwave transmission, or satellite).

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

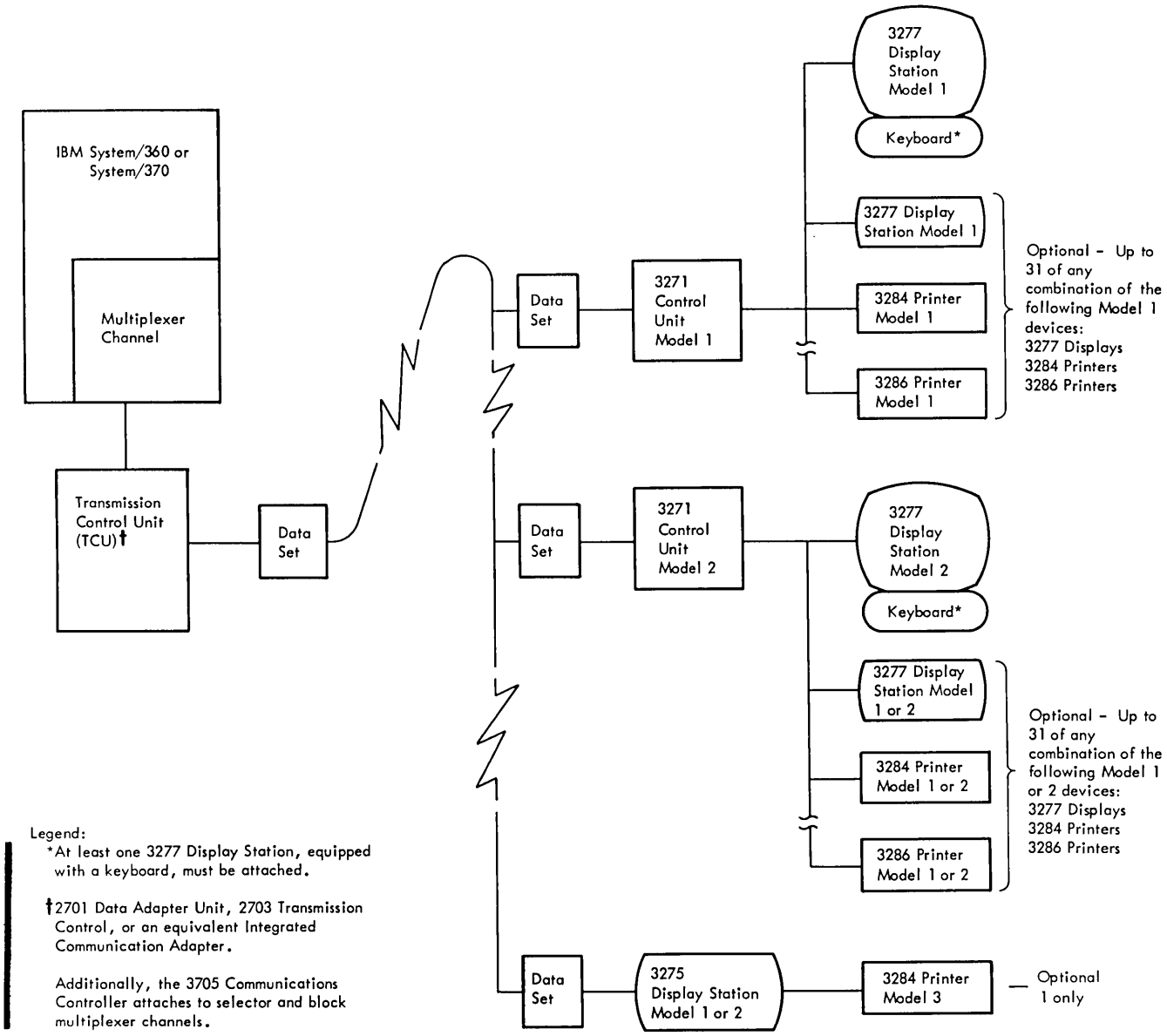



**Figure 2. Remotely Attached 3270 Display System**

be attached to (multi-dropped from) the same remote communication line as other 3270 display systems and other IBM products that use the BSC mode of operation.

## 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.

### *Monocase Character Generator*

Monocase character generators are available in United States English, United Kingdom English, Italian, and German. The French character generator is identical to the United States English character generator.

### *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.

## Special Features

### *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.

### *1200-bps Transmission Speed*

The base 3271 Control Units and 3275 Display Stations can communicate with a TCU from remote locations via communication facilities at speeds of 2000 or 2400 bps. (2000-bps speed is not available to World Trade customers.) Clocking is provided by the data sets.

The 1200-bps transmission speed feature provides the 3271 or 3275 with clocking to permit operating at the 1200-bps transmission rate.

### *4800-bps Transmission Speed*

Installing this feature in a 3271 Control Unit or a 3275 Display Station permits operation with communication facilities at a speed of 4800 bps. Clocking is provided by the data set.

### *ASCII Transmission Code*

This feature, when installed in a 3271 Control Unit or a 3275 Display Station, allows the display system to be attached to central processing systems that communicate in ASCII* code.

*American National Standard Code for Information Interchange, X3.4-1968.

### *ASCII Character Generator*

Either ASCII Character Generator feature, A or B, is required for each unit that will display or print the ASCII character set. ASCII character generators are mutually exclusive with other character generators.

### *Keyboards*

Many different keyboard features are available. Variations between keyboards include 78- and 66-key versions; operator console, data entry, typewriter EBCDIC, and typewriter ASCII layouts (Figure 7); and five different languages: American English, United Kingdom English, French, Italian, and German (shown in Appendix D).

Basic display operator needs are fulfilled by the 66-key keyboard. 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 the same as an IBM 1052 Model 7 keyboard, is available only as a 78-key keyboard. The data entry key layout, which is similar to the keyboard on the IBM 24, 26, 29, 129, and 59 keypunch equipment, is available only as a 66-key keyboard.

### *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 permits the entry of specific upshift characters only. Unless the operator overrides the feature, 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.

*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.

*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 pre-recorded with a unique code for use as security cards.

## SUMMARY

The IBM 3270 Information Display System is a new family of display products that can be tailored to meet the needs of all alphameric 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 a local or remote cluster of up to 32 units (3272 or 3271 with attached 3277's, 3284's and 3286's).
- It can include 480-character display stations, large-capacity 1920-character display stations, or both.
- It can also include printers (40 or 66 cps).
- 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 products.

The 3270 Display System also has exceptional feature flexibility:

- It offers typewriter, data entry, 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 4800 bps (using a MODEM such as the IBM 4872 High-Speed Digital MODEM, Models 2 and 3).
- 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.

The 3275, as a standalone display station, contains its own control unit and executes commands in the same way as the 3271. 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 that the device is, or is not, available, ready, and 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 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

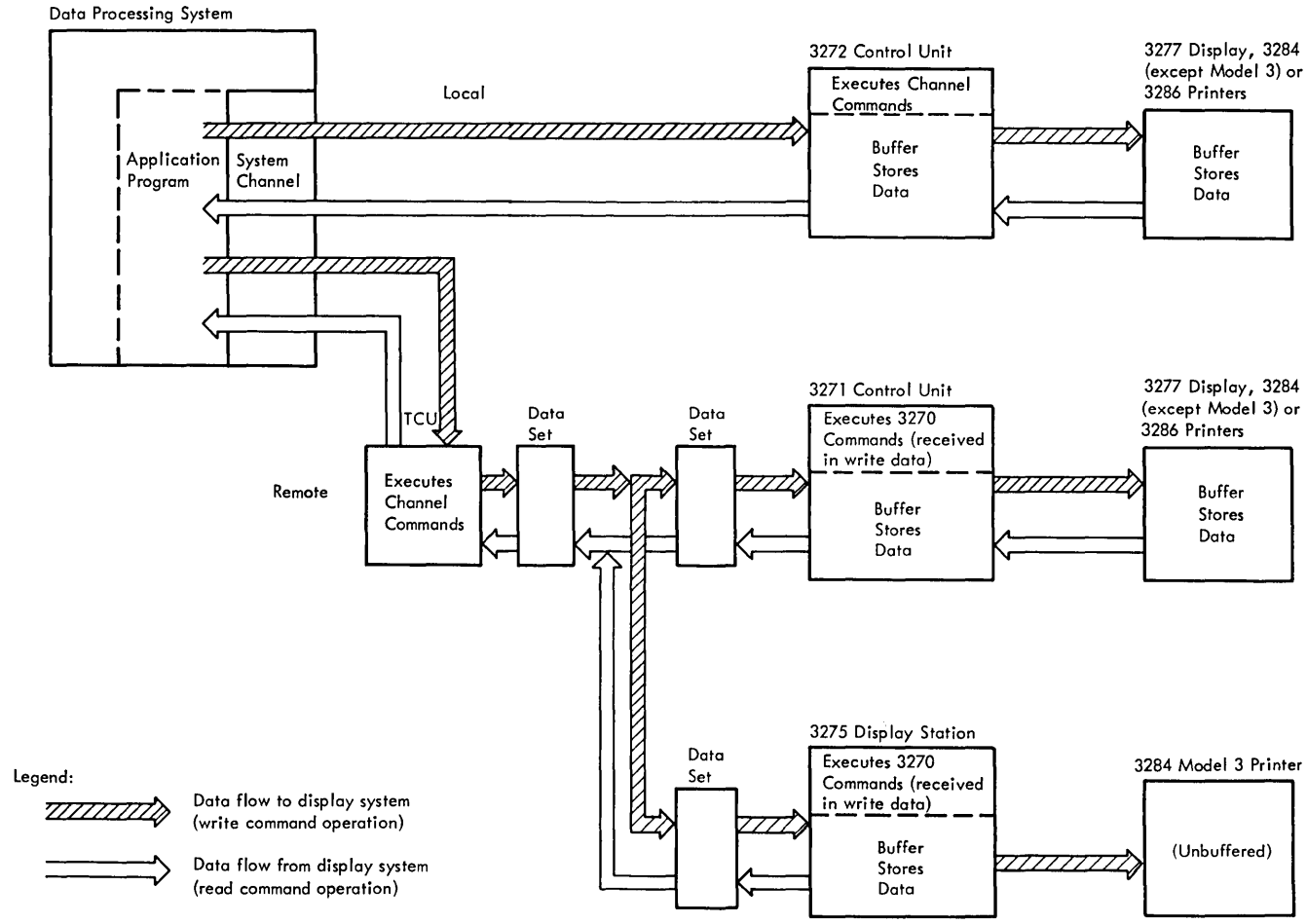



Figure 3. Data Flow between Data Processing System and 3270 Display System

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 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 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

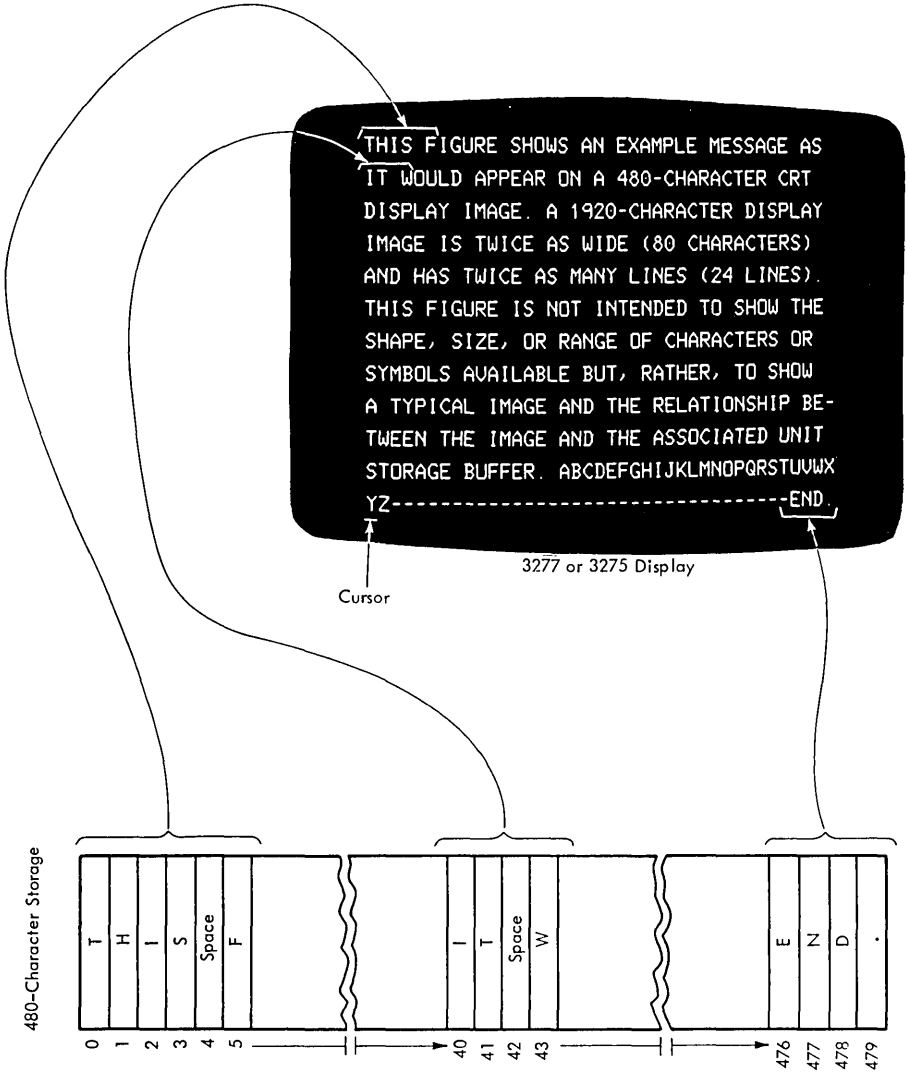
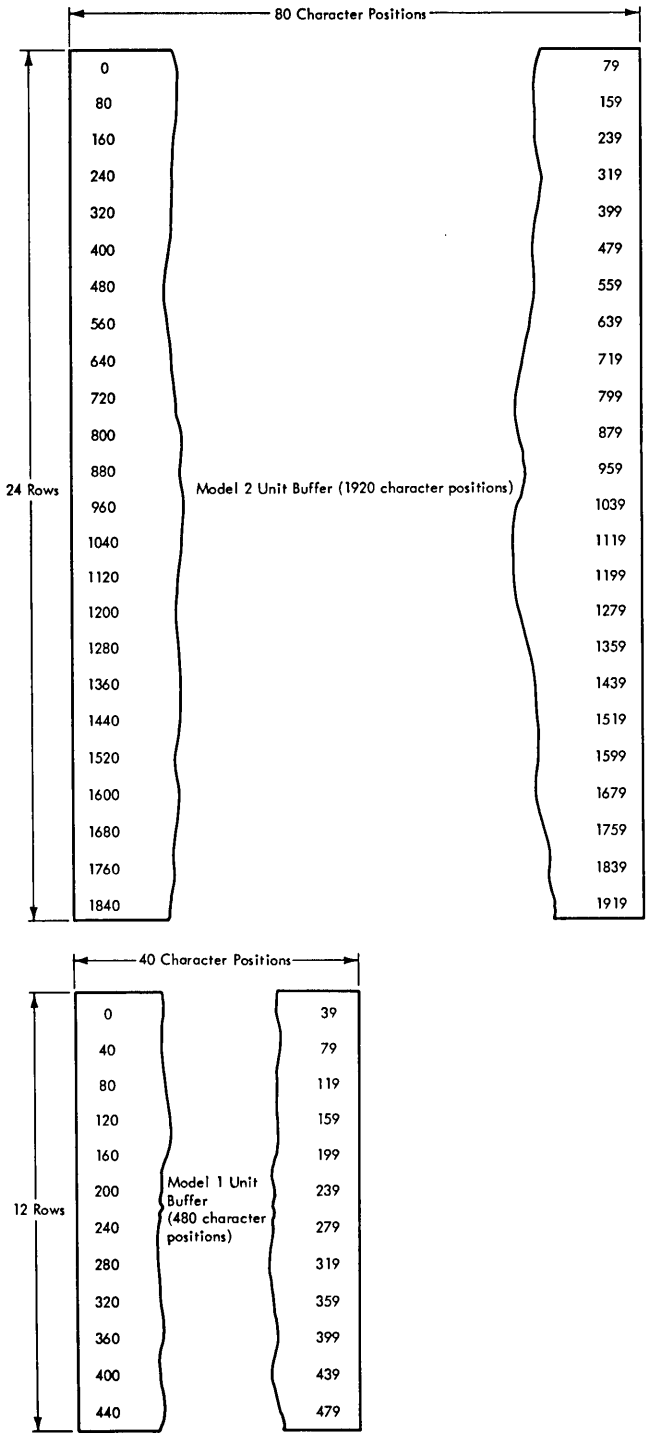



Figure 4. Display Station Buffer and Display Image Screen Character Position Relationships




Note: See Appendix C for hexadecimal equivalents.

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

buffer. These include the uppercase and lowercase alphameric characters and special characters shown in Tables 1 and 2. They include two printer control characters (EM and NL) 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; and 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.

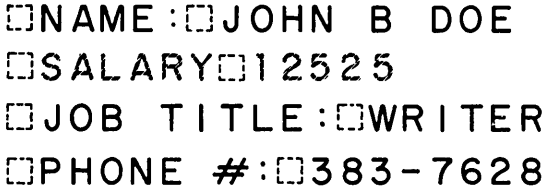



Figure 6. Examples of Display Image Fields (Formatted Display)

### Display Fields

The control characters (dotted squares) shown in Figure 6 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. 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 that involve the storage, display, printing, or transmission of data are primarily field-oriented.

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

| Bits 4567 | Hex 1 | 00 | | | | 01 | | | | 10 | | | | 11 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 |
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| 0000 | 0 | NUL | 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 | | DUP | | RA | < | * | % | @ | | | | | | | | |
| 1101 | D | | SF | ENQ | NAK | ( | ) | _ | ' | | | | | | | | |
| 1110 | E | | FM | | | + | ; | > | = | | | | | | | | |
| 1111 | F | | ITB | | SUB | \| | ¬ | ? | " | | | | | | | | |

Bits 0,1 — Bits 2,3 — Hex 0

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 specific. 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 are converted to uppercase by the display station or printer and displayed or printed as uppercase characters.
3. NL, EM, 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. Bits 0 and 1 are assigned by the 3270 to the following characters prior to transmission to the CPU: attribute, write control (WCC), copy control (CCC), CU and device address, buffer address, sense, and status. These bits are assigned so that each character can be represented by a graphic character within the solid outlined areas of the chart. See Table 3.

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

| $b_4$ | $b_3$ | $b_2$ | $b_1$ | Hex 1 \ Hex 0 | 0 0 0 | 0 0 1 | 0 1 0 | 0 1 1 | 1 0 0 | 1 0 1 | 1 1 0 | 1 1 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $b_7$ $b_6$ $b_5$ | | | | | | | |
| | | | | | 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 | | 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 are converted to uppercase by the display station or printer and displayed or printed as uppercase characters.
3. NL, EM, 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. Bits 0 and 1 are assigned by the 3270 to the following characters prior to transmission to the CPU: attribute, write control (WCC), copy control (CCC), CU and device address, buffer address, sense, and status. These bits are assigned so that each character can be represented by a graphic character within the solid outlined portions of the chart. See Table 3.

Table 3. Assignments for Internal 6-Bit Structured Data

| Bits 2–7 | Graphic | EBCDIC | ASCII |
|---|---|---|---|
| 00 0000 | SP | 40 | 20 |
| 00 0001 | A | C1 | 41 |
| 00 0010 | B | C2 | 42 |
| 00 0011 | C | C3 | 43 |
| 00 0100 | D | C4 | 44 |
| 00 0101 | E | C5 | 45 |
| 00 0110 | F | C6 | 46 |
| 00 0111 | G | C7 | 47 |
| 00 1000 | H | C8 | 48 |
| 00 1001 | I | C9 | 49 |
| 00 1010 | ¢ ,[ | 4A | 5B |
| 00 1011 | . | 4B | 2E |
| 00 1100 | < | 4C | 3C |
| 00 1101 | ( | 4D | 28 |
| 00 1110 | + | 4E | 2B |
| 00 1111 | \|, ! | 4F | 21 |
| 01 0000 | & | 50 | 26 |
| 01 0001 | J | D1 | 4A |
| 01 0010 | K | D2 | 4B |
| 01 0011 | L | D3 | 4C |
| 01 0100 | M | D4 | 4D |
| 01 0101 | N | D5 | 4E |
| 01 0110 | O | D6 | 4F |
| 01 0111 | P | D7 | 50 |
| 01 1000 | Q | D8 | 51 |
| 01 1001 | R | D9 | 52 |
| 01 1010 | !,] | 5A | 5D |
| 01 1011 | $ | 5B | 24 |
| 01 1100 | * | 5C | 2A |
| 01 1101 | ) | 5D | 29 |
| 01 1110 | ; | 5E | 3B |
| 01 1111 | ¬ , ^ | 5F | 5E |

| Bits 2–7 | Graphic | EBCDIC | ASCII |
|---|---|---|---|
| 10 0000 | - | 60 | 2D |
| 10 0001 | / | 61 | 2F |
| 10 0010 | S | E2 | 53 |
| 10 0011 | T | E3 | 54 |
| 10 0100 | U | E4 | 55 |
| 10 0101 | V | E5 | 56 |
| 10 0110 | W | E6 | 57 |
| 10 0111 | X | E7 | 58 |
| 10 1000 | Y | E8 | 59 |
| 10 1001 | Z | E9 | 5A |
| 10 1010 | ¦ \ | 6A | 5C |
| 10 1011 | ' | 6B | 2C |
| 10 1100 | % | 6C | 25 |
| 10 1101 | _ | 6D | 5F |
| 10 1110 | > | 6E | 3E |
| 10 1111 | ? | 6F | 3F |
| 11 0000 | 0 | F0 | 30 |
| 11 0001 | ' | F1 | 31 |
| 11 0010 | 2 | F2 | 32 |
| 11 0011 | 3 | F3 | 33 |
| 11 0100 | 4 | F4 | 34 |
| 11 0101 | 5 | F5 | 35 |
| 11 0110 | 6 | F6 | 36 |
| 11 0111 | 7 | F7 | 37 |
| 11 1000 | 8 | F8 | 38 |
| 11 1001 | 9 | F9 | 39 |
| 11 1010 | : | 7A | 3A |
| 11 1011 | # | 7B | 23 |
| 11 1100 | @ | 7C | 40 |
| 11 1101 | ' | 7D | 27 |
| 11 1110 | = | 7E | 3D |
| 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 of these characters is received by the CU, only the low-order 6 bits are used and the rest are ignored. 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.

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 (defined for use with the Numeric Lock special feature; if the Numeric Lock special feature is *not* installed, any alphabetic, numeric, or symbol characters may be entered).
- Character display (non-display, display, intensified display).
- Detectable or not detectable (by use of the selector pen).
- Tab stop positions (first 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 protected characters. That is, they cannot be modified by the keyboard (except the CLEAR key) or by selector pen action.

PROGRAMMING NOTE: Intensified fields are not selector-pen-detectable unless other selector-pen detect requirements, such as designator characters, are met.

**Table 4. Attribute Character Bit Definition**

Attribute character bit assignments are summarized as follows:

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

| EBCDIC Bit | Field Description |
|---|---|
| 0 & 1 | - Value determined by contents of bits 2–7. See Table 3. |
| 2 | - 0 = Unprotected<br>1 = Protected |
| 3 | - 0 = Alphameric<br>1 = Numeric (causes automatic upshift of data entry keyboard)<br><br>*Note:* Bits 2 and 3 equal to 11 causes an automatic skip. See text. |
| 4 & 5 | - 00 = Display/not selector-pen detectable.<br>01 = Display/selector-pen detectable.<br>10 = Intensified display/selector-pen detectable.<br>11 = Nondisplay, nonprint, nondetectable. |
| 6 | - Reserved. Must always be 0. |
| 7 | - Modified Data Tag; identifies modified fields during Read Modified command operations.<br><br>0 = Field has not been modified.<br>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, bits 0 and 1 are set (as shown in Table 3), depending upon the character being transferred. The default option (bits 2 through 7 all set to 0) results in an unprotected, alphameric, displayed, nondetectable field.

## KEYBOARD OPERATIONS

Keyboards, which may be optionally attached to a 3277, 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 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. However, when the cursor appears beneath a protected character position or an attribute character, that position cannot be modified by keyboard action.

One and only one cursor is always displayed on the display. 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 nondisplay/nonprint field. The cursor will remain displayed when the Key Lock special feature is turned off.

### Keyboards

Three types of keyboards are available for the 3277 and 3275 Display Stations: typewriter, data entry, and operator console keyboard. All three 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 which may be defined to fit the requirements of the application program. The three basic types of keyboards, shown in Figure 7, are defined below:

*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.

*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 keyboard. 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) move 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 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.

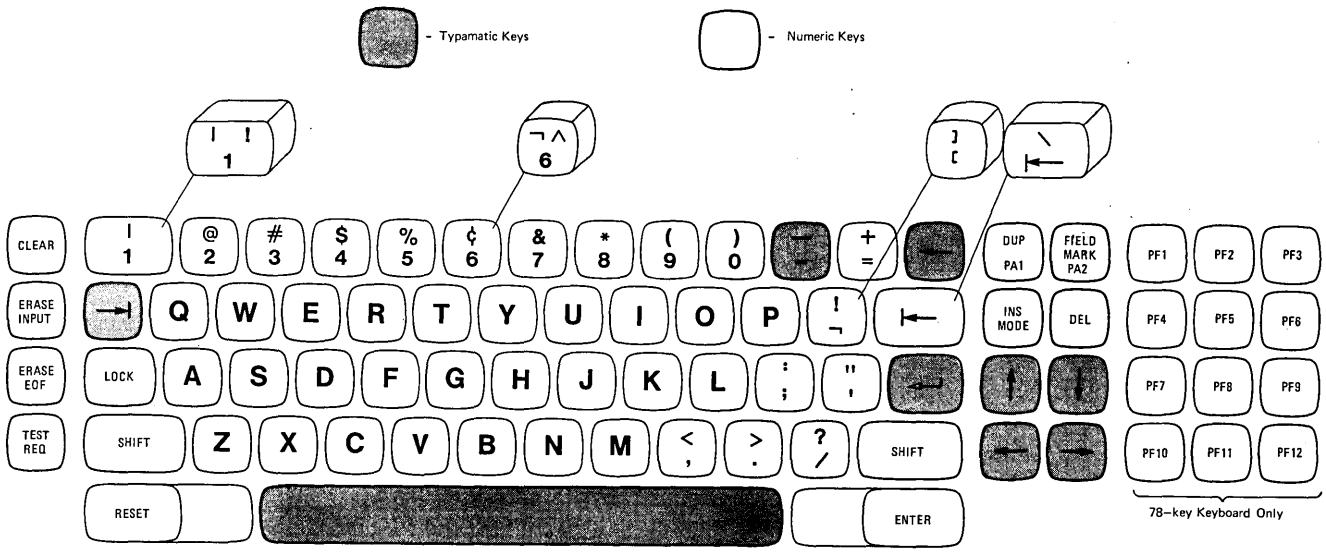
These keys are all capable of causing the cursor to wrap. Horizontal wrap always involves a vertical movement; the cursor repositions to the next or preceding row of characters. Vertical wrap due to operation of the Up or Down keys involves no horizontal movement; the cursor stays in the same character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

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

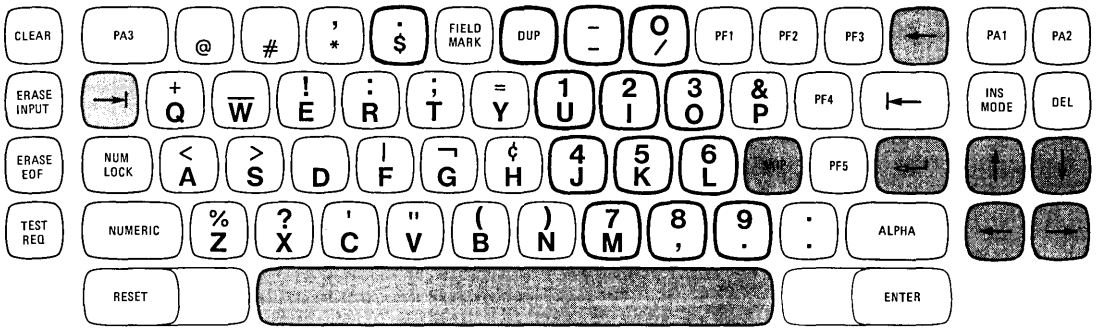
#### *Field-Oriented Keys*

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.

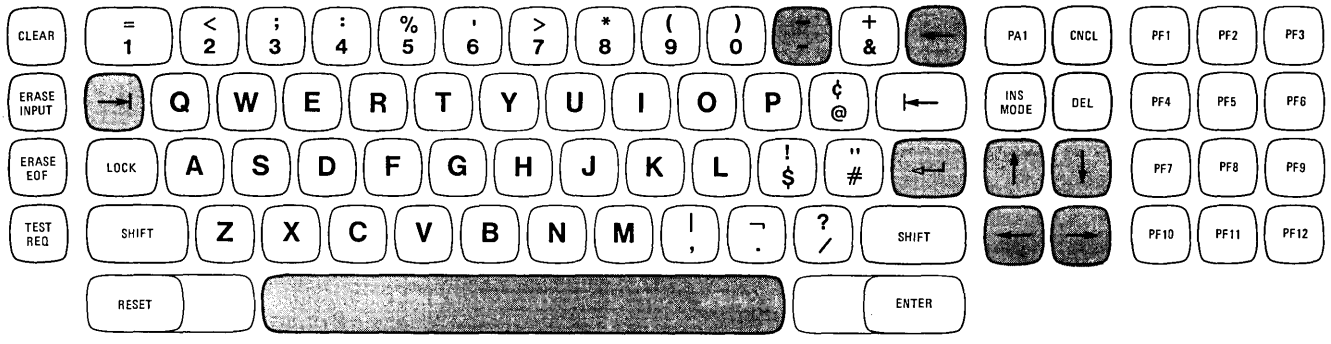
→|(Tab) key - Moves the cursor to the first character location of the next unprotected data field. In a display with no unprotected fields, the cursor is repositioned to character location 0. The Tab key has typamatic capability at a repeat rate of approximately ten operations per second.




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 Keyboard




Operator Console Keyboard

Figure 7. Basic Keyboards for 3277 and 3275 Display Stations

|←(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 Keyboard 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.

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 and the cursor is not moved.

### *ERASE INPUT Key*

This key clears all unprotected character locations to nulls and repositions the cursor to the first unprotected character location on the screen.

In a buffer with no unprotected 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.

If the cursor is located in an unprotected data field, with a null character in the character location occupied by the cursor or in any character location in the field beyond the cursor, depression of an alphameric key causes that alphameric character to be entered at the cursor. 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 character occupying 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, an alphameric key depression 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.

The RESET key is depressed to return 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. 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 occupied by the cursor will not be affected.

### *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 the keyboard when it is disabled 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 and a standard Tab key operation to be performed. 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 (*).

*FIELD MARK Key*

Operation of this key causes a unique character code to be entered into the display buffer. 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 (;).

*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. An Attention identification (AID) character is generated at the time of the interruption to identify which key caused the interruption. The Program Attention keys are: CLEAR, ENTER, CNCL (cancel), TEST REQ, all Program Function (PF) keys, and the Program Access 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 entering data in a numeric field, the data entry keyboard is automatically upshifted if the Numeric Lock special feature is installed, and only those characters indicated by bold-outlined keys in Figure 7 (0–9, period (.), minus sign (-), and DUP code) may be entered. Depression of any other key lights the INPUT INHIBITED indicator and prevents keyboard entry. The RESET key must be pressed to resume data entry.

To override this feature, the NUMERIC shift key must be held down to permit entry of all uppercase characters. Holding down the ALPHA key permits entry of lowercase characters.

Only uppercase characters can be entered in numeric fields on typewriter and operator console keyboards equipped with the Numeric Lock feature. The keyboard will lock if an attempt is made to enter a lowercase character.

**Disabled Keyboard**

A keyboard is disabled when:

1. A command is being executed for the device to which the keyboard is attached.
2. A Program Attention key operation is in process.
3. A completed selector-pen operation is in process.
4. A card is being read at the Operator Identification Card Reader.
5. The operator tries to press an alphameric key, the DUP key, the FIELD MARK key, the ERASE EOF key, or the DEL key when the keyboard is inhibited.
6. The Numeric Lock special feature is installed; the operator tries to press an alphameric key not included in the numeric key grouping (Figure 7) without also pressing the ALPHA or NUMERIC shift key (Data Entry keyboard only).
7. A parity error or cursor check is detected in the device buffer.
8. The 3284 Printer, Model 3, is in the process of a printout.
9. The security key lock is in the off position.

## 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.

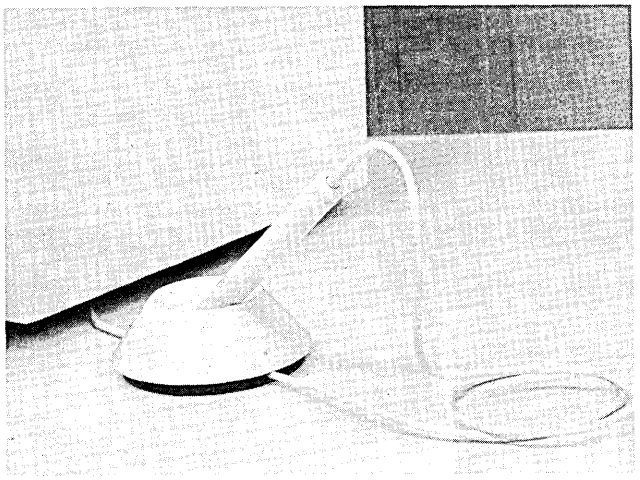
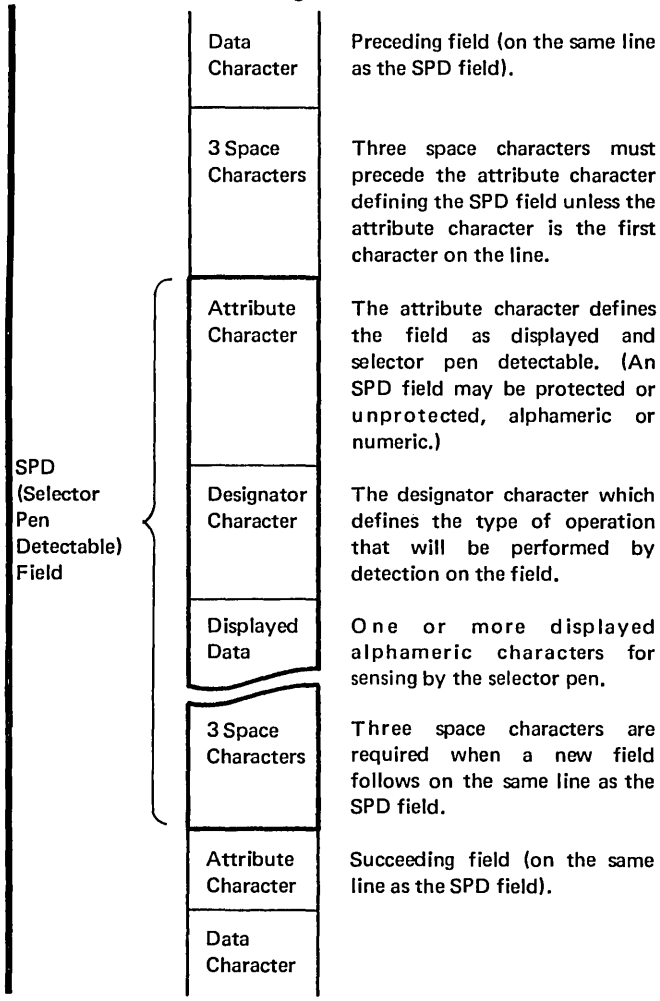


Figure 8. Selector Pen

### Selector Pen Field Format

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




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 or nondetectable) fields in the 3277 or 3275 Model 1 or 13 fields in the 3277 or 3275 Model 2 may precede the last detectable field on any given line.

### 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 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.

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 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 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. The buffered printer includes the 3284 and 3286, Models 1 and 2.

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

Printout operations are specified by a Write command, or a Copy command (3271 only), addressed to the printer.

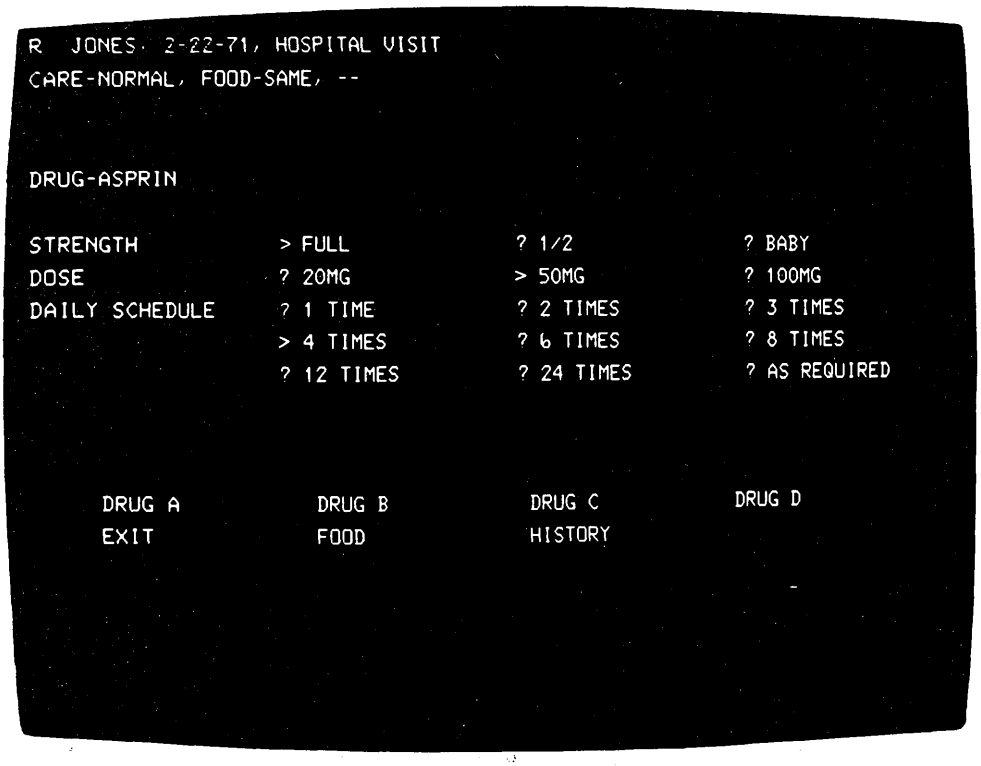



**Figure 9. Sample Display Screen for Selector Pen Operations**

The print line format in which the data is to be printed from the buffer is 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. Also, two printer orders, New Line (NL) and End of Message (EM) are honored.

**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 and EM Printer Orders

NL and EM printer orders are transferred as part of the data stream from the application program. They are stored in the buffer as data and are executed only when encountered in a print field of unspecified length during a printout.

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 the new line function and continues printing. When an EM order is encountered, the printing operation is terminated. None of the data following the EM order in the buffer is printed.

NL and EM orders are not executed when located in a nondisplay/nonprint field; instead, they are treated as alphameric characters and printed as spaces. Neither are they executed when encountered in a print field during a printout using a line length format; instead they are printed as the graphics "5" and "9", respectively.

### 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 transferred to the printer. A new line function is executed after the transfer of each line. when null characters, attribute characters, or alphameric characters in nonprint fields are encountered, they are treated as follows;

1. Embedded in a print line, they are printed as spaces.
2. If they constitute an entire line, they are ignored and the new line function is not performed.
3. If a line contains one or more space characters, an early new line function is performed to cause a blank line in the printout.

Printout of the buffer data begins at character location 0 and continues until the last position of the buffer is printed or until a valid EM character (if honored) is encountered. At the end of each printout, a final new line function is executed so that the printer is ready to start the next printout.

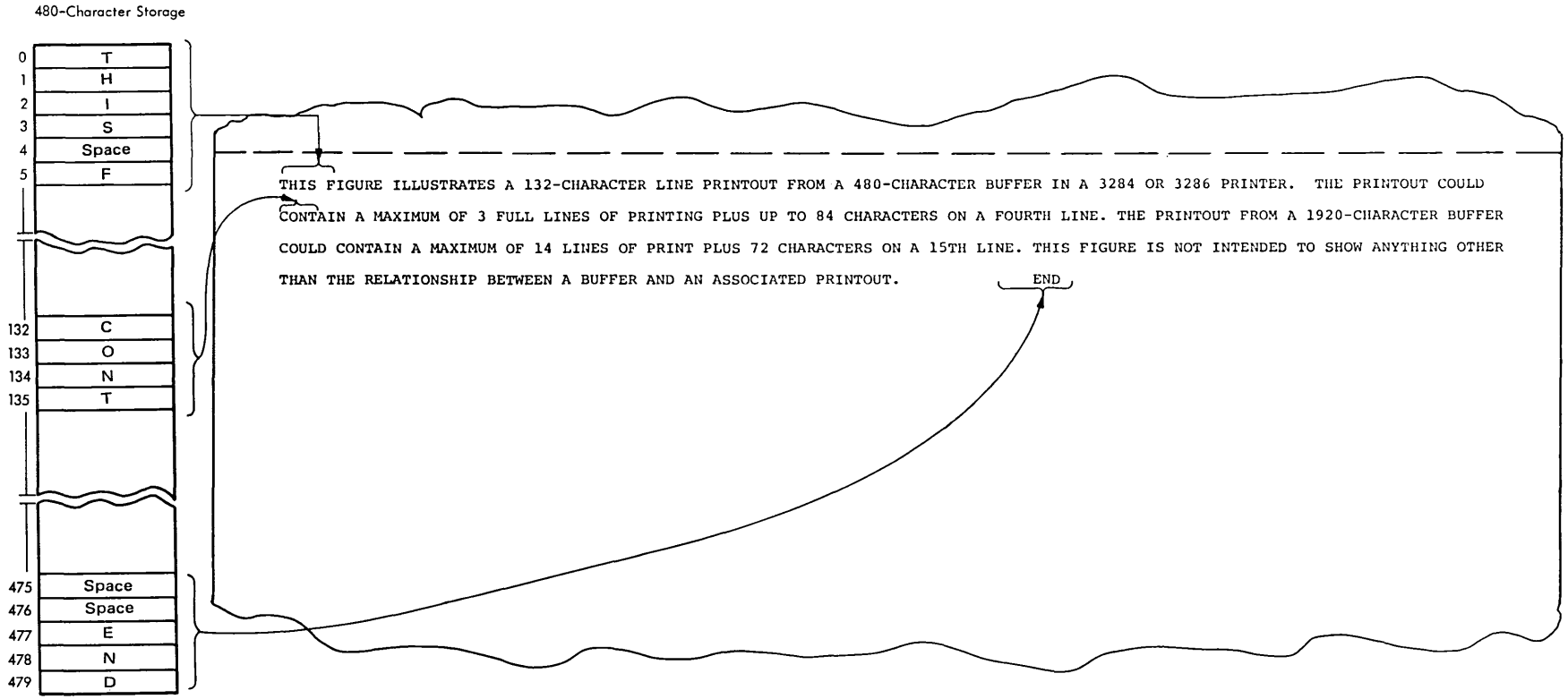



**Figure 10. Relationship between Buffer Data and Printed Data**

### 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 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. If an EM order is encountered, the printing operation is terminated.

At the end of each printout, a final new line function is executed so that the printer is ready to start the next printout.

### 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 accordingly:

*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 printer becomes disabled during a printout, it automatically tries to recover.

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 Errors.* The characters printed by a buffered or an unbuffered printer are a function of the character generator installed. The character sets available are identical to 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 (also called a printer hammer error) 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.

*Parity Error.* If a parity error is detected during the transfer of data from the buffer to the printer character generator, 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 serves to indicate the detection of the parity error.

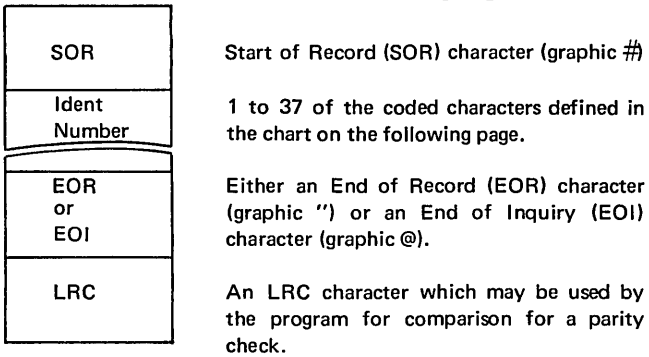
*Command Chaining.* In local operations, if any command is chained to a command that initiates a print operation, an error condition occurs: no printout is performed, the command is aborted, and the system channel is notified of the error. In remote operations, if command chaining is attempted, error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

## 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 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:




When the SOR character is read from the card, an attribute character is entered automatically into the cursor 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.

Operator Identification Card Codes

| Graphic/Data I/O Character |
|---|
| 0 |
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |
| 7 |
| 8 |
| 9 |
| : |
| # (SOR) |
| @ (EOI) |
| , |
| = |
| " (EOR) |

*Note:* The operator identification card reader reads data encoded in ABA specifications for magnetic stripe information. It conforms to the "Report and Recommendations of the Bank Card Standardization Task Force of the American Bankers Association's Bank Card Committee on Encoding Technology for Machine Readable Credit Cards" dated January 1971.

### 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:

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

If, after a card read operation is successfully started, one of the following conditions occurs, the read operation will be terminated at that point: (The application program should determine that each message is correctly terminated with the EOI/EOR and LRC characters as a check against these error conditions.)

1. Detection of a parity error on any data character, or EOR or EOI character.
2. Interruption of normal data flow from the card reader.
3. The cursor is moved under an attribute character.

PROGRAMMING NOTES:

1. If a card data field is to be reused, the hardware-generated attribute character must be removed from the display buffer. Therefore, after the program has checked the data, the attribute character may be removed under program control by the Erase Write command.
2. 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.
3. The application program is responsible for issuing a Read Modified command, satisfying the I/O pending, and for obtaining the card read data from the display buffer.

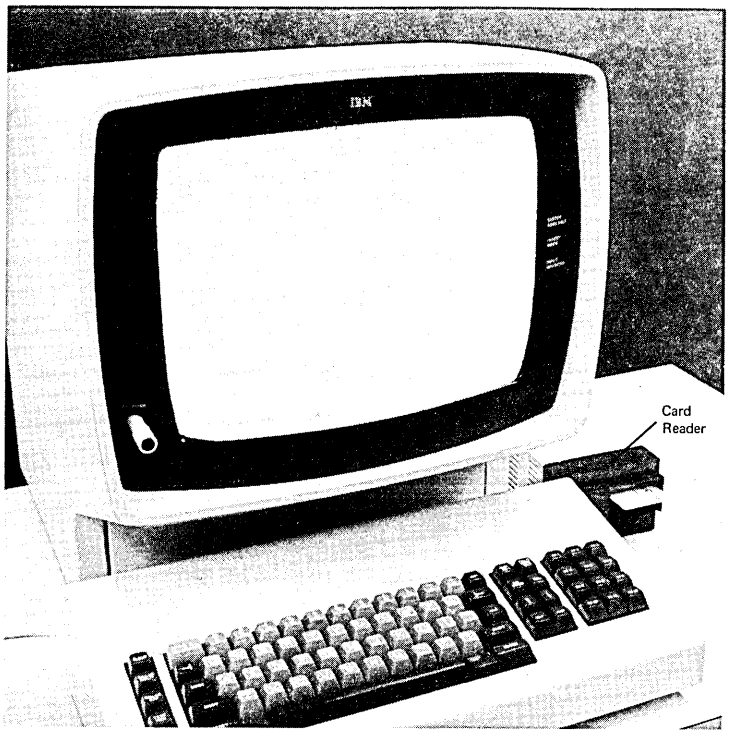



Figure 11. Operator Identification Card Reader

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.

### 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), or 3286 (Model 1 or 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.

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 |

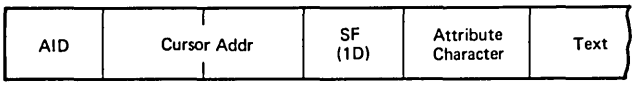
*Note:* Invalid command codes are rejected by the control unit.

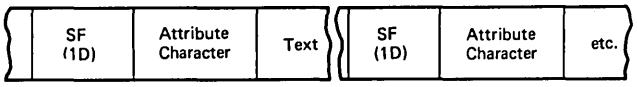
*Read Buffer Command*

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:




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.

*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, Short Read, or Test Request Read operation, but only 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, alphameric characters only, including spaces, are sent to main storage; null codes are not sent.

*Read Modified Operation.* During a Read Modified operation, if an AID other than Selector Pen Attention 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 are 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:

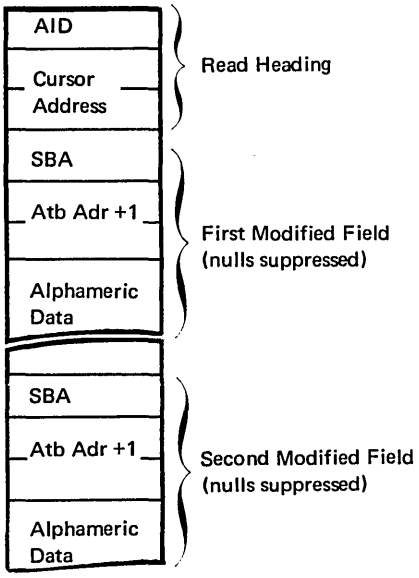


Table 6. Attention ID (AID) Configurations

| AID | Hex Character (EBCDIC) | Hex Character (ASCII) | Graphic Character | Read Modified Command Operation |
|---|---|---|---|---|
| No AID generated (Display or Display Station) | 60 | 2D | - | Rd Mod** |
| No AID generated (Printer) | E8 | 59 | Y | Rd Mod** |
| ENTER key | 7D | 27 | ' | Rd Mod |
| CLEAR key | 6D | 5F | _ | Short Rd |
| TEST REQ key | F0* | 30* | 0 | Tst Req Rd |
| 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 |
| PA 1 key | 6C | 25 | % | Short Rd |
| PA 2 (CNCL) key | 6E | 3E | > | Short Rd |
| PA 3 key | 6B | 2C | , | Short Rd |
| Selector Pen Attention | 7E | 3D | = | Rd Mod*** |
| Operator Identification Card Reader - Enter | E6 | 57 | W | Rd Mod |

*AID transferred on Read Buffer only.
**If remote polling operation, no read operation is performed.
***Only field addresses read, not data

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

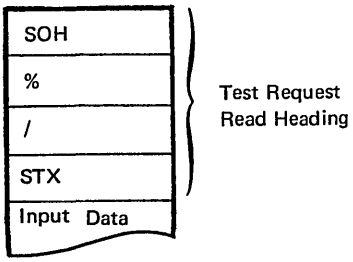
through 79 is transferred (nulls are suppressed); in this case the read operation is terminated with the buffer address set to 80 (the attribute byte of the next field).
2. If the buffer does not contain a wrapped modified field and if the channel byte count has not reached zero (local operation only), 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. 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.

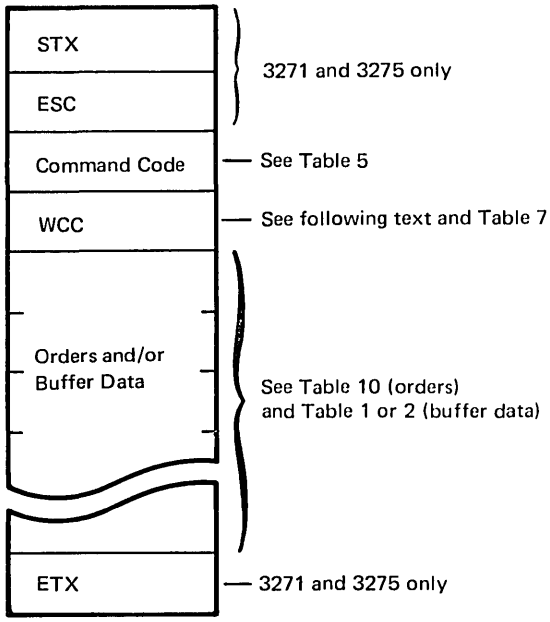
Test Request Read function usage is determined by the access method. Normally, the operator would (1) clear the display, (2) enter test request data in a predefined format, and then (3) press the TEST REQ key.

### 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.

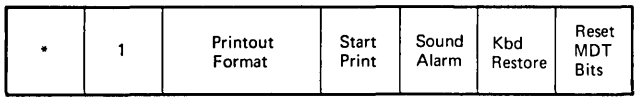
#### *Write Command*

The bytes received by the 3271, 3272, or 3275 for a 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:




*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 & 1 | Determined by the contents of bits 2–7 as shown in Table 3. |
| 2, 3 | Define the printout format, as follows:<br>= 00 - The NL and EM orders in the data stream determine print line length.<br>= 01 - Specifies 40-character print line.<br>= 10 - Specifies 64-character print line.<br>= 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 it is followed by a chained command:
   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. If a Write command is the first command in a chain, and if there is no data following the WCC, execution of the command sets the buffer address to the current cursor location; the cursor location is never affected by a Write command operation.
4. 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.
5. 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.

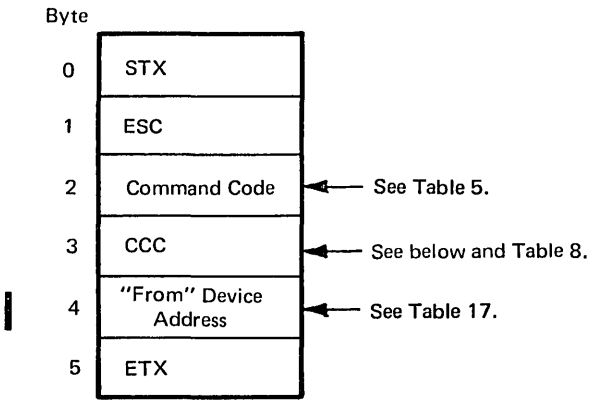
## Control Commands

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.

Table 8. Copy Control Character (CCC)

| Bit | Explanation |
|---|---|
| 0 & 1 | Determined by the contents of bits 2–7 as shown in Table 3. |
| 2, 3 | Define the printout format as follows:<br>= 00 - The NL and EM orders in the data stream determine print line length.<br>= 01 - Specifies a 40-character print line.<br>= 10 - Specifies a 64-character print line.<br>= 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:<br>= 00 - Only attribute characters are copied.<br>= 01 - Attribute characters and unprotected alphameric fields (including nulls) are copied. Nulls are transferred for the alphameric characters not copied from the protected fields.<br>= 10 - All attribute characters and protected alphameric fields (including nulls) are copied. Nulls are transferred for the alphameric characters not copied from the unprotected fields.<br>= 11 - The entire contents of the storage buffer (including nulls) are copied. |

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/alphameric attribute byte (bit 2=1 and 3=0) in address 0 and a null in address 1 of the buffer.

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 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 it is followed by a chained command, 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) should 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. Since a Test I/O instruction or any command to the 3272 other than No Operation or Sense causes the sense information to be reset, Sense should be issued following receipt of Unit Check status to insure 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 Concepts" section under "Printer Operations".

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.

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:<br>1. SBA, RA, or EUA order specifies an illegal buffer address.<br>2. Write data stream ends before all required bytes of SBA, RA, EUA, or SF order sequence are received.<br>3. Write, or Erase/Write with Start Print bit set in WCC, is chained to the next command; the print operation is suppressed. |

Table 10. Buffer Control Orders and Order Codes

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

*Notes:*
1. Table 4 shows attribute byte and Table 3 shows coding of this byte.
2. Table 3 shows 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).

*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 alphameric 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 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.

### 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, then 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 location of the next unprotected field. When the PT order immediately follows an alphameric or null character in the write data stream (other than the character specified by the Repeat to Address order), it also inserts nulls in all the character positions from the current buffer address to the end of the current field. The PT order then begins its search for the attribute character that defines the next unprotected field. This search begins at the current buffer address. Thus, if an unprotected field attribute character is found at the current buffer address, the buffer address is advanced by one character location, completing the tab operation.

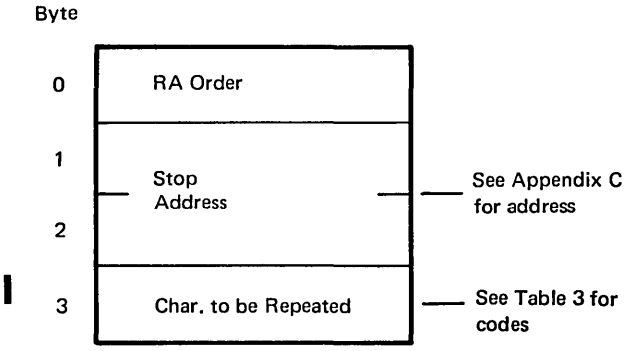
The PT order stops its search at the last location in the buffer. If an attribute character for an unprotected field is not found by this point, the buffer address is set to location 0. (If the PT order finds an attribute character for an unprotected field in the last buffer location, the buffer address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

**PROGRAMMING RESTRICTION (FOR 3271 AND 3275 ONLY):** If the RA order specifies storing a character in more than 480 locations and the character to be stored is followed in the write data stream by additional text characters or order sequences, the write operation may be aborted.

### 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.

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/360 Principles of Operations* manual, Form A22-6821. 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

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

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

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

| Device No. | 3 4 5 6 7 (XXXXX) |
|---|---|
| 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 (XXXXX) |
|---|---|
| 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 Device 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.<br>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.<br>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.

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 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.

Table 14. Initial Status and Sense Conditions - Local

| Status | Sense | Display | Printer | Error Recovery Procedure | Condition |
|---|---|---|---|---|---|
| All Zeros | | X | X | | Normal status for any command other than No Operation, Select, or Erase All Unprotected. |
| CE | | X | X | | Normal status for a Select or Erase All Unprotected command. |
| CE, DE | | X | X | | Normal status for a No Operation command. |
| UC | BOC | X | X | 1 | A parity check was detected on the command byte. |
| UC | IR | X | X | 2 | A command other than Sense was addressed to a device that the 3272 has recorded as "unavailable" or "not ready". |
| UC | CR | X | X | 3 | An invalid command was issued to 3272. |
| B | | 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 | | X | X | | Response to a command addressed to a device other than device whose status is pending or device being serviced by 3272. |

Table 15. Ending Status and Sense Conditions - Local

| Status | Sense | Display | Printer | Error Recovery Procedure | Condition |
|---|---|---|---|---|---|
| CE | | X | X | | Sent at end of data stream on a Write or Erase/Write command. |
| CE, DE (1) | | 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 (1) | BOC | X | X | 1 | The 3272 detected a parity error on a character in data stream of a Write or Erase/Write command. |
| CE, DE, UC (1) | DC, US | X | X | 1 | Addressed device detected a parity or cursor check during a Write, Read Buffer, or Read Modified command. |
| CE, DE, UC (1) | DC | X | X | 1 | The 3272 detected a cursor or parity check (1) during receipt of data stream on a Write or Erase/Write command; or (2) during transmission of data stream on a Read Buffer or Read Modified command. |
| CE, DE, UC (1) | CC | X | X | 1 | 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 (1) | OC | 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 (1) | | 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". |

*Note (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.

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, 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

Table 16. Asynchronous Status and Sense Conditions - Local

| Status | Sense | Display | Printer | Error Recovery Procedure | Condition |
|---|---|---|---|---|---|
| A (1) | | X | | | An attention-generating action (e.g., program access key has been depressed) was performed by the operator. |
| A, UC (1) | EC | 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 (1) | DC, US | X | X | 1 | An idle device detected a parity check or cursor check in its buffer. |
| DE (1, 2) | | X | X | | The 3272-to-device buffer transfer is completed on a Write or Erase/Write command which did not start a printer.<br>The device becomes "not busy" after completing an Erase All Unprotected command or the printer becomes "not busy" after completing a printout.<br>The device-to-3272 buffer transfer is completed on a Select command.<br>A device changes from "not available" to "available" or from "not ready" to "ready".<br>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".<br>The 3272 ONLINE/OFFLINE switch is thrown from OFFLINE to ONLINE. This causes each "available" device to present a Device End to the channel. |
| DE, UC (1, 2) | IR | | X | 6 | The addressed printer became Not Ready (out of paper or cover open) before completion of a print operation, or a command attempting to start a printer found it Not Ready. |
| DE, UC (1, 2) | IR, EC, US | | X | 6 | A printer became mechanically disabled during a printout and an automatic recovery was not successful. Or, a command attempted to start a print operation but the printer power switch is turned off. |
| DE, UC (1, 2) | EC, US | | X | 7 | A printer character generator error occurred or the printer became mechanically disabled during printout. |
| DE, UC (1, 2) | DC | X | X | 1 | The 3272 (1) detected a parity or cursor error during a Select, Write, or Erase/Write command, or (2) detected a parity check on data received from the addressed device in response to an internal poll during a command. |

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

| Status | Sense | Display | Printer | Error Recovery Procedure | Condition |
|---|---|---|---|---|---|
| DE, UC (1, 2) | DC, US | X | X | 8 | The addressed device detected a parity or cursor check while executing a Select, Write, Erase/ Write, or Erase All Unprotected command. |
| DE, UC (1, 2) | OC | 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 (1, 2) | CC | X | X | 1 | 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 (1, 2) | | 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 | | X | X | | The 3272 had been addressed while busy, but is now not busy and is free to accept a new command. |
| DE, CE | | X | X | | This status is sent if Channel End was stacked by the channel and the operation was completed before the channel could accept status. |

*Notes:*

(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.

(2) If CE status is stacked by the channel, this asynchronous status condition could be generated and combined with CE before the stacked status is accepted by the channel. If this combination of stacked CE status and asynchronous status is in turn stacked, an asynchronous CUE status could be generated and combined with it before the stacked status is accepted.

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 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.

## 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 should respond to this status by using a Sense command for further definition of the condition. 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; and 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 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. Retry the chain of commands which was being executed when the Unit Exception (UE) status was received. (If the addressed device is now "busy", it will respond with Busy status rather than UE status.)

### Channel-Detected Errors

Errors detected by the channel are indicated to the program by the channel status byte in the CSW and/or by a Machine Check interrupt. If there is no Machine Check and 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, then request maintenance for the channel that is giving trouble.

## INTRODUCTION

The 3271 and 3275 communicate with the program via an IBM 2701, 2703, 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 Binary Synchronous Communications (BSC) procedures over duplex facilities (leased or privately-owned); these communications use the Multipoint Data Link mode of operation only.

### 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 (2701 or 2703) 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.

### Related Publications

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

- *General Information - Binary Synchronous Communications,* Form GA27-3004, and
- *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),

  or

- *Introduction to IBM 3705 Communications Controller,* GA27-3051

## MULTIPOINT DATA LINK CONTROL

Each 3270 CU can operate on a 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 operates multidropped on the same line with other properly featured units, such as other 3270 units, IBM 2770's, and IBM 2780's.

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 (vertical 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 terminal, 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, acknowledgement 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 imbed 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 imbedded in text, (3) has invalid BCC (3271 only), or (4) contains a TTD sequence (STX ENQ). (The 3275 responds with EOT to a TCU text transmission that has invalid BCC.)

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 from the 3270 CU that ends a text block; this NAK causes the 3270 CU to retransmit the last block.

### *ENQ (Enquiry)*

The 3270 CU transmits ENQ (1) to request a reply from the TCU following a 3-second time-out, (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 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 (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. When the 3270 CU receives RVI from the TCU, it 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; it 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.

The 3270 CU performs text blocking. The first block can contain a maximum of 251 text characters, not including the STX, address bytes, ETB, and BCC characters. The second and all subsequent blocks can contain a maximum of 253 text characters, not including STX, ETB or ETX, and BCC characters (address bytes are transmitted only with the first block). 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. The last text block of the message can contain any number of text characters up to 251 preceded by STX; this block will be terminated with ETX.

*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 (see "Operational Sequences" later in this section).

*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, or (3) when the 3271 has completed General Poll operations with each attached device. 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 for the purpose of dropping line synchronization and returning the 3270 CU to Control mode.

*ITB (End of Intermediate Transmission Block)*

The 3270 CU does not accept conventionally blocked text. However, to co-exist 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 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.

## OPERATIONAL SEQUENCES

The following paragraphs describe the various data and control sequences that can be performed with the 3270. 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.

### 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 addressing or polling selection sequence. This chaining normally is accomplished with separate Write CCWs in the channel program. For example; the channel program could (1) write a selection 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 an address selection 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 poll selection; 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

General and Specific Poll sequences (Figure 12) perform two major functions:

1. If status and sense information is not pending, they are treated as Read Modified commands by the 3270 CU. EOT is returned if no read messages are pending.
2. They are the only means by which the program can retrieve 3270 CU and device status and sense information.

General or Specific Poll is issued to a 3270 CU in the same manner as an addressing selection sequence, and it also accomplishes selection. The only difference in the selection sequence is the configuration of 3270 CU and device address bytes, as follows:

1. General Poll address byte sequence:
   - 3270 CU Poll Address, 3270 CU Poll Address — See Table 17
   - 7F (EBCDIC) or 22 (ASCII), 7F (EBCDIC) or 22 (ASCII) — Used in place of the two device-address bytes
2. Specific Poll address byte sequence:
   - 3270 CU Poll Address
   - 3270 CU Poll Address
   - Device Address*
   - Device Address*

   — See Table 17

*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 is treated as a Specific Poll by the 3275. However, the 3271, upon receipt of a General Poll, 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.

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

Table 17. Remote Control Unit and Device Addressing

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

Examples:

| | | EBCDIC | ASCII |
|---|---|---|---|
| General Poll CU5 | CU | C5 | 45 |
| | Address | C5 | 45 |
| | Device | 7F | 22 |
| | Address | 7F | 22 |
| Specific Poll Device 4 on CU5 | CU | C5 | 45 |
| | Address | C5 | 45 |
| | Device | C4 | 44 |
| | Address | C4 | 44 |
| Select Device 4 on CU5 | CU | E5 | 56 |
| | Address | E5 | 56 |
| | Device | C4 | 44 |
| | Address | C4 | 44 |

*Notes:*
1. I/O character address (") is used as the device address to specify a General Poll operation.
2. I/O character address (SP) is always used as the device address when selecting a 3275.

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.

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) selects the 3275 or the 3271 and an attached device for subsequent command operations. For the 3271, this sequence also performs a function similar to that of a local Select command in that it causes a device-to-3271 buffer transfer. The 3270 CU returns ACK 0 if the selection and buffer transfer has been successfully completed.

Table 17 lists the 3270 CU and device address byte configurations. Note that device number 0 is always addressed when selecting a 3275.

### 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 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.

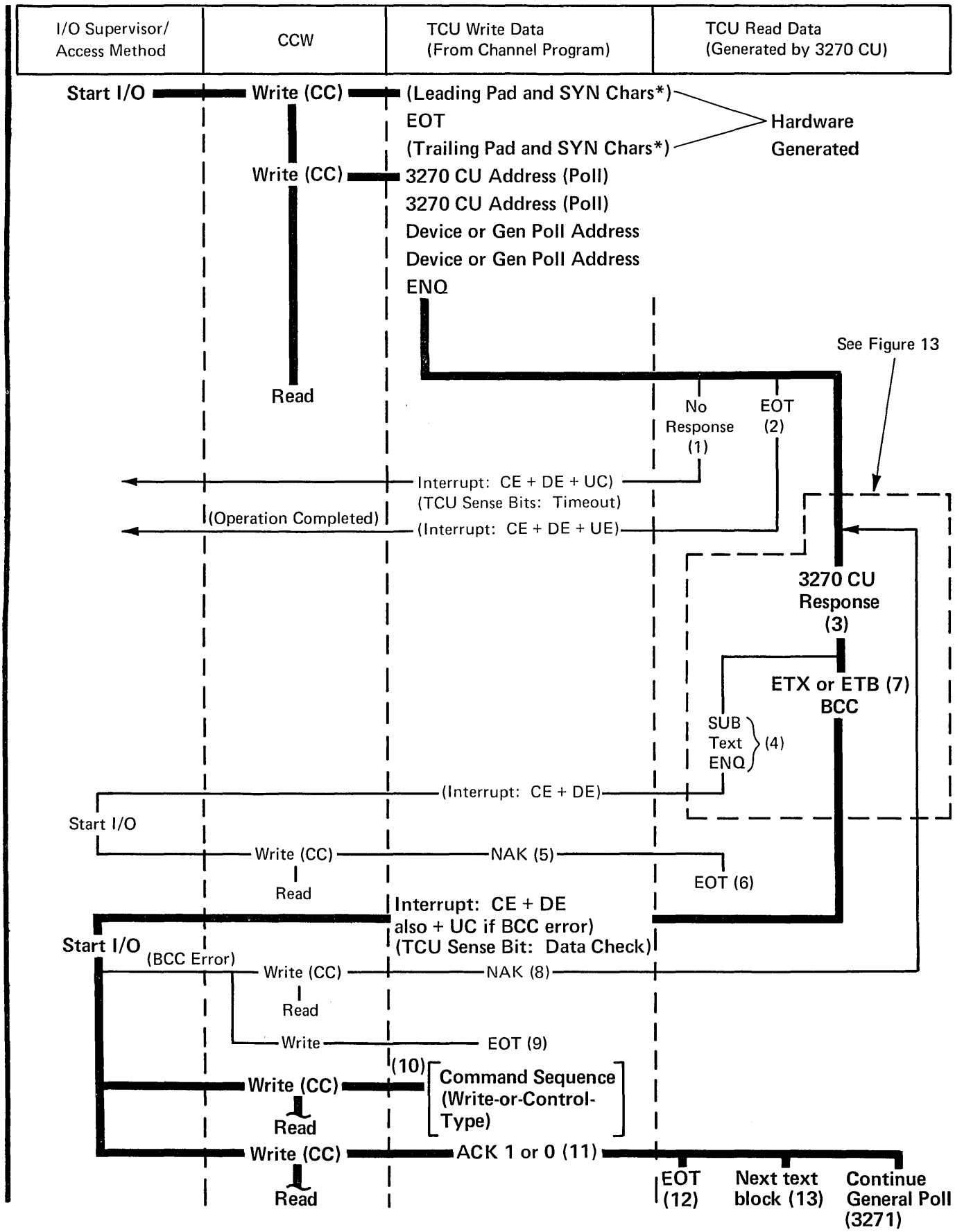



Figure 12. General Poll and Specific Poll, Sequence/Response Diagram (Sheet 1 of 2)

*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 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.
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 device 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.

LEGEND:

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

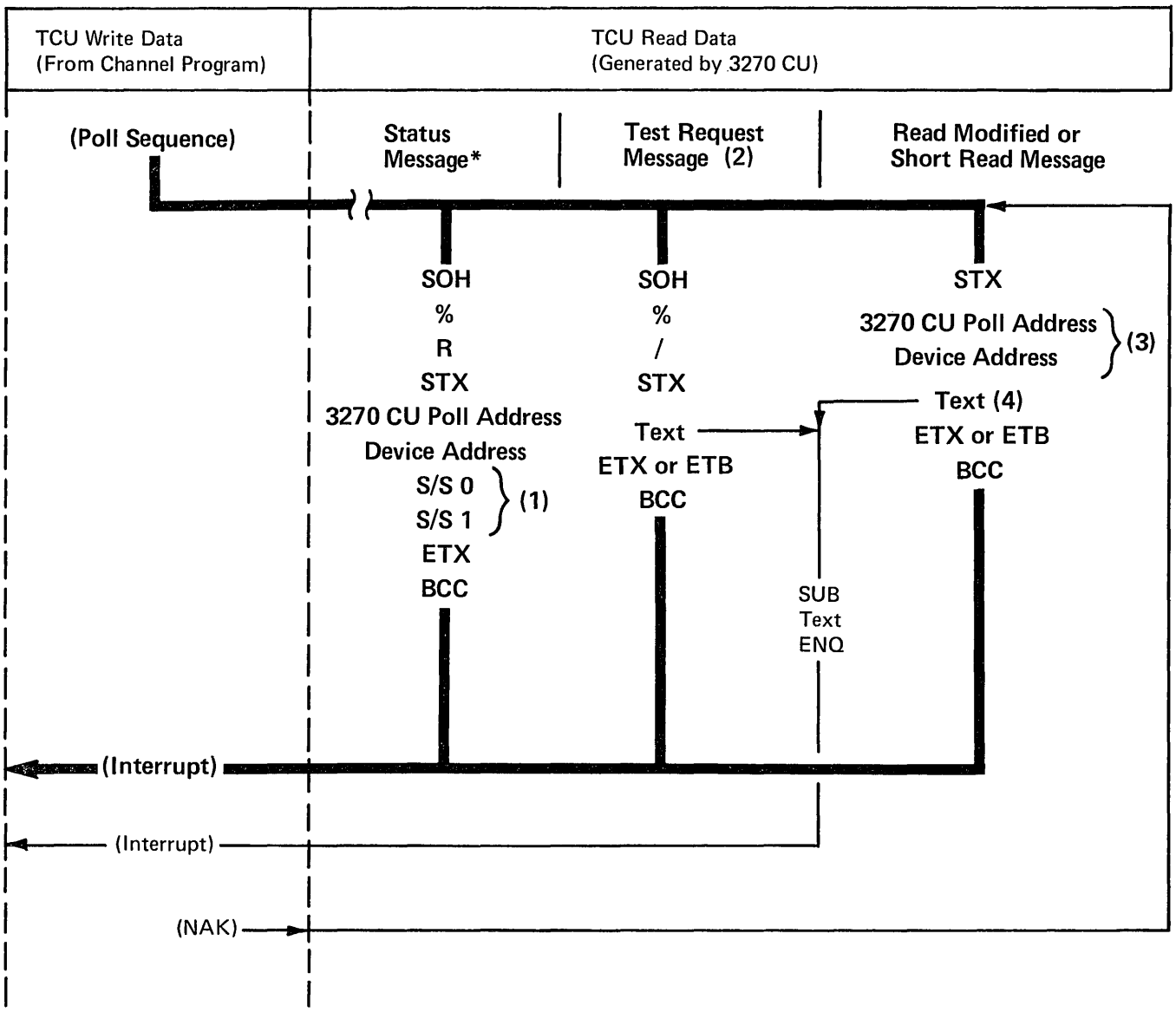
(Interrupt) = TCU - generated interrupt (CE - Channel End, DE = Device End, UE = Unit Exception, UC = Unit Check).

(1) = Number in parentheses refers to note.

*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 14.)




*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".

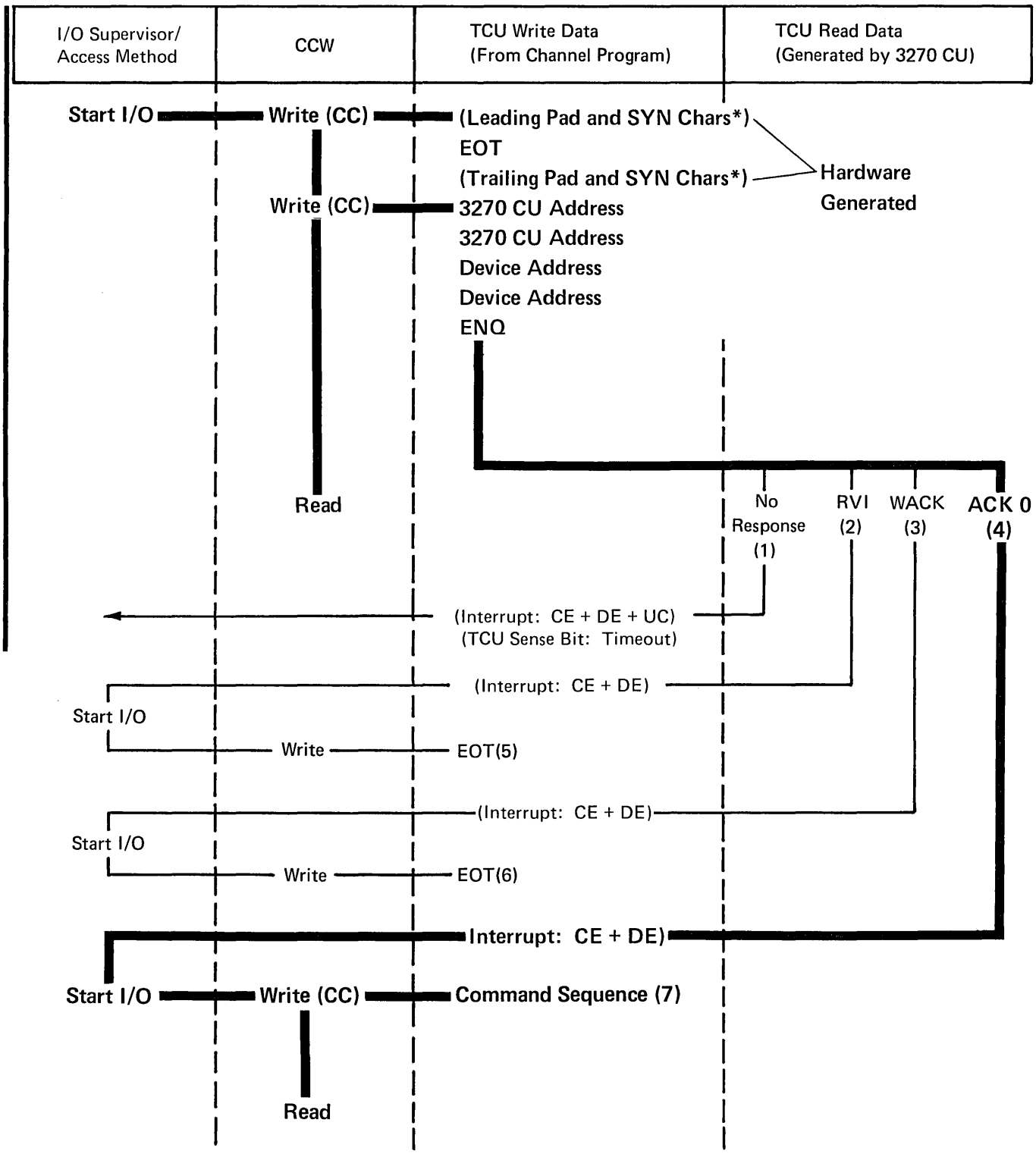
Upon receipt of a non-negative response to polling, the first character transferred to main storage, for a read-type command, is an index character.

LEGEND:

(Interrupt) = TCU - generated interrupt.

(1) = Number in parentheses refers to note.

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 3271 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.

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. A Specific Poll should be issued when Busy is received. A General Poll ignores the condition and proceeds to poll the next device.

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) = Number in parentheses refers to note.

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

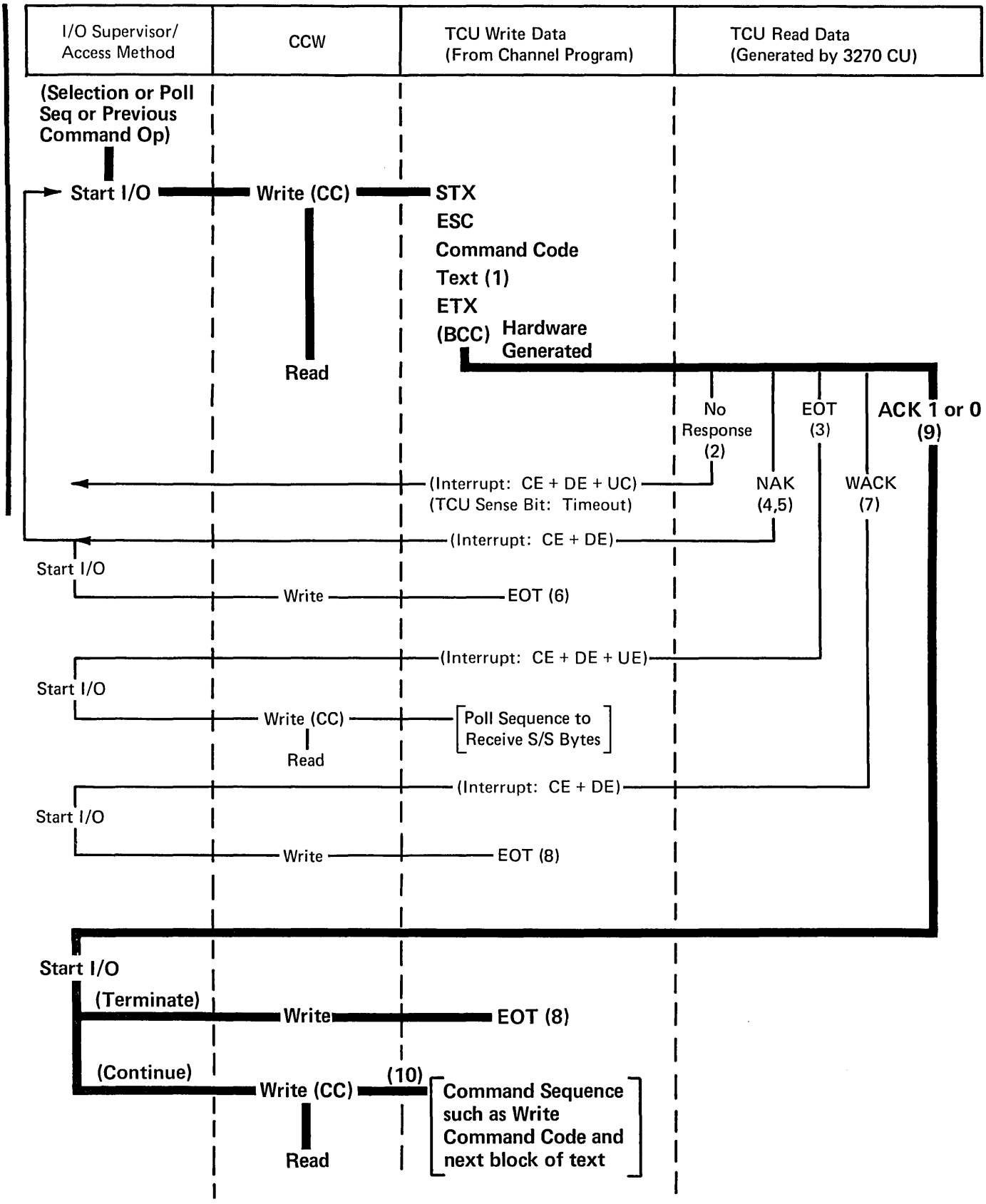



Figure 15. Write-Type and Control-Type Commands, Sequence/Response Diagram (Sheet 1 of 2)

*Notes:*

1. No text is transmitted on an EAU command transmission.

2. Command transmission was not successfully received because of invalid framing (STX or ETX 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 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 or failure to decode a valid command or an I/O interface "overrun" or a parity/cursor check). 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 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.

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.

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)

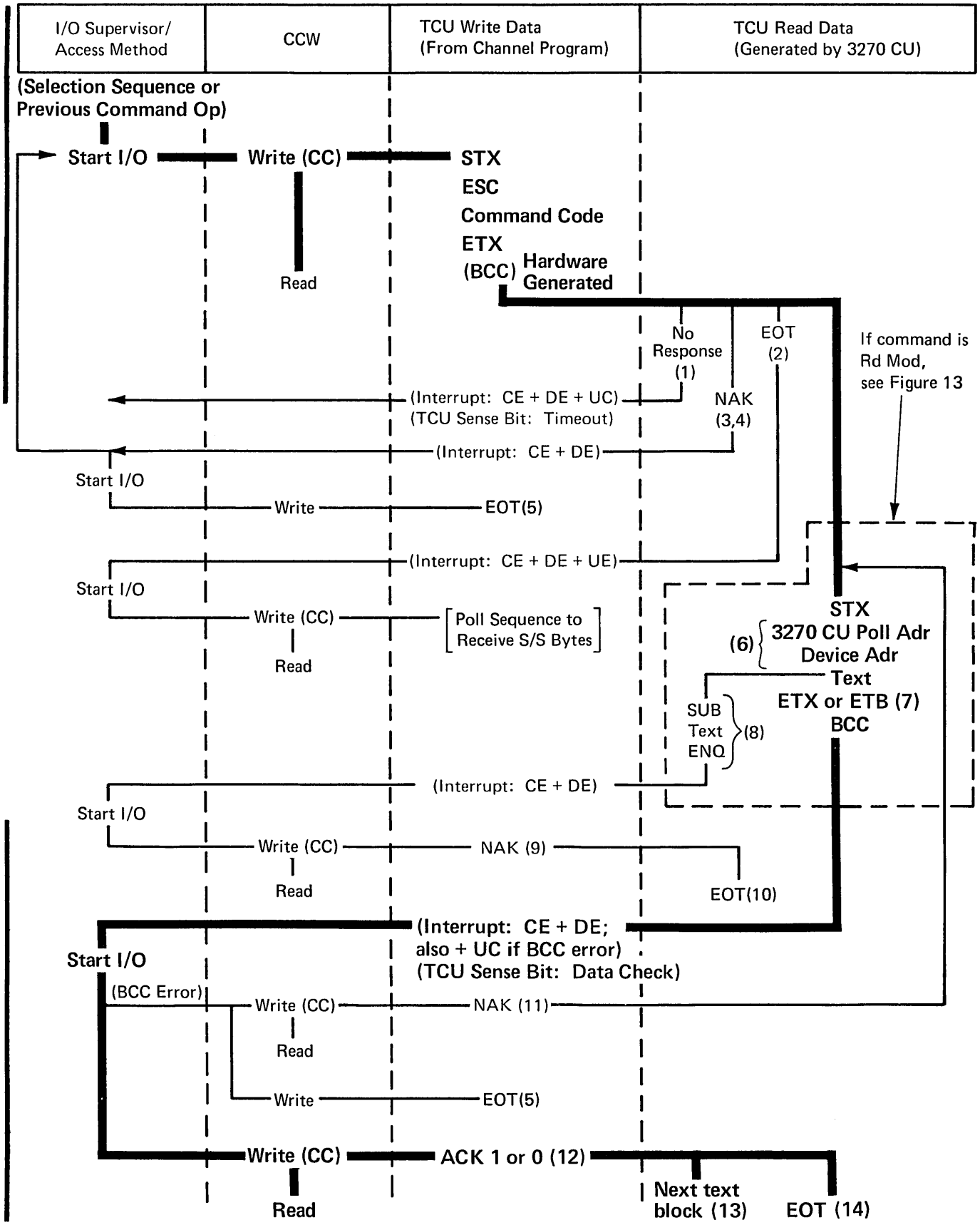



Figure 16. Read-Type Command, Sequence/Response Diagram (Sheet 1 of 2)

*Notes:*

1. Command transmission was not successfully received because of invalid framing (STX or ETX 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 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"). 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 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.
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) = Number in parentheses refers to note.

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

### 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.

Table 18. Remote Status and Sense Byte Definitions

S/S Byte 0:

| Bit No. | Bit Definition |
|---|---|
| 0, 1 | Use bits 2 through 7 and Table 3 to determine translation. |
| 2 | Reserved. |
| 3 | Reserved. |
| 4 | Device Busy (DB) - 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).<br>This bit is set with Operation Check when a Copy command is received which specifies a "busy" device with its "from" address.<br>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. |
| 5 | Bit 5, Unit Specify (US) - 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 | Bit 6, Device End (DE) - 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.<br>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. |
| 7 | Bit 7, Transmission Check (TC) - Not used by the 3271. This bit is set when the 3275 detects a BCC error on the TCU transmission. |

Table 18. Remote Status and Sense Byte Definitions (Cont)

S/S Byte 1:

| Bit No. | Bit Definition |
|---|---|
| 0, 1 | Use bits 2 through 7 and Table 3 to determine translation. |
| 2 | Command Reject (CR) - This bit is set upon receipt of an invalid 3270 command (or Copy command if this feature is not installed). |
| 3 | Intervention Required (IR) - This bit is set if:<br>• A Copy command contains a "from" address in its data stream which specifies an unavailable device.<br>• A command attempted to start a printer but found it not ready. The printout is suppressed.<br>• 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.<br>• The 3271 receives a command for a device which the 3271 has logged as unavailable or not ready. |
| 4 | Equipment Check (EC) - This bit indicates a printer character generator error occurred or the printer became mechanically disabled. |
| 5 | Data Check (DC) - This bit indicates the detection of a parity or Cursor check in either the 3271 or a device buffer or in the 3275 buffer. |
| 6 | Control Check (CC) - 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 | Operation Check (OC) - This bit, when set alone, indicates one of the following:<br>• Receipt of an illegal buffer address or of an incomplete order sequence on a Write or Erase/Write command.<br>• The device did not receive a CCC or a "from" address on a Copy command.<br>• Receipt of an invalid command sequence. (ESC is not received in the second data character position of the sequence.)<br>• 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.<br>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). |

Table 19. Remote Error Status and Sense Responses

| Device Response | Command | S/S Explanation |
|---|---|---|
| RVI | Selection | 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.) *Note:* 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.<br><br>CC - A timeout check is caused by the addressed device. The operation is tried twice before this bit is set.<br><br>IR - The addressed device is unavailable.<br><br>DC - The 3271 detects bad parity on data received from the addressed device. The operation is tried twice before this bit is set.<br><br>DE, EC, US - A character generator error has occurred, or the printer was mechanically disabled but the condition has been corrected.<br><br>DE, IR - The addressed printer is out of paper, its power has been turned off, or its cover is open.<br><br>DE, IR, EC, US - The addressed printer is mechanically disabled and cannot recover.<br><br>DE, DC, US - A parity error is detected at the printer.<br><br>DC, US - A parity check or cursor check is detected by the addressed device on the data it is sending to the control unit. |
| EOT | Read Commands | CR - Invalid or illegal 3270 command is received at the 3271 or 3275.<br><br>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.<br><br>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.<br><br>DB, US, DE - The addressed device becomes not busy before a Specific Poll is issued to retrieve the DB, US status. |

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

| Device Response | Command | S/S Explanation |
|---|---|---|
| EOT | Read Commands | IR - A command is addressed to an unavailable device. (This is not applicable to the 3275.)<br><br>DC - (1) A cursor check is detected at the 3271 before data transmission starts. 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.<br><br>TC - A BCC error is detected at the 3275. |
| EOT | Write Commands | CR - An invalid or illegal 3270 command is received.<br><br>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.<br><br>TC - A BCC error is detected at the 3275.<br><br>DC - The 3271 detects a parity or cursor check on its buffer during command operation.<br><br>DC, US - The device detects a parity or cursor check on its buffer during the command operation.<br><br>CC - The device fails to complete an operation or respond to the 3271 in a certain time (timeout check).<br><br>DB, US - The addressed device is busy. The message is accepted but not stored in the 3271 or 3275 buffer. The command is aborted.<br><br>DE, DB, US - The addressed device becomes not busy before a specific poll is issued to retrieve the DB, US status (described above). |
| EOT | Copy Command | DC, OC - The "from" device fails to complete an operation or respond to the 3271 in a certain time (timeout check). |

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

| Device Response | Command | S/S Explanation |
|---|---|---|
| EOT | Copy Command | 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.<br><br>IR, OC - The device is not available.<br><br>US, OC - The device has a locked buffer.<br><br>OC - The data stream contains more or less than two bytes (the CCC and the "from" address). The command is aborted.<br><br>OC, DC (and sometimes US) - The 3271 or "from" device tests a parity or cursor check during command operation.<br><br>DB, US - The addressed "to" device is busy.<br><br>DB, US, OC - The addressed "to" device is also specified as the "from" device and is busy.<br><br>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). |
| EOT | Write, Erase/Write, Copy Commands | IR - Addressed device is not available, or addressed printer is not ready. |
| EOT | Erase All Unprotected Command | OC - One or more data bytes followed the command (buffer overrun). |
| EOT | Specific and General Poll | DE, IR, EC, US - An unrecoverable mechanical failure is detected at the printer.<br><br>DE, EC, US - A character generator error or a mechanical failure is detected at the printer but then recovered from.<br><br>DC, US - A parity check or cursor check is detected by the addressed device on the data it is sending to the control unit.<br><br>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 |

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

| Device Response | Command | S/S Explanation |
|---|---|---|
| | | 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. (4) The 3271 detects a parity check on data received from the device. The operation is tried twice before DC is set.<br><br>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.) *Note:* When 3271 power is turned on, the DE bit is set for every available and ready device that is attached.<br><br>IR, DE - The poll finds a device, previously recorded as ready, available, and busy, now not ready and not busy. (The 3271 record is updated.)<br><br>CC - The poll finds a device, previously recorded as unavailable, still unavailable (timeout check).<br><br>IR, DE - The printer went not ready during a printout. |
| EOT | Specific Poll | CC - The poll finds a device, previously recorded as available and ready, now unavailable (timeout check). (The 3271 record is updated.)<br><br>DB - The addressed device is busy. |
| NAK | Read and Write Commands | 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. |

## 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). 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 for these errors are as follows:

1. Execute a new address selection 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

Table 20. Remote Status and Sense Conditions

| | Detected During 3270 Operation | | | | | Transmitted in Response to: | | Recovery Procedure | |
|---|---|---|---|---|---|---|---|---|---|
| Sense/ Status Bits | Selection Addressing Sequence | Specific Poll Sequence | General Poll Sequence | A 3270 Command | Asynchro-nous † | Specific Poll | General Poll | 3271 | 3275 |
| CR | | | | D, P | | D, P | | 6 | 6 |
| OC | | | | D, P | | D, P | | 6 | 6 |
| OC, US | | | | D, P | | D, P | | 13 | NA |
| CC | D, P | D, P | D, P | D, P | | D, P | D, P | 2 | NA |
| CC, OC | | | | D, P | | D, P | | 1 | NA |
| IR | D, P | D, P | | D, P | | D, P | | 4 | 4 |
| IR, OC | | | | D, P | | D, P | | 5 | NA |
| DC | D, P | D, P | D, P | D, P | D, P | D, P | D, P | 2 | 2 |
| DC, OC | | | | D, P | | D, P | | 1 | NA |
| DC, US | D, P | D, P | D, P | D, P | D, P | D, P | D, P | 2 | NA |
| DC, OC, US | | | | D, P | | D, P | | 3 | NA |
| DC, DE | | | | | P | | P | NA | 8 |
| DC, US, DE | | | | | P | P | P | 8 | NA |
| IR, DE | | | | | P | P | P | 4 | 4 |
| IR, EC, DE | | | | | P | P | P | NA | 7 |
| EC, DE | | | | | P | P | P | NA | 7 |
| EC, US, DE | | | | | P | P | P | 7 | NA |
| IR, EC, US, DE | | | | | P | P | P | 7 | NA |
| DB | | D, P | | | | D, P | | 9 | 9 |
| DB, US* | | | | D, P | | D, P | | 10 | 10 |
| DB, US, DE | | | | D, P | | D, P | | 2 | 2 |
| OC, DB* | | | | D, P | | D, P | | 11 | NA |
| TC | | | | D | | D | | NA | 12 |
| DE | | D, P | | | | D, P | D, P | None | None |

*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 error was detected while the 3271 or 3275 was idle or during a printout.

Legend

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

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.

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. A nonrecoverable program error has occurred. Examine the data stream to locate the problem.
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 2.
11. Indicates that, in attempting to execute a Copy command, the "from" device was found to be busy. Follow supplementary procedure C 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 E.

    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 follow supplementary procedure A.

D. Same as procedure 1, except a new address selection sequence is not performed, and this message is transmitted as part of the present device selection.

E. 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 D (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).

*Note:* When the 3275 detects a BCC error, it will set the Transmission Check (TC) sense/status bit and respond EOT.

### 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. Then the recovery procedures referenced in Table 20 should be executed.

### 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.

## Appendix A. Indicators and Controls

The external indicators and controls associated with each 3270 unit are listed in Table 21 and are described below:

OFF-PUSH: This triple-function concentric 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.

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.

It is turned on by:

1. Operation of any program attention key.
2. Operation of any alphameric key, the DUP key, the FIELD MARK key, the ERASE EOF key, or the DEL key, when the keyboard is inhibited.
3. Operation of any alphameric key not included in the numeric key grouping, without simultaneously operating either the ALPHA or NUMERIC shift key, when the Numeric Lock special feature is installed.
4. A selector-pen-attention operation that caused an I/O interruption to occur.
5. An operator-identification-card-reader operation that caused an I/O interruption to occur.
6. Turning the Security Key Lock to the OFF position if the Security Key Lock feature is installed.
7. Initiation of a printout at an unbuffered printer attached to the 3275 Display Station.
8. A system-initiated I/O operation addressed to that unit.
9. Detection of a parity or Cursor Check in the device buffer.

It is turned off by:

1. Operation of the keyboard RESET key. The RESET key operation is not honored during the time an I/O operation is in process to that unit or if a parity or Cursor Check has been detected.
2. Receipt and execution of a WCC with the Keyboard Restore bit set.
3. Receipt and execution of an Erase All Unprotected command.
4. Turning the Security Key Lock to the On position (if it was turned on because the Security Key Lock was in the Off position).
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.

Table 21. Indicators and Controls

| Indicator or Control | 3270 Unit | | | | |
|---|---|---|---|---|---|
| | 3277 | 3275 | 3272 | 3271 | 3284, 3286 |
| 1. OFF-PUSH (Sw/Ctl) | X | X | | | |
| 2. INSERT MODE (Ind) | X | X | | | |
| 3. INPUT INHIBITED (Ind) | X | X | | | |
| 4. SYSTEM AVAILABLE (Ind) | X | X | | | |
| 5. SYSTEM READY (Ind) | | X | | X | |
| 6. SYNC SEARCH (Ind) | | X | | X | |
| 7. SELECTED (Ind) | | X | | X | |
| 8. TRANSMIT (Ind) | | X | | X | |
| 9. STATUS (Ind) | | X | | X | |
| 10. POWER ON (Sw) | | | X | | |
| 11. POWER OFF (Sw) | | | X | | |
| 12. POWER ON/OFF (Sw) | | | | X | X |
| 13. POWER ON (Ind) | | | X | | |
| 14. Address I.D. (Label) | X | X | | | X |

Key: Sw - Switch
Ctl - Control
Ind - Indicator

SYSTEM AVAILABLE: 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. Receipt of an ACK or an STX ESC command transmission terminated in ETX (resulting from a General or Specific Poll), in remote operation.

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.

SYNC SEARCH: When lighted, this indicator shows that the unit is attempting to establish line synchronization.

SELECTED: 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.

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: This momentary-contact switch is used to turn on power for a 3272.

POWER OFF: This momentary-contact switch is used to turn off power 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.

POWER ON: When lighted, this indicator shows that power has been turned on for a 3272.

Address Identification: Provision is made on each display station and printer to identify both the physical (hexadecimal) and symbolic address assigned to that unit at installation time.

# Appendix B. Configurators

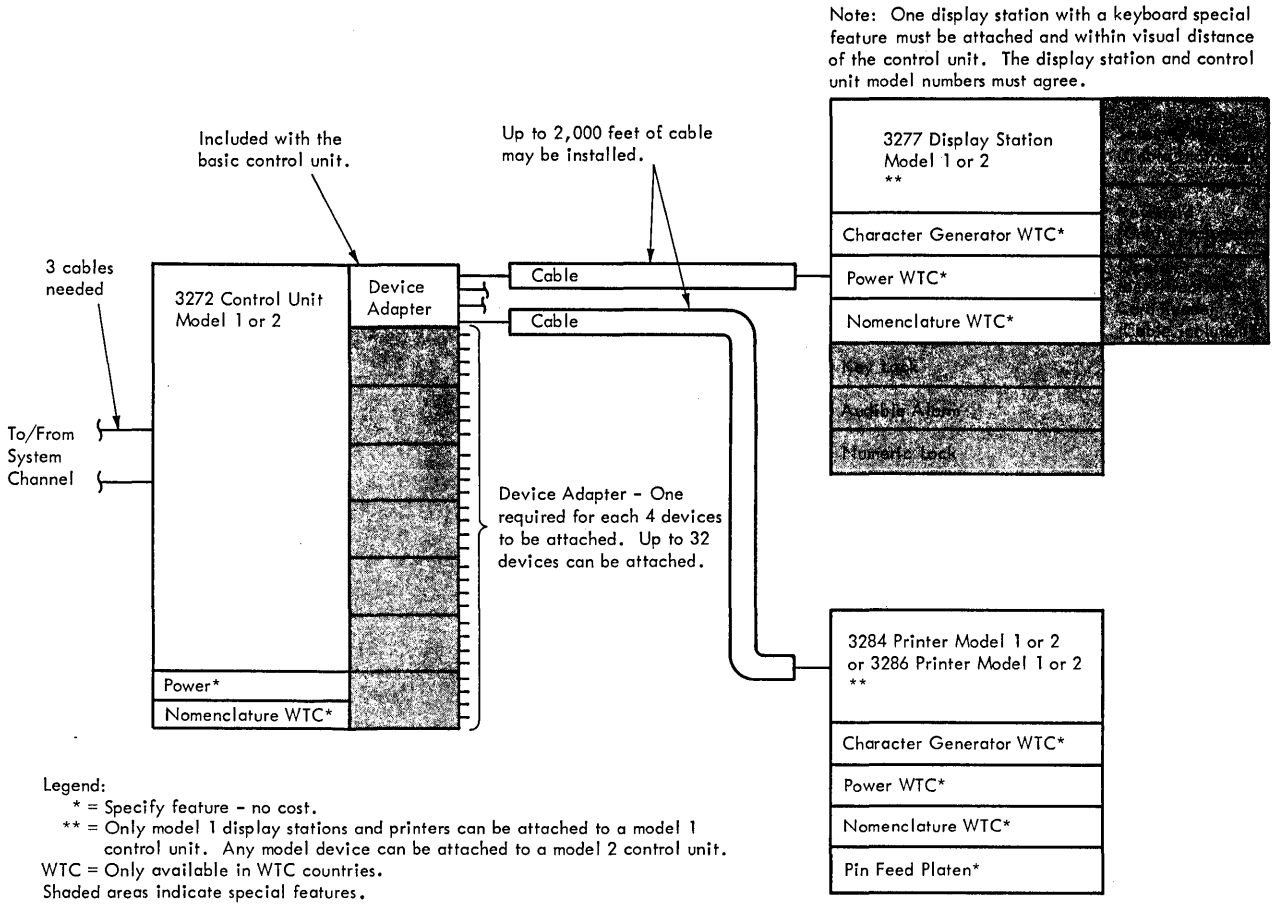



**Figure 17. 3270 Display System, Local Configurator (3272 and Attached Devices)**

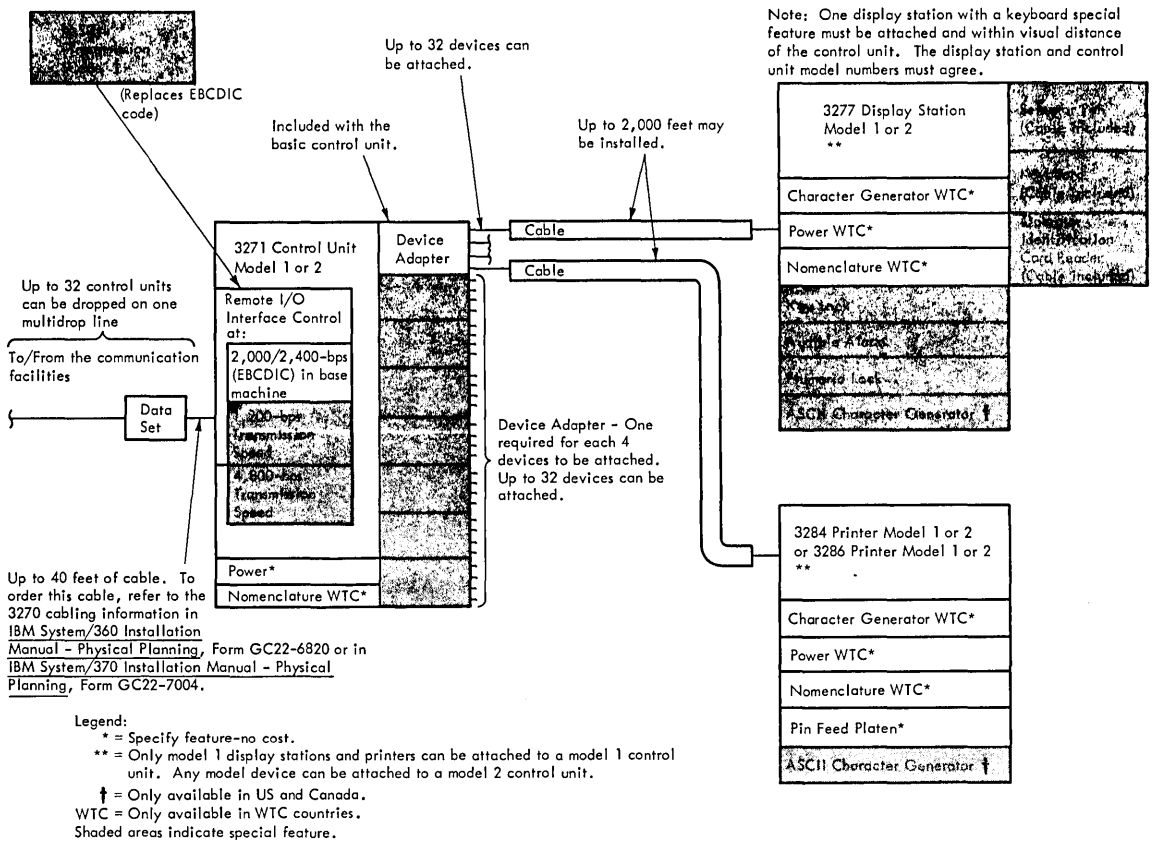



**Figure 18. 3270 Display System, Remote Configurator (3271 and Attached Devices)**

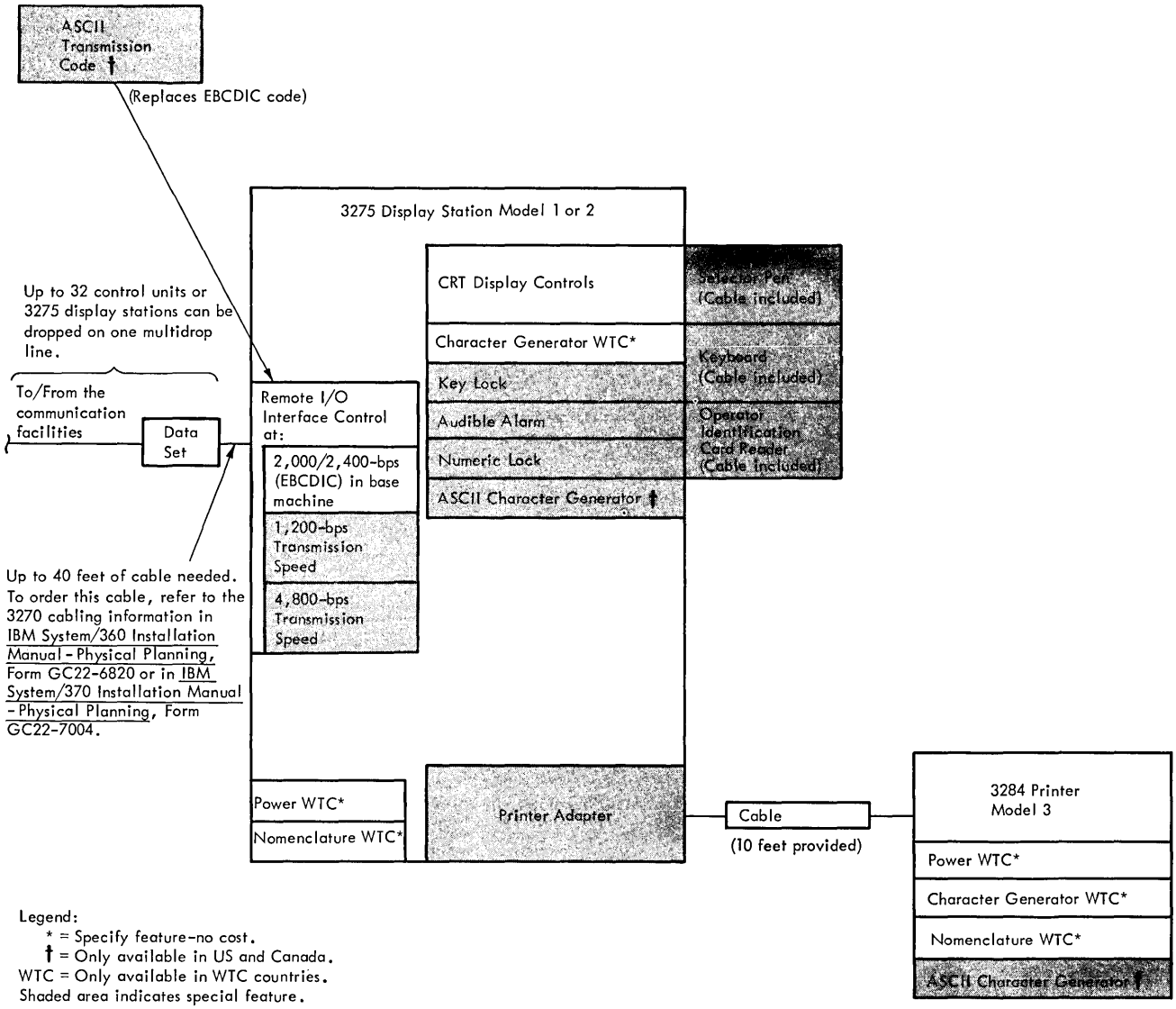



**Figure 19. 3270 Display System, Remote Configurator (3275 and Attached Printer)**

| Mod 1 | Mod 2 | Position | | Buffer Address (Hex) | | | |
|---|---|---|---|---|---|---|---|
| R C | R C | Dec | Hex | EBCDIC | | ASCII | |
| 01 01 | 01 01 | 0000 | 0000 | 40 | 40 | 20 | 20 |
| 01 02 | 01 02 | 0001 | 0001 | 40 | C1 | 20 | 41 |
| 01 03 | 01 03 | 0002 | 0002 | 40 | C2 | 20 | 42 |
| 01 04 | 01 04 | 0003 | 0003 | 40 | C3 | 20 | 43 |
| 01 05 | 01 05 | 0004 | 0004 | 40 | C4 | 20 | 44 |
| 01 06 | 01 06 | 0005 | 0005 | 40 | C5 | 20 | 45 |
| 01 07 | 01 07 | 0006 | 0006 | 40 | C6 | 20 | 46 |
| 01 08 | 01 08 | 0007 | 0007 | 40 | C7 | 20 | 47 |
| 01 09 | 01 09 | 0008 | 0008 | 40 | C8 | 20 | 48 |
| 01 10 | 01 10 | 0009 | 0009 | 40 | C9 | 20 | 49 |
| 01 11 | 01 11 | 0010 | 000A | 40 | 4A | 20 | 5B |
| 01 12 | 01 12 | 0011 | 000B | 40 | 4B | 20 | 2E |
| 01 13 | 01 13 | 0012 | 000C | 40 | 4C | 20 | 3C |
| 01 14 | 01 14 | 0013 | 000D | 40 | 4D | 20 | 28 |
| 01 15 | 01 15 | 0014 | 000E | 40 | 4E | 20 | 2B |
| 01 16 | 01 16 | 0015 | 000F | 40 | 4F | 20 | 21 |
| 01 17 | 01 17 | 0016 | 0010 | 40 | 50 | 20 | 26 |
| 01 18 | 01 18 | 0017 | 0011 | 40 | D1 | 20 | 4A |
| 01 19 | 01 19 | 0018 | 0012 | 40 | D2 | 20 | 4B |
| 01 20 | 01 20 | 0019 | 0013 | 40 | D3 | 20 | 4C |
| 01 21 | 01 21 | 0020 | 0014 | 40 | D4 | 20 | 4D |
| 01 22 | 01 22 | 0021 | 0015 | 40 | D5 | 20 | 4E |
| 01 23 | 01 23 | 0022 | 0016 | 40 | D6 | 20 | 4F |
| 01 24 | 01 24 | 0023 | 0017 | 40 | D7 | 20 | 50 |
| 01 25 | 01 25 | 0024 | 0018 | 40 | D8 | 20 | 51 |
| 01 26 | 01 26 | 0025 | 0019 | 40 | D9 | 20 | 52 |
| 01 27 | 01 27 | 0026 | 001A | 40 | 5A | 20 | 5D |
| 01 28 | 01 28 | 0027 | 001B | 40 | 5B | 20 | 24 |
| 01 29 | 01 29 | 0028 | 001C | 40 | 5C | 20 | 2A |
| 01 30 | 01 30 | 0029 | 001D | 40 | 5D | 20 | 29 |
| 01 31 | 01 31 | 0030 | 001E | 40 | 5E | 20 | 3B |
| 01 32 | 01 32 | 0031 | 001F | 40 | 5F | 20 | 5E |
| 01 33 | 01 33 | 0032 | 0020 | 40 | 60 | 20 | 2D |
| 01 34 | 01 34 | 0033 | 0021 | 40 | 61 | 20 | 2F |
| 01 35 | 01 35 | 0034 | 0022 | 40 | E2 | 20 | 53 |
| 01 36 | 01 36 | 0035 | 0023 | 40 | E3 | 20 | 54 |
| 01 37 | 01 37 | 0036 | 0024 | 40 | E4 | 20 | 55 |
| 01 38 | 01 38 | 0037 | 0025 | 40 | E5 | 20 | 56 |
| 01 39 | 01 39 | 0038 | 0026 | 40 | E6 | 20 | 57 |
| 01 40 | 01 40 | 0039 | 0027 | 40 | E7 | 20 | 58 |
| 02 01 | 01 41 | 0040 | 0028 | 40 | E8 | 20 | 59 |
| 02 02 | 01 42 | 0041 | 0029 | 40 | E9 | 20 | 5A |
| 02 03 | 01 43 | 0042 | 002A | 40 | 6A | 20 | 5C |
| 02 04 | 01 44 | 0043 | 002B | 40 | 6B | 20 | 2C |
| 02 05 | 01 45 | 0044 | 002C | 40 | 6C | 20 | 25 |
| 02 06 | 01 46 | 0045 | 002D | 40 | 6D | 20 | 5F |
| 02 07 | 01 47 | 0046 | 002E | 40 | 6E | 20 | 3E |
| 02 08 | 01 48 | 0047 | 002F | 40 | 6F | 20 | 3F |
| 02 09 | 01 49 | 0048 | 0030 | 40 | F0 | 20 | 30 |
| 02 10 | 01 50 | 0049 | 0031 | 40 | F1 | 20 | 31 |
| 02 11 | 01 51 | 0050 | 0032 | 40 | F2 | 20 | 32 |
| 02 12 | 01 52 | 0051 | 0033 | 40 | F3 | 20 | 33 |
| 02 13 | 01 53 | 0052 | 0034 | 40 | F4 | 20 | 34 |
| 02 14 | 01 54 | 0053 | 0035 | 40 | F5 | 20 | 35 |
| 02 15 | 01 55 | 0054 | 0036 | 40 | F6 | 20 | 36 |
| 02 16 | 01 56 | 0055 | 0037 | 40 | F7 | 20 | 37 |
| 02 17 | 01 57 | 0056 | 0038 | 40 | F8 | 20 | 38 |
| 02 18 | 01 58 | 0057 | 0039 | 40 | F9 | 20 | 39 |
| 02 19 | 01 59 | 0058 | 003A | 40 | 7A | 20 | 3A |
| 02 20 | 01 60 | 0059 | 003B | 40 | 7B | 20 | 23 |
| 02 21 | 01 61 | 0060 | 003C | 40 | 7C | 20 | 40 |
| 02 22 | 01 62 | 0061 | 003D | 40 | 7D | 20 | 27 |
| 02 23 | 01 63 | 0062 | 003E | 40 | 7E | 20 | 3D |
| 02 24 | 01 64 | 0063 | 003F | 40 | 7F | 20 | 22 |
| 02 25 | 01 65 | 0064 | 0040 | C1 | 40 | 41 | 20 |
| 02 26 | 01 66 | 0065 | 0041 | C1 | C1 | 41 | 41 |
| 02 27 | 01 67 | 0066 | 0042 | C1 | C2 | 41 | 42 |
| 02 28 | 01 68 | 0067 | 0043 | C1 | C3 | 41 | 43 |
| 02 29 | 01 69 | 0068 | 0044 | C1 | C4 | 41 | 44 |
| 02 30 | 01 70 | 0069 | 0045 | C1 | C5 | 41 | 45 |
| 02 31 | 01 71 | 0070 | 0046 | C1 | C6 | 41 | 46 |
| 02 32 | 01 72 | 0071 | 0047 | C1 | C7 | 41 | 47 |
| 02 33 | 01 73 | 0072 | 0048 | C1 | C8 | 41 | 48 |
| 02 34 | 01 74 | 0073 | 0049 | C1 | C9 | 41 | 49 |
| 02 35 | 01 75 | 0074 | 004A | C1 | 4A | 41 | 5B |
| 02 36 | 01 76 | 0075 | 004B | C1 | 4B | 41 | 2E |
| 02 37 | 01 77 | 0076 | 004C | C1 | 4C | 41 | 3C |
| 02 38 | 01 78 | 0077 | 004D | C1 | 4D | 41 | 28 |
| 02 39 | 01 79 | 0078 | 004E | C1 | 4E | 41 | 2B |
| 02 40 | 01 80 | 0079 | 004F | C1 | 4F | 41 | 21 |
| 03 01 | 02 01 | 0080 | 0050 | C1 | 50 | 41 | 26 |
| 03 02 | 02 02 | 0081 | 0051 | C1 | D1 | 41 | 4A |
| 03 03 | 02 03 | 0082 | 0052 | C1 | D2 | 41 | 4B |
| 03 04 | 02 04 | 0083 | 0053 | C1 | D3 | 41 | 4C |
| 03 05 | 02 05 | 0084 | 0054 | C1 | D4 | 41 | 4D |
| 03 06 | 02 06 | 0085 | 0055 | C1 | D5 | 41 | 4E |
| 03 07 | 02 07 | 0086 | 0056 | C1 | D6 | 41 | 4F |
| 03 08 | 02 08 | 0087 | 0057 | C1 | D7 | 41 | 50 |
| 03 09 | 02 09 | 0088 | 0058 | C1 | D8 | 41 | 51 |
| 03 10 | 02 10 | 0089 | 0059 | C1 | D9 | 41 | 52 |
| 03 11 | 02 11 | 0090 | 005A | C1 | 5A | 41 | 5D |
| 03 12 | 02 12 | 0091 | 005B | C1 | 5B | 41 | 24 |
| 03 13 | 02 13 | 0092 | 005C | C1 | 5C | 41 | 2A |
| 03 14 | 02 14 | 0093 | 005D | C1 | 5D | 41 | 29 |
| 03 15 | 02 15 | 0094 | 005E | C1 | 5E | 41 | 3B |
| 03 16 | 02 16 | 0095 | 005F | C1 | 5F | 41 | 5E |
| 03 17 | 02 17 | 0096 | 0060 | C1 | 60 | 41 | 2D |
| 03 18 | 02 18 | 0097 | 0061 | C1 | 61 | 41 | 2F |
| 03 19 | 02 19 | 0098 | 0062 | C1 | E2 | 41 | 53 |
| 03 20 | 02 20 | 0099 | 0063 | C1 | E3 | 41 | 54 |
| 03 21 | 02 21 | 0100 | 0064 | C1 | E4 | 41 | 55 |
| 03 22 | 02 22 | 0101 | 0065 | C1 | E5 | 41 | 56 |
| 03 23 | 02 23 | 0102 | 0066 | C1 | E6 | 41 | 57 |
| 03 24 | 02 24 | 0103 | 0067 | C1 | E7 | 41 | 58 |
| 03 25 | 02 25 | 0104 | 0068 | C1 | E8 | 41 | 59 |
| 03 26 | 02 26 | 0105 | 0069 | C1 | E9 | 41 | 5A |
| 03 27 | 02 27 | 0106 | 006A | C1 | 6A | 41 | 5C |
| 03 28 | 02 28 | 0107 | 006B | C1 | 6B | 41 | 2C |
| 03 29 | 02 29 | 0108 | 006C | C1 | 6C | 41 | 25 |
| 03 30 | 02 30 | 0109 | 006D | C1 | 6D | 41 | 5F |
| 03 31 | 02 31 | 0110 | 006E | C1 | 6E | 41 | 3E |
| 03 32 | 02 32 | 0111 | 006F | C1 | 6F | 41 | 3F |
| 03 33 | 02 33 | 0112 | 0070 | C1 | F0 | 41 | 30 |
| 03 34 | 02 34 | 0113 | 0071 | C1 | F1 | 41 | 31 |
| 03 35 | 02 35 | 0114 | 0072 | C1 | F2 | 41 | 32 |
| 03 36 | 02 36 | 0115 | 0073 | C1 | F3 | 41 | 33 |
| 03 37 | 02 37 | 0116 | 0074 | C1 | F4 | 41 | 34 |
| 03 38 | 02 38 | 0117 | 0075 | C1 | F5 | 41 | 35 |
| 03 39 | 02 39 | 0118 | 0076 | C1 | F6 | 41 | 36 |
| 03 40 | 02 40 | 0119 | 0077 | C1 | F7 | 41 | 37 |
| 04 01 | 02 41 | 0120 | 0078 | C1 | F8 | 41 | 38 |
| 04 02 | 02 42 | 0121 | 0079 | C1 | F9 | 41 | 39 |
| 04 03 | 02 43 | 0122 | 007A | C1 | 7A | 41 | 3A |
| 04 04 | 02 44 | 0123 | 007B | C1 | 7B | 41 | 23 |

| Mod 1 | Mod 2 | Position | | Buffer Address (Hex) | | | |
|---|---|---|---|---|---|---|---|
| R C | R C | Dec | Hex | EBCDIC | | ASCII | |
| 04 05 | 02 45 | 0124 | 007C | C1 | 7C | 41 | 40 |
| 04 06 | 02 46 | 0125 | 007D | C1 | 7D | 41 | 27 |
| 04 07 | 02 47 | 0126 | 007E | C1 | 7E | 41 | 3D |
| 04 08 | 02 48 | 0127 | 007F | C1 | 7F | 41 | 22 |
| 04 09 | 02 49 | 0128 | 0080 | C2 | 40 | 42 | 20 |
| 04 10 | 02 50 | 0129 | 0081 | C2 | C1 | 42 | 41 |
| 04 11 | 02 51 | 0130 | 0082 | C2 | C2 | 42 | 42 |
| 04 12 | 02 52 | 0131 | 0083 | C2 | C3 | 42 | 43 |
| 04 13 | 02 53 | 0132 | 0084 | C2 | C4 | 42 | 44 |
| 04 14 | 02 54 | 0133 | 0085 | C2 | C5 | 42 | 45 |
| 04 15 | 02 55 | 0134 | 0086 | C2 | C6 | 42 | 46 |
| 04 16 | 02 56 | 0135 | 0087 | C2 | C7 | 42 | 47 |
| 04 17 | 02 57 | 0136 | 0088 | C2 | C8 | 42 | 48 |
| 04 18 | 02 58 | 0137 | 0089 | C2 | C9 | 42 | 49 |
| 04 19 | 02 59 | 0138 | 008A | C2 | 4A | 42 | 5B |
| 04 20 | 02 60 | 0139 | 008B | C2 | 4B | 42 | 2E |
| 04 21 | 02 61 | 0140 | 008C | C2 | 4C | 42 | 3C |
| 04 22 | 02 62 | 0141 | 008D | C2 | 4D | 42 | 28 |
| 04 23 | 02 63 | 0142 | 008E | C2 | 4E | 42 | 2B |
| 04 24 | 02 64 | 0143 | 008F | C2 | 4F | 42 | 21 |
| 04 25 | 02 65 | 0144 | 0090 | C2 | 50 | 42 | 26 |
| 04 26 | 02 66 | 0145 | 0091 | C2 | D1 | 42 | 4A |
| 04 27 | 02 67 | 0146 | 0092 | C2 | D2 | 42 | 4B |
| 04 28 | 02 68 | 0147 | 0093 | C2 | D3 | 42 | 4C |
| 04 29 | 02 69 | 0148 | 0094 | C2 | D4 | 42 | 4D |
| 04 30 | 02 70 | 0149 | 0095 | C2 | D5 | 42 | 4E |
| 04 31 | 02 71 | 0150 | 0096 | C2 | D6 | 42 | 4F |
| 04 32 | 02 72 | 0151 | 0097 | C2 | D7 | 42 | 50 |
| 04 33 | 02 73 | 0152 | 0098 | C2 | D8 | 42 | 51 |
| 04 34 | 02 74 | 0153 | 0099 | C2 | D9 | 42 | 52 |
| 04 35 | 02 75 | 0154 | 009A | C2 | 5A | 42 | 5D |
| 04 36 | 02 76 | 0155 | 009B | C2 | 5B | 42 | 24 |
| 04 37 | 02 77 | 0156 | 009C | C2 | 5C | 42 | 2A |
| 04 38 | 02 78 | 0157 | 009D | C2 | 5D | 42 | 29 |
| 04 39 | 02 79 | 0158 | 009E | C2 | 5E | 42 | 3B |
| 04 40 | 02 80 | 0159 | 009F | C2 | 5F | 42 | 5E |
| 05 01 | 03 01 | 0160 | 00A0 | C2 | 60 | 42 | 2D |
| 05 02 | 03 02 | 0161 | 00A1 | C2 | 61 | 42 | 2F |
| 05 03 | 03 03 | 0162 | 00A2 | C2 | E2 | 42 | 53 |
| 05 04 | 03 04 | 0163 | 00A3 | C2 | E3 | 42 | 54 |
| 05 05 | 03 05 | 0164 | 00A4 | C2 | E4 | 42 | 55 |
| 50 06 | 03 06 | 0165 | 00A5 | C2 | E5 | 42 | 56 |
| 05 07 | 03 07 | 0166 | 00A6 | C2 | E6 | 42 | 57 |
| 05 08 | 03 08 | 0167 | 00A7 | C2 | E7 | 42 | 58 |
| 05 09 | 03 09 | 0168 | 00A8 | C2 | E8 | 42 | 59 |
| 05 10 | 03 10 | 0169 | 00A9 | C2 | E9 | 42 | 5A |
| 05 11 | 03 11 | 0170 | 00AA | C2 | 6A | 42 | 5C |
| 05 12 | 03 12 | 0171 | 00AB | C2 | 6B | 42 | 2C |
| 05 13 | 03 13 | 0172 | 00AC | C2 | 6C | 42 | 25 |
| 05 14 | 03 14 | 0173 | 00AD | C2 | 6D | 42 | 5F |
| 05 15 | 03 15 | 0174 | 00AE | C2 | 6E | 42 | 3E |
| 05 16 | 03 16 | 0175 | 00AF | C2 | 6F | 42 | 3F |
| 05 17 | 03 17 | 0176 | 00B0 | C2 | F0 | 42 | 30 |
| 05 18 | 03 18 | 0177 | 00B1 | C2 | F1 | 42 | 31 |
| 05 19 | 03 19 | 0178 | 00B2 | C2 | F2 | 42 | 32 |
| 05 20 | 03 20 | 0179 | 00B3 | C2 | F3 | 42 | 33 |
| 05 21 | 03 21 | 0180 | 00B4 | C2 | F4 | 42 | 34 |
| 05 22 | 03 22 | 0181 | 00B5 | C2 | F5 | 42 | 35 |
| 05 23 | 03 23 | 0182 | 00B6 | C2 | F6 | 42 | 36 |
| 05 24 | 03 24 | 0183 | 00B7 | C2 | F7 | 42 | 37 |
| 05 25 | 03 25 | 0184 | 00B8 | C2 | F8 | 42 | 38 |
| 05 26 | 03 26 | 0185 | 00B9 | C2 | F9 | 42 | 39 |
| 05 27 | 03 27 | 0186 | 00BA | C2 | 7A | 42 | 3A |
| 05 28 | 03 28 | 0187 | 00BB | C2 | 7B | 42 | 23 |
| 05 29 | 03 29 | 0188 | 00BC | C2 | 7C | 42 | 40 |
| 05 30 | 03 30 | 0189 | 00BD | C2 | 7D | 42 | 27 |
| 05 31 | 03 31 | 0190 | 00BE | C2 | 7E | 42 | 3D |
| 05 32 | 03 32 | 0191 | 00BF | C2 | 7F | 42 | 22 |
| 05 33 | 03 33 | 0192 | 00C0 | C3 | 40 | 43 | 20 |
| 05 34 | 03 34 | 0193 | 00C1 | C3 | C1 | 43 | 41 |
| 05 35 | 03 35 | 0194 | 00C2 | C3 | C2 | 43 | 42 |
| 05 36 | 03 36 | 0195 | 00C3 | C3 | C3 | 43 | 43 |
| 05 37 | 03 37 | 0196 | 00C4 | C3 | C4 | 43 | 44 |
| 05 38 | 03 38 | 0197 | 00C5 | C3 | C5 | 43 | 45 |
| 05 39 | 03 39 | 0198 | 00C6 | C3 | C6 | 43 | 46 |
| 05 40 | 03 40 | 0199 | 00C7 | C3 | C7 | 43 | 47 |
| 06 01 | 03 41 | 0200 | 00C8 | C3 | C8 | 43 | 48 |
| 06 02 | 03 42 | 0201 | 00C9 | C3 | C9 | 43 | 49 |
| 06 03 | 03 43 | 0202 | 00CA | C3 | 4A | 43 | 5B |
| 06 04 | 03 44 | 0203 | 00CB | C3 | 4B | 43 | 2F |
| 06 05 | 03 45 | 0204 | 00CC | C3 | 4C | 43 | 3C |
| 06 06 | 03 46 | 0205 | 00CD | C3 | 4D | 43 | 28 |
| 06 07 | 03 47 | 0206 | 00CE | C3 | 4E | 43 | 2B |
| 06 08 | 03 48 | 0207 | 00CF | C3 | 4F | 43 | 21 |
| 06 09 | 03 49 | 0208 | 00D0 | C3 | 50 | 43 | 26 |
| 06 10 | 03 50 | 0209 | 00D1 | C3 | D1 | 43 | 4A |
| 06 11 | 03 51 | 0210 | 00D2 | C3 | D2 | 43 | 4B |
| 06 12 | 03 52 | 0211 | 00D3 | C3 | D3 | 43 | 4C |
| 06 13 | 03 53 | 0212 | 00D4 | C3 | D4 | 43 | 4D |
| 06 14 | 03 54 | 0213 | 00D5 | C3 | D5 | 43 | 4E |
| 06 15 | 03 55 | 0214 | 00D6 | C3 | D6 | 43 | 4F |
| 06 16 | 03 56 | 0215 | 00D7 | C3 | D7 | 43 | 50 |
| 06 17 | 03 57 | 0216 | 00D8 | C3 | D8 | 43 | 51 |
| 06 18 | 03 58 | 0217 | 00D9 | C3 | D9 | 43 | 52 |
| 06 19 | 03 59 | 0218 | 00DA | C3 | 5A | 43 | 5D |
| 06 20 | 03 60 | 0219 | 00DB | C3 | 5B | 43 | 24 |
| 06 21 | 03 61 | 0220 | 00DC | C3 | 5C | 43 | 2A |
| 06 22 | 03 62 | 0221 | 00DD | C3 | 5D | 43 | 29 |
| 06 23 | 03 63 | 0222 | 00DE | C3 | 5E | 43 | 3B |
| 06 24 | 03 64 | 0223 | 00DF | C3 | 5F | 43 | 5E |
| 06 25 | 03 65 | 0224 | 00E0 | C3 | 60 | 43 | 2D |
| 06 26 | 03 66 | 0225 | 00E1 | C3 | 61 | 43 | 2F |
| 06 27 | 03 67 | 0226 | 00E2 | C3 | E2 | 43 | 53 |
| 06 28 | 03 68 | 0227 | 00E3 | C3 | E3 | 43 | 54 |
| 06 29 | 03 69 | 0228 | 00E4 | C3 | E4 | 43 | 55 |
| 06 30 | 03 70 | 0229 | 00E5 | C3 | E5 | 43 | 56 |
| 06 31 | 03 71 | 0230 | 00E6 | C3 | E6 | 43 | 57 |
| 06 32 | 03 72 | 0231 | 00E7 | C3 | E7 | 43 | 58 |
| 06 33 | 03 73 | 0232 | 00E8 | C3 | E8 | 43 | 59 |
| 06 34 | 03 74 | 0233 | 00E9 | C3 | E9 | 43 | 5A |
| 06 35 | 03 75 | 0234 | 00EA | C3 | 6A | 43 | 5C |
| 06 36 | 03 76 | 0235 | 00EB | C3 | 6B | 43 | 2C |
| 06 37 | 03 77 | 0236 | 00EC | C3 | 6C | 43 | 25 |
| 06 38 | 03 78 | 0237 | 00ED | C3 | 6D | 43 | 5F |
| 06 39 | 03 79 | 0238 | 00EE | C3 | 6E | 43 | 3E |
| 06 40 | 03 80 | 0239 | 00EF | C3 | 6F | 43 | 3F |
| 07 01 | 04 01 | 0240 | 00F0 | C3 | F0 | 43 | 30 |
| 07 02 | 04 02 | 0241 | 00F1 | C3 | F1 | 43 | 31 |
| 07 03 | 04 03 | 0242 | 00F2 | C3 | F2 | 43 | 32 |
| 07 04 | 04 04 | 0243 | 00F3 | C3 | F3 | 43 | 33 |
| 07 05 | 04 05 | 0244 | 00F4 | C3 | F4 | 43 | 34 |
| 07 06 | 04 06 | 0245 | 00F5 | C3 | F5 | 43 | 35 |
| 07 07 | 04 07 | 0246 | 00F6 | C3 | F6 | 43 | 36 |
| 07 08 | 04 08 | 0247 | 00F7 | C3 | F7 | 43 | 37 |

| Mod 1 R C | Mod 2 R C | Position Dec | Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|
| 07 09 | 04 09 | 0248 | 00F8 | C3 | F8 | 43 | 38 |
| 07 10 | 04 10 | 0249 | 00F9 | C3 | F9 | 43 | 39 |
| 07 11 | 04 11 | 0250 | 00FA | C3 | 7A | 43 | 3A |
| 07 12 | 04 12 | 0251 | 00FB | C3 | 7B | 43 | 23 |
| 07 13 | 04 13 | 0252 | 00FC | C3 | 7C | 43 | 40 |
| 07 14 | 04 14 | 0253 | 00FD | C3 | 7D | 43 | 27 |
| 07 15 | 04 15 | 0254 | 00FE | C3 | 7E | 43 | 3D |
| 07 16 | 04 16 | 0255 | 00FF | C3 | 7F | 43 | 22 |
| 07 17 | 04 17 | 0256 | 0100 | C4 | 40 | 44 | 20 |
| 07 18 | 04 18 | 0257 | 0101 | C4 | C1 | 44 | 41 |
| 07 19 | 04 19 | 0258 | 0102 | C4 | C2 | 44 | 42 |
| 07 20 | 04 20 | 0259 | 0103 | C4 | C3 | 44 | 43 |
| 07 21 | 04 21 | 0260 | 0104 | C4 | C4 | 44 | 44 |
| 07 22 | 04 22 | 0261 | 0105 | C4 | C5 | 44 | 45 |
| 07 23 | 04 23 | 0262 | 0106 | C4 | C6 | 44 | 46 |
| 07 24 | 04 24 | 0263 | 0107 | C4 | C7 | 44 | 47 |
| 07 25 | 04 25 | 0264 | 0108 | C4 | C8 | 44 | 48 |
| 07 26 | 04 26 | 0265 | 0109 | C4 | C9 | 44 | 49 |
| 07 27 | 04 27 | 0266 | 010A | C4 | 4A | 44 | 5B |
| 07 28 | 04 28 | 0267 | 010B | C4 | 4B | 44 | 2E |
| 07 29 | 04 29 | 0268 | 010C | C4 | 4C | 44 | 3C |
| 07 30 | 04 30 | 0269 | 010D | C4 | 4D | 44 | 28 |
| 07 31 | 04 31 | 0270 | 010E | C4 | 4E | 44 | 2B |
| 07 32 | 04 32 | 0271 | 010F | C4 | 4F | 44 | 21 |
| 07 33 | 04 33 | 0272 | 0110 | C4 | 50 | 44 | 26 |
| 07 34 | 04 34 | 0273 | 0111 | C4 | D1 | 44 | 4A |
| 07 35 | 04 35 | 0274 | 0112 | C4 | D2 | 44 | 4B |
| 07 36 | 04 36 | 0275 | 0113 | C4 | D3 | 44 | 4C |
| 07 37 | 04 37 | 0276 | 0114 | C4 | D4 | 44 | 4D |
| 07 38 | 04 38 | 0277 | 0115 | C4 | D5 | 44 | 4E |
| 07 39 | 04 39 | 0278 | 0116 | C4 | D6 | 44 | 4F |
| 07 40 | 04 40 | 0279 | 0117 | C4 | D7 | 44 | 50 |
| 08 01 | 04 41 | 0280 | 0118 | C4 | D8 | 44 | 51 |
| 08 02 | 04 42 | 0281 | 0119 | C4 | D9 | 44 | 52 |
| 08 03 | 04 43 | 0282 | 011A | C4 | 5A | 44 | 5D |
| 08 04 | 04 44 | 0283 | 011B | C4 | 5B | 44 | 24 |
| 08 05 | 04 45 | 0284 | 011C | C4 | 5C | 44 | 2A |
| 08 06 | 04 46 | 0285 | 011D | C4 | 5D | 44 | 29 |
| 08 07 | 04 47 | 0286 | 011E | C4 | 5E | 44 | 3B |
| 08 08 | 04 48 | 0287 | 011F | C4 | 5F | 44 | 5E |
| 08 09 | 04 49 | 0288 | 0120 | C4 | 60 | 44 | 2D |
| 08 10 | 04 50 | 0289 | 0121 | C4 | 61 | 44 | 2F |
| 08 11 | 04 51 | 0290 | 0122 | C4 | E2 | 44 | 53 |
| 08 12 | 04 52 | 0291 | 0123 | C4 | E3 | 44 | 54 |
| 08 13 | 04 53 | 0292 | 0124 | C4 | E4 | 44 | 55 |
| 08 14 | 04 54 | 0293 | 0125 | C4 | E5 | 44 | 56 |
| 08 15 | 04 55 | 0294 | 0126 | C4 | E6 | 44 | 57 |
| 08 16 | 04 56 | 0295 | 0127 | C4 | E7 | 44 | 58 |
| 08 17 | 04 57 | 0296 | 0128 | C4 | E8 | 44 | 59 |
| 08 18 | 04 58 | 0297 | 0129 | C4 | E9 | 44 | 5A |
| 08 19 | 04 59 | 0298 | 012A | C4 | 6A | 44 | 5C |
| 08 20 | 04 60 | 0299 | 012B | C4 | 6B | 44 | 2C |
| 08 21 | 04 61 | 0300 | 012C | C4 | 6C | 44 | 25 |
| 08 22 | 04 62 | 0301 | 012D | C4 | 6D | 44 | 5F |
| 08 23 | 04 63 | 0302 | 012E | C4 | 6E | 44 | 3E |
| 08 24 | 04 64 | 0303 | 012F | C4 | 6F | 44 | 3F |
| 08 25 | 04 65 | 0304 | 0130 | C4 | F0 | 44 | 30 |
| 08 26 | 04 66 | 0305 | 0131 | C4 | F1 | 44 | 31 |
| 08 27 | 04 67 | 0306 | 0132 | C4 | F2 | 44 | 32 |
| 08 28 | 04 68 | 0307 | 0133 | C4 | F3 | 44 | 33 |
| 08 29 | 04 69 | 0308 | 0134 | C4 | F4 | 44 | 34 |
| 08 30 | 04 70 | 0309 | 0135 | C4 | F5 | 44 | 35 |
| 08 31 | 04 71 | 0310 | 0136 | C4 | F6 | 44 | 36 |
| 08 32 | 04 72 | 0311 | 0137 | C4 | F7 | 44 | 37 |
| 08 33 | 04 73 | 0312 | 0138 | C4 | F8 | 44 | 38 |
| 08 34 | 04 74 | 0313 | 0139 | C4 | F9 | 44 | 39 |
| 08 35 | 04 75 | 0314 | 013A | C4 | 7A | 44 | 3A |
| 08 36 | 04 76 | 0315 | 013B | C4 | 7B | 44 | 23 |
| 08 37 | 04 77 | 0316 | 013C | C4 | 7C | 44 | 40 |
| 08 38 | 04 78 | 0317 | 013D | C4 | 7D | 44 | 27 |
| 08 39 | 04 79 | 0318 | 013E | C4 | 7E | 44 | 3D |
| 08 40 | 04 80 | 0319 | 013F | C4 | 7F | 44 | 22 |
| 09 01 | 05 01 | 0320 | 0140 | C5 | 40 | 45 | 20 |
| 09 02 | 05 02 | 0321 | 0141 | C5 | C1 | 45 | 41 |
| 09 03 | 05 03 | 0322 | 0142 | C5 | C2 | 45 | 42 |
| 09 04 | 05 04 | 0323 | 0143 | C5 | C3 | 45 | 43 |
| 09 05 | 05 05 | 0324 | 0144 | C5 | C4 | 45 | 44 |
| 09 06 | 05 06 | 0325 | 0145 | C5 | C5 | 45 | 45 |
| 09 07 | 05 07 | 0326 | 0146 | C5 | C6 | 45 | 46 |
| 09 08 | 05 08 | 0327 | 0147 | C5 | C7 | 45 | 47 |
| 09 09 | 05 09 | 0328 | 0148 | C5 | C8 | 45 | 48 |
| 09 10 | 05 10 | 0329 | 0149 | C5 | C9 | 45 | 49 |
| 09 11 | 05 11 | 0330 | 014A | C5 | 4A | 45 | 5B |
| 09 12 | 05 12 | 0331 | 014B | C5 | 4B | 45 | 2E |
| 09 13 | 05 13 | 0332 | 014C | C5 | 4C | 45 | 3C |
| 09 14 | 05 14 | 0333 | 014D | C5 | 4D | 45 | 28 |
| 09 15 | 05 15 | 0334 | 014E | C5 | 4E | 45 | 2B |
| 09 16 | 05 16 | 0335 | 014F | C5 | 4F | 45 | 21 |
| 09 17 | 05 17 | 0336 | 0150 | C5 | 50 | 45 | 26 |
| 09 18 | 05 18 | 0337 | 0151 | C5 | D1 | 45 | 4A |
| 09 19 | 05 19 | 0338 | 0152 | C5 | D2 | 45 | 4B |
| 09 20 | 05 20 | 0339 | 0153 | C5 | D3 | 45 | 4C |
| 09 21 | 05 21 | 0340 | 0154 | C5 | D4 | 45 | 4D |
| 09 22 | 05 22 | 0341 | 0155 | C5 | D5 | 45 | 4E |
| 09 23 | 05 23 | 0342 | 0156 | C5 | D6 | 45 | 4F |
| 09 24 | 05 24 | 0343 | 0157 | C5 | D7 | 45 | 50 |
| 09 25 | 05 25 | 0344 | 0158 | C5 | D8 | 45 | 51 |
| 09 26 | 05 26 | 0345 | 0159 | C5 | D9 | 45 | 52 |
| 09 27 | 05 27 | 0346 | 015A | C5 | 5A | 45 | 5D |
| 09 28 | 05 28 | 0347 | 015B | C5 | 5B | 45 | 24 |
| 09 29 | 05 29 | 0348 | 015C | C5 | 5C | 45 | 2A |
| 09 30 | 05 30 | 0349 | 015D | C5 | 5D | 45 | 29 |
| 09 31 | 05 31 | 0350 | 015E | C5 | 5E | 45 | 3B |
| 09 32 | 05 32 | 0351 | 015F | C5 | 5F | 45 | 5E |
| 09 33 | 05 33 | 0352 | 0160 | C5 | 60 | 45 | 2D |
| 09 34 | 05 34 | 0353 | 0161 | C5 | 61 | 45 | 2F |
| 09 35 | 05 35 | 0354 | 0162 | C5 | E2 | 45 | 53 |
| 09 36 | 05 36 | 0355 | 0163 | C5 | E3 | 45 | 54 |
| 09 37 | 05 37 | 0356 | 0164 | C5 | E4 | 45 | 55 |
| 09 38 | 05 38 | 0357 | 0165 | C5 | E5 | 45 | 56 |
| 09 39 | 05 39 | 0358 | 0166 | C5 | E6 | 45 | 57 |
| 09 40 | 05 40 | 0359 | 0167 | C5 | E7 | 45 | 58 |
| 10 01 | 05 41 | 0360 | 0168 | C5 | E8 | 45 | 59 |
| 10 02 | 05 42 | 0361 | 0169 | C5 | E9 | 45 | 5A |
| 10 03 | 05 43 | 0362 | 016A | C5 | 6A | 45 | 5C |
| 10 04 | 05 44 | 0363 | 016B | C5 | 6B | 45 | 2C |
| 10 05 | 05 45 | 0364 | 016C | C5 | 6C | 45 | 25 |
| 10 06 | 05 46 | 0365 | 016D | C5 | 6D | 45 | 5F |
| 10 07 | 05 47 | 0366 | 016E | C5 | 6E | 45 | 3E |
| 10 08 | 05 48 | 0367 | 016F | C5 | 6F | 45 | 3F |
| 10 09 | 05 49 | 0368 | 0170 | C5 | F0 | 45 | 30 |
| 10 10 | 05 50 | 0369 | 0171 | C5 | F1 | 45 | 31 |
| 10 11 | 05 51 | 0370 | 0172 | C5 | F2 | 45 | 32 |
| 10 12 | 05 52 | 0371 | 0173 | C5 | F3 | 45 | 33 |

| Mod 1 | Mod 2 | Position | | Buffer Address (Hex) | | | |
|---|---|---|---|---|---|---|---|
| R C | R C | Dec | Hex | EBCDIC | | ASCII | |
| 10 13 | 05 53 | 0372 | 0174 | C5 | F4 | 45 | 34 |
| 10 14 | 05 54 | 0373 | 0175 | C5 | F5 | 45 | 35 |
| 10 15 | 05 55 | 0374 | 0176 | C5 | F6 | 45 | 36 |
| 10 16 | 05 56 | 0375 | 0177 | C5 | F7 | 45 | 37 |
| 10 17 | 05 57 | 0376 | 0178 | C5 | F8 | 45 | 38 |
| 10 18 | 05 58 | 0377 | 0179 | C5 | F9 | 45 | 39 |
| 10 19 | 05 59 | 0378 | 017A | C5 | 7A | 45 | 3A |
| 10 20 | 05 60 | 0379 | 017B | C5 | 7B | 45 | 23 |
| 10 21 | 05 61 | 0380 | 017C | C5 | 7C | 45 | 40 |
| 10 22 | 05 62 | 0381 | 017D | C5 | 7D | 45 | 27 |
| 10 23 | 05 63 | 0382 | 017E | C5 | 7E | 45 | 3D |
| 10 24 | 05 64 | 0383 | 017F | C5 | 7F | 45 | 22 |
| 10 25 | 05 65 | 0384 | 0180 | C6 | 40 | 46 | 20 |
| 10 26 | 05 66 | 0385 | 0181 | C6 | C1 | 46 | 41 |
| 10 27 | 05 67 | 0386 | 0182 | C6 | C2 | 46 | 42 |
| 10 28 | 05 68 | 0387 | 0183 | C6 | C3 | 46 | 43 |
| 10 29 | 05 69 | 0388 | 0184 | C6 | C4 | 46 | 44 |
| 10 30 | 05 70 | 0389 | 0185 | C6 | C5 | 46 | 45 |
| 10 31 | 05 71 | 0390 | 0186 | C6 | C6 | 46 | 46 |
| 10 32 | 05 72 | 0391 | 0187 | C6 | C7 | 46 | 47 |
| 10 33 | 05 73 | 0392 | 0188 | C6 | C8 | 46 | 48 |
| 10 34 | 05 74 | 0393 | 0189 | C6 | C9 | 46 | 49 |
| 10 35 | 05 75 | 0394 | 018A | C6 | 4A | 46 | 5B |
| 10 36 | 05 76 | 0395 | 018B | C6 | 4B | 46 | 2E |
| 10 37 | 05 77 | 0396 | 018C | C6 | 4C | 46 | 3C |
| 10 38 | 05 78 | 0397 | 018D | C6 | 4D | 46 | 28 |
| 10 39 | 05 79 | 0398 | 018E | C6 | 4E | 46 | 2B |
| 10 40 | 05 80 | 0399 | 018F | C6 | 4F | 46 | 21 |
| 11 01 | 06 01 | 0400 | 0190 | C6 | 50 | 46 | 26 |
| 11 02 | 06 02 | 0401 | 0191 | C6 | D1 | 46 | 4A |
| 11 03 | 06 03 | 0402 | 0192 | C6 | D2 | 46 | 4B |
| 11 04 | 06 04 | 0403 | 0193 | C6 | D3 | 46 | 4C |
| 11 05 | 06 05 | 0404 | 0194 | C6 | D4 | 46 | 4D |
| 11 06 | 06 06 | 0405 | 0195 | C6 | D5 | 46 | 4E |
| 11 07 | 06 07 | 0406 | 0196 | C6 | D6 | 46 | 4F |
| 11 08 | 06 08 | 0407 | 0197 | C6 | D7 | 46 | 50 |
| 11 09 | 06 09 | 0408 | 0198 | C6 | D8 | 46 | 51 |
| 11 10 | 06 10 | 0409 | 0199 | C6 | D9 | 46 | 52 |
| 11 11 | 06 11 | 0410 | 019A | C6 | 5A | 46 | 5D |
| 11 12 | 06 12 | 0411 | 019B | C6 | 5B | 46 | 24 |
| 11 13 | 06 13 | 0412 | 019C | C6 | 5C | 46 | 2A |
| 11 14 | 06 14 | 0413 | 019D | C6 | 5D | 46 | 29 |
| 11 15 | 06 15 | 0414 | 019E | C6 | 5E | 46 | 3B |
| 11 16 | 06 16 | 0415 | 019F | C6 | 5F | 46 | 5E |
| 11 17 | 06 17 | 0416 | 01A0 | C6 | 60 | 46 | 2D |
| 11 18 | 06 18 | 0417 | 01A1 | C6 | 61 | 46 | 2F |
| 11 19 | 06 19 | 0418 | 01A2 | C6 | E2 | 46 | 53 |
| 11 20 | 06 20 | 0419 | 01A3 | C6 | E3 | 46 | 54 |
| 11 21 | 06 21 | 0420 | 01A4 | C6 | E4 | 46 | 55 |
| 11 22 | 06 22 | 0421 | 01A5 | C6 | E5 | 46 | 56 |
| 11 23 | 06 23 | 0422 | 01A6 | C6 | E6 | 46 | 57 |
| 11 24 | 06 24 | 0423 | 01A7 | C6 | E7 | 46 | 58 |
| 11 25 | 06 25 | 0424 | 01A8 | C6 | E8 | 46 | 59 |
| 11 26 | 06 26 | 0425 | 01A9 | C6 | E9 | 46 | 5A |
| 11 27 | 06 27 | 0426 | 01AA | C6 | 6A | 46 | 5C |
| 11 28 | 06 28 | 0427 | 01AB | C6 | 6B | 46 | 2C |
| 11 29 | 06 29 | 0428 | 01AC | C6 | 6C | 46 | 25 |
| 11 30 | 06 30 | 0429 | 01AD | C6 | 6D | 46 | 5F |
| 11 31 | 06 31 | 0430 | 01AE | C6 | 6E | 46 | 3E |
| 11 32 | 06 32 | 0431 | 01AF | C6 | 6F | 46 | 3F |
| 11 33 | 06 33 | 0432 | 01B0 | C6 | F0 | 46 | 30 |
| 11 34 | 06 34 | 0433 | 01B1 | C6 | F1 | 46 | 31 |
| 11 35 | 06 35 | 0434 | 01B2 | C6 | F2 | 46 | 32 |
| 11 36 | 06 36 | 0435 | 01B3 | C6 | F3 | 46 | 33 |
| 11 37 | 06 37 | 0436 | 01B4 | C6 | F4 | 46 | 34 |
| 11 38 | 06 38 | 0437 | 01B5 | C6 | F5 | 46 | 35 |
| 11 39 | 06 39 | 0438 | 01B6 | C6 | F6 | 46 | 36 |
| 11 40 | 06 40 | 0439 | 01B7 | C6 | F7 | 46 | 37 |
| 12 01 | 06 41 | 0440 | 01B8 | C6 | F8 | 46 | 38 |
| 12 02 | 06 42 | 0441 | 01B9 | C6 | F9 | 46 | 39 |
| 12 03 | 06 43 | 0442 | 01BA | C6 | 7A | 46 | 3A |
| 12 04 | 06 44 | 0443 | 01BB | C6 | 7B | 46 | 23 |
| 12 05 | 06 45 | 0444 | 01BC | C6 | 7C | 46 | 40 |
| 12 06 | 06 46 | 0445 | 01BD | C6 | 7D | 46 | 27 |
| 12 07 | 06 47 | 0446 | 01BE | C6 | 7E | 46 | 3D |
| 12 08 | 06 48 | 0447 | 01BF | C6 | 7F | 46 | 22 |
| 12 09 | 06 49 | 0448 | 01C0 | C7 | 40 | 47 | 20 |
| 12 10 | 06 50 | 0449 | 01C1 | C7 | C1 | 47 | 41 |
| 12 11 | 06 51 | 0450 | 01C2 | C7 | C2 | 47 | 42 |
| 12 12 | 06 52 | 0451 | 01C3 | C7 | C3 | 47 | 43 |
| 12 13 | 06 53 | 0452 | 01C4 | C7 | C4 | 47 | 44 |
| 12 14 | 06 54 | 0453 | 01C5 | C7 | C5 | 47 | 45 |
| 12 15 | 06 55 | 0454 | 01C6 | C7 | C6 | 47 | 46 |
| 12 16 | 06 56 | 0455 | 01C7 | C7 | C7 | 47 | 47 |
| 12 17 | 06 57 | 0456 | 01C8 | C7 | C8 | 47 | 48 |
| 12 18 | 06 58 | 0457 | 01C9 | C7 | C9 | 47 | 49 |
| 12 19 | 06 59 | 0458 | 01CA | C7 | 4A | 47 | 5B |
| 12 20 | 06 60 | 0459 | 01CB | C7 | 4B | 47 | 2E |
| 12 21 | 06 61 | 0460 | 01CC | C7 | 4C | 47 | 3C |
| 12 22 | 06 62 | 0461 | 01CD | C7 | 4D | 47 | 28 |
| 12 23 | 06 63 | 0462 | 01CE | C7 | 4E | 47 | 2B |
| 12 24 | 06 64 | 0463 | 01CF | C7 | 4F | 47 | 21 |
| 12 25 | 06 65 | 0464 | 01D0 | C7 | 50 | 47 | 26 |
| 12 26 | 06 66 | 0465 | 01D1 | C7 | D1 | 47 | 4A |
| 12 27 | 06 67 | 0466 | 01D2 | C7 | D2 | 47 | 4B |
| 12 28 | 06 68 | 0467 | 01D3 | C7 | D3 | 47 | 4C |
| 12 29 | 06 69 | 0468 | 01D4 | C7 | D4 | 47 | 4D |
| 12 30 | 06 70 | 0469 | 01D5 | C7 | D5 | 47 | 4E |
| 12 31 | 06 71 | 0470 | 01D6 | C7 | D6 | 47 | 4F |
| 12 32 | 06 72 | 0471 | 01D7 | C7 | D7 | 47 | 50 |
| 12 33 | 06 73 | 0472 | 01D8 | C7 | D8 | 47 | 51 |
| 12 34 | 06 74 | 0473 | 01D9 | C7 | D9 | 47 | 52 |
| 12 35 | 06 75 | 0474 | 01DA | C7 | 5A | 47 | 5D |
| 12 36 | 06 76 | 0475 | 01DB | C7 | 5B | 47 | 24 |
| 12 37 | 06 77 | 0476 | 01DC | C7 | 5C | 47 | 2A |
| 12 38 | 06 78 | 0477 | 01DD | C7 | 5D | 47 | 29 |
| 12 39 | 06 79 | 0478 | 01DE | C7 | 5E | 47 | 3B |
| 12 40 | 06 80 | 0479 | 01DF | C7 | 5F | 47 | 5E |
| | 07 01 | 0480 | 01E0 | C7 | 60 | 47 | 2D |
| | 07 02 | 0481 | 01E1 | C7 | 61 | 47 | 2F |
| | 07 03 | 0482 | 01E2 | C7 | E2 | 47 | 53 |
| | 07 04 | 0483 | 01E3 | C7 | E3 | 47 | 54 |
| | 07 05 | 0484 | 01E4 | C7 | E4 | 47 | 55 |
| | 07 06 | 0485 | 01E5 | C7 | E5 | 47 | 56 |
| | 07 07 | 0486 | 01E6 | C7 | E6 | 47 | 57 |
| | 07 08 | 0487 | 01E7 | C7 | E7 | 47 | 58 |
| | 07 09 | 0488 | 01E8 | C7 | E8 | 47 | 59 |
| | 07 10 | 0489 | 01E9 | C7 | E9 | 47 | 5A |
| | 07 11 | 0490 | 01EA | C7 | 6A | 47 | 5C |
| | 07 12 | 0491 | 01EB | C7 | 6B | 47 | 2C |
| | 07 13 | 0492 | 01EC | C7 | 6C | 47 | 25 |
| | 07 14 | 0493 | 01ED | C7 | 6D | 47 | 5F |
| | 07 15 | 0494 | 01EE | C7 | 6E | 47 | 3E |
| | 07 16 | 0495 | 01EF | C7 | 6F | 47 | 3F |

| Mod 1 R C | Mod 2 R C | Position Dec | Hex | Buffer Address (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 | 5C |
| | 07 76 | 0555 | 022B | C8 | 6B | 48 | 2C |
| | 07 77 | 0556 | 022C | C8 | 6C | 48 | 25 |
| | 07 78 | 0557 | 022D | C8 | 6D | 48 | 5F |
| | 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 | 5C |
| | 08 60 | 0619 | 026B | C9 | 6B | 49 | 2C |

| Mod 1 R C | Mod 2 R C | Position Dec | Position Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|
| | 08 61 | 0620 | 026C | C9 | 6C | 49 | 25 |
| | 08 62 | 0621 | 026D | C9 | 6D | 49 | 5F |
| | 08 63 | 0622 | 026E | C9 | 6E | 49 | 3E |
| | 08 64 | 0623 | 026F | C9 | 6F | 49 | 3F |
| | 08 65 | 0624 | 0270 | C9 | F0 | 49 | 30 |
| | 08 66 | 0625 | 0271 | C9 | F1 | 49 | 31 |
| | 08 67 | 0626 | 0272 | C9 | F2 | 49 | 32 |
| | 08 68 | 0627 | 0273 | C9 | F3 | 49 | 33 |
| | 08 69 | 0628 | 0274 | C9 | F4 | 49 | 34 |
| | 08 70 | 0629 | 0275 | C9 | F5 | 49 | 35 |
| | 08 71 | 0630 | 0276 | C9 | F6 | 49 | 36 |
| | 08 72 | 0631 | 0277 | C9 | F7 | 49 | 37 |
| | 08 73 | 0632 | 0278 | C9 | F8 | 49 | 38 |
| | 08 74 | 0633 | 0279 | C9 | F9 | 49 | 39 |
| | 08 75 | 0634 | 027A | C9 | 7A | 49 | 3A |
| | 08 76 | 0635 | 027B | C9 | 7B | 49 | 23 |
| | 08 77 | 0636 | 027C | C9 | 7C | 49 | 40 |
| | 08 78 | 0637 | 027D | C9 | 7D | 49 | 27 |
| | 08 79 | 0638 | 027E | C9 | 7E | 49 | 3D |
| | 08 80 | 0639 | 027F | C9 | 7F | 49 | 22 |
| | 09 01 | 0640 | 0280 | 4A | 40 | 5B | 20 |
| | 09 02 | 0641 | 0281 | 4A | C1 | 5B | 41 |
| | 09 03 | 0642 | 0282 | 4A | C2 | 5B | 42 |
| | 09 04 | 0643 | 0283 | 4A | C3 | 5B | 43 |
| | 09 05 | 0644 | 0284 | 4A | C4 | 5B | 44 |
| | 09 06 | 0645 | 0285 | 4A | C5 | 5B | 45 |
| | 09 07 | 0646 | 0286 | 4A | C6 | 5B | 46 |
| | 09 08 | 0647 | 0287 | 4A | C7 | 5B | 47 |
| | 09 09 | 0648 | 0288 | 4A | C8 | 5B | 48 |
| | 09 10 | 0649 | 0289 | 4A | C9 | 5B | 49 |
| | 09 11 | 0650 | 028A | 4A | 4A | 5B | 5B |
| | 09 12 | 0651 | 028B | 4A | 4B | 5B | 2E |
| | 09 13 | 0652 | 028C | 4A | 4C | 5B | 3C |
| | 09 14 | 0653 | 028D | 4A | 4D | 5B | 28 |
| | 09 15 | 0654 | 028E | 4A | 4E | 5B | 2B |
| | 09 16 | 0655 | 028F | 4A | 4F | 5B | 21 |
| | 09 17 | 0656 | 0290 | 4A | 50 | 5B | 26 |
| | 09 18 | 0657 | 0291 | 4A | D1 | 5B | 4A |
| | 09 19 | 0658 | 0292 | 4A | D2 | 5B | 4B |
| | 09 20 | 0659 | 0293 | 4A | D3 | 5B | 4C |
| | 09 21 | 0660 | 0294 | 4A | D4 | 5B | 4D |
| | 09 22 | 0661 | 0295 | 4A | D5 | 5B | 4E |
| | 09 23 | 0662 | 0296 | 4A | D6 | 5B | 4F |
| | 09 24 | 0663 | 0297 | 4A | D7 | 5B | 50 |
| | 09 25 | 0664 | 0298 | 4A | D8 | 5B | 51 |
| | 09 26 | 0665 | 0299 | 4A | D9 | 5B | 52 |
| | 09 27 | 0666 | 029A | 4A | 5A | 5B | 5D |
| | 09 28 | 0667 | 029B | 4A | 5B | 5B | 24 |
| | 09 29 | 0668 | 029C | 4A | 5C | 5B | 2A |
| | 09 30 | 0669 | 029D | 4A | 5D | 5B | 29 |
| | 09 31 | 0670 | 029E | 4A | 5E | 5B | 3B |
| | 09 32 | 0671 | 029F | 4A | 5F | 5B | 5E |
| | 09 33 | 0672 | 02A0 | 4A | 60 | 5B | 2D |
| | 09 34 | 0673 | 02A1 | 4A | 61 | 5B | 2F |
| | 09 35 | 0674 | 02A2 | 4A | E2 | 5B | 53 |
| | 09 36 | 0675 | 02A3 | 4A | E3 | 5B | 54 |
| | 09 37 | 0676 | 02A4 | 4A | E4 | 5B | 55 |
| | 09 38 | 0677 | 02A5 | 4A | E5 | 5B | 56 |
| | 09 39 | 0678 | 02A6 | 4A | E6 | 5B | 57 |
| | 09 40 | 0679 | 02A7 | 4A | E7 | 5B | 58 |
| | 09 41 | 0680 | 02A8 | 4A | E8 | 5B | 59 |
| | 09 42 | 0681 | 02A9 | 4A | E9 | 5B | 5A |
| | 09 43 | 0682 | 02AA | 4A | 6A | 5B | 5C |
| | 09 44 | 0683 | 02AB | 4A | 6B | 5B | 2C |
| | 09 45 | 0684 | 02AC | 4A | 6C | 5B | 25 |
| | 09 46 | 0685 | 02AD | 4A | 6D | 5B | 5F |
| | 09 47 | 0686 | 02AE | 4A | 6E | 5B | 3E |
| | 09 48 | 0687 | 02AF | 4A | 6F | 5B | 3F |
| | 09 49 | 0688 | 02B0 | 4A | F0 | 5B | 30 |
| | 09 50 | 0689 | 02B1 | 4A | F1 | 5B | 31 |
| | 09 51 | 0690 | 02B2 | 4A | F2 | 5B | 32 |
| | 09 52 | 0691 | 02B3 | 4A | F3 | 5B | 33 |
| | 09 53 | 0692 | 02B4 | 4A | F4 | 5B | 34 |
| | 09 54 | 0693 | 02B5 | 4A | F5 | 5B | 35 |
| | 09 55 | 0694 | 02B6 | 4A | F6 | 5B | 36 |
| | 09 56 | 0695 | 02B7 | 4A | F7 | 5B | 37 |
| | 09 57 | 0696 | 02B8 | 4A | F8 | 5B | 38 |
| | 09 58 | 0697 | 02B9 | 4A | F9 | 5B | 39 |
| | 09 59 | 0698 | 02BA | 4A | 7A | 5B | 3A |
| | 09 60 | 0699 | 02BB | 4A | 7B | 5B | 23 |
| | 09 61 | 0700 | 02BC | 4A | 7C | 5B | 40 |
| | 09 62 | 0701 | 02BD | 4A | 7D | 5B | 27 |
| | 09 63 | 0702 | 02BE | 4A | 7E | 5B | 3D |
| | 09 64 | 0703 | 02BF | 4A | 7F | 5B | 22 |
| | 09 65 | 0704 | 02C0 | 4B | 40 | 2E | 20 |
| | 09 66 | 0705 | 02C1 | 4B | C1 | 2E | 41 |
| | 09 67 | 0706 | 02C2 | 4B | C2 | 2E | 42 |
| | 09 68 | 0707 | 02C3 | 4B | C3 | 2E | 43 |
| | 09 69 | 0708 | 02C4 | 4B | C4 | 2E | 44 |
| | 09 70 | 0709 | 02C5 | 4B | C5 | 2E | 45 |
| | 09 71 | 0710 | 02C6 | 4B | C6 | 2E | 46 |
| | 09 72 | 0711 | 02C7 | 4B | C7 | 2E | 47 |
| | 09 73 | 0712 | 02C8 | 4B | C8 | 2E | 48 |
| | 09 74 | 0713 | 02C9 | 4B | C9 | 2E | 49 |
| | 09 75 | 0714 | 02CA | 4B | 4A | 2E | 5B |
| | 09 76 | 0715 | 02CB | 4B | 4B | 2E | 2E |
| | 09 77 | 0716 | 02CC | 4B | 4C | 2E | 3C |
| | 09 78 | 0717 | 02CD | 4B | 4D | 2E | 28 |
| | 09 79 | 0718 | 02CE | 4B | 4E | 2E | 2B |
| | 09 80 | 0719 | 02CF | 4B | 4F | 2E | 21 |
| | 10 01 | 0720 | 02D0 | 4B | 50 | 2E | 26 |
| | 10 02 | 0721 | 02D1 | 4B | D1 | 2E | 4A |
| | 10 03 | 0722 | 02D2 | 4B | D2 | 2E | 4B |
| | 10 04 | 0723 | 02D3 | 4B | D3 | 2E | 4C |
| | 10 05 | 0724 | 02D4 | 4B | D4 | 2E | 4D |
| | 10 06 | 0725 | 02D5 | 4B | D5 | 2E | 4E |
| | 10 07 | 0726 | 02D6 | 4B | D6 | 2E | 4F |
| | 10 08 | 0727 | 02D7 | 4B | D7 | 2E | 50 |
| | 10 09 | 0728 | 02D8 | 4B | D8 | 2E | 51 |
| | 10 10 | 0729 | 02D9 | 4B | D9 | 2E | 52 |
| | 10 11 | 0730 | 02DA | 4B | 5A | 2E | 5D |
| | 10 12 | 0731 | 02DB | 4B | 5B | 2E | 24 |
| | 10 13 | 0732 | 02DC | 4B | 5C | 2E | 2A |
| | 10 14 | 0733 | 02DD | 4B | 5D | 2E | 29 |
| | 10 15 | 0734 | 02DE | 4B | 5E | 2E | 3B |
| | 10 16 | 0735 | 02DF | 4B | 5F | 2E | 5E |
| | 10 17 | 0736 | 02E0 | 4B | 60 | 2E | 2D |
| | 10 18 | 0737 | 02E1 | 4B | 61 | 2E | 2F |
| | 10 19 | 0738 | 02E2 | 4B | E2 | 2E | 53 |
| | 10 20 | 0739 | 02E3 | 4B | E3 | 2E | 54 |
| | 10 21 | 0740 | 02E4 | 4B | E4 | 2E | 55 |
| | 10 22 | 0741 | 02E5 | 4B | E5 | 2E | 56 |
| | 10 23 | 0742 | 02E6 | 4B | E6 | 2E | 57 |
| | 10 24 | 0743 | 02E7 | 4B | E7 | 2E | 58 |

| Mod 1 R C | Mod 2 R C | Position Dec | Position Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|
| | 10 25 | 0744 | 02E8 | 4B | E8 | 2E | 59 |
| | 10 26 | 0745 | 02E9 | 4B | E9 | 2E | 5A |
| | 10 27 | 0746 | 02EA | 4B | 6A | 2E | 5C |
| | 10 28 | 0747 | 02EB | 4B | 6B | 2E | 2C |
| | 10 29 | 0748 | 02EC | 4B | 6C | 2E | 25 |
| | 10 30 | 0749 | 02ED | 4B | 6D | 2E | 5F |
| | 10 31 | 0750 | 02EE | 4B | 6E | 2E | 3E |
| | 10 32 | 0751 | 02EF | 4B | 6F | 2E | 3F |
| | 10 33 | 0752 | 02F0 | 4B | F0 | 2E | 30 |
| | 10 34 | 0753 | 02F1 | 4B | F1 | 2E | 31 |
| | 10 35 | 0754 | 02F2 | 4B | F2 | 2E | 32 |
| | 10 36 | 0755 | 02F3 | 4B | F3 | 2E | 33 |
| | 10 37 | 0756 | 02F4 | 4B | F4 | 2E | 34 |
| | 10 38 | 0757 | 02F5 | 4B | F5 | 2E | 35 |
| | 10 39 | 0758 | 02F6 | 4B | F6 | 2E | 36 |
| | 10 40 | 0759 | 02F7 | 4B | F7 | 2E | 37 |
| | 10 41 | 0760 | 02F8 | 4B | F8 | 2E | 38 |
| | 10 42 | 0761 | 02F9 | 4B | F9 | 2E | 39 |
| | 10 43 | 0762 | 02FA | 4B | 7A | 2E | 3A |
| | 10 44 | 0763 | 02FB | 4B | 7B | 2E | 23 |
| | 10 45 | 0764 | 02FC | 4B | 7C | 2E | 40 |
| | 10 46 | 0765 | 02FD | 4B | 7D | 2E | 27 |
| | 10 47 | 0766 | 02FE | 4B | 7E | 2E | 3D |
| | 10 48 | 0767 | 02FF | 4B | 7F | 2E | 22 |
| | 10 49 | 0768 | 0300 | 4C | 40 | 3C | 20 |
| | 10 50 | 0769 | 0301 | 4C | C1 | 3C | 41 |
| | 10 51 | 0770 | 0302 | 4C | C2 | 3C | 42 |
| | 10 52 | 0771 | 0303 | 4C | C3 | 3C | 43 |
| | 10 53 | 0772 | 0304 | 4C | C4 | 3C | 44 |
| | 10 54 | 0773 | 0305 | 4C | C5 | 3C | 45 |
| | 10 55 | 0774 | 0306 | 4C | C6 | 3C | 46 |
| | 10 56 | 0775 | 0307 | 4C | C7 | 3C | 47 |
| | 10 57 | 0776 | 0308 | 4C | C8 | 3C | 48 |
| | 10 58 | 0777 | 0309 | 4C | C9 | 3C | 49 |
| | 10 59 | 0778 | 030A | 4C | 4A | 3C | 5B |
| | 10 60 | 0779 | 030B | 4C | 4B | 3C | 2E |
| | 10 61 | 0780 | 030C | 4C | 4C | 3C | 3C |
| | 10 62 | 0781 | 030D | 4C | 4D | 3C | 28 |
| | 10 63 | 0782 | 030E | 4C | 4E | 3C | 2B |
| | 10 64 | 0783 | 030F | 4C | 4F | 3C | 21 |
| | 10 65 | 0784 | 0310 | 4C | 50 | 3C | 26 |
| | 10 66 | 0785 | 0311 | 4C | D1 | 3C | 4A |
| | 10 67 | 0786 | 0312 | 4C | D2 | 3C | 4B |
| | 10 68 | 0787 | 0313 | 4C | D3 | 3C | 4C |
| | 10 69 | 0788 | 0314 | 4C | D4 | 3C | 4D |
| | 10 70 | 0789 | 0315 | 4C | D5 | 3C | 4E |
| | 10 71 | 0790 | 0316 | 4C | D6 | 3C | 4F |
| | 10 72 | 0791 | 0317 | 4C | D7 | 3C | 50 |
| | 10 73 | 0792 | 0318 | 4C | D8 | 3C | 51 |
| | 10 74 | 0793 | 0319 | 4C | D9 | 3C | 52 |
| | 10 75 | 0794 | 031A | 4C | 5A | 3C | 5D |
| | 10 76 | 0795 | 031B | 4C | 5B | 3C | 24 |
| | 10 77 | 0796 | 031C | 4C | 5C | 3C | 2A |
| | 10 78 | 0797 | 031D | 4C | 5D | 3C | 29 |
| | 10 79 | 0798 | 031E | 4C | 5E | 3C | 3B |
| | 10 80 | 0799 | 031F | 4C | 5F | 3C | 5E |
| | 11 01 | 0800 | 0320 | 4C | 60 | 3C | 2D |
| | 11 02 | 0801 | 0321 | 4C | 61 | 3C | 2F |
| | 11 03 | 0802 | 0322 | 4C | E2 | 3C | 53 |
| | 11 04 | 0803 | 0323 | 4C | E3 | 3C | 54 |
| | 11 05 | 0804 | 0324 | 4C | E4 | 3C | 55 |
| | 11 06 | 0805 | 0325 | 4C | E5 | 3C | 56 |
| | 11 07 | 0806 | 0326 | 4C | E6 | 3C | 57 |
| | 11 08 | 0807 | 0327 | 4C | E7 | 3C | 58 |
| | 11 09 | 0808 | 0328 | 4C | E8 | 3C | 59 |
| | 11 10 | 0809 | 0329 | 4C | E9 | 3C | 5A |
| | 11 11 | 0810 | 032A | 4C | 6A | 3C | 5C |
| | 11 12 | 0811 | 032B | 4C | 6B | 3C | 2C |
| | 11 13 | 0812 | 032C | 4C | 6C | 3C | 25 |
| | 11 14 | 0813 | 032D | 4C | 6D | 3C | 5F |
| | 11 15 | 0814 | 032E | 4C | 6E | 3C | 3E |
| | 11 16 | 0815 | 032F | 4C | 6F | 3C | 3F |
| | 11 17 | 0816 | 0330 | 4C | F0 | 3C | 30 |
| | 11 18 | 0817 | 0331 | 4C | F1 | 3C | 31 |
| | 11 19 | 0818 | 0332 | 4C | F2 | 3C | 32 |
| | 11 20 | 0819 | 0333 | 4C | F3 | 3C | 33 |
| | 11 21 | 0820 | 0334 | 4C | F4 | 3C | 34 |
| | 11 22 | 0821 | 0335 | 4C | F5 | 3C | 35 |
| | 11 23 | 0822 | 0336 | 4C | F6 | 3C | 36 |
| | 11 24 | 0823 | 0337 | 4C | F7 | 3C | 37 |
| | 11 25 | 0824 | 0338 | 4C | F8 | 3C | 38 |
| | 11 26 | 0825 | 0339 | 4C | F9 | 3C | 39 |
| | 11 27 | 0826 | 033A | 4C | 7A | 3C | 3A |
| | 11 28 | 0827 | 033B | 4C | 7B | 3C | 23 |
| | 11 29 | 0828 | 033C | 4C | 7C | 3C | 40 |
| | 11 30 | 0829 | 033D | 4C | 7D | 3C | 27 |
| | 11 31 | 0830 | 033E | 4C | 7E | 3C | 3D |
| | 11 32 | 0831 | 033F | 4C | 7F | 3C | 22 |
| | 11 33 | 0832 | 0340 | 4D | 40 | 28 | 20 |
| | 11 34 | 0833 | 0341 | 4D | C1 | 28 | 41 |
| | 11 35 | 0834 | 0342 | 4D | C2 | 28 | 42 |
| | 11 36 | 0835 | 0343 | 4D | C3 | 28 | 43 |
| | 11 37 | 0836 | 0344 | 4D | C4 | 28 | 44 |
| | 11 38 | 0837 | 0345 | 4D | C5 | 28 | 45 |
| | 11 39 | 0838 | 0346 | 4D | C6 | 28 | 46 |
| | 11 40 | 0839 | 0347 | 4D | C7 | 28 | 47 |
| | 11 41 | 0840 | 0348 | 4D | C8 | 28 | 48 |
| | 11 42 | 0841 | 0349 | 4D | C9 | 28 | 49 |
| | 11 43 | 0842 | 034A | 4D | 4A | 28 | 5B |
| | 11 44 | 0843 | 034B | 4D | 4B | 28 | 2E |
| | 11 45 | 0844 | 034C | 4D | 4C | 28 | 3C |
| | 11 46 | 0845 | 034D | 4D | 4D | 28 | 28 |
| | 11 47 | 0846 | 034E | 4D | 4E | 28 | 2B |
| | 11 48 | 0847 | 034F | 4D | 4F | 28 | 21 |
| | 11 49 | 0848 | 0350 | 4D | 50 | 28 | 26 |
| | 11 50 | 0849 | 0351 | 4D | D1 | 28 | 4A |
| | 11 51 | 0850 | 0352 | 4D | D2 | 28 | 4B |
| | 11 52 | 0851 | 0353 | 4D | D3 | 28 | 4C |
| | 11 53 | 0852 | 0354 | 4D | D4 | 28 | 4D |
| | 11 54 | 0853 | 0355 | 4D | D5 | 28 | 4E |
| | 11 55 | 0854 | 0356 | 4D | D6 | 28 | 4F |
| | 11 56 | 0855 | 0357 | 4D | D7 | 28 | 50 |
| | 11 57 | 0856 | 0358 | 4D | D8 | 28 | 51 |
| | 11 58 | 0857 | 0359 | 4D | D9 | 28 | 52 |
| | 11 59 | 0858 | 035A | 4D | 5A | 28 | 5D |
| | 11 60 | 0859 | 035B | 4D | 5B | 28 | 24 |
| | 11 61 | 0860 | 035C | 4D | 5C | 28 | 2A |
| | 11 62 | 0861 | 035D | 4D | 5D | 28 | 29 |
| | 11 63 | 0862 | 035E | 4D | 5E | 28 | 3B |
| | 11 64 | 0863 | 035F | 4D | 5F | 28 | 5E |
| | 11 65 | 0864 | 0360 | 4D | 60 | 28 | 2D |
| | 11 66 | 0865 | 0361 | 4D | 61 | 28 | 2F |
| | 11 67 | 0866 | 0362 | 4D | E2 | 28 | 53 |
| | 11 68 | 0867 | 0363 | 4D | E3 | 28 | 54 |

| Mod 1 R C | Mod 2 R C | Position Dec | Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|
| | 11 69 | 0868 | 0364 | 4D | E4 | 28 | 55 |
| | 11 70 | 0869 | 0365 | 4D | E5 | 28 | 56 |
| | 11 71 | 0870 | 0366 | 4D | E6 | 28 | 57 |
| | 11 72 | 0871 | 0367 | 4D | E7 | 28 | 58 |
| | 11 73 | 0872 | 0368 | 4D | E8 | 28 | 59 |
| | 11 74 | 0873 | 0369 | 4D | E9 | 28 | 5A |
| | 11 75 | 0874 | 036A | 4D | 6A | 28 | 5C |
| | 11 76 | 0875 | 036B | 4D | 6B | 28 | 2C |
| | 11 77 | 0876 | 036C | 4D | 6C | 28 | 25 |
| | 11 78 | 0877 | 036D | 4D | 6D | 28 | 5F |
| | 11 79 | 0878 | 036E | 4D | 6E | 28 | 3E |
| | 11 80 | 0879 | 036F | 4D | 6F | 28 | 3F |
| | 12 01 | 0880 | 0370 | 4D | F0 | 28 | 30 |
| | 12 02 | 0881 | 0371 | 4D | F1 | 28 | 31 |
| | 12 03 | 0882 | 0372 | 4D | F2 | 28 | 32 |
| | 12 04 | 0883 | 0373 | 4D | F3 | 28 | 33 |
| | 12 05 | 0884 | 0374 | 4D | F4 | 28 | 34 |
| | 12 06 | 0885 | 0375 | 4D | F5 | 28 | 35 |
| | 12 07 | 0886 | 0376 | 4D | F6 | 28 | 36 |
| | 12 08 | 0887 | 0377 | 4D | F7 | 28 | 37 |
| | 12 09 | 0888 | 0378 | 4D | F8 | 28 | 38 |
| | 12 10 | 0889 | 0379 | 4D | F9 | 28 | 39 |
| | 12 11 | 0890 | 037A | 4D | 7A | 28 | 3A |
| | 12 12 | 0891 | 037B | 4D | 7B | 28 | 23 |
| | 12 13 | 0892 | 037C | 4D | 7C | 28 | 40 |
| | 12 14 | 0893 | 037D | 4D | 7D | 28 | 27 |
| | 12 15 | 0894 | 037E | 4D | 7E | 28 | 3D |
| | 12 16 | 0895 | 037F | 4D | 7F | 28 | 22 |
| | 12 17 | 0896 | 0380 | 4E | 40 | 2B | 20 |
| | 12 18 | 0897 | 0381 | 4E | C1 | 2B | 41 |
| | 12 19 | 0898 | 0382 | 4E | C2 | 2B | 42 |
| | 12 20 | 0899 | 0383 | 4E | C3 | 2B | 43 |
| | 12 21 | 0900 | 0384 | 4E | C4 | 2B | 44 |
| | 12 22 | 0901 | 0385 | 4E | C5 | 2B | 45 |
| | 12 23 | 0902 | 0386 | 4E | C6 | 2B | 46 |
| | 12 24 | 0903 | 0387 | 4E | C7 | 2B | 47 |
| | 12 25 | 0904 | 0388 | 4E | C8 | 2B | 48 |
| | 12 26 | 0905 | 0389 | 4E | C9 | 2B | 49 |
| | 12 27 | 0906 | 038A | 4E | 4A | 2B | 5B |
| | 12 28 | 0907 | 038B | 4E | 4B | 2B | 2E |
| | 12 29 | 0908 | 038C | 4E | 4C | 2B | 3C |
| | 12 30 | 0909 | 038D | 4E | 4D | 2B | 28 |
| | 12 31 | 0910 | 038E | 4E | 4E | 2B | 2B |
| | 12 32 | 0911 | 038F | 4E | 4F | 2B | 21 |
| | 12 33 | 0912 | 0390 | 4E | 50 | 2B | 26 |
| | 12 34 | 0913 | 0391 | 4E | D1 | 2B | 4A |
| | 12 35 | 0914 | 0392 | 4E | D2 | 2B | 4B |
| | 12 36 | 0915 | 0393 | 4E | D3 | 2B | 4C |
| | 12 37 | 0916 | 0394 | 4E | D4 | 2B | 4D |
| | 12 38 | 0917 | 0395 | 4E | D5 | 2B | 4E |
| | 12 39 | 0918 | 0396 | 4E | D6 | 2B | 4F |
| | 12 40 | 0919 | 0397 | 4E | D7 | 2B | 50 |
| | 12 41 | 0920 | 0398 | 4E | D8 | 2B | 51 |
| | 12 42 | 0921 | 0399 | 4E | D9 | 2B | 52 |
| | 12 43 | 0922 | 039A | 4E | 5A | 2B | 5D |
| | 12 44 | 0923 | 039B | 4E | 5B | 2B | 24 |
| | 12 45 | 0924 | 039C | 4E | 5C | 2B | 2A |
| | 12 46 | 0925 | 039D | 4E | 5D | 2B | 29 |
| | 12 47 | 0926 | 039E | 4E | 5E | 2B | 3B |
| | 12 48 | 0927 | 039F | 4E | 5F | 2B | 5E |
| | 12 49 | 0928 | 03A0 | 4E | 60 | 2B | 2D |
| | 12 50 | 0929 | 03A1 | 4E | 61 | 2B | 2F |
| | 12 51 | 0930 | 03A2 | 4E | E2 | 2B | 53 |
| | 12 52 | 0931 | 03A3 | 4E | E3 | 2B | 54 |
| | 12 53 | 0932 | 03A4 | 4E | E4 | 2B | 55 |
| | 12 54 | 0933 | 03A5 | 4E | E5 | 2B | 56 |
| | 12 55 | 0934 | 03A6 | 4E | E6 | 2B | 57 |
| | 12 56 | 0935 | 03A7 | 4E | E7 | 2B | 58 |
| | 12 57 | 0936 | 03A8 | 4E | E8 | 2B | 59 |
| | 12 58 | 0937 | 03A9 | 4E | E9 | 2B | 5A |
| | 12 59 | 0938 | 03AA | 4E | 6A | 2B | 5C |
| | 12 60 | 0939 | 03AB | 4E | 6B | 2B | 2C |
| | 12 61 | 0940 | 03AC | 4E | 6C | 2B | 25 |
| | 12 62 | 0941 | 03AD | 4E | 6D | 2B | 5F |
| | 12 63 | 0942 | 03AE | 4E | 6E | 2B | 3E |
| | 12 64 | 0943 | 03AF | 4E | 6F | 2B | 3F |
| | 12 65 | 0944 | 03B0 | 4E | F0 | 2B | 30 |
| | 12 66 | 0945 | 03B1 | 4E | F1 | 2B | 31 |
| | 12 67 | 0946 | 03B2 | 4E | F2 | 2B | 32 |
| | 12 68 | 0947 | 03B3 | 4E | F3 | 2B | 33 |
| | 12 69 | 0948 | 03B4 | 4E | F4 | 2B | 34 |
| | 12 70 | 0949 | 03B5 | 4E | F5 | 2B | 35 |
| | 12 71 | 0950 | 03B6 | 4E | F6 | 2B | 36 |
| | 12 72 | 0951 | 03B7 | 4E | F7 | 2B | 37 |
| | 12 73 | 0952 | 03B8 | 4E | F8 | 2B | 38 |
| | 12 74 | 0953 | 03B9 | 4E | F9 | 2B | 39 |
| | 12 75 | 0954 | 03BA | 4E | 7A | 2B | 3A |
| | 12 76 | 0955 | 03BB | 4E | 7B | 2B | 23 |
| | 12 77 | 0956 | 03BC | 4E | 7C | 2B | 40 |
| | 12 78 | 0957 | 03BD | 4E | 7D | 2B | 27 |
| | 12 79 | 0958 | 03BE | 4E | 7E | 2B | 3D |
| | 12 80 | 0959 | 03BF | 4E | 7F | 2B | 22 |
| | 13 01 | 0960 | 03C0 | 4F | 40 | 21 | 20 |
| | 13 02 | 0961 | 03C1 | 4F | C1 | 21 | 41 |
| | 13 03 | 0962 | 03C2 | 4F | C2 | 21 | 42 |
| | 13 04 | 0963 | 03C3 | 4F | C3 | 21 | 43 |
| | 13 05 | 0964 | 03C4 | 4F | C4 | 21 | 44 |
| | 13 06 | 0965 | 03C5 | 4F | C5 | 21 | 45 |
| | 13 07 | 0966 | 03C6 | 4F | C6 | 21 | 46 |
| | 13 08 | 0967 | 03C7 | 4F | C7 | 21 | 47 |
| | 13 09 | 0968 | 03C8 | 4F | C8 | 21 | 48 |
| | 13 10 | 0969 | 03C9 | 4F | C9 | 21 | 49 |
| | 13 11 | 0970 | 03CA | 4F | 4A | 21 | 5B |
| | 13 12 | 0971 | 03CB | 4F | 4B | 21 | 2E |
| | 13 13 | 0972 | 03CC | 4F | 4C | 21 | 3C |
| | 13 14 | 0973 | 03CD | 4F | 4D | 21 | 28 |
| | 13 15 | 0974 | 03CE | 4F | 4E | 21 | 2B |
| | 13 16 | 0975 | 03CF | 4F | 4F | 21 | 21 |
| | 13 17 | 0976 | 03D0 | 4F | 50 | 21 | 26 |
| | 13 18 | 0977 | 03D1 | 4F | D1 | 21 | 4A |
| | 13 19 | 0978 | 03D2 | 4F | D2 | 21 | 4B |
| | 13 20 | 0979 | 03D3 | 4F | D3 | 21 | 4C |
| | 13 21 | 0980 | 03D4 | 4F | D4 | 21 | 4D |
| | 13 22 | 0981 | 03D5 | 4F | D5 | 21 | 4E |
| | 13 23 | 0982 | 03D6 | 4F | D6 | 21 | 4F |
| | 13 24 | 0983 | 03D7 | 4F | D7 | 21 | 50 |
| | 13 25 | 0984 | 03D8 | 4F | D8 | 21 | 51 |
| | 13 26 | 0985 | 03D9 | 4F | D9 | 21 | 52 |
| | 13 27 | 0986 | 03DA | 4F | 5A | 21 | 5D |
| | 13 28 | 0987 | 03DB | 4F | 5B | 21 | 24 |
| | 13 29 | 0988 | 03DC | 4F | 5C | 21 | 2A |
| | 13 30 | 0989 | 03DD | 4F | 5D | 21 | 29 |
| | 13 31 | 0990 | 03DE | 4F | 5E | 21 | 3B |
| | 13 32 | 0991 | 03DF | 4F | 5F | 21 | 5E |

| Mod 1 R C | Mod 2 R C | Position Dec | Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|
| | 13 33 | 0992 | 03E0 | 4F | 60 | 21 | 2D |
| | 13 34 | 0993 | 03E1 | 4F | 61 | 21 | 2F |
| | 13 35 | 0994 | 03E2 | 4F | E2 | 21 | 53 |
| | 13 36 | 0995 | 03E3 | 4F | E3 | 21 | 54 |
| | 13 37 | 0996 | 03E4 | 4F | E4 | 21 | 55 |
| | 13 38 | 0997 | 03E5 | 4F | E5 | 21 | 56 |
| | 13 39 | 0998 | 03E6 | 4F | E6 | 21 | 57 |
| | 13 40 | 0999 | 03E7 | 4F | E7 | 21 | 58 |
| | 13 41 | 1000 | 03E8 | 4F | E8 | 21 | 59 |
| | 13 42 | 1001 | 03E9 | 4F | E9 | 21 | 5A |
| | 13 43 | 1002 | 03EA | 4F | 6A | 21 | 5C |
| | 13 44 | 1003 | 03EB | 4F | 6B | 21 | 2C |
| | 13 45 | 1004 | 03EC | 4F | 6C | 21 | 25 |
| | 13 46 | 1005 | 03ED | 4F | 6D | 21 | 5F |
| | 13 47 | 1006 | 03EE | 4F | 6E | 21 | 3E |
| | 13 48 | 1007 | 03EF | 4F | 6F | 21 | 3F |
| | 13 49 | 1008 | 03F0 | 4F | F0 | 21 | 30 |
| | 13 50 | 1009 | 03F1 | 4F | F1 | 21 | 31 |
| | 13 51 | 1010 | 03F2 | 4F | F2 | 21 | 32 |
| | 13 52 | 1011 | 03F3 | 4F | F3 | 21 | 33 |
| | 13 53 | 1012 | 03F4 | 4F | F4 | 21 | 34 |
| | 13 54 | 1013 | 03F5 | 4F | F5 | 21 | 35 |
| | 13 55 | 1014 | 03F6 | 4F | F6 | 21 | 36 |
| | 13 56 | 1015 | 03F7 | 4F | F7 | 21 | 37 |
| | 13 57 | 1016 | 03F8 | 4F | F8 | 21 | 38 |
| | 13 58 | 1017 | 03F9 | 4F | F9 | 21 | 39 |
| | 13 59 | 1018 | 03FA | 4F | 7A | 21 | 3A |
| | 13 60 | 1019 | 03FB | 4F | 7B | 21 | 23 |
| | 13 61 | 1020 | 03FC | 4F | 7C | 21 | 40 |
| | 13 62 | 1021 | 03FD | 4F | 7D | 21 | 27 |
| | 13 63 | 1022 | 03FE | 4F | 7E | 21 | 3D |
| | 13 64 | 1023 | 03FF | 4F | 7F | 21 | 22 |
| | 13 65 | 1024 | 0400 | 50 | 40 | 26 | 20 |
| | 13 66 | 1025 | 0401 | 50 | C1 | 26 | 41 |
| | 13 67 | 1026 | 0402 | 50 | C2 | 26 | 42 |
| | 13 68 | 1027 | 0403 | 50 | C3 | 26 | 43 |
| | 13 69 | 1028 | 0404 | 50 | C4 | 26 | 44 |
| | 13 70 | 1029 | 0405 | 50 | C5 | 26 | 45 |
| | 13 71 | 1030 | 0406 | 50 | C6 | 26 | 46 |
| | 13 72 | 1031 | 0407 | 50 | C7 | 26 | 47 |
| | 13 73 | 1032 | 0408 | 50 | C8 | 26 | 48 |
| | 13 74 | 1033 | 0409 | 50 | C9 | 26 | 49 |
| | 13 75 | 1034 | 040A | 50 | 4A | 26 | 5B |
| | 13 76 | 1035 | 040B | 50 | 4B | 26 | 2E |
| | 13 77 | 1036 | 040C | 50 | 4C | 26 | 3C |
| | 13 78 | 1037 | 040D | 50 | 4D | 26 | 28 |
| | 13 79 | 1038 | 040E | 50 | 4E | 26 | 2B |
| | 13 80 | 1039 | 040F | 50 | 4F | 26 | 21 |
| | 14 01 | 1040 | 0410 | 50 | 50 | 26 | 26 |
| | 14 02 | 1041 | 0411 | 50 | D1 | 26 | 4A |
| | 14 03 | 1042 | 0412 | 50 | D2 | 26 | 4B |
| | 14 04 | 1043 | 0413 | 50 | D3 | 26 | 4C |
| | 14 05 | 1044 | 0414 | 50 | D4 | 26 | 4D |
| | 14 06 | 1045 | 0415 | 50 | D5 | 26 | 4E |
| | 14 07 | 1046 | 0416 | 50 | D6 | 26 | 4F |
| | 14 08 | 1047 | 0417 | 50 | D7 | 26 | 50 |
| | 14 09 | 1048 | 0418 | 50 | D8 | 26 | 51 |
| | 14 10 | 1049 | 0419 | 50 | D9 | 26 | 52 |
| | 14 11 | 1050 | 041A | 50 | 5A | 26 | 5D |
| | 14 12 | 1051 | 041B | 50 | 5B | 26 | 24 |
| | 14 13 | 1052 | 041C | 50 | 5C | 26 | 2A |
| | 14 14 | 1053 | 041D | 50 | 5D | 26 | 29 |
| | 14 15 | 1054 | 041E | 50 | 5E | 26 | 3B |
| | 14 16 | 1055 | 041F | 50 | 5F | 26 | 5E |
| | 14 17 | 1056 | 0420 | 50 | 60 | 26 | 2D |
| | 14 18 | 1057 | 0421 | 50 | 61 | 26 | 2F |
| | 14 19 | 1058 | 0422 | 50 | E2 | 26 | 53 |
| | 14 20 | 1059 | 0423 | 50 | E3 | 26 | 54 |
| | 14 21 | 1060 | 0424 | 50 | E4 | 26 | 55 |
| | 14 22 | 1061 | 0425 | 50 | E5 | 26 | 56 |
| | 14 23 | 1062 | 0426 | 50 | E6 | 26 | 57 |
| | 14 24 | 1063 | 0427 | 50 | E7 | 26 | 58 |
| | 14 25 | 1064 | 0428 | 50 | E8 | 26 | 59 |
| | 14 26 | 1065 | 0429 | 50 | E9 | 26 | 5A |
| | 14 27 | 1066 | 042A | 50 | 6A | 26 | 5C |
| | 14 28 | 1067 | 042B | 50 | 6B | 26 | 2C |
| | 14 29 | 1068 | 042C | 50 | 6C | 26 | 25 |
| | 14 30 | 1069 | 042D | 50 | 6D | 26 | 5F |
| | 14 31 | 1070 | 042E | 50 | 6E | 26 | 3E |
| | 14 32 | 1071 | 042F | 50 | 6F | 26 | 3F |
| | 14 33 | 1072 | 0430 | 50 | F0 | 26 | 30 |
| | 14 34 | 1073 | 0431 | 50 | F1 | 26 | 31 |
| | 14 35 | 1074 | 0432 | 50 | F2 | 26 | 32 |
| | 14 36 | 1075 | 0433 | 50 | F3 | 26 | 33 |
| | 14 37 | 1076 | 0434 | 50 | F4 | 26 | 34 |
| | 14 38 | 1077 | 0435 | 50 | F5 | 26 | 35 |
| | 14 39 | 1078 | 0436 | 50 | F6 | 26 | 36 |
| | 14 40 | 1079 | 0437 | 50 | F7 | 26 | 37 |
| | 14 41 | 1080 | 0438 | 50 | F8 | 26 | 38 |
| | 14 42 | 1081 | 0439 | 50 | F9 | 26 | 39 |
| | 14 43 | 1082 | 043A | 50 | 7A | 26 | 3A |
| | 14 44 | 1083 | 043B | 50 | 7B | 26 | 23 |
| | 14 45 | 1084 | 043C | 50 | 7C | 26 | 40 |
| | 14 46 | 1085 | 043D | 50 | 7D | 26 | 27 |
| | 14 47 | 1086 | 043E | 50 | 7E | 26 | 3D |
| | 14 48 | 1087 | 043F | 50 | 7F | 26 | 22 |
| | 14 49 | 1088 | 0440 | D1 | 40 | 4A | 20 |
| | 14 50 | 1089 | 0441 | D1 | C1 | 4A | 41 |
| | 14 51 | 1090 | 0442 | D1 | C2 | 4A | 42 |
| | 14 52 | 1091 | 0443 | D1 | C3 | 4A | 43 |
| | 14 53 | 1092 | 0444 | D1 | C4 | 4A | 44 |
| | 14 54 | 1093 | 0445 | D1 | C5 | 4A | 45 |
| | 14 55 | 1094 | 0446 | D1 | C6 | 4A | 46 |
| | 14 56 | 1095 | 0447 | D1 | C7 | 4A | 47 |
| | 14 57 | 1096 | 0448 | D1 | C8 | 4A | 48 |
| | 14 58 | 1097 | 0449 | D1 | C9 | 4A | 49 |
| | 14 59 | 1098 | 044A | D1 | 4A | 4A | 5B |
| | 14 60 | 1099 | 044B | D1 | 4B | 4A | 2E |
| | 14 61 | 1100 | 044C | D1 | 4C | 4A | 3C |
| | 14 62 | 1101 | 044D | D1 | 4D | 4A | 28 |
| | 14 63 | 1102 | 044E | D1 | 4E | 4A | 2B |
| | 14 64 | 1103 | 044F | D1 | 4F | 4A | 21 |
| | 14 65 | 1104 | 0450 | D1 | 50 | 4A | 26 |
| | 14 66 | 1105 | 0451 | D1 | D1 | 4A | 4A |
| | 14 67 | 1106 | 0452 | D1 | D2 | 4A | 4B |
| | 14 68 | 1107 | 0453 | D1 | D3 | 4A | 4C |
| | 14 69 | 1108 | 0454 | D1 | D4 | 4A | 4D |
| | 14 70 | 1109 | 0455 | D1 | D5 | 4A | 4E |
| | 14 71 | 1110 | 0456 | D1 | D6 | 4A | 4F |
| | 14 72 | 1111 | 0457 | D1 | D7 | 4A | 50 |
| | 14 73 | 1112 | 0458 | D1 | D8 | 4A | 51 |
| | 14 74 | 1113 | 0459 | D1 | D9 | 4A | 52 |
| | 14 75 | 1114 | 045A | D1 | 5A | 4A | 5D |
| | 14 76 | 1115 | 045B | D1 | 5B | 4A | 24 |

| Mod 1 R C | Mod 2 R C | Position Dec | Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|
| | 14 77 | 1116 | 045C | D1 | 5C | 4A | 2A |
| | 14 78 | 1117 | 045D | D1 | 5D | 4A | 29 |
| | 14 79 | 1118 | 045E | D1 | 5E | 4A | 3B |
| | 14 80 | 1119 | 045F | D1 | 5F | 4A | 5E |
| | 15 01 | 1120 | 0460 | D1 | 60 | 4A | 2D |
| | 15 02 | 1121 | 0461 | D1 | 61 | 4A | 2F |
| | 15 03 | 1122 | 0462 | D1 | E2 | 4A | 53 |
| | 15 04 | 1123 | 0463 | D1 | E3 | 4A | 54 |
| | 15 05 | 1124 | 0464 | D1 | E4 | 4A | 55 |
| | 15 06 | 1125 | 0465 | D1 | E5 | 4A | 56 |
| | 15 07 | 1126 | 0466 | D1 | E6 | 4A | 57 |
| | 15 08 | 1127 | 0467 | D1 | E7 | 4A | 58 |
| | 15 09 | 1128 | 0468 | D1 | E8 | 4A | 59 |
| | 15 10 | 1129 | 0469 | D1 | E9 | 4A | 5A |
| | 15 11 | 1130 | 046A | D1 | 6A | 4A | 5C |
| | 15 12 | 1131 | 046B | D1 | 6B | 4A | 2C |
| | 15 13 | 1132 | 046C | D1 | 6C | 4A | 25 |
| | 15 14 | 1133 | 046D | D1 | 6D | 4A | 5F |
| | 15 15 | 1134 | 046E | D1 | 6E | 4A | 3E |
| | 15 16 | 1135 | 046F | D1 | 6F | 4A | 3F |
| | 15 17 | 1136 | 0470 | D1 | F0 | 4A | 30 |
| | 15 18 | 1137 | 0471 | D1 | F1 | 4A | 31 |
| | 15 19 | 1138 | 0472 | D1 | F2 | 4A | 32 |
| | 15 20 | 1139 | 0473 | D1 | F3 | 4A | 33 |
| | 15 21 | 1140 | 0474 | D1 | F4 | 4A | 34 |
| | 15 22 | 1141 | 0475 | D1 | F5 | 4A | 35 |
| | 15 23 | 1142 | 0476 | D1 | F6 | 4A | 36 |
| | 15 24 | 1143 | 0477 | D1 | F7 | 4A | 37 |
| | 15 25 | 1144 | 0478 | D1 | F8 | 4A | 38 |
| | 15 26 | 1145 | 0479 | D1 | F9 | 4A | 39 |
| | 15 27 | 1146 | 047A | D1 | 7A | 4A | 3A |
| | 15 28 | 1147 | 047B | D1 | 7B | 4A | 23 |
| | 15 29 | 1148 | 047C | D1 | 7C | 4A | 40 |
| | 15 30 | 1149 | 047D | D1 | 7D | 4A | 27 |
| | 15 31 | 1150 | 047E | D1 | 7E | 4A | 3D |
| | 15 32 | 1151 | 047F | D1 | 7F | 4A | 22 |
| | 15 33 | 1152 | 0480 | D2 | 40 | 4B | 20 |
| | 15 34 | 1153 | 0481 | D2 | C1 | 4B | 41 |
| | 15 35 | 1154 | 0482 | D2 | C2 | 4B | 42 |
| | 15 36 | 1155 | 0483 | D2 | C3 | 4B | 43 |
| | 15 37 | 1156 | 0484 | D2 | C4 | 4B | 44 |
| | 15 38 | 1157 | 0485 | D2 | C5 | 4B | 45 |
| | 15 39 | 1158 | 0486 | D2 | C6 | 4B | 46 |
| | 15 40 | 1159 | 0487 | D2 | C7 | 4B | 47 |
| | 15 41 | 1160 | 0488 | D2 | C8 | 4B | 48 |
| | 15 42 | 1161 | 0489 | D2 | C9 | 4B | 49 |
| | 15 43 | 1162 | 048A | D2 | 4A | 4B | 5B |
| | 15 44 | 1163 | 048B | D2 | 4B | 4B | 2E |
| | 15 45 | 1164 | 048C | D2 | 4C | 4B | 3C |
| | 15 46 | 1165 | 048D | D2 | 4D | 4B | 28 |
| | 15 47 | 1166 | 048E | D2 | 4E | 4B | 2B |
| | 15 48 | 1167 | 048F | D2 | 4F | 4B | 21 |
| | 15 49 | 1168 | 0490 | D2 | 50 | 4B | 26 |
| | 15 50 | 1169 | 0491 | D2 | D1 | 4B | 4A |
| | 15 51 | 1170 | 0492 | D2 | D2 | 4B | 4B |
| | 15 52 | 1171 | 0493 | D2 | D3 | 4B | 4C |
| | 15 53 | 1172 | 0494 | D2 | D4 | 4B | 4D |
| | 15 54 | 1173 | 0495 | D2 | D5 | 4B | 4E |
| | 15 55 | 1174 | 0496 | D2 | D6 | 4B | 4F |
| | 15 56 | 1175 | 0497 | D2 | D7 | 4B | 50 |
| | 15 57 | 1176 | 0498 | D2 | D8 | 4B | 51 |
| | 15 58 | 1177 | 0499 | D2 | D9 | 4B | 52 |
| | 15 59 | 1178 | 049A | D2 | 5A | 4B | 5D |
| | 15 60 | 1179 | 049B | D2 | 5B | 4B | 24 |
| | 15 61 | 1180 | 049C | D2 | 5C | 4B | 2A |
| | 15 62 | 1181 | 049D | D2 | 5D | 4B | 29 |
| | 15 63 | 1182 | 049E | D2 | 5E | 4B | 3B |
| | 15 64 | 1183 | 049F | D2 | 5F | 4B | 5E |
| | 15 65 | 1184 | 04A0 | D2 | 60 | 4B | 2D |
| | 15 66 | 1185 | 04A1 | D2 | 61 | 4B | 2F |
| | 15 67 | 1186 | 04A2 | D2 | E2 | 4B | 53 |
| | 15 68 | 1187 | 04A3 | D2 | E3 | 4B | 54 |
| | 15 69 | 1188 | 04A4 | D2 | E4 | 4B | 55 |
| | 15 70 | 1189 | 04A5 | D2 | E5 | 4B | 56 |
| | 15 71 | 1190 | 04A6 | D2 | E6 | 4B | 57 |
| | 15 72 | 1191 | 04A7 | D2 | E7 | 4B | 58 |
| | 15 73 | 1192 | 04A8 | D2 | E8 | 4B | 59 |
| | 15 74 | 1193 | 04A9 | D2 | E9 | 4B | 5A |
| | 15 75 | 1194 | 04AA | D2 | 6A | 4B | 5C |
| | 15 76 | 1195 | 04AB | D2 | 6B | 4B | 2C |
| | 15 77 | 1196 | 04AC | D2 | 6C | 4B | 25 |
| | 15 78 | 1197 | 04AD | D2 | 6D | 4B | 5F |
| | 15 79 | 1198 | 04AE | D2 | 6E | 4B | 3E |
| | 15 80 | 1199 | 04AF | D2 | 6F | 4B | 3F |
| | 16 01 | 1200 | 04B0 | D2 | F0 | 4B | 30 |
| | 16 02 | 1201 | 04B1 | D2 | F1 | 4B | 31 |
| | 16 03 | 1202 | 04B2 | D2 | F2 | 4B | 32 |
| | 16 04 | 1203 | 04B3 | D2 | F3 | 4B | 33 |
| | 16 05 | 1204 | 04B4 | D2 | F4 | 4B | 34 |
| | 16 06 | 1205 | 04B5 | D2 | F5 | 4B | 35 |
| | 16 07 | 1206 | 04B6 | D2 | F6 | 4B | 36 |
| | 16 08 | 1207 | 04B7 | D2 | F7 | 4B | 37 |
| | 16 09 | 1208 | 04B8 | D2 | F8 | 4B | 38 |
| | 16 10 | 1209 | 04B9 | D2 | F9 | 4B | 39 |
| | 16 11 | 1210 | 04BA | D2 | 7A | 4B | 3A |
| | 16 12 | 1211 | 04BB | D2 | 7B | 4B | 23 |
| | 16 13 | 1212 | 04BC | D2 | 7C | 4B | 40 |
| | 16 14 | 1213 | 04BD | D2 | 7D | 4B | 27 |
| | 16 15 | 1214 | 04BE | D2 | 7E | 4B | 3D |
| | 16 16 | 1215 | 04BF | D2 | 7F | 4B | 22 |
| | 16 17 | 1216 | 04C0 | D3 | 40 | 4C | 20 |
| | 16 18 | 1217 | 04C1 | D3 | C1 | 4C | 41 |
| | 16 19 | 1218 | 04C2 | D3 | C2 | 4C | 42 |
| | 16 20 | 1219 | 04C3 | D3 | C3 | 4C | 43 |
| | 16 21 | 1220 | 04C4 | D3 | C4 | 4C | 44 |
| | 16 22 | 1221 | 04C5 | D3 | C5 | 4C | 45 |
| | 16 23 | 1222 | 04C6 | D3 | C6 | 4C | 46 |
| | 16 24 | 1223 | 04C7 | D3 | C7 | 4C | 47 |
| | 16 25 | 1224 | 04C8 | D3 | C8 | 4C | 48 |
| | 16 26 | 1225 | 04C9 | D3 | C9 | 4C | 49 |
| | 16 27 | 1226 | 04CA | D3 | 4A | 4C | 5B |
| | 16 28 | 1227 | 04CB | D3 | 4B | 4C | 2E |
| | 16 29 | 1228 | 04CC | D3 | 4C | 4C | 3C |
| | 16 30 | 1229 | 04CD | D3 | 4D | 4C | 28 |
| | 16 31 | 1230 | 04CE | D3 | 4E | 4C | 2B |
| | 16 32 | 1231 | 04CF | D3 | 4F | 4C | 21 |
| | 16 33 | 1232 | 04D0 | D3 | 50 | 4C | 26 |
| | 16 34 | 1233 | 04D1 | D3 | D1 | 4C | 4A |
| | 16 35 | 1234 | 04D2 | D3 | D2 | 4C | 4B |
| | 16 36 | 1235 | 04D3 | D3 | D3 | 4C | 4C |
| | 16 37 | 1236 | 04D4 | D3 | D4 | 4C | 4D |
| | 16 38 | 1237 | 04D5 | D3 | D5 | 4C | 4E |
| | 16 39 | 1238 | 04D6 | D3 | D6 | 4C | 4F |
| | 16 40 | 1239 | 04D7 | D3 | D7 | 4C | 50 |

| Mod 1 R C | Mod 2 R C | Position Dec | Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|
| | 16 41 | 1240 | 04D8 | D3 | D8 | 4C | 51 |
| | 16 42 | 1241 | 04D9 | D3 | D9 | 4C | 52 |
| | 16 43 | 1242 | 04DA | D3 | 5A | 4C | 5D |
| | 16 44 | 1243 | 04DB | D3 | 5B | 4C | 24 |
| | 16 45 | 1244 | 04DC | D3 | 5C | 4C | 2A |
| | 16 46 | 1245 | 04DD | D3 | 5D | 4C | 29 |
| | 16 47 | 1246 | 04DE | D3 | 5E | 4C | 3B |
| | 16 48 | 1247 | 04DF | D3 | 5F | 4C | 5E |
| | 16 49 | 1248 | 04E0 | D3 | 60 | 4C | 2D |
| | 16 50 | 1249 | 04E1 | D3 | 61 | 4C | 2F |
| | 16 51 | 1250 | 04E2 | D3 | E2 | 4C | 53 |
| | 16 52 | 1251 | 04E3 | D3 | E3 | 4C | 54 |
| | 16 53 | 1252 | 04E4 | D3 | E4 | 4C | 55 |
| | 16 54 | 1253 | 04E5 | D3 | E5 | 4C | 56 |
| | 16 55 | 1254 | 04E6 | D3 | E6 | 4C | 57 |
| | 16 56 | 1255 | 04E7 | D3 | E7 | 4C | 58 |
| | 16 57 | 1256 | 04E8 | D3 | E8 | 4C | 59 |
| | 16 58 | 1257 | 04E9 | D3 | E9 | 4C | 5A |
| ▌ | 16 59 | 1258 | 04EA | D3 | 6A | 4C | 5C |
| | 16 60 | 1259 | 04EB | D3 | 6B | 4C | 2C |
| | 16 61 | 1260 | 04EC | D3 | 6C | 4C | 25 |
| | 16 62 | 1261 | 04ED | D3 | 6D | 4C | 5F |
| | 16 63 | 1262 | 04EE | D3 | 6E | 4C | 3E |
| | 16 64 | 1263 | 04EF | D3 | 6F | 4C | 3F |
| | 16 65 | 1264 | 04F0 | D3 | F0 | 4C | 30 |
| | 16 66 | 1265 | 04F1 | D3 | F1 | 4C | 31 |
| | 16 67 | 1266 | 04F2 | D3 | F2 | 4C | 32 |
| | 16 68 | 1267 | 04F3 | D3 | F3 | 4C | 33 |
| | 16 69 | 1268 | 04F4 | D3 | F4 | 4C | 34 |
| | 16 70 | 1269 | 04F5 | D3 | F5 | 4C | 35 |
| | 16 71 | 1270 | 04F6 | D3 | F6 | 4C | 36 |
| | 16 72 | 1271 | 04F7 | D3 | F7 | 4C | 37 |
| | 16 73 | 1272 | 04F8 | D3 | F8 | 4C | 38 |
| | 16 74 | 1273 | 04F9 | D3 | F9 | 4C | 39 |
| | 16 75 | 1274 | 04FA | D3 | 7A | 4C | 3A |
| | 16 76 | 1275 | 04FB | D3 | 7B | 4C | 23 |
| | 16 77 | 1276 | 04FC | D3 | 7C | 4C | 40 |
| | 16 78 | 1277 | 04FD | D3 | 7D | 4C | 27 |
| | 16 79 | 1278 | 04FE | D3 | 7E | 4C | 3D |
| | 16 80 | 1279 | 04FF | D3 | 7F | 4C | 22 |
| | 17 01 | 1280 | 0500 | D4 | 40 | 4D | 20 |
| | 17 02 | 1281 | 0501 | D4 | C1 | 4D | 41 |
| | 17 03 | 1282 | 0502 | D4 | C2 | 4D | 42 |
| | 17 04 | 1283 | 0503 | D4 | C3 | 4D | 43 |
| | 17 05 | 1284 | 0504 | D4 | C4 | 4D | 44 |
| | 17 06 | 1285 | 0505 | D4 | C5 | 4D | 45 |
| | 17 07 | 1286 | 0506 | D4 | C6 | 4D | 46 |
| | 17 08 | 1287 | 0507 | D4 | C7 | 4D | 47 |
| | 17 09 | 1288 | 0908 | D4 | C8 | 4D | 48 |
| | 17 10 | 1289 | 0509 | D4 | C9 | 4D | 49 |
| | 17 11 | 1290 | 050A | D4 | 4A | 4D | 5B |
| | 17 12 | 1291 | 050B | D4 | 4B | 4D | 2E |
| | 17 13 | 1292 | 050C | D4 | 4C | 4D | 3C |
| | 17 14 | 1293 | 050D | D4 | 4D | 4D | 28 |
| | 17 15 | 1294 | 050E | D4 | 4E | 4D | 2B |
| | 17 16 | 1295 | 050F | D4 | 4F | 4D | 21 |
| | 17 17 | 1296 | 0510 | D4 | 50 | 4D | 26 |
| | 17 18 | 1297 | 0511 | D4 | D1 | 4D | 4A |
| | 17 19 | 1298 | 0512 | D4 | D2 | 4D | 4B |
| | 17 20 | 1299 | 0513 | D4 | D3 | 4D | 4C |
| | 17 21 | 1300 | 0514 | D4 | D4 | 4D | 4D |
| | 17 22 | 1301 | 0515 | D4 | D5 | 4D | 4E |

| Mod 1 R C | Mod 2 R C | Position Dec | Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|
| | 17 23 | 1302 | 0516 | D4 | D6 | 4D | 4F |
| | 17 24 | 1303 | 0517 | D4 | D7 | 4D | 50 |
| | 17 25 | 1304 | 0518 | D4 | D8 | 4D | 51 |
| | 17 26 | 1305 | 0519 | D4 | D9 | 4D | 52 |
| | 17 27 | 1306 | 051A | D4 | 5A | 4D | 5D |
| | 17 28 | 1307 | 051B | D4 | 5B | 4D | 24 |
| | 17 29 | 1308 | 051C | D4 | 5C | 4D | 2A |
| | 17 30 | 1309 | 051D | D4 | 5D | 4D | 29 |
| | 17 31 | 1310 | 051E | D4 | 5E | 4D | 3B |
| | 17 32 | 1311 | 051F | D4 | 5F | 4D | 5E |
| | 17 33 | 1312 | 0520 | D4 | 60 | 4D | 2D |
| | 17 34 | 1313 | 0521 | D4 | 61 | 4D | 2F |
| | 17 35 | 1314 | 0522 | D4 | E2 | 4D | 53 |
| | 17 36 | 1315 | 0523 | D4 | E3 | 4D | 54 |
| | 17 37 | 1316 | 0524 | D4 | E4 | 4D | 55 |
| | 17 38 | 1317 | 0525 | D4 | E5 | 4D | 56 |
| | 17 39 | 1318 | 0526 | D4 | E6 | 4D | 57 |
| | 17 40 | 1319 | 0527 | D4 | E7 | 4D | 58 |
| | 17 41 | 1320 | 0528 | D4 | E8 | 4D | 59 |
| | 17 42 | 1321 | 0529 | D4 | E9 | 4D | 5A |
| ▌ | 17 43 | 1322 | 052A | D4 | 6A | 4D | 5C |
| | 17 44 | 1323 | 052B | D4 | 6B | 4D | 2C |
| | 17 45 | 1324 | 052C | D4 | 6C | 4D | 25 |
| | 17 46 | 1325 | 052D | D4 | 6D | 4D | 5F |
| | 17 47 | 1326 | 052E | D4 | 6E | 4D | 3E |
| | 17 48 | 1327 | 052F | D4 | 6F | 4D | 3F |
| | 17 49 | 1328 | 0530 | D4 | F0 | 4D | 30 |
| | 17 50 | 1329 | 0531 | D4 | F1 | 4D | 31 |
| | 17 51 | 1330 | 0532 | D4 | F2 | 4D | 32 |
| | 17 52 | 1331 | 0533 | D4 | F3 | 4D | 33 |
| | 17 53 | 1332 | 0534 | D4 | F4 | 4D | 34 |
| | 17 54 | 1333 | 0535 | D4 | F5 | 4D | 35 |
| | 17 55 | 1334 | 0536 | D4 | F6 | 4D | 36 |
| | 17 56 | 1335 | 0537 | D4 | F7 | 4D | 37 |
| | 17 57 | 1336 | 0538 | D4 | F8 | 4D | 38 |
| | 17 58 | 1337 | 0539 | D4 | F9 | 4D | 39 |
| | 17 59 | 1338 | 053A | D4 | 7A | 4D | 3A |
| | 17 60 | 1339 | 053B | D4 | 7B | 4D | 23 |
| | 17 61 | 1340 | 053C | D4 | 7C | 4D | 40 |
| | 17 62 | 1341 | 053D | D4 | 7D | 4D | 27 |
| | 17 63 | 1342 | 053E | D4 | 7E | 4D | 3D |
| | 17 64 | 1343 | 053F | D4 | 7F | 4D | 22 |
| | 17 65 | 1344 | 0540 | D5 | 40 | 4E | 20 |
| | 17 66 | 1345 | 0541 | D5 | C1 | 4E | 41 |
| | 17 67 | 1346 | 0542 | D5 | C2 | 4E | 42 |
| | 17 68 | 1347 | 0543 | D5 | C3 | 4E | 43 |
| | 17 69 | 1348 | 0544 | D5 | C4 | 4E | 44 |
| | 17 70 | 1349 | 0545 | D5 | C5 | 4E | 45 |
| | 17 71 | 1350 | 0546 | D5 | C6 | 4E | 46 |
| | 17 72 | 1351 | 0547 | D5 | C7 | 4E | 47 |
| | 17 73 | 1352 | 0548 | D5 | C8 | 4E | 48 |
| | 17 74 | 1353 | 0549 | D5 | C9 | 4E | 49 |
| | 17 75 | 1354 | 054A | D5 | 4A | 4E | 5B |
| | 17 76 | 1355 | 054B | D5 | 4B | 4E | 2E |
| | 17 77 | 1356 | 054C | D5 | 4C | 4E | 3C |
| | 17 78 | 1357 | 054D | D5 | 4D | 4E | 28 |
| | 17 79 | 1358 | 054E | D5 | 4E | 4E | 2B |
| | 17 80 | 1359 | 054F | D5 | 4F | 4E | 21 |
| | 18 01 | 1360 | 0550 | D5 | 50 | 4E | 26 |
| | 18 02 | 1361 | 0551 | D5 | D1 | 4E | 4A |
| | 18 03 | 1362 | 0552 | D5 | D2 | 4E | 4B |
| | 18 04 | 1363 | 0553 | D5 | D3 | 4E | 4C |

| Mod 1 R C | Mod 2 R C | Position Dec | Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|
| | 18 05 | 1364 | 0554 | D5 | D4 | 4E | 4D |
| | 18 06 | 1365 | 0555 | D5 | D5 | 4E | 4E |
| | 18 07 | 1366 | 0556 | D5 | D6 | 4E | 4F |
| | 18 08 | 1367 | 0557 | D5 | D7 | 4E | 50 |
| | 18 09 | 1368 | 0558 | D5 | D8 | 4E | 51 |
| | 18 10 | 1369 | 0559 | D5 | D9 | 4E | 52 |
| | 18 11 | 1370 | 055A | D5 | 5A | 4E | 5D |
| | 18 12 | 1371 | 055B | D5 | 5B | 4E | 24 |
| | 18 13 | 1372 | 055C | D5 | 5C | 4E | 2A |
| | 18 14 | 1373 | 055D | D5 | 5D | 4E | 29 |
| | 18 15 | 1374 | 055E | D5 | 5E | 4E | 3B |
| | 18 16 | 1375 | 055F | D5 | 5F | 4E | 5E |
| | 18 17 | 1376 | 0560 | D5 | 60 | 4E | 2D |
| | 18 18 | 1377 | 0561 | D5 | 61 | 4E | 2F |
| | 18 19 | 1378 | 0562 | D5 | E2 | 4E | 53 |
| | 18 20 | 1379 | 0563 | D5 | E3 | 4E | 54 |
| | 18 21 | 1380 | 0564 | D5 | E4 | 4E | 55 |
| | 18 22 | 1381 | 0565 | D5 | E5 | 4E | 56 |
| | 18 23 | 1382 | 0566 | D5 | E6 | 4E | 57 |
| | 18 24 | 1383 | 0567 | D5 | E7 | 4E | 58 |
| | 18 25 | 1384 | 0568 | D5 | E8 | 4E | 59 |
| | 18 26 | 1385 | 0569 | D5 | E9 | 4E | 5A |
| | 18 27 | 1386 | 056A | D5 | 6A | 4E | 5C |
| | 18 28 | 1387 | 056B | D5 | 6B | 4E | 2C |
| | 18 29 | 1388 | 056C | D5 | 6C | 4E | 25 |
| | 18 30 | 1389 | 056D | D5 | 6D | 4E | 5F |
| | 18 31 | 1390 | 056E | D5 | 6E | 4E | 3E |
| | 18 32 | 1391 | 056F | D5 | 6F | 4E | 3F |
| | 18 33 | 1392 | 0570 | D5 | F0 | 4E | 30 |
| | 18 34 | 1393 | 0571 | D5 | F1 | 4E | 31 |
| | 18 35 | 1394 | 0572 | D5 | F2 | 4E | 32 |
| | 18 36 | 1395 | 0573 | D5 | F3 | 4E | 33 |
| | 18 37 | 1396 | 0574 | D5 | F4 | 4E | 34 |
| | 18 38 | 1397 | 0575 | D5 | F5 | 4E | 35 |
| | 18 39 | 1398 | 0576 | D5 | F6 | 4E | 36 |
| | 18 40 | 1399 | 0577 | D5 | F7 | 4E | 37 |
| | 18 41 | 1400 | 0578 | D5 | F8 | 4E | 38 |
| | 18 42 | 1401 | 0579 | D5 | F9 | 4E | 39 |
| | 18 43 | 1402 | 057A | D5 | 7A | 4E | 3A |
| | 18 44 | 1403 | 057B | D5 | 7B | 4E | 23 |
| | 18 45 | 1404 | 057C | D5 | 7C | 4E | 40 |
| | 18 46 | 1405 | 057D | D5 | 7D | 4E | 27 |
| | 18 47 | 1406 | 057E | D5 | 7E | 4E | 3D |
| | 18 48 | 1407 | 057F | D5 | 7F | 4E | 22 |
| | 18 49 | 1408 | 0580 | D6 | 40 | 4F | 20 |
| | 18 50 | 1409 | 0581 | D6 | C1 | 4F | 41 |
| | 18 51 | 1410 | 0582 | D6 | C2 | 4F | 42 |
| | 18 52 | 1411 | 0583 | D6 | C3 | 4F | 43 |
| | 18 53 | 1412 | 0584 | D6 | C4 | 4F | 44 |
| | 18 54 | 1413 | 0585 | D6 | C5 | 4F | 45 |
| | 18 55 | 1414 | 0586 | D6 | C6 | 4F | 46 |
| | 18 56 | 1415 | 0587 | D6 | C7 | 4F | 47 |
| | 18 57 | 1416 | 0588 | D6 | C8 | 4F | 48 |
| | 18 58 | 1417 | 0589 | D6 | C9 | 4F | 49 |
| | 18 59 | 1418 | 058A | D6 | 4A | 4F | 5B |
| | 18 60 | 1419 | 058B | D6 | 4B | 4F | 2E |
| | 18 61 | 1420 | 058C | D6 | 4C | 4F | 3C |
| | 18 62 | 1421 | 058D | D6 | 4D | 4F | 28 |
| | 18 63 | 1422 | 058E | D6 | 4E | 4F | 2B |
| | 18 64 | 1423 | 058F | D6 | 4F | 4F | 21 |
| | 18 65 | 1424 | 0590 | D6 | 50 | 4F | 26 |
| | 18 66 | 1425 | 0591 | D6 | D1 | 4F | 4A |
| | 18 67 | 1426 | 0592 | D6 | D2 | 4F | 4B |
| | 18 68 | 1427 | 0593 | D6 | D3 | 4F | 4C |
| | 18 69 | 1428 | 0594 | D6 | D4 | 4F | 4D |
| | 18 70 | 1429 | 0595 | D6 | D5 | 4F | 4E |
| | 18 71 | 1430 | 0596 | D6 | D6 | 4F | 4F |
| | 18 72 | 1431 | 0597 | D6 | D7 | 4F | 50 |
| | 18 73 | 1432 | 0598 | D6 | D8 | 4F | 51 |
| | 18 74 | 1433 | 0599 | D6 | D9 | 4F | 52 |
| | 18 75 | 1434 | 059A | D6 | 5A | 4F | 5D |
| | 18 76 | 1435 | 059B | D6 | 5B | 4F | 24 |
| | 18 77 | 1436 | 059C | D6 | 5C | 4F | 2A |
| | 18 78 | 1437 | 059D | D6 | 5D | 4F | 29 |
| | 18 79 | 1438 | 059E | D6 | 5E | 4F | 3B |
| | 18 80 | 1439 | 059F | D6 | 5F | 4F | 5E |
| | 19 01 | 1440 | 05A0 | D6 | 60 | 4F | 2D |
| | 19 02 | 1441 | 05A1 | D6 | 61 | 4F | 2F |
| | 19 03 | 1442 | 05A2 | D6 | E2 | 4F | 53 |
| | 19 04 | 1443 | 05A3 | D6 | E3 | 4F | 54 |
| | 19 05 | 1444 | 05A4 | D6 | E4 | 4F | 55 |
| | 19 06 | 1445 | 05A5 | D6 | E5 | 4F | 56 |
| | 19 07 | 1446 | 05A6 | D6 | E6 | 4F | 57 |
| | 19 08 | 1447 | 05A7 | D6 | E7 | 4F | 58 |
| | 19 09 | 1448 | 05A8 | D6 | E8 | 4F | 59 |
| | 19 10 | 1449 | 05A9 | D6 | E9 | 4F | 5A |
| | 19 11 | 1450 | 05AA | D6 | 6A | 4F | 5C |
| | 19 12 | 1451 | 05AB | D6 | 6B | 4F | 2C |
| | 19 13 | 1452 | 05AC | D6 | 6C | 4F | 25 |
| | 19 14 | 1453 | 05AD | D6 | 6D | 4F | 5F |
| | 19 15 | 1454 | 05AE | D6 | 6E | 4F | 3E |
| | 19 16 | 1455 | 05AF | D6 | 6F | 4F | 3F |
| | 19 17 | 1456 | 05B0 | D6 | F0 | 4F | 30 |
| | 19 18 | 1457 | 05B1 | D6 | F1 | 4F | 31 |
| | 19 19 | 1458 | 05B2 | D6 | F2 | 4F | 32 |
| | 19 20 | 1459 | 05B3 | D6 | F3 | 4F | 33 |
| | 19 21 | 1460 | 05B4 | D6 | F4 | 4F | 34 |
| | 19 22 | 1461 | 05B5 | D6 | F5 | 4F | 35 |
| | 19 23 | 1462 | 05B6 | D6 | F6 | 4F | 36 |
| | 19 24 | 1463 | 05B7 | D6 | F7 | 4F | 37 |
| | 19 25 | 1464 | 05B8 | D6 | F8 | 4F | 38 |
| | 19 26 | 1465 | 05B9 | D6 | F9 | 4F | 39 |
| | 19 27 | 1466 | 05BA | D6 | 7A | 4F | 3A |
| | 19 28 | 1467 | 05BB | D6 | 7B | 4F | 23 |
| | 19 29 | 1468 | 05BC | D6 | 7C | 4F | 40 |
| | 19 30 | 1469 | 05BD | D6 | 7D | 4F | 27 |
| | 19 31 | 1470 | 05BE | D6 | 7E | 4F | 3D |
| | 19 32 | 1471 | 05BF | D6 | 7F | 4F | 22 |
| | 19 33 | 1472 | 05C0 | D7 | 40 | 50 | 20 |
| | 19 34 | 1473 | 05C1 | D7 | C1 | 50 | 41 |
| | 19 35 | 1474 | 05C2 | D7 | C2 | 50 | 42 |
| | 19 36 | 1475 | 05C3 | D7 | C3 | 50 | 43 |
| | 19 37 | 1476 | 05C4 | D7 | C4 | 50 | 44 |
| | 19 38 | 1477 | 05C5 | D7 | C5 | 50 | 45 |
| | 19 39 | 1478 | 05C6 | D7 | C6 | 50 | 46 |
| | 19 40 | 1479 | 05C7 | D7 | C7 | 50 | 47 |
| | 19 41 | 1480 | 05C8 | D7 | C8 | 50 | 48 |
| | 19 42 | 1481 | 05C9 | D7 | C9 | 50 | 49 |
| | 19 43 | 1482 | 05CA | D7 | 4A | 50 | 5B |
| | 19 44 | 1483 | 05CB | D7 | 4B | 50 | 2E |
| | 19 45 | 1484 | 05CC | D7 | 4C | 50 | 3C |
| | 19 46 | 1485 | 05CD | D7 | 4D | 50 | 28 |
| | 19 47 | 1486 | 05CE | D7 | 4E | 50 | 2B |
| | 19 48 | 1487 | 05CF | D7 | 4F | 50 | 21 |

| Mod 1 R C | Mod 2 R C | Position Dec | Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|
| | 19 49 | 1488 | 05D0 | D7 | 50 | 50 | 26 |
| | 19 50 | 1489 | 05D1 | D7 | D1 | 50 | 4A |
| | 19 51 | 1490 | 05D2 | D7 | D2 | 50 | 4B |
| | 19 52 | 1491 | 05D3 | D7 | D3 | 50 | 4C |
| | 19 53 | 1492 | 05D4 | D7 | D4 | 50 | 4D |
| | 19 54 | 1493 | 05D5 | D7 | D5 | 50 | 4E |
| | 19 55 | 1494 | 05D6 | D7 | D6 | 50 | 4F |
| | 19 56 | 1495 | 05D7 | D7 | D7 | 50 | 50 |
| | 19 57 | 1496 | 05D8 | D7 | D8 | 50 | 51 |
| | 19 58 | 1497 | 05D9 | D7 | D9 | 50 | 52 |
| | 19 59 | 1498 | 05DA | D7 | 5A | 50 | 5D |
| | 19 60 | 1499 | 05DB | D7 | 5B | 50 | 24 |
| | 19 61 | 1500 | 05DC | D7 | 5C | 50 | 2A |
| | 19 62 | 1501 | 05DD | D7 | 5D | 50 | 29 |
| | 19 63 | 1502 | 05DE | D7 | 5E | 50 | 3B |
| | 19 64 | 1503 | 05DF | D7 | 5F | 50 | 5E |
| | 19 65 | 1504 | 05E0 | D7 | 60 | 50 | 2D |
| | 19 66 | 1505 | 05E1 | D7 | 61 | 50 | 2F |
| | 19 67 | 1506 | 05E2 | D7 | E2 | 50 | 53 |
| | 19 68 | 1507 | 05E3 | D7 | E3 | 50 | 54 |
| | 19 69 | 1508 | 05E4 | D7 | E4 | 50 | 55 |
| | 19 70 | 1509 | 05E5 | D7 | E5 | 50 | 56 |
| | 19 71 | 1510 | 05E6 | D7 | E6 | 50 | 57 |
| | 19 72 | 1511 | 05E7 | D7 | E7 | 50 | 58 |
| | 19 73 | 1512 | 05E8 | D7 | E8 | 50 | 59 |
| | 19 74 | 1513 | 05E9 | D7 | E9 | 50 | 5A |
| | 19 75 | 1514 | 05EA | D7 | 6A | 50 | 5C |
| | 19 76 | 1515 | 05EB | D7 | 6B | 50 | 2C |
| | 19 77 | 1516 | 05EC | D7 | 6C | 50 | 25 |
| | 19 78 | 1517 | 05ED | D7 | 6D | 50 | 5F |
| | 19 79 | 1518 | 05EE | D7 | 6E | 50 | 3E |
| | 19 80 | 1519 | 05EF | D7 | 6F | 50 | 3F |
| | 20 01 | 1520 | 05F0 | D7 | F0 | 50 | 30 |
| | 20 02 | 1521 | 05F1 | D7 | F1 | 50 | 31 |
| | 20 03 | 1522 | 05F2 | D7 | F2 | 50 | 32 |
| | 20 04 | 1523 | 05F3 | D7 | F3 | 50 | 33 |
| | 20 05 | 1524 | 05F4 | D7 | F4 | 50 | 34 |
| | 20 06 | 1525 | 05F5 | D7 | F5 | 50 | 35 |
| | 20 07 | 1526 | 05F6 | D7 | F6 | 50 | 36 |
| | 20 08 | 1527 | 05F7 | D7 | F7 | 50 | 37 |
| | 20 09 | 1528 | 05F8 | D7 | F8 | 50 | 38 |
| | 20 10 | 1529 | 05F9 | D7 | F9 | 50 | 39 |
| | 20 11 | 1530 | 05FA | D7 | 7A | 50 | 3A |
| | 20 12 | 1531 | 05FB | D7 | 7B | 50 | 23 |
| | 20 13 | 1532 | 05FC | D7 | 7C | 50 | 40 |
| | 20 14 | 1533 | 05FD | D7 | 7D | 50 | 27 |
| | 20 15 | 1534 | 05FE | D7 | 7E | 50 | 3D |
| | 20 16 | 1535 | 05FF | D7 | 7F | 50 | 22 |
| | 20 17 | 1536 | 0600 | D8 | 40 | 51 | 20 |
| | 20 18 | 1537 | 0601 | D8 | C1 | 51 | 41 |
| | 20 19 | 1538 | 0602 | D8 | C2 | 51 | 42 |
| | 20 20 | 1539 | 0603 | D8 | C3 | 51 | 43 |
| | 20 21 | 1540 | 0604 | D8 | C4 | 51 | 44 |
| | 20 22 | 1541 | 0605 | D8 | C5 | 51 | 45 |
| | 20 23 | 1542 | 0606 | D8 | C6 | 51 | 46 |
| | 20 24 | 1543 | 0607 | D8 | C7 | 51 | 47 |
| | 20 25 | 1544 | 0608 | D8 | C8 | 51 | 48 |
| | 20 26 | 1545 | 0609 | D8 | C9 | 51 | 49 |
| | 20 27 | 1546 | 060A | D8 | 4A | 51 | 5B |
| | 20 28 | 1547 | 060B | D8 | 4B | 51 | 2E |
| | 20 29 | 1548 | 060C | D8 | 4C | 51 | 3C |
| | 20 30 | 1549 | 060D | D8 | 4D | 51 | 28 |
| | 20 31 | 1550 | 060E | D8 | 4E | 51 | 2B |
| | 20 32 | 1551 | 060F | D8 | 4F | 51 | 21 |
| | 20 33 | 1552 | 0610 | D8 | 50 | 51 | 26 |
| | 20 34 | 1553 | 0611 | D8 | D1 | 51 | 4A |
| | 20 35 | 1554 | 0612 | D8 | D2 | 51 | 4B |
| | 20 36 | 1555 | 0613 | D8 | D3 | 51 | 4C |
| | 20 37 | 1556 | 0614 | D8 | D4 | 51 | 4D |
| | 20 38 | 1557 | 0615 | D8 | D5 | 51 | 4E |
| | 20 39 | 1558 | 0616 | D8 | D6 | 51 | 4F |
| | 20 40 | 1559 | 0617 | D8 | D7 | 51 | 50 |
| | 20 41 | 1560 | 0618 | D8 | D8 | 51 | 51 |
| | 20 42 | 1561 | 0619 | D8 | D9 | 51 | 52 |
| | 20 43 | 1562 | 061A | D8 | 5A | 51 | 5D |
| | 20 44 | 1563 | 061B | D8 | 5B | 51 | 24 |
| | 20 45 | 1564 | 061C | D8 | 5C | 51 | 2A |
| | 20 46 | 1565 | 061D | D8 | 5D | 51 | 29 |
| | 20 47 | 1566 | 061E | D8 | 5E | 51 | 3B |
| | 20 48 | 1567 | 061F | D8 | 5F | 51 | 5E |
| | 20 49 | 1568 | 0620 | D8 | 60 | 51 | 2D |
| | 20 50 | 1569 | 0621 | D8 | 61 | 51 | 2F |
| | 20 51 | 1570 | 0622 | D8 | E2 | 51 | 53 |
| | 20 52 | 1571 | 0623 | D8 | E3 | 51 | 54 |
| | 20 53 | 1572 | 0624 | D8 | E4 | 51 | 55 |
| | 20 54 | 1573 | 0625 | D8 | E5 | 51 | 56 |
| | 20 55 | 1574 | 0626 | D8 | E6 | 51 | 57 |
| | 20 56 | 1575 | 0627 | D8 | E7 | 51 | 58 |
| | 20 57 | 1576 | 0628 | D8 | E8 | 51 | 59 |
| | 20 58 | 1577 | 0629 | D8 | E9 | 51 | 5A |
| | 20 59 | 1578 | 062A | D8 | 6A | 51 | 5C |
| | 20 60 | 1579 | 062B | D8 | 6B | 51 | 2C |
| | 20 61 | 1580 | 062C | D8 | 6C | 51 | 25 |
| | 20 62 | 1581 | 062D | D8 | 6D | 51 | 5F |
| | 20 63 | 1582 | 062E | D8 | 6E | 51 | 3E |
| | 20 64 | 1583 | 062F | D8 | 6F | 51 | 3F |
| | 20 65 | 1584 | 0630 | D8 | F0 | 51 | 30 |
| | 20 66 | 1585 | 0631 | D8 | F1 | 51 | 31 |
| | 20 67 | 1586 | 0632 | D8 | F2 | 51 | 32 |
| | 20 68 | 1587 | 0633 | D8 | F3 | 51 | 33 |
| | 20 69 | 1588 | 0634 | D8 | F4 | 51 | 34 |
| | 20 70 | 1589 | 0635 | D8 | F5 | 51 | 35 |
| | 20 71 | 1590 | 0636 | D8 | F6 | 51 | 36 |
| | 20 72 | 1591 | 0637 | D8 | F7 | 51 | 37 |
| | 20 73 | 1592 | 0638 | D8 | F8 | 51 | 38 |
| | 20 74 | 1593 | 0639 | D8 | F9 | 51 | 39 |
| | 20 75 | 1594 | 063A | D8 | 7A | 51 | 3A |
| | 20 76 | 1595 | 063B | D8 | 7B | 51 | 23 |
| | 20 77 | 1596 | 063C | D8 | 7C | 51 | 40 |
| | 20 78 | 1597 | 063D | D8 | 7D | 51 | 27 |
| | 20 79 | 1598 | 063E | D8 | 7E | 51 | 3D |
| | 20 80 | 1599 | 063F | D8 | 7F | 51 | 22 |
| | 21 01 | 1600 | 0640 | D9 | 40 | 52 | 20 |
| | 21 02 | 1601 | 0641 | D9 | C1 | 52 | 41 |
| | 21 03 | 1602 | 0642 | D9 | C2 | 52 | 42 |
| | 21 04 | 1603 | 0643 | D9 | C3 | 52 | 43 |
| | 21 05 | 1604 | 0644 | D9 | C4 | 52 | 44 |
| | 21 06 | 1605 | 0645 | D9 | C5 | 52 | 45 |
| | 21 07 | 1606 | 0646 | D9 | C6 | 52 | 46 |
| | 21 08 | 1607 | 0647 | D9 | C7 | 52 | 47 |
| | 21 09 | 1608 | 0648 | D9 | C8 | 52 | 48 |
| | 21 10 | 1609 | 0649 | D9 | C9 | 52 | 49 |
| | 21 11 | 1610 | 064A | D9 | 4A | 52 | 5B |
| | 21 12 | 1611 | 064B | D9 | 4B | 52 | 2E |

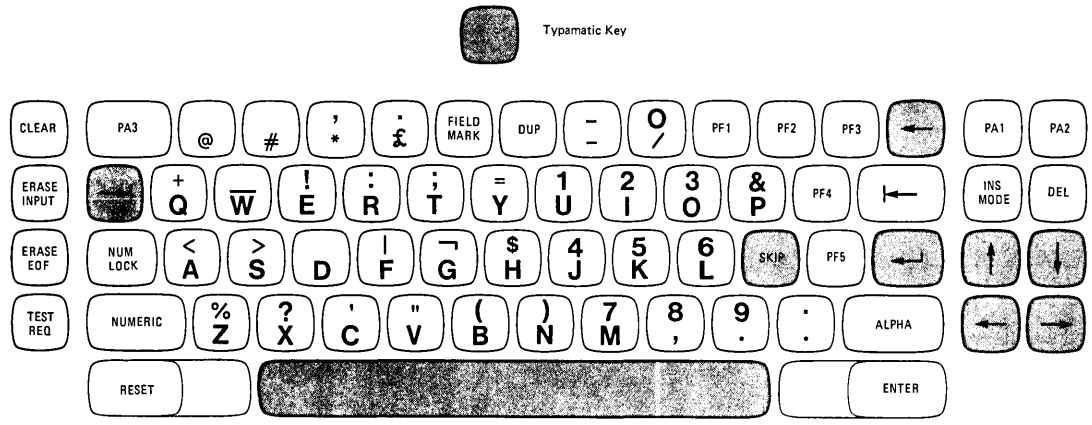
| Mod 1 R C | Mod 2 R C | Position Dec | Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|
| | 21 13 | 1612 | 064C | D9 | 4C | 52 | 3C |
| | 21 14 | 1613 | 064D | D9 | 4D | 52 | 28 |
| | 21 15 | 1614 | 064E | D9 | 4E | 52 | 2B |
| | 21 16 | 1615 | 064F | D9 | 4F | 52 | 21 |
| | 21 17 | 1616 | 0650 | D9 | 50 | 52 | 26 |
| | 21 18 | 1617 | 0651 | D9 | D1 | 52 | 4A |
| | 21 19 | 1618 | 0652 | D9 | D2 | 52 | 4B |
| | 21 20 | 1619 | 0653 | D9 | D3 | 52 | 4C |
| | 21 21 | 1620 | 0654 | D9 | D4 | 52 | 4D |
| | 21 22 | 1621 | 0655 | D9 | D5 | 52 | 4E |
| | 21 23 | 1622 | 0656 | D9 | D6 | 52 | 4F |
| | 21 24 | 1623 | 0657 | D9 | D7 | 52 | 50 |
| | 21 25 | 1624 | 0658 | D9 | D8 | 52 | 51 |
| | 21 26 | 1625 | 0659 | D9 | D9 | 52 | 52 |
| | 21 27 | 1626 | 065A | D9 | 5A | 52 | 5D |
| | 21 28 | 1627 | 065B | D9 | 5B | 52 | 24 |
| | 21 29 | 1628 | 065C | D9 | 5C | 52 | 2A |
| | 21 30 | 1629 | 065D | D9 | 5D | 52 | 29 |
| | 21 31 | 1630 | 065E | D9 | 5E | 52 | 3B |
| | 21 32 | 1631 | 065F | D9 | 5F | 52 | 5E |
| | 21 33 | 1632 | 0660 | D9 | 60 | 52 | 2D |
| | 21 34 | 1633 | 0661 | D9 | 61 | 52 | 2F |
| | 21 35 | 1634 | 0662 | D9 | E2 | 52 | 53 |
| | 21 36 | 1635 | 0663 | D9 | E3 | 52 | 54 |
| | 21 37 | 1636 | 0664 | D9 | E4 | 52 | 55 |
| | 21 38 | 1637 | 0665 | D9 | E5 | 52 | 56 |
| | 21 39 | 1638 | 0666 | D9 | E6 | 52 | 57 |
| | 21 40 | 1639 | 0667 | D9 | E7 | 52 | 58 |
| | 21 41 | 1640 | 0668 | D9 | E8 | 52 | 59 |
| | 21 42 | 1641 | 0669 | D9 | E9 | 52 | 5A |
| | 21 43 | 1642 | 066A | D9 | 6A | 52 | 5C |
| | 21 44 | 1643 | 066B | D9 | 6B | 52 | 2C |
| | 21 45 | 1644 | 066C | D9 | 6C | 52 | 25 |
| | 21 46 | 1645 | 066D | D9 | 6D | 52 | 5F |
| | 21 47 | 1646 | 066E | D9 | 6E | 52 | 3E |
| | 21 48 | 1647 | 066F | D9 | 6F | 52 | 3F |
| | 21 49 | 1648 | 0670 | D9 | F0 | 52 | 30 |
| | 21 50 | 1649 | 0671 | D9 | F1 | 52 | 31 |
| | 21 51 | 1650 | 0672 | D9 | F2 | 52 | 32 |
| | 21 52 | 1651 | 0673 | D9 | F3 | 52 | 33 |
| | 21 53 | 1652 | 0674 | D9 | F4 | 52 | 34 |
| | 21 54 | 1653 | 0675 | D9 | F5 | 52 | 35 |
| | 21 55 | 1654 | 0676 | D9 | F6 | 52 | 36 |
| | 21 56 | 1655 | 0677 | D9 | F7 | 52 | 37 |
| | 21 57 | 1656 | 0678 | D9 | F8 | 52 | 38 |
| | 21 58 | 1657 | 0679 | D9 | F9 | 52 | 39 |
| | 21 59 | 1658 | 067A | D9 | 7A | 52 | 3A |
| | 21 60 | 1659 | 067B | D9 | 7B | 52 | 23 |
| | 21 61 | 1660 | 067C | D9 | 7C | 52 | 40 |
| | 21 62 | 1661 | 067D | D9 | 7D | 52 | 27 |
| | 21 63 | 1662 | 067E | D9 | 7E | 52 | 3D |
| | 21 64 | 1663 | 067F | D9 | 7F | 52 | 22 |
| | 21 65 | 1664 | 0680 | 5A | 40 | 5D | 20 |
| | 21 66 | 1665 | 0681 | 5A | C1 | 5D | 41 |
| | 21 67 | 1666 | 0682 | 5A | C2 | 5D | 42 |
| | 21 68 | 1667 | 0683 | 5A | C3 | 5D | 43 |
| | 21 69 | 1668 | 0684 | 5A | C4 | 5D | 44 |
| | 21 70 | 1669 | 0685 | 5A | C5 | 5D | 45 |
| | 21 71 | 1670 | 0686 | 5A | C6 | 5D | 46 |
| | 21 72 | 1671 | 0687 | 5A | C7 | 5D | 47 |
| | 21 73 | 1672 | 0688 | 5A | C8 | 5D | 48 |
| | 21 74 | 1673 | 0689 | 5A | C9 | 5D | 49 |
| | 21 75 | 1674 | 068A | 5A | 4A | 5D | 5B |
| | 21 76 | 1675 | 068B | 5A | 4B | 5D | 2E |
| | 21 77 | 1676 | 068C | 5A | 4C | 5D | 3C |
| | 21 78 | 1677 | 068D | 5A | 4D | 5D | 28 |
| | 21 79 | 1678 | 068E | 5A | 4E | 5D | 2B |
| | 21 80 | 1679 | 068F | 5A | 4F | 5D | 21 |
| | 22 01 | 1680 | 0690 | 5A | 50 | 5D | 26 |
| | 22 02 | 1681 | 0691 | 5A | D1 | 5D | 4A |
| | 22 03 | 1682 | 0692 | 5A | D2 | 5D | 4B |
| | 22 04 | 1683 | 0693 | 5A | D3 | 5D | 4C |
| | 22 05 | 1684 | 0694 | 5A | D4 | 5D | 4D |
| | 22 06 | 1685 | 0695 | 5A | D5 | 5D | 4E |
| | 22 07 | 1686 | 0696 | 5A | D6 | 5D | 4F |
| | 22 08 | 1687 | 0697 | 5A | D7 | 5D | 50 |
| | 22 09 | 1688 | 0698 | 5A | D8 | 5D | 51 |
| | 22 10 | 1689 | 0699 | 5A | D9 | 5D | 52 |
| | 22 11 | 1690 | 069A | 5A | 5A | 5D | 5D |
| | 22 12 | 1691 | 069B | 5A | 5B | 5D | 24 |
| | 22 13 | 1692 | 069C | 5A | 5C | 5D | 2A |
| | 22 14 | 1693 | 069D | 5A | 5D | 5D | 29 |
| | 22 15 | 1694 | 069E | 5A | 5E | 5D | 3B |
| | 22 16 | 1695 | 069F | 5A | 5F | 5D | 5E |
| | 22 17 | 1696 | 06A0 | 5A | 60 | 5D | 2D |
| | 22 18 | 1697 | 06A1 | 5A | 61 | 5D | 2F |
| | 22 19 | 1698 | 06A2 | 5A | E2 | 5D | 53 |
| | 22 20 | 1699 | 06A3 | 5A | E3 | 5D | 54 |
| | 22 21 | 1700 | 06A4 | 5A | E4 | 5D | 55 |
| | 22 22 | 1701 | 06A5 | 5A | E5 | 5D | 56 |
| | 22 23 | 1702 | 06A6 | 5A | E6 | 5D | 57 |
| | 22 24 | 1703 | 06A7 | 5A | E7 | 5D | 58 |
| | 22 25 | 1704 | 06A8 | 5A | E8 | 5D | 59 |
| | 22 26 | 1705 | 06A9 | 5A | E9 | 5D | 5A |
| | 22 27 | 1706 | 06AA | 5A | 6A | 5D | 5C |
| | 22 28 | 1707 | 06AB | 5A | 6B | 5D | 2C |
| | 22 29 | 1708 | 06AC | 5A | 6C | 5D | 25 |
| | 22 30 | 1709 | 06AD | 5A | 6D | 5D | 5F |
| | 22 31 | 1710 | 06AE | 5A | 6E | 5D | 3E |
| | 22 32 | 1711 | 06AF | 5A | 6F | 5D | 3F |
| | 22 33 | 1712 | 06B0 | 5A | F0 | 5D | 30 |
| | 22 34 | 1713 | 06B1 | 5A | F1 | 5D | 31 |
| | 22 35 | 1714 | 06B2 | 5A | F2 | 5D | 32 |
| | 22 36 | 1715 | 06B3 | 5A | F3 | 5D | 33 |
| | 22 37 | 1716 | 06B4 | 5A | F4 | 5D | 34 |
| | 22 38 | 1717 | 06B5 | 5A | F5 | 5D | 35 |
| | 22 39 | 1718 | 06B6 | 5A | F6 | 5D | 36 |
| | 22 40 | 1719 | 06B7 | 5A | F7 | 5D | 37 |
| | 22 41 | 1720 | 06B8 | 5A | F8 | 5D | 38 |
| | 22 42 | 1721 | 06B9 | 5A | F9 | 5D | 39 |
| | 22 43 | 1722 | 06BA | 5A | 7A | 5D | 3A |
| | 22 44 | 1723 | 06BB | 5A | 7B | 5D | 23 |
| | 22 45 | 1724 | 06BC | 5A | 7C | 5D | 40 |
| | 22 46 | 1725 | 06BD | 5A | 7D | 5D | 27 |
| | 22 47 | 1726 | 06BE | 5A | 7E | 5D | 3D |
| | 22 48 | 1727 | 06BF | 5A | 7F | 5D | 22 |
| | 22 49 | 1728 | 06C0 | 5B | 40 | 24 | 20 |
| | 22 50 | 1729 | 06C1 | 5B | C1 | 24 | 41 |
| | 22 51 | 1730 | 06C2 | 5B | C2 | 24 | 42 |
| | 22 52 | 1731 | 06C3 | 5B | C3 | 24 | 43 |
| | 22 53 | 1732 | 06C4 | 5B | C4 | 24 | 44 |
| | 22 54 | 1733 | 06C5 | 5B | C5 | 24 | 45 |
| | 22 55 | 1734 | 06C6 | 5B | C6 | 24 | 46 |
| | 22 56 | 1735 | 06C7 | 5B | C7 | 24 | 47 |

| Mod 1 R C | Mod 2 R C | Position Dec | Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|
| | 22 57 | 1736 | 06C8 | 5B | C8 | 24 | 48 |
| | 22 58 | 1737 | 06C9 | 5B | C9 | 24 | 49 |
| | 22 59 | 1738 | 06CA | 5B | 4A | 24 | 5B |
| | 22 60 | 1739 | 06CB | 5B | 4B | 24 | 2E |
| | 22 61 | 1740 | 06CC | 5B | 4C | 24 | 3C |
| | 22 62 | 1741 | 06CD | 5B | 4D | 24 | 28 |
| | 22 63 | 1742 | 06CE | 5B | 4E | 24 | 2B |
| | 22 64 | 1743 | 06CF | 5B | 4F | 24 | 21 |
| | 22 65 | 1744 | 06D0 | 5B | 50 | 24 | 26 |
| | 22 66 | 1745 | 06D1 | 5B | D1 | 24 | 4A |
| | 22 67 | 1746 | 06D2 | 5B | D2 | 24 | 4B |
| | 22 68 | 1747 | 06D3 | 5B | D3 | 24 | 4C |
| | 22 69 | 1748 | 06D4 | 5B | D4 | 24 | 4D |
| | 22 70 | 1749 | 06D5 | 5B | D5 | 24 | 4E |
| | 22 71 | 1750 | 06D6 | 5B | D6 | 24 | 4F |
| | 22 72 | 1751 | 06D7 | 5B | D7 | 24 | 50 |
| | 22 73 | 1752 | 06D8 | 5B | D8 | 24 | 51 |
| | 22 74 | 1753 | 06D9 | 5B | D9 | 24 | 52 |
| | 22 75 | 1754 | 06DA | 5B | 5A | 24 | 5D |
| | 22 67 | 1755 | 06DB | 5B | 5B | 24 | 24 |
| | 22 77 | 1756 | 06DC | 5B | 5C | 24 | 2A |
| | 22 78 | 1757 | 06DD | 5B | 5D | 24 | 29 |
| | 22 79 | 1758 | 06DE | 5B | 5E | 24 | 3B |
| | 22 80 | 1759 | 06DF | 5B | 5F | 24 | 5E |
| | 23 01 | 1760 | 06E0 | 5B | 60 | 24 | 2D |
| | 23 02 | 1761 | 06E1 | 5B | 61 | 24 | 2F |
| | 23 03 | 1762 | 06E2 | 5B | E2 | 24 | 53 |
| | 23 04 | 1763 | 06E3 | 5B | E3 | 24 | 54 |
| | 23 05 | 1764 | 06E4 | 5B | E4 | 24 | 55 |
| | 23 06 | 1765 | 06E5 | 5B | E5 | 24 | 56 |
| | 23 07 | 1766 | 06E6 | 5B | E6 | 24 | 57 |
| | 23 08 | 1767 | 06E7 | 5B | E7 | 24 | 58 |
| | 23 09 | 1768 | 06E8 | 5B | E8 | 24 | 59 |
| | 23 10 | 1769 | 06E9 | 5B | E9 | 24 | 5A |
| | 23 11 | 1770 | 06EA | 5B | 6A | 24 | 5C |
| | 23 12 | 1771 | 06EB | 5B | 6B | 24 | 2C |
| | 23 13 | 1772 | 06EC | 5B | 6C | 24 | 25 |
| | 23 14 | 1773 | 06ED | 5B | 6D | 24 | 5F |
| | 23 15 | 1774 | 06EE | 5B | 6E | 24 | 3E |
| | 23 16 | 1775 | 06EF | 5B | 6F | 24 | 3F |
| | 23 17 | 1776 | 06F0 | 5B | F0 | 24 | 30 |
| | 23 18 | 1777 | 06F1 | 5B | F1 | 24 | 31 |
| | 23 19 | 1778 | 06F2 | 5B | F2 | 24 | 32 |
| | 23 20 | 1779 | 06F3 | 5B | F3 | 24 | 33 |
| | 23 21 | 1780 | 06F4 | 5B | F4 | 24 | 34 |
| | 23 22 | 1781 | 06F5 | 5B | F5 | 24 | 35 |
| | 23 23 | 1782 | 06F6 | 5B | F6 | 24 | 36 |
| | 23 24 | 1783 | 06F7 | 5B | F7 | 24 | 37 |
| | 23 25 | 1784 | 06F8 | 5B | F8 | 24 | 38 |
| | 23 26 | 1785 | 06F9 | 5B | F9 | 24 | 39 |
| | 23 27 | 1786 | 06FA | 5B | 7A | 24 | 3A |
| | 23 28 | 1787 | 06FB | 5B | 7B | 24 | 23 |
| | 23 29 | 1788 | 06FC | 5B | 7C | 24 | 40 |
| | 23 30 | 1789 | 06FD | 5B | 7D | 24 | 27 |
| | 23 31 | 1790 | 06FE | 5B | 7E | 24 | 3D |
| | 23 32 | 1791 | 06FF | 5B | 7F | 24 | 22 |
| | 23 33 | 1792 | 0700 | 5C | 40 | 2A | 20 |
| | 23 34 | 1793 | 0701 | 5C | C1 | 2A | 41 |
| | 23 35 | 1794 | 0702 | 5C | C2 | 2A | 42 |
| | 23 36 | 1795 | 0703 | 5C | C3 | 2A | 43 |
| | 23 37 | 1796 | 0704 | 5C | C4 | 2A | 44 |
| | 23 38 | 1797 | 0705 | 5C | C5 | 2A | 45 |
| | 23 39 | 1798 | 0706 | 5C | C6 | 2A | 46 |
| | 23 40 | 1799 | 0707 | 5C | C7 | 2A | 47 |
| | 23 41 | 1800 | 0708 | 5C | C8 | 2A | 48 |
| | 23 42 | 1801 | 0709 | 5C | C9 | 2A | 49 |
| | 23 43 | 1802 | 070A | 5C | 4A | 2A | 5B |
| | 23 44 | 1803 | 070B | 5C | 4B | 2A | 2E |
| | 23 45 | 1804 | 070C | 5C | 4C | 2A | 3C |
| | 23 46 | 1805 | 070D | 5C | 4D | 2A | 28 |
| | 23 47 | 1806 | 070E | 5C | 4E | 2A | 2B |
| | 23 48 | 1807 | 070F | 5C | 4F | 2A | 21 |
| | 23 49 | 1808 | 0710 | 5C | 50 | 2A | 26 |
| | 23 50 | 1809 | 0711 | 5C | D1 | 2A | 4A |
| | 23 51 | 1810 | 0712 | 5C | D2 | 2A | 4B |
| | 23 52 | 1811 | 0713 | 5C | D3 | 2A | 4C |
| | 23 53 | 1812 | 0714 | 5C | D4 | 2A | 4D |
| | 23 54 | 1813 | 0715 | 5C | D5 | 2A | 4E |
| | 23 55 | 1814 | 0716 | 5C | D6 | 2A | 4F |
| | 23 56 | 1815 | 0717 | 5C | D7 | 2A | 50 |
| | 23 57 | 1816 | 0718 | 5C | D8 | 2A | 51 |
| | 23 58 | 1817 | 0719 | 5C | D9 | 2A | 52 |
| | 23 59 | 1818 | 071A | 5C | 5A | 2A | 5D |
| | 23 60 | 1819 | 071B | 5C | 5B | 2A | 24 |
| | 23 61 | 1820 | 071C | 5C | 5C | 2A | 2A |
| | 23 62 | 1821 | 071D | 5C | 5D | 2A | 29 |
| | 23 63 | 1822 | 071E | 5C | 5E | 2A | 3B |
| | 23 64 | 1823 | 071F | 5C | 5F | 2A | 5E |
| | 23 65 | 1824 | 0720 | 5C | 60 | 2A | 2D |
| | 23 66 | 1825 | 0721 | 5C | 61 | 2A | 2F |
| | 23 67 | 1826 | 0722 | 5C | E2 | 2A | 53 |
| | 23 68 | 1827 | 0723 | 5C | E3 | 2A | 54 |
| | 23 69 | 1828 | 0724 | 5C | E4 | 2A | 55 |
| | 23 70 | 1829 | 0725 | 5C | E5 | 2A | 56 |
| | 23 71 | 1830 | 0726 | 5C | E6 | 2A | 57 |
| | 23 72 | 1831 | 0727 | 5C | E7 | 2A | 58 |
| | 23 73 | 1832 | 0728 | 5C | E8 | 2A | 59 |
| | 23 74 | 1833 | 0729 | 5C | E9 | 2A | 5A |
| | 23 75 | 1834 | 072A | 5C | 6A | 2A | 5C |
| | 23 76 | 1835 | 072B | 5C | 6B | 2A | 2C |
| | 23 77 | 1836 | 072C | 5C | 6C | 2A | 25 |
| | 23 78 | 1837 | 072D | 5C | 6D | 2A | 5F |
| | 23 79 | 1838 | 072E | 5C | 6E | 2A | 3E |
| | 23 80 | 1839 | 072F | 5C | 6F | 2A | 3F |
| | 24 01 | 1840 | 0730 | 5C | F0 | 2A | 30 |
| | 24 02 | 1841 | 0731 | 5C | F1 | 2A | 31 |
| | 24 03 | 1842 | 0732 | 5C | F2 | 2A | 32 |
| | 24 04 | 1843 | 0733 | 5C | F3 | 2A | 33 |
| | 24 05 | 1844 | 0734 | 5C | F4 | 2A | 34 |
| | 24 06 | 1845 | 0735 | 5C | F5 | 2A | 35 |
| | 24 07 | 1846 | 0736 | 5C | F6 | 2A | 36 |
| | 24 08 | 1847 | 0737 | 5C | F7 | 2A | 37 |
| | 24 09 | 1848 | 0738 | 5C | F8 | 2A | 38 |
| | 24 10 | 1849 | 0739 | 5C | F9 | 2A | 39 |
| | 24 11 | 1850 | 073A | 5C | 7A | 2A | 3A |
| | 24 12 | 1851 | 073B | 5C | 7B | 2A | 23 |
| | 24 13 | 1852 | 073C | 5C | 7C | 2A | 40 |
| | 24 14 | 1853 | 073D | 5C | 7D | 2A | 27 |
| | 24 15 | 1854 | 073E | 5C | 7E | 2A | 3D |
| | 24 16 | 1855 | 073F | 5C | 7F | 2A | 22 |
| | 24 17 | 1856 | 0740 | 5D | 40 | 29 | 20 |
| | 24 18 | 1857 | 0741 | 5D | C1 | 29 | 41 |
| | 24 19 | 1858 | 0742 | 5D | C2 | 29 | 42 |
| | 24 20 | 1859 | 0743 | 5D | C3 | 29 | 43 |

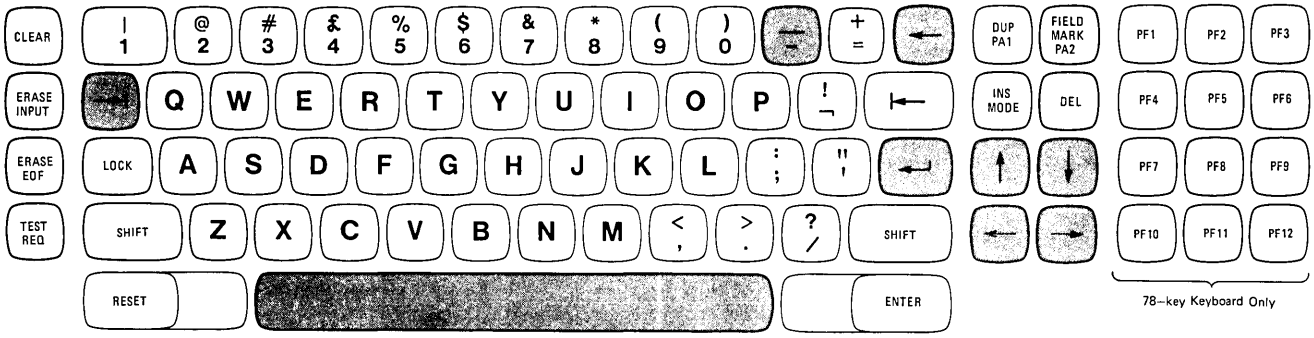
| Mod 1 R | C | Mod 2 R | C | Position Dec | Hex | Buffer Address (Hex) EBCDIC | | ASCII | |
|---|---|---|---|---|---|---|---|---|---|
| | | 24 | 21 | 1860 | 0744 | 5D | C4 | 29 | 44 |
| | | 24 | 22 | 1861 | 0745 | 5D | C5 | 29 | 45 |
| | | 24 | 23 | 1862 | 0746 | 5D | C6 | 29 | 46 |
| | | 24 | 24 | 1863 | 0747 | 5D | C7 | 29 | 47 |
| | | 24 | 25 | 1864 | 0748 | 5D | C8 | 29 | 48 |
| | | 24 | 26 | 1865 | 0749 | 5D | C9 | 29 | 49 |
| | | 24 | 27 | 1866 | 074A | 5D | 4A | 29 | 5B |
| | | 24 | 28 | 1867 | 074B | 5D | 4B | 29 | 2E |
| | | 24 | 29 | 1868 | 074C | 5D | 4C | 29 | 3C |
| | | 24 | 30 | 1869 | 074D | 5D | 4D | 29 | 28 |
| | | 24 | 31 | 1870 | 074E | 5D | 4E | 29 | 2B |
| | | 24 | 32 | 1871 | 074F | 5D | 4F | 29 | 21 |
| | | 24 | 33 | 1872 | 0750 | 5D | 50 | 29 | 26 |
| | | 24 | 34 | 1873 | 0751 | 5D | D1 | 29 | 4A |
| | | 24 | 35 | 1874 | 0752 | 5D | D2 | 29 | 4B |
| | | 24 | 36 | 1875 | 0753 | 5D | D3 | 29 | 4C |
| | | 24 | 37 | 1876 | 0754 | 5D | D4 | 29 | 4D |
| | | 24 | 38 | 1877 | 0755 | 5D | D5 | 29 | 4E |
| | | 24 | 39 | 1878 | 0756 | 5D | D6 | 29 | 4F |
| | | 24 | 40 | 1879 | 0757 | 5D | D7 | 29 | 50 |
| | | 24 | 41 | 1880 | 0758 | 5D | D8 | 29 | 51 |
| | | 24 | 42 | 1881 | 0759 | 5D | D9 | 29 | 52 |
| | | 24 | 43 | 1882 | 075A | 5D | 5A | 29 | 5D |
| | | 24 | 44 | 1883 | 075B | 5D | 5B | 29 | 24 |
| | | 24 | 45 | 1884 | 075C | 5D | 5C | 29 | 2A |
| | | 24 | 46 | 1885 | 075D | 5D | 5D | 29 | 29 |
| | | 24 | 47 | 1886 | 075E | 5D | 5E | 29 | 3B |
| | | 24 | 48 | 1887 | 075F | 5D | 5F | 29 | 5E |
| | | 24 | 49 | 1888 | 0760 | 5D | 60 | 29 | 2D |
| | | 24 | 50 | 1889 | 0761 | 5D | 61 | 29 | 2F |
| | | 24 | 51 | 1890 | 0762 | 5D | E2 | 29 | 53 |
| | | 24 | 52 | 1891 | 0763 | 5D | E3 | 29 | 54 |
| | | 24 | 53 | 1892 | 0764 | 5D | E4 | 29 | 55 |
| | | 24 | 54 | 1893 | 0765 | 5D | E5 | 29 | 56 |
| | | 24 | 55 | 1894 | 0766 | 5D | E6 | 29 | 57 |
| | | 24 | 56 | 1895 | 0767 | 5D | E7 | 29 | 58 |
| | | 24 | 57 | 1896 | 0768 | 5D | E8 | 29 | 59 |
| | | 24 | 58 | 1897 | 0769 | 5D | E9 | 29 | 5A |
| | | 24 | 59 | 1898 | 076A | 5D | 6A | 29 | 5C |
| | | 24 | 60 | 1899 | 076B | 5D | 6B | 29 | 2C |
| | | 24 | 61 | 1900 | 076C | 5D | 6C | 29 | 25 |
| | | 24 | 62 | 1901 | 076D | 5D | 6D | 29 | 5F |
| | | 24 | 63 | 1902 | 076E | 5D | 6E | 29 | 3E |
| | | 24 | 64 | 1903 | 076F | 5D | 6F | 29 | 3F |
| | | 24 | 65 | 1904 | 0770 | 5D | F0 | 29 | 30 |
| | | 24 | 66 | 1905 | 0771 | 5D | F1 | 29 | 31 |
| | | 24 | 67 | 1906 | 0772 | 5D | F2 | 29 | 32 |
| | | 24 | 68 | 1907 | 0773 | 5D | F3 | 29 | 33 |
| | | 24 | 69 | 1908 | 0774 | 5D | F4 | 29 | 34 |
| | | 24 | 70 | 1909 | 0775 | 5D | F5 | 29 | 35 |
| | | 24 | 71 | 1910 | 0776 | 5D | F6 | 29 | 36 |
| | | 24 | 72 | 1911 | 0777 | 5D | F7 | 29 | 37 |
| | | 24 | 73 | 1912 | 0778 | 5D | F8 | 29 | 38 |
| | | 24 | 74 | 1913 | 0779 | 5D | F9 | 29 | 39 |
| | | 24 | 75 | 1914 | 077A | 5D | 7A | 29 | 3A |
| | | 24 | 76 | 1915 | 077B | 5D | 7B | 29 | 23 |
| | | 24 | 77 | 1916 | 077C | 5D | 7C | 29 | 40 |
| | | 24 | 78 | 1917 | 077D | 5D | 7D | 29 | 27 |
| | | 24 | 79 | 1918 | 077E | 5D | 7E | 29 | 3D |
| | | 24 | 80 | 1919 | 077F | 5D | 7F | 29 | 22 |

Legend:
R = Row
C = Column

# Appendix D. World Trade Keyboards and I/O Interface Codes




Data Entry Keyboard



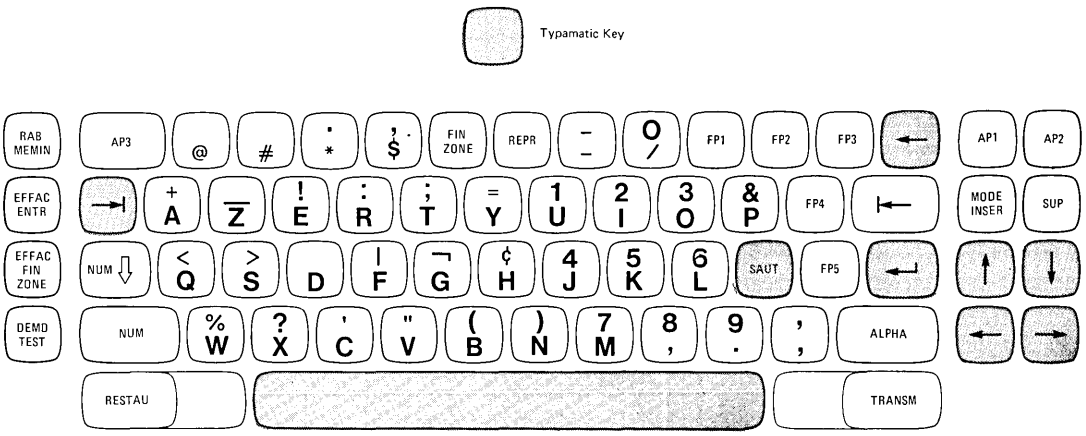

Typewriter Keyboard

Figure D-1. United Kingdom Keyboards

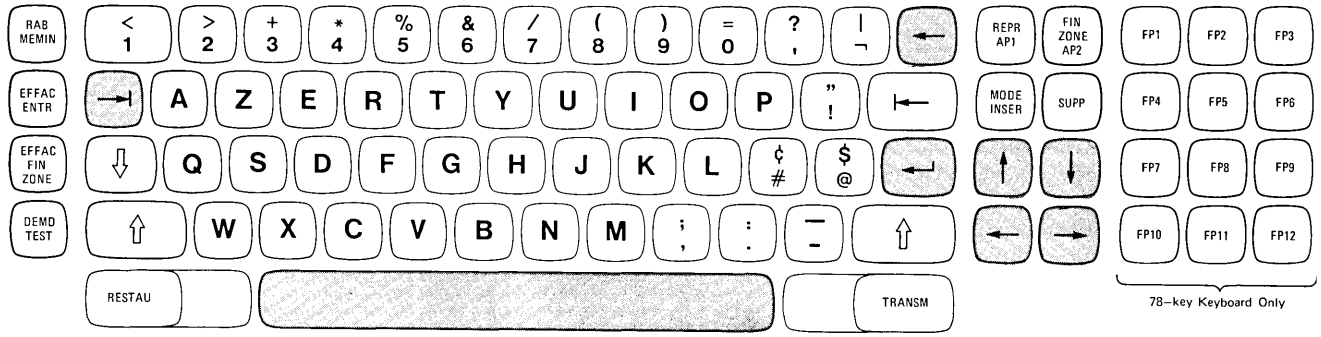
| Bits 4567 | Hex 1 | 00 | | | | 01 | | | | 10 | | | | 11 | | | | Bits 0,1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 2,3 |
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | 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 | | DUP | | RA | < | * | % | @ | | | | | | | | | |
| 1101 | D | | SF | ENQ | NAK | ( | ) | _ | ' | | | | | | | | | |
| 1110 | E | | FM | | | + | ; | > | = | | | | | | | | | |
| 1111 | F | | ITB | | SUB | \| | ¬ | ? | " | | | | | | | | | |

Character code assignments other than those shown within the heavily 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.

**Figure D-2. United Kingdom I/O Interface Code**




Data Entry Keyboard



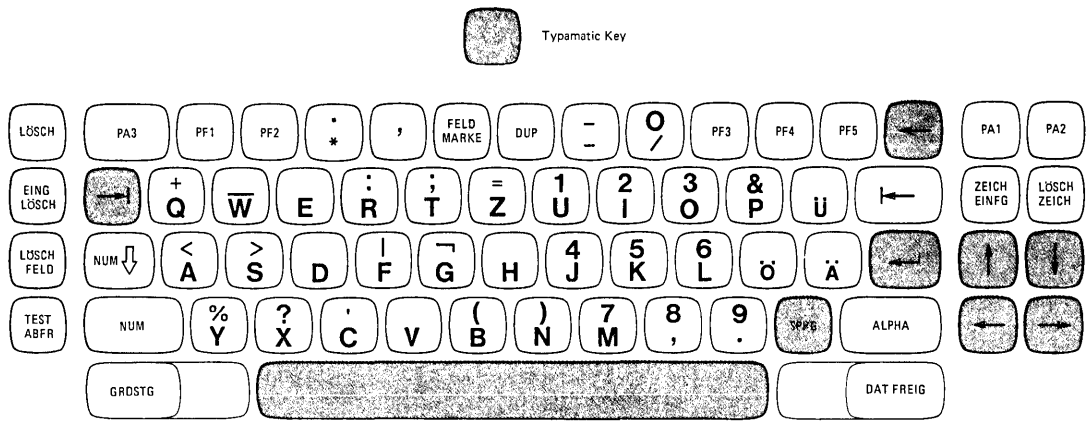

Typewriter Keyboard

**Figure D-3. French Keyboards**

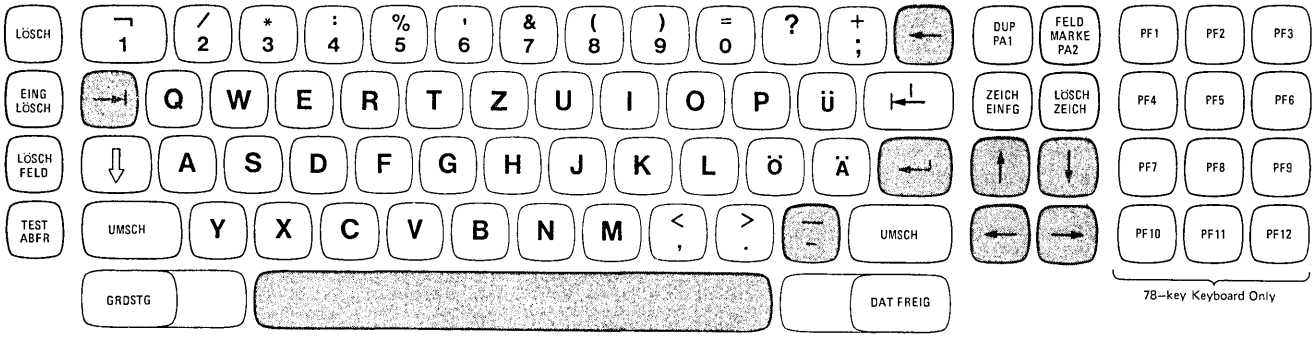
| Bits 4567 | Hex 1 | 00 | | | | 01 | | | | 10 | | | | 11 | | | | Bits 0,1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 2,3 |
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | 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 | | DUP | | RA | < | * | % | @ | | | | | | | | | |
| 1101 | D | | SF | ENQ | NAK | ( | ) | _ | ' | | | | | | | | | |
| 1110 | E | | FM | | | + | ; | > | = | | | | | | | | | |
| 1111 | F | | ITB | | SUB | \| | ¬ | ? | " | | | | | | | | | |

Character code assignments other than those shown within the heavily 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.

**Figure D-4. French I/O Interface Code**




Data Entry Keyboard



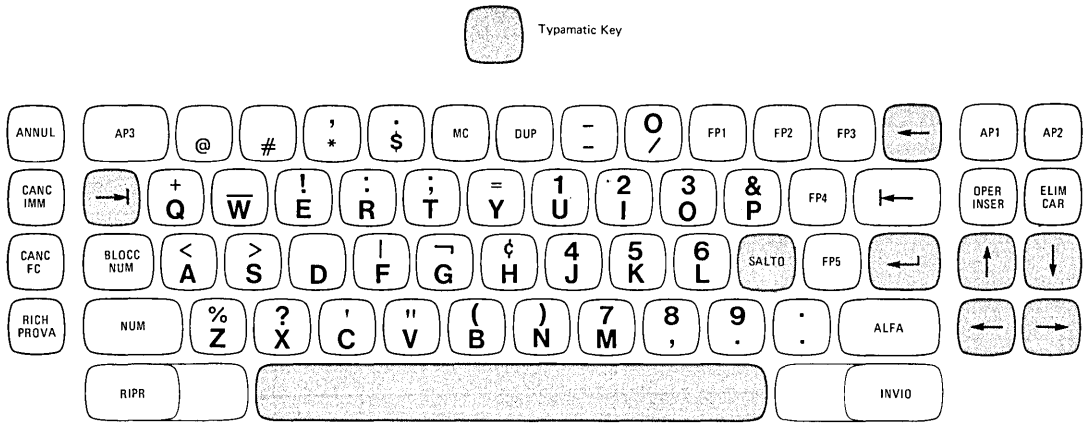

Typewriter Keyboard

**Figure D-5. German Keyboards**

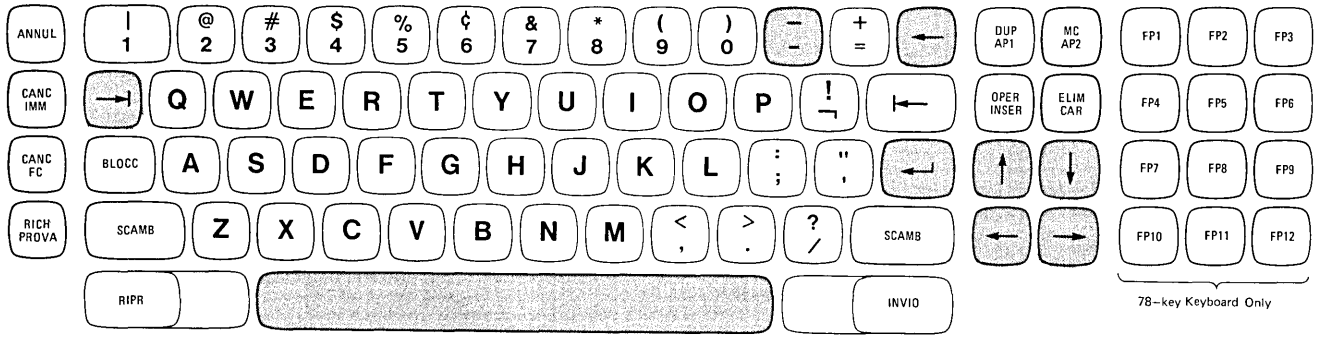
| Bits 4567 | Hex 1 | 00 | | | | 01 | | | | 10 | | | | 11 | | | | Bits 0,1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 00 | 01 | 10 | 11 | 2,3 |
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | 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 | Ü | | : | | | | | | | | | |
| 1011 | B | | | | | . | ü | , | ä | | | | | | | | | |
| 1100 | C | | DUP | | RA | < | * | % | @ | | | | | | | | | |
| 1101 | D | | SF | ENQ | NAK | ( | ) | _ | ' | | | | | | | | | |
| 1110 | E | | FM | | | + | ; | > | = | | | | | | | | | |
| 1111 | F | | ITB | | SUB | \| | ¬ | ? | Ä | | | | | | | | | |

Character code assignments other than those shown within the heavily 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.

**Figure D-6. German I/O Interface Code**




Data Entry Keyboard




Typewriter Keyboard

Figure D-7. Italian Keyboards

| Bits 4567 | Hex 1 | 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 |
| | | 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 | | DUP | | RA | < | * | % | @ | | | | | | | | | |
| 1101 | D | | SF | ENQ | NAK | ( | ) | _ | ' | | | | | | | | | |
| 1110 | E | | FM | | | + | ; | > | = | | | | | | | | | |
| 1111 | F | | ITB | | SUB | \| | ¬ | ? | " | | | | | | | | | |

Character code assignments other than those shown within the heavily 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.

Figure D-8. Italian I/O Interface Code

## Glossary

Terms in this glossary are defined here as they apply to the 3270 Display System.

*Alphameric Field:* A field that may contain any alphabetic, numeric, or special character that is available on any of the 3270 keyboards.

*Alphameric 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 alphameric 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.

*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.

*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 Stream:* All data transmitted through a channel in a single read or write operation to 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 alphameric 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 following character that 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.

*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.

*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.

*Printer Hang:* This condition exists when the print mechanism is unable to advance successfully. This condition can occur anytime 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".)

*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.

*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.

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