Program Product

IBM Virtual Machine/System Product: Terminal User's Guide

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IBM Virtual Machine/System Product: Terminal User's Guide

Program Number 5664-167

This publication is for the terminal user who needs information about:

- Terminal Initialization and General Procedures for All VM/SP Terminals

- Gaining Access to VM/SP

- Accessing VM/SP via Common Carrier Facilities

- VM/SP Logon and Logoff Procedures

- Typing Conventions after Logging On

- Display Terminals and Their Usage including Screen Management

- Typewriter-Like Terminals and Their Usage

- Program Function (PF) Keys -- Setup and Usage

- APL Considerations

PREREQUISITE PUBLICATION

For a thorough understanding and for effective use of this publication, the user should read *IBM Virtual Machine/System Product: Introduction*, Order No. GC19-6200.

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It is possible that this material may contain reference to, or
information about, IBM products (machines and programs), programming, or
services that are not announced in products (machines and programs),
programming, services that are announced   in your country.   Such
references or information must not be construed to mean that IBM intends
to announce such IBM products, programming, or services in your country.

This publication discusses the various terminal types supported by the IBM Virtual Machine/System Product (VM/SP). The Virtual Machine/System Product comprises the Control Program (CP) and the Conversational Monitor System (CMS). The Remote Spooling Communication Subsystem (RSCS) and the Interactive Problem Control System (IPCS) components of IBM Virtual Machine Facility/370, although not expanded by VM/SP, are available in the Release 6 package. However, you can appreciably extend the capabilities of these components in a VM/SP system by installing the RSCS Networking program product (5748-XP1) and the VM/IPCS Extension program product (5748-SA1).

Intended for all terminal users who plan to use VM/SP in their operations, the purpose of this publication is to allow a potential user of a virtual machine to gain access to VM/SP via one of these VM/SP supported terminals.

The user of any terminal that is supported by VM/SP -- whether a display unit or a typewriter-like terminal -- should be thoroughly versed in the use of the particular device. This publication does not include instructions in the use of terminals; only how to gain access to VM/SP.

Note: Throughout this publication, the term "VM/SP" refers to the VM/SP program product package when you use it in conjunction with VM/370 Release 6. The terms "CP" and "CMS" refer to the VM/370 components enhanced by the functions included in the VM/SP package. Any reference to "RSCS" or "IPCS", unless otherwise noted, is to the VM/370 components that are unchanged by the VM/SP package.

PREREQUISITE PUBLICATION

To use this publication effectively, users of VM/SP supported terminals should obtain the following prerequisite publications:

IBM Virtual Machine/System Product:

   General Information Manual, GC20-1838

   Introduction, GC19-6200

   Planning and System Generation Guide, SC19-6201

System Messages and Codes, SC19-6204

CP Command Reference for General Users, SC19-6211

CMS Command and Macro Reference, SC19-6209

System Product Editor User's Guide, SC24-5220

System Product Editor Command and Macro Reference, SC24-5221

System Product EXEC 2 Guide and Macro Reference, SC24-5219

IBM Virtual Machine Facility/370: Interactive Problem Control System (IPCS) User's Guide, GC20-1823, and the program product supplement to the VM/370 IPCS, Program No. 5748-SA1.

IBM 1050 Data Communication System:

   Operator's Guide, GA24-3425

   Principles of Operation, GA24-3474

IBM System/360 Component Descriptions and Operating Procedures IBM 1052 Printer-Keyboard Model 7 and IBM 2150 Console, GA22-6877

IBM 3767 Communication Terminal Operator's Guide, GA18-2000

IBM 3270 Information Display System Operator's Guide:

   IBM 3275 Display Station, IBM 3277 Display Station, IBM 3284 Printer, IBM 3286 Printer, IBM 3288 Line Printer, GA27-2742

   IBM 3274 Control Unit, IBM 3276 Control Unit/Display Station, IBM 3278 Display Station, GA27-2890

IBM 3033 Processor Complex and IBM 3033 Multiprocessor Complex Operating Procedures, GC38-0031

IBM 4331 Functional Characteristics and Processor Complex Configurator, GA33-1526

IBM 4341 Functional Characteristics and Processor Complex Configurator, GA24-3672

An Introduction to the IBM 3101 Display Terminal, GA18-2051

IBM 3101

Display Terminal Description, GA18-2033

Setup Instructions, GA18-2034

Operator's Guide, GA18-2035

Problem Analysis and Resolution Guide, GA18-2036

COREQUISITE PUBLICATIONS

The following publications are recommended for users of VM/SP supported devices and should be studied with care.

IBM 2741 Component Description, GA24-3415

IBM 3210 Console Printer-Keyboard Model 2 Component Description, GA24-3552

IBM 3215 Console Printer-Keyboard Component Description, GA24-3550

IBM 3767 Communications Terminal Component Description, GA27-3096

IBM System/370 Model 138 Functional Characteristics, GA24-3632

IBM System/370 Model 148 Functional Characteristics, GA24-3634

IBM System/370 Model 158 Functional Characteristics, GA22-7011

IBM System/370 Model 168 Procedures, GC38-0030

IBM 3033 Processor Complex and IBM 3033 Multiprocessor Complex:

Functional Characteristics, GA22-7060

Configurator, GA22-7065

IBM 3032 Processor Complex and IBM 3032 Multiprocessor Complex:

Functional Characteristics, GA22-7061

Configurator, GA22-7062

IBM 3031 Processor Complex and IBM 3031 Multiprocessor Complex:

Functional Characteristics, GA22-7066

Configurator, GA22-7071

IBM 2780 Data Transmission Terminal Component Description, GA27-3005

SUPPLEMENTAL PUBLICATIONS

Certain devices are also supported for remote spooling under the VM/370 component Remote Spooling Communications Subsystem (RSCS). These devices and how you use them are described in:

IBM Virtual Machine Facility/370: Remote Spooling Communications Subsystem (RSCS) User's Guide, SC20-1816

For users of certain other VM/370 supported devices that have APL compatible keyboards, the following publication is useful:

VS APL for CMS: Terminal User's Guide, SH20-9067.

The following publications provide added information about VM/370 and its features:

VM/370 Features Supplement, GC20-1757

OS/VS-DOS/VS-VM/370 Assembler Language, GC33-4010

If the VTAM Communications Network Application (VM/VCNA) program product (5735-RC5) is used to provide support for SNA terminals, the following publications are also required.

IBM VM/VCNA

General Information Manual, GC27-0501
Installation and Terminal Use, SC27-0502

HOW TO USE THIS MANUAL

In this publication, there are four parts as follows:

"Section 1. Introduction" contains general information on how to logon to the VM/SP system.

"Section 2. Display Terminals" gives some features of the video-type screens and their varying sizes. It also describes such things as data handling and screen management facilities as well as the APL feature on some of them.

"Section 3. Typewriter-Like Terminals" details the different typewriter-like terminals and how they are used with VM/SP.

"Section 4. General Procedures for All VM/SP Terminals" covers features common to many terminals. It also discusses multiple access, system logon, and terminal disconnect.

In addition, there are five Appendixes that detail a sample terminal session, give graphic-hexadecimal substitutions for the various terminal devices, and list terminals that access VM/SP.

TERMINOLOGY IN THIS PUBLICATION

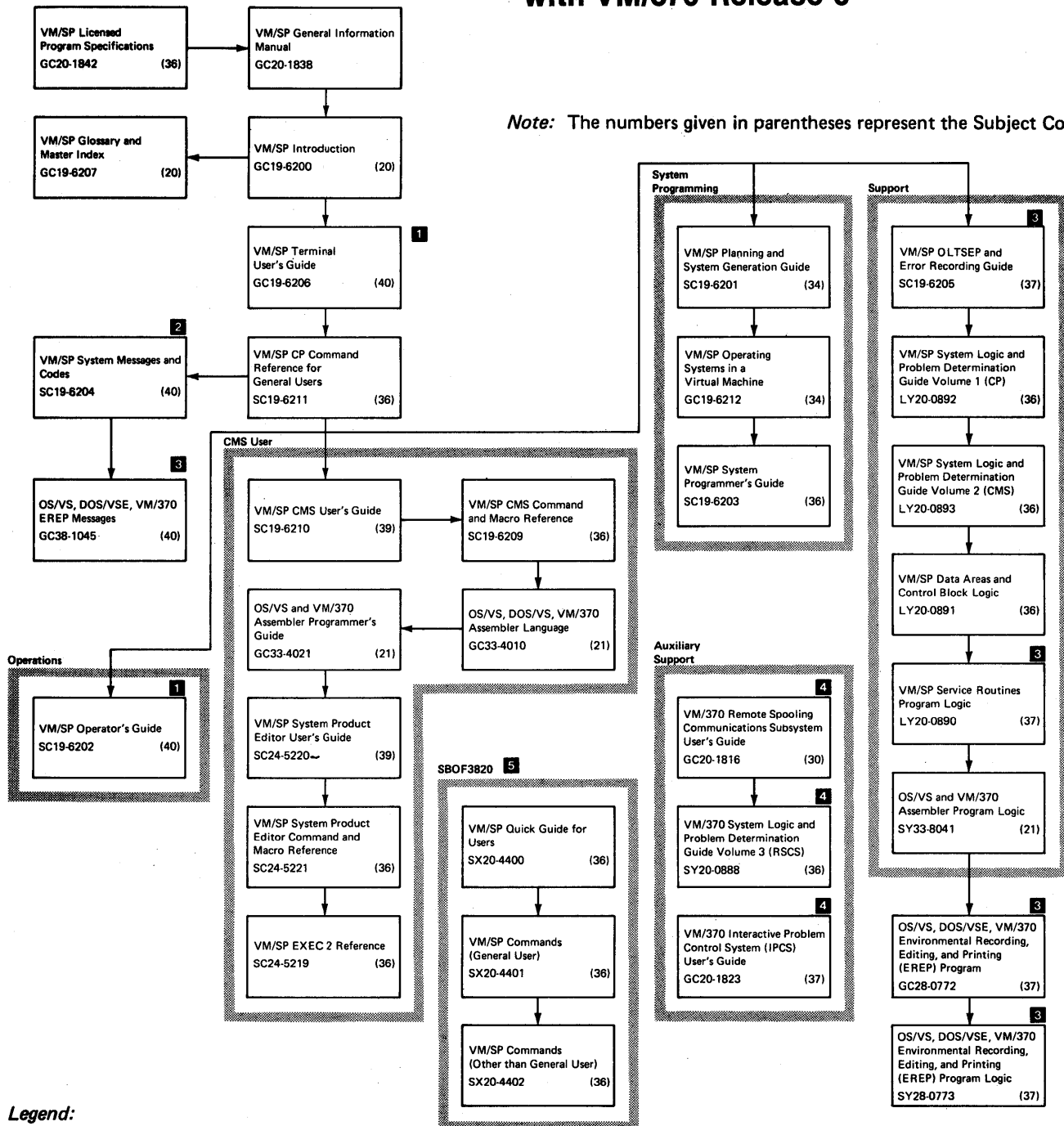The following terms in this publication refer to the indicated support devices:

- System/370 Processor also refers to the 4300 series processors as well as to the 303x series processors.

- Control Units(s) refers to any and all transmission control units (for example, the 270x series) as well as to adapters (that is, the Integrated Communications Adapter (ICA) on the System/360 Model 135).

- Display Device(s) refers to any and all display units (for example, the 327x series) as well as to consoles, terminals, and printers.

- Communications Controller(s) refers to any controllers (for example, the 370x series).

- Typewriter-Like Unit(s) refers to all nondisplay terminals (for example, the 2741).

- Display terminal usage information also pertains to display consoles used in display mode.

- Printer information pertains to all printers (for example, the 3270 Display Printer series).

- "3380" refers to the IBM 3380 Storage Facility. Information on the IBM 3380 Storage Facility is for planning purposes only until the availability of the product.

- "3880" refers to the IBM 3880 Storage Control Unit. Information on the IBM 3880 Models 2 and 3 Storage Control Units is for planning purposes only until the availability of the product.

- "3262" refers to the IBM 3262 Printer. Information on the IBM 3262 Printer is for planning purposes only until the availability of the product.

VM/SP LIBRARY

To understand the interrelationships of the publications in the VM/SP library, see Figure 1, which follows this "Preface."

Publications that support VM/SP as used in conjunction with VM/370 Release 6

Note: The numbers given in parentheses represent the Subject Code.

```
VM/SP Licensed
Program Specifications
GC20-1842          (36)

VM/SP General Information
Manual
GC20-1838

VM/SP Glossary and
Master Index
GC19-6207          (20)

VM/SP Introduction
GC19-6200          (20)

VM/SP Terminal
User's Guide
GC19-6206          (40)         [1]

VM/SP System Messages and
Codes
SC19-6204          (40)         [2]

VM/SP CP Command
Reference for
General Users
SC19-6211          (36)

OS/VS, DOS/VSE, VM/370
EREP Messages
GC38-1045          (40)         [3]
```

CMS User
```
VM/SP CMS User's Guide
SC19-6210          (39)

VM/SP CMS Command
and Macro Reference
SC19-6209          (36)

OS/VS and VM/370
Assembler Programmer's
Guide
GC33-4021          (21)

OS/VS, DOS/VS, VM/370
Assembler Language
GC33-4010          (21)
```

Operations
```
VM/SP Operator's Guide
SC19-6202          (40)         [1]

VM/SP System Product
Editor User's Guide
SC24-5220          (39)

VM/SP System Product
Editor Command and
Macro Reference
SC24-5221          (36)

VM/SP EXEC 2 Reference
SC24-5219          (36)
```

SBOF3820 [5]
```
VM/SP Quick Guide for
Users
SX20-4400          (36)

VM/SP Commands
(General User)
SX20-4401          (36)

VM/SP Commands
(Other than General User)
SX20-4402          (36)
```

System Programming
```
VM/SP Planning and
System Generation Guide
SC19-6201          (34)

VM/SP Operating
Systems in a
Virtual Machine
GC19-6212          (34)

VM/SP System
Programmer's Guide
SC19-6203          (36)
```

Auxiliary Support
```
VM/370 Remote Spooling
Communications Subsystem
User's Guide
GC20-1816          (30)         [4]

VM/370 System Logic and
Problem Determination
Guide Volume 3 (RSCS)
SY20-0888          (36)         [4]

VM/370 Interactive Problem
Control System (IPCS)
User's Guide
GC20-1823          (37)         [4]
```

Support
```
VM/SP OLTSEP and
Error Recording Guide
SC19-6205          (37)         [3]

VM/SP System Logic and
Problem Determination
Guide Volume 1 (CP)
LY20-0892          (36)

VM/SP System Logic and
Problem Determination
Guide Volume 2 (CMS)
LY20-0893          (36)

VM/SP Data Areas and
Control Block Logic
LY20-0891          (36)

VM/SP Service Routines
Program Logic
LY20-0890          (37)         [3]

OS/VS and VM/370
Assembler Program Logic
SY33-8041          (21)

OS/VS, DOS/VSE, VM/370
Environmental Recording,
Editing, and Printing
(EREP) Program
GC28-0772          (37)         [3]

OS/VS, DOS/VSE, VM/370
Environmental Recording,
Editing, and Printing
(EREP) Program Logic
SY28-0773          (37)         [3]
```

Legend:

[1] For SNA terminal users, the prerequisite publication is: *VM/VCNA Installation, Operations, and Terminal Use*, Order No. SC27-0502.

[2] All users of virtual machines must use the *VM/SP System Messages and Codes* publication.

[3] Contains information on VM/SP EREP support.

[4] VM/370 Release 6 components. However, the IPCS Extension Program Product (5748-SA1) and the RSCS Networking Program Product (5748-XP1) are recommended for use with VM/SP.

[5] If you want all three of the Reference Summary publications, use the SBOF number when ordering.

Figure 1.   Library -- Interrelationship of Publications

Contents

FIGURES

The terminal, a conversational input/output device, transmits information that you key in over dedicated leased lines, switched lines (telephone dialing facilities), or a local attachment to the VM/SP processor. A local attachment is the attachment of the terminal control unit(s) directly to a channel of the processor without using a transmission control unit or a communication controller.

Terminals that Access VM/SP

There are a variety of terminals -- both monochrome and color -- that can access the VM/SP system. These terminals are listed in "Appendix F. Terminals that Access VM/SP." Note that terminals that are equivalent to those explicitly supported by VM/SP may also function satisfactorily. However, it is incumbent on the customer to determine the equivalency. IBM does not assume any responsibility for the impact that any changes to IBM-supplied products or programs may have on such terminals.

CONNECTION WITH THE PROCESSOR

Any of the listed terminals (except the system consoles and those display stations attached to local control units) can be connected to the processor via switched or leased line facilities. The remote display stations must use leased line facilities. Only those remote display terminals that are the sole terminal on the switched line can be attached via dial-up -- for example, the 3275 or a 3276 equipped with one display station.

If the terminal uses switched or dial-up line connections, you must use a permanent communications data set attachment or an acoustic coupler. Whether you have a communications data set attachment or an accoustic coupler, you must dial a telephone number to establish a physical connection with the processor. Terminals that are connected to a control unit that has the facility to handle multiple display terminals must use the leased line hookup. Dial-up facilities to these units are not supported. For additional detailed description, see "Terminal Connection with the Processor" later in this section.

MESSAGES RECEIVED AT THE TERMINAL

This publication contains a sampling of system error messages. These messages are shown as they appear in VM/SP System Messages and Codes. They are included as an aid to understanding logging on and dialing procedures. Other console messages may occur because of System/370 error conditions, or CP or CMS command syntax errors. To understand such messages, see VM/SP System Messages and Codes.

Both uppercase and lowercase characters appear in the sampling of messages. The lowercase characters are used to represent situation-dependent terms or expressions whereas the uppercase characters designate constant segments of a message. Thus, uppercase characters indicate system responses that represent actual console printout or display. Lowercase characters indicate variables keyed in by the user or operator as input to VM/SP.

ATTENTION AND END-OF-INPUT-LINE SIGNALING

Two functions common to both display-type and typewriter-like terminals are attention and end-of-input-line signaling. These functions are as important to VM/SP as they are to the virtual machine. Attention signaling posts a pending interruption to the selected system -- either to CP or to the virtual machine. The end-of-input signal requests the controlling system to accept the previously keyed-in data line. The names of the keys on the associated terminal types that perform these functions are given in Figure 2.

In the balance of text,

    ATTN   refers to attention signal
    ENTER refers to end-of-input signal

Gaining Access to VM/SP

Gaining access to VM/SP requires two separate actions:

1. Being connected electrically to the processor.

2. Logging on with a LOGON command.

Signal	Terminal or Console Type	Key
Attention	2741, 3767	ATTN
	1050	RESET LINE
	3101 Models 10, 12, 13, 20, 22, 23	BREAK
	Teletype Models 33, 35[1]	BREAK
	3210, 3215	REQUEST
	System/370 Models 138, 148, 158	ENTER
	3066	ENTER
	3270	PA1, ENTER
	3036	ENTER, CNCL, or IRPT
	3278 Model 2A	ENTER, REQUEST
End-of-Input	2741, 3767	RETURN
	1050	RETURN[2] or ALTN coding plus numeral 5 (EOB)
	3101 Models 10, 12, 13, 20, 22, 23	Break key or X-OFF
	Teletype Models 33, 35	CTRL plus X-OFF (or with the appropriate terminal control unit feature on the computer, RETURN)
	3210, 3215	END
	3270, 3066	ENTER
	System/370 Models 138, 148, 158	ENTER
	3036	ENTER (or as indicated for a particular step)
	3278 Model 2A	ENTER

[1] Trademark of the Teletype Corporation, Skokie, Illinois.
[2] Requires RPQ #28235

Figure 2. Keys Used for Signaling Attention and End-of-Input

TERMINAL CONNECTION WITH THE COMPUTER

Most terminals and display consoles, as well as the display consoles for processors, are attached to the System/370 processor in one of four ways:

1. Integrated as part of the processor. This method is reserved for system consoles and alternate system console devices.

2. Attached by means of leased or switched lines through a transmission control unit. Those IBM and Teletype terminals that are attached to control units use this method.

3. Attached locally (that is, connected to the processor without a transmission control unit) through a control unit to a selector, a byte multiplexer, or a block multiplexer channel.

4. Attached remotely on leased lines via a transmission control unit and a display control unit.

Both leased lines and switched lines are common carrier communication facilities. The leased line is a dedicated line that contains no switching systems and permanently links the terminal to the processor. Switched lines employ normal telephone dialing facilities to effect a temporary terminal-to-computer connection. The connection exists for as long as necessary and only you, or VM/SP, can break it. Terminals using switched lines can use a special communications data set or a standard telephone with a special acoustic coupler arrangement. Figure 3 shows the various terminal links to the processor.

Channel-Attached (Local) Display Consoles

Channel-attached connections for terminals and system consoles are similar to locally attached display terminals because they are attached directly to the multiplexer channel (see Figure 3) without line transmission control units.

For the message "VM/370 online" to appear on the screen, VM/SP must be operational, the device must have power on, be enabled, and online to the system.

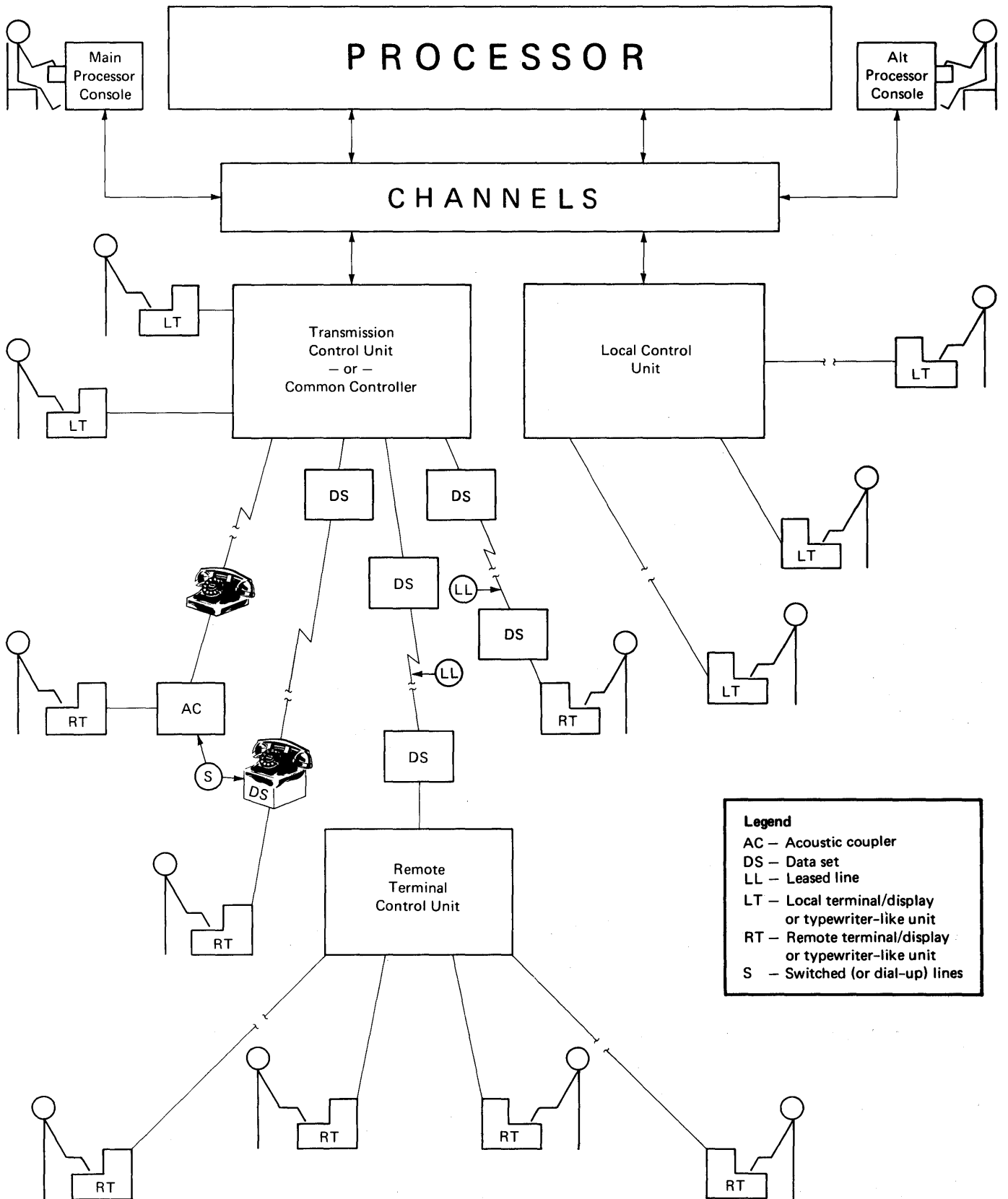Figure 3. Terminal Links to the Processor (Uniprocessor Configuration)

Legend
AC — Acoustic coupler
DS — Data set
LL — Leased line
LT — Local terminal/display
or typewriter-like unit
RT — Remote terminal/display
or typewriter-like unit
S — Switched (or dial-up) lines

Initiation Procedures for Processor Link

The procedures and steps for use of any VM/SP-supported terminal enables terminal-to-processor communication and terminal printing format. Use the following procedure if your unit is attached to a leased (nonswitched) line.

SETTING SWITCHES: Place the switches in the settings as indicated in your unit's User's Guide making sure to turn on the power-on switch last. Ignore all blocked or inoperative switches.

Display Terminals on Leased Lines

Figure 3 shows display terminal leased line (nonswitched) connections. For additional and detailed information on the individual display terminal system availability, see the appropriate publication cited in the "Preface."

Typewriter-Like Terminals on Leased Lines

The leased line (nonswitched) connection for typewriter-like terminals are shown in Figure 3. For information in greater detail, see the appropriate publication for your unit cited in the "Preface".

Display Terminals on Switched Lines with a Data Set

Figure 3 shows the switched line (dial) connection for display terminals using common carrier data sets.

If the terminal uses a switched (or dial-up) line with a common carrier data set to establish contact with the VM/SP processor, certain procedures must be used. You must follow the procedures detailed in the appropriate publication for your unit listed in the "Preface".

Typewriter-Like Terminals on Switched Lines with a Data Set

The switched line (dial) connections for typewriter-like terminals using common carrier data sets are shown in Figure 3.

Note: For procedures pertinent to those typewriter-like terminals that connect to a Western Electric[1] 103A2 (or equivalent) data set or for other types of models of data sets, consult the appropriate User's Guide or the common carrier for specific operating instructions.

If the terminal uses a switched (or dial-up) line with a common carrier data set to establish contact with the VM/SP processor, use the procedures outlined in the User's Guide for your particular unit cited in the "Preface".

Display Terminals on Switched Lines with an Acoustic Coupler

Figure 3 shows the switched line (dial) facilities for display terminals using an acoustic coupler.

The procedures for activating any of these units are found in the appropriate User's Guide or Operator's Guide listed in the "Preface".

Typewriter-Like Terminals on Switched Lines with an Acoustic Coupler

The switched line (dial) facilities for typewriter-like terminals using acoustic couplers are shown in Figure 3.

The procedures to activate any of these units are given in the appropriate User's Guide or Operator's Guide cited in the "Preface".

Connecting Teletype Model 33/35 with VM/SP on Switched Lines

To make a telephone connection between a Teletype terminal and the VM/SP processor:

1. Press the ORIG pushbutton to obtain a dial tone. The speaker volume control is under the keyboard shelf to the right. Make sure that the volume is high enough to hear the dial tone. After establishing contact, turn down the volume.

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[1]Trademark of Western Electric Co., New York, N.Y.

2. Dial the VM/SP system's telephone number.

   Note: On the Model 35, press the "K" (keyboard) pushbutton on the left side of the panel.

3. The system should answer with a high-pitched tone. At this point, the ORIG pushbutton lights up. If the pushbutton does not light up, or if it goes out during the terminal session, repeat steps 1 and 2 above.

If there is no answer, or the number is busy, push the CLR pushbutton to break the connection and try again later. Otherwise, "VM/370 ONLINE" should type out at the terminal.

VM/SP LOGON PROCEDURES

Before the facilities of the VM/SP system are made available to you, identify yourself to VM/SP by giving your user identification code word (userid) and your password (both of which were assigned to you when you were originally authorized to have access to the VM/SP system). This identification procedure is called logon. When you finish logging on, use the CP IPL command to load your virtual machine with some operating system, such as DOS, OS, OS/VS1, or the Conversational Monitor System (CMS).

Before implementing the logon procedure outlined below, familiarize yourself with the terminal you are using and prepare it for use with VM/SP. Enter your input in uppercase or lowercase characters, or a combination of both.

1. Establish a communications connection between the terminal and the processor as discussed under "Terminal Connection with the Processor."

2. VM/SP acknowledges that communication has been established by displaying or typing a message in one of the following formats; the format depends on your particular unit.

   -- Format 1

   vm/370 online   xxxxxx xxxxx

   This line appears if the terminal has a PTTC/EBCD character set and is attached to either a control unit or a transmission control unit in emulator mode.

-- Format 2

   xxxxxx xxxxx   vm/370 online

This line appears if the terminal is a standard Selectric typewriter-like unit (or has the correspondence character set) and is attached to a control unit or a transmission control unit in emulator mode.

Note: In either of the foregoing cases, the portion indicated by the x string is meaningless; just ignore it.

-- Format 3

   vm/370 online

This line appears if the terminal is a display device equipped with lowercase letters or a unit attached to a transmission control unit (non-emulator mode).

-- Format 4

   VM/370 ONLINE

This line appears if the terminal is a Teletype or a display unit that is not equipped with lowercase letter display capability.

Note: VM/SP does not support NCP (Network Control Program) mode. VM/SP also does not support the MTA (Multiple Terminal Access) feature of NCP. However, if the VTAM service machine component of SNA (Systems Network Architecture) is in place, the appropriate network control program will be in effect.

3. At this point, press the ATTN key (or equivalent) to unlock the keyboard. On all display consoles the keyboard is already unlocked.

4. The system responds by unlocking the keyboard on most units or unlocking the keyboard and turning on the PROCEED light on some units. When the PROCEED light turns on, it indicates that keyed-in data can now be accepted. On Teletype Model 33 or 35, VM/SP responds by typing a period (.) to indicate that you can start keying in data.

5. You identify yourself to the system by entering the LOGON command and your userid, as follows:

   logon userid

VM/SP responds with a prompt, as follows:

ENTER PASSWORD

When you key in your password, it is not displayed either in the user input area or the screen output area.

If your terminal is a 2741, an eight-character mask is printed along with the prompt, as follows:

ENTER PASSWORD:
XXXXXXXX

You key in your password in the area covered by this mask. VM/SP thus preserves the security of your password. Three different letters overprint each other without advancing the line so you can type your password on top of them.

When you use real system consoles or a VM/SP system console, you, or the system operator, can log on again but cannot automatically protect your password. In such case, once the password is typed, you (or the system operator) must mark over it or obliterate it somehow.

Any portion of the LOGON command line may be edited using the VM/SP logical line editing symbols, or -- if on a display device -- by using the keyboard's cursor control keys (see "Logical Line Editing Character Usage" in Section 4).

If you enter the LOGON command line incorrectly, an error message is displayed in one of the following four formats:

restart   XXXXXX XXXXXX

XXXXXX XXXXXX   restart

restart

RESTART

The format variations are detailed in item 2 above. You must then reenter the LOGON command line.

6. When the system prompts:

ENTER PASSWORD:

type your password, then press the ENTER key or its equivalent.

If your particular terminal is equipped with the optional operator's

identification card reader, the system further prompts with:

INSERT ID CARD:

You must respond by inserting a magnetically encoded identification card into the read slot. The reader scans data stored in the card and the value does not appear in the user input area of the screen. The reader transmits this data to VM/SP where it is compared with system administrator supplied values. If the system accepts the comparison, the logon procedure completes as it does for other terminals.

Note: The identification data never appears in the output display area.

7. Assuming no logon errors, VM/SP displays one, two, or all of the following kinds of messages:

• LOGMSG setup time; that is, the time and date that the logon message started

• LOGMSG messages with an asterisk (*) as the first character

• FILES message (which describes the status of your unit record spool files)

• VM/370 LOGON message

If the VM/SP system operator has set up log messages preceded by an asterisk (*), they automatically appear on your terminal at this time. For example:

LOGMSG 09:34:54 02/15/72
*FOR CMS, IPL 190 UNTIL FURTHER NOTICE
*QUERY LOG FOR ADDITIONAL INFORMATION

Additional lower priority log messages can be present in the VM/SP system. You can enter the command:

query logmsg

Any remaining log messages are displayed.

Following the log message, if any card image files are in your virtual card reader or output image files for your virtual printer or punch, the message:

FILES: xxx RDR, xxx PRT, xxx PCH

is displayed, where xxx indicates the number of files of each type. VM/SP omits this message if there are no spool files.

The system then responds with the
LOGON message:

LOGON AT hh:mm:ss zzz weekday mm/dd/yy

where:

hh:mm:ss   is the time of day
zzz   is the time zone (for
              example, EST, EDT,
              CST, etc.)
weekday   is the day of the week
mm/dd/yy   is the date

This message indicates that VM/SP
accepted the password and that the
VM/370 LOGON procedure finished. Your
terminal is in the control program
(CP) environment and you can issue any
valid CP console function. To load
CMS into the virtual machine, proceed
to Step 9. To load any other
operating system, proceed to Step 8.

During the logon procedure for dial-up
terminals, VM/SP uses the Line Timeout
feature when it reads the userid and
password. If you fail to type any
character during a 28-second period,
the line is considered to be idle and
unused whereupon VM/SP disconnects the
line. This feature prevents
teleprocessing facilities from being
inadvertently tied up by unauthorized
or accidental connections to the VM/SP
processor. If you are using a
switched line, you must redial the
processor.

Note: Issue the CP LOGOFF command when
you finish using VM/SP. VM/SP
responds by displaying a message that
indicates the duration of the terminal
session and disconnects the terminal
if it is on a switched line. If you
turn off the terminal without logging
off, you are charged with at least 15
minutes more of system connect time
than you used (see "VM/SP Logoff
Procedures" for more details).

8. You can now load any operating system
into your virtual machine. To load in
CMS, proceed to Step 9. To load
another operating system, issue the
IPL command specifying the address of
the virtual device that contains the
operating system to be loaded (for
example, IPL 293, or IPL 00C), or the
system name if it is a saved system
(for example, IPL CMS). If the device
identified in the IPL command contains
an operating system (such as, OS/VS1),
the terminal becomes the system
console for that virtual machine.

9. If it is not done automatically for
your virtual machine, you can invoke
CMS in a typical installation by
typing in:

    ipl 190

    -- or --

    ipl cms

This loads a copy of the CMS system
into the virtual machine.

Note: CMS can reside on a device at
some address other than 190, and a
saved CMS system need not be named
"CMS."

10. The terminal then receives a message
similar to the following:

    VM/SP CMS - mm/dd/yy hh:mm [other
       installation-dependent information]

where:

mm/dd/yy   is the latest generation
              date

hh:mm   is the latest time of CMS
              system use

The CMS system is now in control and
you can issue any CMS command. For a
detailed description of the CMS
facilities available, see the VM/SP
CMS User's Guide.

ERROR MESSAGES DURING LOGON

Some of the many reasons that VM/SP may
reject your request for access are:

• Invalid password used

• Userid is in use by someone else

• Userid is invalid or missing

• Userid given is not in VM/SP directory

• Maximum number of users on system

• An error occurred while reading your
  VM/SP directory entry.

Error messages and other system messages
always print or display on your console in
uppercase letters. In this publication,
variable terms are shown in lowercase; for
example, raddr (real address) or userid
(user identification). When these
expressions appear on the display screen or

print on your console sheet during a
session, they give you the real device
address or your identification.

Examples of VM/SP Error Messages

The following are some error messages that
may appear at your terminal. Their meaning
and suggested user actions are given.

DMKxxx050E   PASSWORD INCORRECT. REINITIATE
              LOGON PROCEDURE
              indicates that you specified an
              invalid password. The logon
              procedure must be repeated.
              Refer   to   "VM/SP   Logon
              Procedures" Step 5.

DMKxxx054F   ALREADY LOGGED ON LINE raddr
              indicates that   another user
              with the same userid is logged
              on at   the terminal   whose real
              line   address   (raddr)   is
              specified by three hexadecimal
              digits.

    VM/SP does not allow two users with the
same userid to log on at the same time.
Although the second user cannot log on, the
CP MESSAGE   command can be   issued to
communicate with the user who is already
logged on with that userid. The CP MESSAGE
command can also be used to communicate
with the system operator.

    For other messages and their meanings,
see VM/SP System Messages and Codes.

Gaining Control of Your Virtual Machine

If a conflict occurs where someone else is
using your userid and it is imperative that
you gain control of your virtual machine,
you can request the other user to log off
the virtual machine. If this does not
achieve the desired results, you can send a
message to   the VM/SP   system operator
requesting that he force the other user off
the system.

    Both of   these techniques use the CP
MESSAGE command. The MESSAGE command is
one of the few VM/SP commands that you can
use before logging on.

    You can   use the   following console
examples of the MESSAGE command in the
situations described above. Assume JONES is
your user identification   and that the
active user of your userid knows that you

may want to use your virtual machine, you
would send a message as follows:

        message jones need my virtual machine
        plz logoff

the user of your virtual machine would
receive:

    MSG FROM   LOGONxxx   NEED   MY   VIRTUAL
    MACHINE PLZ LOGOFF

where xxx is the real line address to which
your terminal is attached. This enables
the user of your virtual machine to send a
response message to you if he desires (see
Note). If you receive no response and you
are still unable to log on, you could
contact the VM/SP system operator:

    m op need my virtual machine force
      current user off-jones

The operator not only can force the active
user off the system, but also can disable
that user's teleprocessing line to prevent
subsequent logon attempts.

Note: A message sent to an active logged-on
user does not guarantee that a response
will be received. The user may be away from
his terminal, or he may have invoked CP
options that inhibit receiving of messages.

AFTER LOGON

The commands that you use between logon and
logoff, depend upon your assigned privilege
class or classes.

    There   are   VM/SP   publications   that
indicate the category of user for each of
the various privilege classes as well as
the range of CP commands within each class.
If you do not know the privilege class
assigned to   your   virtual machine, you
should contact the VM/SP system programmer.
If you wish to know which CP commands are
available to your assigned privilege class
or classes, refer to the VM/SP CP Command
Reference for General Users and the VM/SP
Operator's Guide.

    In the CP environment, if you enter a
command that is not a valid CP command or
one that requires a privilege class that
you do not have, the message:

    ?CP: xxxxx

occurs, where xxxxx is the command line
that you entered.

In the CMS environment, the following message is displayed when you issue an invalid or unknown CP or CMS command:

UNKNOWN CP/CMS COMMAND

If you use the CMS command CP to prefix an invalid or unknown CP command, VM/SP types the following message:

UNKNOWN CP COMMAND

Note: If you have problems, you may want to use the CMS HELP command. For details, see VM/SP CMS Command and Macro Reference.

When the virtual machine requires a response from you, but you wish to issue one or more CP commands before responding, press the attention key once or twice, depending on the mode (edit or input) setting, to enter the CP environment. Then enter the desired CP commands, for example:

MSG OP PLEASE ATTACH A SCRATCH
TAPE AS MY 181

When you finish entering commands, return to the virtual machine environment via the BEGIN command. VM/SP cancels the virtual machine's read to the terminal with a unit exception. The virtual machine operating system then reissues the read, and you can now enter the required virtual machine response. As an alternative, you could:

• Provide the required response first, which goes to the virtual machine operating system. However, instead of ending the input line in the normal manner, enter three blank characters and press the ATTN key one or two times depending upon the terminal mode setting.

• The virtual machine then enters the CP environment, where CP performs the function. (If the ON option of the SET RUN command is in effect, you can enter only one line of input before control returns to the virtual machine operating system.)

• Return to the virtual machine operating system via the BEGIN command. (If the ON option of the SET RUN command is in effect, control automatically returns to the virtual machine operating system after you enter the first CP function.)

VM/SP LOGOFF PROCEDURES

When you finish using the VM/SP system and wish to end the terminal session, log off from VM/SP. If you are not already in the VM/SP control program (CP) environment at the time you wish to log off (that is, you are still using CMS, DOS, OS, or OS/VS1 in your virtual machine), you can enter the CP environment by issuing the #CP command, or by quickly pressing the ATTN key once or twice (depending on the operational mode of the virtual machine). The keyboard, if previously locked, is unlocked and you now type LOGOFF then press the ENTER key or its equivalent. The system responds with:

CONNECT=hh:mm:ss VIRTCPU=mmm:ss.hs
   TOTCPU=mmm:ss.hs
LOGOFF AT hh:mm:ss zone weekday
   mm/dd/yy

and connection to the computer terminates if the terminal is on a switched or dial-up line. The connect time is in hours, minutes, and seconds; the virtual processor and total processor times are in minutes, seconds, and hundredths of a second. The logoff procedure then ends, and you may turn off terminal power.

Note: If you turn off the terminal without issuing the CP LOGOFF command when you finish using VM/SP, you are charged with a minimum of 15 minutes more of system connect time than you actually used.

If you want to end the terminal session, but do not want to lose the dial-up connection with the processor (so that another user may logon from the same terminal), you enter:

logoff hold

The keyword HOLD indicates to CP that it should not disconnect the terminal from the VM/SP computer but should type out the "vm/370 online" message again, as in step 2 of the logon procedure. The next user can then log on to VM/SP.

Logoff and Security

When telecommunication line failures affect VM/SP, it places the user virtual machine in a DISCONNECT status for 15 minutes then severs the connection to the user terminal. You have 15 minutes in which to reestablish the connection for your virtual machine before a forced logoff occurs.

Now, assume you complete your virtual machine activity. You turn off power on your terminal instead of invoking the LOGOFF command and then walk away. When this occurs, your virtual machine is put into DISCONNECT status. The DISCONNECT status is for 15 minutes if, and only if, (1) CP attempts to write data to your

terminal while it is powered off, or (2) another user powers on your terminal. Note that the same sequence of events occurs:

- If your terminal is disconnected from the control unit

- If the security key is turned to the locked position and then turned back to the unlocked position

- When, on some display terminals, the unit is switched to TEST mode and then back

VM/SP Environment Conventions

Each input line that you key in at the terminal is transmitted to the VM/SP system, where a routine processes (examines and accepts or rejects) the line. The portion of the system that has control at the time of the input determines the particular processing routine. Each portion of the system into which you can enter input constitutes a unique environment, and only a part of all possible input is acceptable to any given environment. The following are the environments of the VM/SP system:

- CP and Echo commands environment

- CMS and IPCS command environment:

  --Debug environment

  --Editing environment (input or edit mode)

- RSCS command environment

In addition to these specific environments, you can enter input to any other executing program that requests terminal input. These other input-processing programs fall into an additional category called the "program environment," in which the executing program (for example, EDGAR, FORTRAN Interactive Debug, or any user-written program) determines the acceptability of an input line.

You can, at any time, cause control to pass from one environment to another. Figure 4 illustrates the transfer of control as you issue various commands and subcommands. For more detailed information, consult the VM/SP CMS User's Guide.

For further information on RSCS and IPCS, refer to VM/370 Remote Spooling Communication Subsystem (RSCS) User's Guide

and VM/370 Interactive Problem Control System (IPCS) User's Guide, respectively.

PROCESSING ROUTINES

The input processing routines fall into three main categories:

- The VM/SP Control Program (CP command environment)

- A central CMS service routine (CMS command environment)

- A particular CMS command (debug, edit, or input environments)

Input lines acceptable to the CP environment are CP commands; they are sometimes referred to as console functions because, for the most part, they simulate functions that you can perform at a System/370 console. Any CMS command can be input to the CMS command environment. You can also issue CP commands from the CMS command environment.

CP enters the Echo environment when you issue the CP command ECHO. All keyed-in text lines entered as input in the Echo environment return unchanged to the sending terminal for the number of times you specify. This command checks out the operation of a terminal and its communication line.

The DEBUG and EDIT commands cause you to enter CMS subenvironments. Lines acceptable to the environments of these commands are subcommands, or input, depending on the particular mode that is entered when the command is issued.

Use of the EDIT command enables the user to create a new file or make changes to an existing file. Two editors are available with VM/SP: (1) The original CMS editor and (2) the System Product editor. In this publication, all information about editing refers to the orginal CMS editor.

After you issue the EDIT command, the System Product editor automatically places you in CMS editor compatability mode. In this mode, you can issue CMS EDIT subcommands and the System Product editor's XEDIT subcommands. For complete information on EDIT compatability mode as well as instructions on how to invoke the original CMS editor, see "Appendix B" in IBM VM/SP System Product Editor Command and Macro Reference.

If you use an EDIT command with a fileid that is the same as an existing fileid, CMS

IPL
CMS

EDIT
command

INPUT
mode

CP		CMS		EDIT		INPUT
CP commands		CMS commands IPCS commands		EDIT subcommands #CP (command)		Any input line #CP (command)

IPL
RSCS

DEBUG command
Program check

RSCS		DEBUG
commands		DEBUG subcommands

IPL
a system

Program loaded
and started

Other Operating Systems		PROGRAM
Any acceptable input		Any acceptable input

ECHO
command

EXEC
procedure

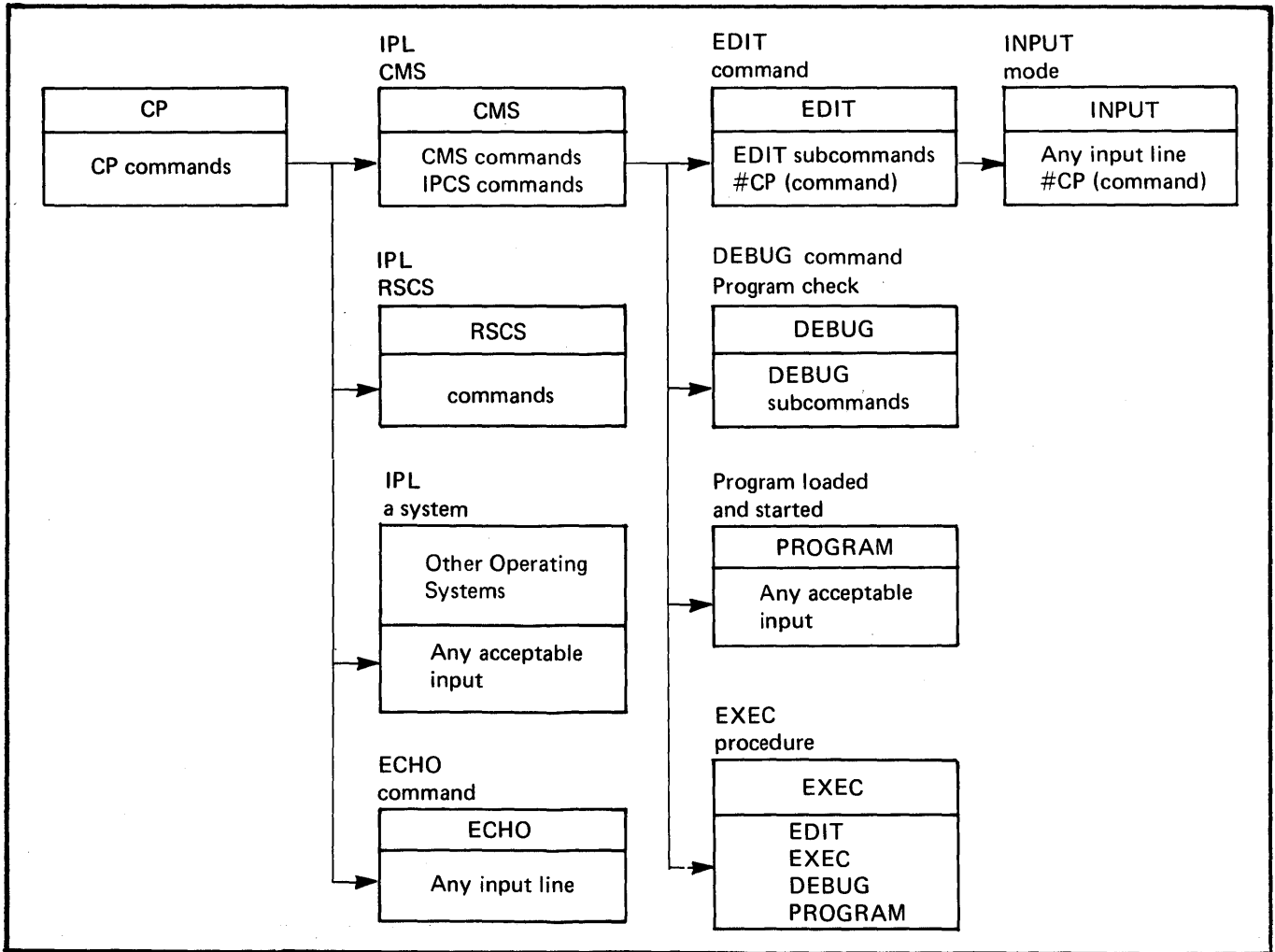| ECHO		EXEC
Any input line		EDIT EXEC DEBUG PROGRAM

Figure 4. VM/SP Operating Environments and Commands

enters edit mode. Edit mode allows you to examine and modify an existing file. You can enter input mode while in edit mode by typing "input."   Input mode allows you to enter new lines into your file. If you use an EDIT command with a fileid different from any existing file, you can enter input mode to create the new file. Any data you now type at the terminal becomes part of the new file. The CMS EDIT function does not check input line validity while in input mode.

If at any time you wish to verify which environment you are in, enter a null (blank) line.   Pressing the ENTER key (or equivalent) creates a null line that is a logical or physical line.   The system then responds   with   the   environment   that currently has control (for example, CMS or edit). A null line entered while in input mode returns control to edit mode.

Attention Handling and Mode Switching

Users of virtual machines can use an attention interruption to signal CP or their program running in a virtual environment. Pressing the ATTN key on the virtual machine console causes an attention interruption to CP or the virtual machine. The interruption condition suspends the current virtual machine activity to allow you to initiate alternative action in the environment of your choice.

To determine which key on your terminal signals an attention interruption, see Figure 1.

REFLECTING THE INTERRUPTION

Every logged-on user of VM/SP basically has two operating environments:

- CP mode--the environment for initiating CP console functions.

- VM mode--the environment of the virtual machine.

When your virtual machine is in CP mode, you can issue CP commands to control the system and the I/O resources of your virtual machine. The operating system subsequently uses these resources in your virtual machine environment. VM mode refers to the virtual machine environment within which the Conversational Monitor System (CMS) or any other operating system can reside.

The method that you use to select the operating mode depends on:

- The current operating environment

- The current status of the terminal regarding attention signaling

- The operating mode that you want

CP is the base mode from which all other modes must operate. A logon operation puts your terminal into CP mode. Other operational modes, such as CMS, OS, or DOS, are VM modes. They are entered by the CP IPL command. Therefore, if you have not loaded an operating system, you can only reflect attention signaling to CP. If you load an operating system into the virtual machine, then the choice of interruption reflection may be either to CP or to the virtual machine.

You can specify VM/SP handling of attention signaling by using the CP TERMINAL command:

    TERMINAL MODE {CP|VM}

If you specify TERMINAL MODE CP, pressing the ATTN key one or more times forces the virtual machine to CP mode for console input. To get back to CMS, use the BEGIN command.

If you specify TERMINAL MODE VM, pressing the ATTN key once signals the operating system running in the virtual machine (VM mode); pressing the ATTN key twice in quick succession places the virtual machine in console function mode (CP mode). If you have reset your virtual machine while in TERMINAL MODE VM, you must press the ATTN key more than once to unlock the keyboard for CP input.

Note: On some terminals, the ENTER key performs the same function as the ATTN key. However, the CP TERMINAL MODE command affects only the ENTER key.

Figure 5 shows the response of CP to ATTN signaling when the virtual machine is running in VM mode. This design allows an escape to the CP console function level from virtual machines that may be in an I/O loop or are not recognizing an attention interruption.

Note: One exception to this is the 3210/3215 because there is no way to enter CP mode on a 3210/3215 while in VM mode without first getting a read from the virtual machine and then using the #CP function.

VM mode is the default mode for all users of the VM/SP system except for the primary system operator, who defaults to CP mode. In some cases, the action differs depending upon whether you press the ATTN key once or more than once; in cases where ATTN is once or more than once, the action is the same regardless of the number of times you press the ATTN key.

Figure 6 details the action of the control program when you press the terminal's ATTN key while the virtual machine is in CP mode. CP mode is the mode for users who have issued TERMINAL MODE CP and for the primary VM/SP system operator. The action is the same whether the ATTN key is pressed once or more than once.

State	Press ATTN Key	Action
Terminal idle; keyboard entry blocked; virtual machine running	1	Attention interruption pending; virtual machine running
	>1	Keyboard activated for CP input
Terminal receiving output from virtual machine	1	Attention interruption pending; virtual machine running
	>1	Keyboard activated for CP input at completion of console I/O
Keyboard activated for input to virtual machine; no data entered or all data deleted	1	Device end (DE) and attention status pending; virtual machine running[1]
	>1	Unit exception (UE) status pending; keyboard activated for input
Keyboard activated for input to virtual machine; some data entered	1	Unit exception (UE) status pending; virtual machine running
	>1	Device end (DE) status pending; keyboard activated for CP input
Keyboard entry blocked; executing CP command	1 or >1	Attention ignored
Keyboard entry blocked; in SLEEP mode entered via ATTN command	1 or >1	Keyboard activated for CP input
Keyboard entry blocked; in SLEEP mode entered via DIAGNOSE instruction	1 or >1	Virtual machine resumes execution
Terminal receiving output from CP but not from user command	1	Attention interruption pending; virtual machine running
	>1	Keyboard activated for CP input
Terminal receiving output in response to CP command	1 or >1	Output line canceled and in some cases command output canceled
Keyboard activated for CP input; no data entered or all data canceled	1 or >1	Attention interruption made pending; virtual machine running
Keyboard activated for CP input; some data entered	1 or >1	Input line canceled; keyboard activated for CP input

[1] To perform this function on a display unit, position the cursor one position to the left of the user input area and press the ENTER key.

Figure 5. Attention Handling in VM Mode

State	Action
Terminal idle; keyboard entry blocked; virtual machine running	Keyboard activated for CP input
Terminal receiving output from virtual machine	Keyboard activated for CP input
Keyboard activated for input to virtual machine; no data entered or all data deleted	Unit exception (UE) status pending; keyboard activated for CP input
Keyboard activated for input to virtual machine; some data entered	Device end (DE) status pending; keyboard activated for CP input
Keyboard entry blocked; executing CP command	Attention ignored
Keyboard entry blocked; in SLEEP mode entered via command	Keyboard activated for CP input
Keyboard entry blocked; in SLEEP mode entered via DIAGNOSE instruction	Virtual machine resumes execution
Terminal receiving output from CP but not from user command	Keyboard activated for CP input
Terminal receiving output in response to CP command	Output line canceled and in some cases command output canceled
Keyboard activated for CP input; no data entered or all data canceled	Attention interruption pending; virtual machine running
Keyboard activated for CP input; some data entered	Input line canceled; keyboard activated for CP input

Figure 6. Attention Handling in CP Mode

OTHER MODE SWITCHING AND ATTENTION PROCESSING FACILITIES

In addition to signaling attention via a designated console key, VM/SP has other features that enhance mode switching and attention handling activity. They are:

- The CP ATTN or REQUEST command
- The CMS CP command
- The CP TERMINAL ATTN ON/OFF command
- The #CP command
- The CMS SET AUTOREAD ON/OFF command

The CP ATTN and REQUEST Commands

The ATTN and REQUEST commands are functionally identical. They execute while in CP mode, creating an attention interruption pending to the operating system running in the virtual machine. This pending interruption is for or from the device acting as the system console.

The CMS CP Command

The CMS CP command allows you to invoke CP commands and execute them while in CMS.

In most instances, the CMS CP command is unnecessary. CP commands are accepted and executed while in the CMS environment provided the SET IMPCP ON (the default) command is in place. The CMS CP command is necessary when both CP and CMS command names are identical (for example, SET, START) and in EXECs.

Note: Use of the CMS CP command is not allowed from within a CMS subsystem (for example, edit or debug), but is permitted in a subset of edit. For additional information, see VM/SP CMS Command and Macro Reference.

This command is useful when you wish the system operator to mount a tape or disk pack or attach an I/O device to your system. The form of this request issued from the CMS environment would be:

    cp msg operator mount my 384 pack asap

Note: If you, as a CMS user, wish to enter CP mode for an extended period of time and not immediately revert to CMS, enter:

    cp

To return to the CMS environment, issue the CP command BEGIN.

The CP TERMINAL ATTN ON/OFF Command

The CP TERMINAL command with the ATTN ON/OFF operand, which is applicable only to typewriter-like or printer terminals, provides an alternative to the normal handling of console-invoked terminal interruptions. In response to an attention interrupt from the console, VM/SP causes a carriage return and prints the exclamation point (or its equivalent). The exclamation point indicates:

- The attention interruptions

- When the interruption happened, in relation to other user activity

- Which operating mode you selected (CP or VM)

For example, two exclamation points (!!) indicate that you pressed the ATTN key twice to enter CP mode, whereas one

exclamation point (!) indicates you pressed the key only once to enter VM mode.

For additional and detailed information on the CP TERMINAL command, see VM/SP CP Command Reference for General Users.

The #CP Command

Normally, you must press the ATTN key to get to the CP environment. The #CP form of the command permits you to execute a CP command while in a virtual machine command environment without first pressing the ATTN key.

The pound symbol (#) represents the logical line end symbol in effect for your virtual machine. Note that any other character can perform the same function if you so designate it. For additional information and details, see VM/SP CP Command Reference for General Users.

The CMS SET AUTOREAD ON/OFF Command

The SET command used with the AUTOREAD ON/OFF operand allows the user the option of a console read immediately following command execution. This command exists because of differences between display and typewriter-like terminal operations when you key in input data.

You can determine your initial AUTOREAD status by the following terminal console performance indications:

Display Terminal: AUTOREAD is OFF (the default) if the screen status indicates RUNNING after the display of the CMS ready message (R;). AUTOREAD is ON if the screen status is VM READ.

Typewriter-Like Terminal: If the AUTOREAD is ON (the default), the keyboard is locked during RUNNING status.

Note: If you disconnect from a typewriter-like terminal and reconnect to a display terminal, the AUTOREAD status remains unchanged. For example, if you have AUTOREAD OFF while running on a display terminal and you disconnect from it, the AUTOREAD OFF status remains in effect when you reconnect to a typewriter-like terminal.

For additional information on this command, see VM/SP CMS Command and Macro Reference.

CANCELLING TERMINAL OUTPUT

Certain CP console functions produce one or
more lines of output at your terminal in
response to specific requests. If you
should wish to cancel the output after
several lines, press the ATTN key. You can
stop the storage display function as well
as the output by use of specific QUERY
functions. For more information about the
QUERY command, see *VM/SP CP Command
Reference for General Users.*

Numerous available display type consoles and terminals — both monochrome and color — are supported by the VM/SP system. Ascertain whether your terminal is one of the supported units and follow the logon procedures described.

Note: Because there are many differences between the 3278 Model 2A and other display-type terminals, do not apply to the 3278 Model 2A any of the specifically detailed information, such as screen size and layout and certain keyboard keys, contained in this section. Instead, consult the IBM 4331 Functional Characteristics and Processor Complex Configurator or the IBM 4341 Functional Characteristics and Processor Complex Configurator for detailed information (you may still wish to review this section for general information). The 3278 Model 2A can be used only as the system operator console for the 4300 series processors. It is the only terminal supported as the operator console for these processors.

VM/SP System Operator and Virtual Machine Console Usage

Any VM/SP supported system display console can be used with VM/SP. For a list of these units, see "Appendix F. Terminals that Access VM/SP," and for a list of their pertinent publications, see the "Preface" as well as VM/SP Planning and System Generation Guide.

Any 327x display station, used as a locally attached device equipped with an EBCDIC keyboard, can serve either as the VM/SP system operator console, the alternate VM/SP system console, or as a user terminal. In addition, any 327x display station connected as a remote device can serve as a VM/SP virtual machine console and as an attachment to a virtual network on a separate 370x.

Note: Locally attached means that the control unit of the device is connected to a selector, a block multiplexer, or a multiplexer channel instead of using a communications control unit (see Figure 3).

VM/SP SUPPORTED FEATURES

VM/SP supports features that are compatible with 327x terminals. These features include:

• Audible alarms

• Lowercase character display

• Keyboard numeric lock

• Operator identification card reader (where available or applicable)

• Magnetic slot reader with magnetic reader control (where available or applicable)

• Security keylock

• Color

• Extended highlighting

• Wide screen

• Programmed symbols

Except where noted, locally connected display devices can serve as virtual machine operator consoles or as dedicated devices attached to a multiple-access system. The locally connected display device can operate as a VM/SP system operator's console and as a simulated console for the virtual machine. The locally connected display device cannot operate as a VM/SP system operator's console if the virtual machine is using a terminal in native mode (that is, the device is dedicated to the virtual machine).

The display devices connected at remote locations operate as virtual machine consoles only. The leased line that connects the remote display devices to the processor can be dedicated but individual display stations cannot be dedicated.

Additional information about console devices can be found in the publications cited in the "Preface."

Display Terminals -- Functions and Characteristics

Display terminal usage for VM/SP as well as virtual machine input and output message handling differs from that of typewriter-like terminals. Along with the normal data entry and attention handling requirements of a terminal, you must familiarize yourself with VM/SP screen management techniques.

DISPLAY SCREENS AND SCREEN MANAGEMENT

Figure 7 is a representation of the general layout of a screen, whether monochrome or color, used with the VM/SP control program and virtual machine. The screen has three unequal sized areas as can be seen in Figure 7. Note that the screen represents a discrete series of character positions starting with the top line -- line 0 -- and progressing in sequence to the bottom of the screen. For other display screen parameters, details are given in the following text.

Screen Statistics

The physical attributes of VM/SP-supported display screens and keyboards vary according to system and model. However, they all begin from the top at line 0, and have a left-to-right column designation with numerical sequence from 0 through 79. For additional information, see Figure 8.

OUTPUT DISPLAY AREA: This largest of the areas contains all but the two bottom lines of display on the screen. Note that the Output Display Area is also the VMOUT area, the CPOUT area, and the Screen Redisplay area. If the unit is the VM/SP system console, the bottom two lines display the most recent VM/SP system operations activity or the most recent virtual machine and CP activity as it pertains to the virtual machine. Lines 0 through nn-2, displaying either 80 characters per line on most display consoles or 132 characters per line for some others, contain data sent to the System/370 that is keyboard entered and, on entry,


```
┌─────────────────────────────────────────────┐
│     Col                            Col        │
│Line  0                            79/131      │
│    ┌─────────────────────────────────────┐    │
│ 0  │     Output Display Area         │    │   │
│ 1  │     VMOUT Area                  │    │   │
│ 2  │     CPOUT Area                  │    │   │
│    │     Screen Redisplay Area       │    │   │
│    │                                 │    │   │
│    │                                 │    │   │
│    │                                 │    │   │
│    │                                 │    │   │
│    │                              □│<─¹ │   │
│    ├─────────────────────────────────┤    │   │
│    │User Input Area                  │    │   │
│    │                                 │    │   │
│    │          ┌──────────────────┐   │    │   │
│ ▼  │          │□ Screen Status│   │    │   │
│nn² └──────────┴──────────────────┘       │   │
│xx³              ▲                             │
│                └─¹                            │
├─────────────────────────────────────────────┤
│¹The lozenge represents screen attri-         │
│ bute bytes, These bytes are associated       │
│ only with the 327x display console           │
│²nn represents the bottom line of your        │
│ display console, as follows:                 │
│                                              │
│                   No. of Characters          │
│         Bottom Line    per Screen            │
│             19          1600                 │
│             23          1920                 │
│             26          3564(132 char/line)  │
│             31          2560                 │
│             34          2800                 │
│             42          3440                 │
│                                              │
│ Check the unit's Terminal User's Guide       │
│ to determine the bottom line default         │
│ for your particular display console.         │
│³xx represents a special Operator             │
│ Information Area below the bottom line        │
│ of the display area on some display          │
│ stations and display consoles.               │
└─────────────────────────────────────────────┘
```
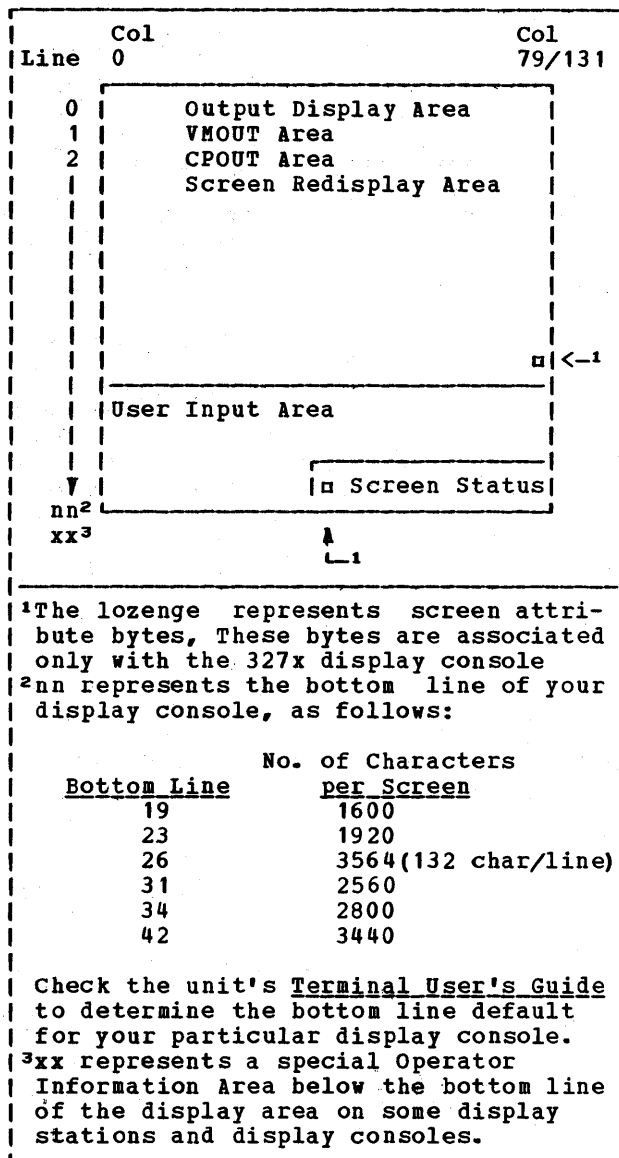
Figure 7. Display Screen Layout for Monochrome and Color Display Terminals

initially displayed in the user input area. For certain other devices, the character columns are 0 through 78 plus the attribute character. Note that data cannot be entered into the output display area or the attribute character position.

Messages as well as responses from both the virtual machine and CP appear in this area.[1] See the footnote about "nn" in Figure 7 for the actual bottom-line configurations. For some units, no hardware feature exists to prevent the entering of data into the output display area. Check the User's Guide for your particular terminal to determine whether or not this fact pertains to your unit and proceed accordingly.

USER INPUT AREA: This area consists of the bottom two lines of the screen. On a terminal with an 80-character screen width, the total number of characters that can be entered in the input area is 139. On a terminal with 132-character screen width, the total number of characters that can be entered in the input area is 243. The balance of 21 characters for both screen widths is used to display the status of the screen. This area is solely an input line assembly and editing area prior to sending the information to VM/SP.[1] All entered data appears in this area (except for prompted passwords) from left to right. Note that your password does not appear in the user input area when keyed in after the prompting message "ENTER PASSWORD," nor is it redisplayed in either the output display area or copied onto the virtual console spool file. Cursor control and other text editing facilities can alter the data in this area. When you press the ENTER key, the data in this area disappears then reappears as the next entry in the output display area unless (1) the data is a prompted password, (2) you canceled the data with VM/SP's logical line delete symbol, or (3) you pressed the key designated for canceling or the ERASE INPUT key in place of the ENTER key. Check the User's Guide for your unit to determine which of these possibilities applies to your unit.

Caution: When running VM/SP standalone utilities on some display terminals, note that a lozenge (◻) appears in column 0 of the user input area. Therefore, when entering text, press the space bar once before keying your input if your terminal is one that shows the lozenge.

SCREEN STATUS AREA: This area comprises the rightmost 21 characters of the bottom line of the screen. You cannot key into this

----

[1]This discussion does not include how a CMS editing facility uses the screen. For a discussion about any CMS editor usage, refer to the VM/SP CMS User's Guide, the VM/SP CMS Command and Macro Reference, and the VM/SP System Product Editor User's Guide.

area. Messages that indicate the status of the screen as it relates to the operation and synchronization of screen output and data input appear here. Screen status appears as follows: RUNNING, CP READ, VM READ, MORE..., HOLDING, NOT ACCEPTED.

The RUNNING Message: VM/SP or the virtual machine is operating. The screen output display area is blank or partially filled and you have not requested the system to retain the present output area image. Additionally, neither CP nor the virtual machine is waiting for you to respond to a console message (read request); you have not tried to enter data with a previously entered input buffer pending that has not been processed by CP or by your operating system. The running condition also occurs if the screen is filled and VM/SP has no additional lines to display.

The CP READ Message: The system is waiting for you to respond to a read from CP before it displays the next line.

The VM READ Message: The operating system running in the virtual machine issued a read request to the virtual machine console and is waiting for a reply. This occurs, for example, after a console message that requires a response.

While in VM READ, you can pass a null line attention interruption to CMS by using the cursor movement key to move the cursor one position prior to the normal input area start position and pressing the ENTER key.

The MORE... Message: The system is in a RUNNING status but the output display area is full and more lines must be displayed on the screen.

When the screen is in a MORE... status, a one minute timeout begins. Fifty seconds later the audible alarm sounds (if the device has it) to inform you that in 10 seconds the control program (CP) will erase the current output display area unless you manually intervene and force a HOLD status with the ENTER key. At the end of the time limit, if you have not pressed the keyboard ENTER key, the output display area disappears and the screen reverts to RUNNING status with the previously pending output lines of data appearing. If the screen is in MORE... status and you press the key designated for canceling, the output display area disappears immediately without waiting for the one minute timeout period to elapse and the screen status changes to RUNNING.

The system does not stop if the screen is in a MORE... status. Those virtual machines that can run continue to run.

Screen Areas	Description
Output Display Area	All but the last two lines of the screen. The last character position of the last line of the output display area of a 327x contains an attribute character. You cannot enter data into the output display area or the attribute character position. Note: Exceptions are those display units that have no hardware feature to prevent you from entering data into the output display area.
User Input Area	The last two lines of the screen, with the exception of the rightmost 21 character positions of the last line.
Screen Status Area	The rightmost 21 character positions of the last line.
Operator Information Area	In those units that have this area, it appears below the last line of the user input area. A user cannot enter data into this area. The area (see footnote on "xx" in Figure 7) provides graphic status messages to the operator. The explanation of the graphic symbol is provided in a Problem Determination Guide that is located beneath the keyboard in the hand rest.

Figure 8. Screen Statistics for Monochrome and Color Display Terminals

With some remote terminals, it is possible to achieve a MORE... screen status condition without a full display screen. When this occurs, press the key designated for canceling to change the screen status so you can use the screen again.

The HOLDING Message: The system is running, but you have decided to retain the current output display area image.

The HOLDING condition also occurs when a screen full condition with a message displayed causes the audible alarm to sound. This image remains until you press the ENTER key or the CNCL/CANCEL key. Pressing the ENTER key causes the screen to revert to the MORE... status and the one minute timeout must end before the output display area disappears and the RUNNING status recurs. Normally, pressing the key designated for canceling immediately erases the output display area and the screen status changes to RUNNING.

If you press the PA1 key while the screen is in a MORE... or HOLDING status, the next line that is scheduled to appear in the output display area may be deleted.

The NOT ACCEPTED Message: A previously stacked active input buffer (that is, a user-keyed data or command line) is still pending. The control program (CP) constructed this input buffer when you entered data and pressed the ENTER key. If you are running in VM mode, the virtual machine must issue a console read or a

SYSTEM RESET command to clear the input buffer. In the case where you are running in a CP environment, "NOT ACCEPTED" indicates that a previously initiated CP command has not yet completed. VM/SP inhibits input from the keyboard for 3 seconds while it displays the NOT ACCEPTED status and activates the display console, the processors, or the audible alarm (if one is present) to inform you of the status message. When the 3-second interval expires, the screen reverts to its previous status. The rejected data stays in the user input area of the screen to allow you to retry the operation without keying it in again.

When using the SET PFnn COPY command, "NOT ACCEPTED" also appears for remote printers that are busy or unavailable.

OPERATOR INFORMATION AREA: This area appears under the user input area and screen status area. Data cannot be entered in this area. The operator receives graphic status messages in this area of the screen. Explanations of these graphic symbols are found in a Problem Determination Guide (for the particular keyboard) placed in a small drawer/slot under the hand rest of the keyboard.

Note: Some display consoles do not have an operator-information area on the screen.

Figure 9 summarizes the action taken for ENTER/CANCEL under each screen status and mode condition.

Initial Status	Mode	Key Pressed	Data	Action	Resulting Status
RUNNING	CP	ENTER	NONE	Enter console function mode	CPREAD
			DATA	Execute console function	RUNNING
		KEY[1]	N/A	Clear output area	RUNNING
	VM	ENTER	NONE	"Attn" pending, VM/SP running	RUNNING[2]
			DATA	"Attn" pending, stack data, VM/SP running	RUNNING[3]
		KEY[1]	N/A	Clear output area	RUNNING
		PA2 (if APL on)	N/A	Clear output area	RUNNING
MORE	CP/VM	ENTER	NONE	Hold screen output	HOLDING
			DATA	Same as RUNNING	MORE
		KEY[1]	N/A	Clear output area, continues output	RUNNING
HOLDING	CP/VM	ENTER	NONE	Hold screen output	MORE
			DATA	Same as RUNNING	HOLDING
		KEY[1]	N/A	Clear output area, continues output	RUNNING[4]
CPREAD	CP/VM	ENTER	NONE	"Null" line return	RUNNING[5]
			DATA	Data return for function	RUNNING
		KEY[1]	N/A	Clear output area	CPREAD
VMREAD	CP/VM	ENTER	NONE	"Null" line return, VM run	RUNNING
			DATA	Data return for read, VM run	RUNNING
		KEY[1]	N/A	Clear output area	VMREAD
		PA2 (if APL on)	N/A	Clear output area. Present external interruption to virtual machine.	RUNNING
NOT ACCEPTED	Busy or unavailable 3270 remote printer. A previously stacked input buffer is still pending.				Returns to former status

[1] The key designated for canceling as determined on your terminal keyboard.
[2] The status shown is RUNNING; however, the virtual machine should respond to the ATTN with a read, whereupon the status goes to VMREAD.
[3] If a data buffer is already stacked for a virtual machine, the terminal displays NOT ACCEPTED status before returning to the RUNNING status.
[4] If you are running with TERMINAL MODE CP (the default for the primary system operator), an attention return also occurs which cancels the function. Operators at a variety of consoles use this function to allow termination of certain QUERY or DISPLAY functions because these consoles do not have a PA1 key.
[5] Unless you are the VM/SP primary system operator or are running with the SET RUN on option, the status returns to CP READ for another console function if the previous read was for a console function.

Figure 9. Summary of Screen Status Action on Monochrome and Color Units

SCREEN DATA HANDLING

In addition to the printable characters, display keyboards have the following features and capabilities:

- Cursor controls
- Attention signaling
- End-of-data entry signaling
- Other screen management controls
- Keyboard lock

Cursor Controls

The cursor symbol, an underscore or whatever is used as a cursor on your particular unit, is displayed to indicate the position of the next input character. Cursor keys control vertical and horizontal movement of the cursor symbol. Use the SPACE BAR to enter blanks as they are needed. The cursor, used only for editing in VM/SP, does not enter any blanks (or spaces) into the input line. Any cursor-indicated blank disappears when you press the ENTER key and all entered characters are compressed to the left.

- Example 1

    Sampleⓑsentenceⓑtypedⓑwithⓑspaceⓑbar.

    The above input line appears on the input screen area as well as on the output screen area as follows:

    Sample sentence typed with space bar.

    When spooled to a printer, it will also appear as it does with proper spacing between words on the listing.

- Example 2

    Sampleⓑsentenceⓑtypedⓑwithⓑcursorⓑkey.

    The above line appears in the input screen area as follows:

    Sample sentence typed with cursor key.

    After pressing the enter key, the line appears on the screen output area as follows:

    Samplesentencetypedwithcursorkey.

    When spooled to a printer, it will still have no spacing between the words on the listing.

Note: Some cursor keys are Typematic keys so check the cursor keys on your keyboard to determine how they work.

Attention Signaling

Attention signaling (pressing ATTN or its equivalent) posts a pending interruption to the selected system -- either to CP or to the virtual machine.

End-of-Input Entry Signaling

The end-of-input signal (pressing ENTER or its equivalent) requests the control system to accept the keyed-in data line. VM/SP then accepts and processes the data.

Other Screen Management Controls

In addition to cursor controls, and attention and data entry keys, Figure 10 shows keys found on display console keyboards depending upon the console and model. Your User's Guide shows the position of the keys for your particular model.

Using Display Units with VS APL

You must know the capabilities of your installation's implementation of the VS APL program and whether or not the VSAPL-CMS interface is in place.

Assuming it is, log on to VM/SP in the normal way. To use VS APL, initialize CMS (via IPL) and then invoke the VS APL machine via the command name specified in the APL program product documentation. This command invokes the VSAPL-CMS interface program. Press the APL ON/OFF key, which changes your keyboard to APL character input mode. Then press the ENTER key to notify VS APL that processing may continue. The display screen is not affected by this key and can display either APL or EBCDIC characters. The APL EXEC program automatically invokes the TERMINAL APL ON command. The VS APL program itself is then invoked and the VSAPL ready message appears on the screen. You can now use APL.

CAUTION: If you disconnect your terminal, you lose your connection to VSAPL-CMS. When you logon again, you must issue the command:

    TERM APL ON LINESIZE 255

Key	Usage
INS MODE -- or -- ⚠	When you press this key, the INSERT MODE indicator lights up at the right edge of the screen. On 327x units, a symbol lights up in the indicator line or the bottom line. Press any character key and it is inserted into the line of data (pushing other data to the right) and displayed in the user-input area at the position indicated by the cursor. Press the RESET key to leave INSERT MODE.
DEL -- or -- ✗	When you press this key, the character above the cursor in the user-input area disappears and the data line is compressed to the left, in effect eliminating the inherent blank.
CLEAR	Clears entire screen -- output area, input area, and status area -- under hardware control. Note: On bimodal display terminals, pressing the CLEAR key resets the screen buffer to the default size (1920 characters per screen). Thus, if the virtual machine control program attempts writing outside the default buffer size prior to reformatting the screen, unpredictable results will accrue both in the display and the virtual machine.
ERASE INPUT	When you press this key, the entire user-input area is erased.
ERASE EOF	When you press this key, that part of the line in the user-input area that is at and to the right of the cursor is erased.
PF1 through PF24	These keys have either command or data capability by using the CP SET PFnn command. For information on this command, see VM/SP CP Command Reference for General Users. Note that the PF key functions for some display consoles and processors are implemented by pressing the REQ (request) key, which changes keys 1 thru 0, the hyphen (-), and ampersand (&) to program function (PF) keys 1 thru 12. This action also causes the letters "PFK" to appear at the bottom of the screen. Note also that PF keys 13 through 24, available on some 327x display consoles, as well as 1 through 12 are activated by pressing and holding the ALT key before pressing the PF key.

Figure 10.   Screen Management Control Keys and Their Usage (Part 1 of 2)

Key	Usage
PA1	This key posts an attention interruption pending to the CP command environment. The PA1 key causes entry into CP mode if it is pressed while the screen indicates RUNNING status. If you press the PA1 key while the screen indicates CPREAD, the key signals attention to the virtual operating system. Note that the CP TERMINAL MODE command does not affect the PA1 key, it affects only the ENTER key. The action taken for each status is shown in Figure 11. Note also that on some locally attached 327x display terminals, the PA1 key cannot restore the virtual machine to the CP environment. When this occurs, turn off power on the 327x, then turn it back on and press PA1 key.
PA2	Clears output area under the CP component of VM/SP.
PA2 (APL off)	Clears the entire screen except for the user-input and screen status area.
PA2 (APL on)	Clears the screen and presents an external interruption to the virtual machine.
PA3	When you press this key on those keyboards that have only PF1 to PF5 keys, it acts as a PF6 key.
TESTREQ	On locally attached display terminals, pressing this key displays data in the user-input area in the next output display area line position. CP does not translate or edit the data nor does it pass the data to any virtual machine function or read request. Note that on some 327x display terminals, this function is provided by the SYS RES key. Notes: 1. On the 3276 and 3278 display terminals, when you press the ALT key followed by pressing the TESTREQ key, you activate RAS checking logic at the subsystem. 2. The PA2, PA3, and TESTREQ keys are not available on the 3138 or 3148.
ALT	On certain keyboards, several functions are assigned from one key. In order to activate the function capability shown on the front face -- versus the top -- of the key, press and hold this key before pressing the main key.

Figure 10. Screen Management Control Keys and Their Usage (Part 2 of 2)

```
r------------------------------------------------,
| State  |        Action        |   Status   |
|--------|----------------------|------------|
| RUNNING | Enter       console | CPREAD     |
|         | function mode       |            |
|--------|----------------------|------------|
| MORE    | Clear output area,  | RUNNING¹   |
|         | ATTN return  code   |            |
|         | continues output²   |            |
|--------|----------------------|------------|
| HOLDING | Same as MORE        | RUNNING¹   |
|--------|----------------------|------------|
| CPREAD  | ATTN pending,       | RUNNING    |
|         | VM/SP run           |            |
|--------|----------------------|------------|
| VMREAD  | UE status return,   | RUNNING¹   |
|         | ATTN return code    |            |
|--------|----------------------|------------|
|¹The immediate status shown is  RUNNING. |
| However,  the  ATTN  return   code may  |
| eventually   place the  terminal  in  a |
| CPREAD status.                          |
|²The ATTN return code may cause the next |
| output line to be deleted.              |
L------------------------------------------------J
```

Figure 11. PA1 Action and Status Table

Data Analysis-APL Feature

When the Data   Analysis-APL Feature is
attached to your display unit, you must
take precautions to make proper use of its
capabilities.   For additional information
on this enhancement, see the appropriate
publication cited in the "Preface."

Note: The APL ON/OFF key is a key and not a
switch. Each time you press the key, the
hardware changes your terminal from one
mode (APL) to the other (EBCDIC). When in
doubt as to which mode your unit is in,
press a key that has either type character.
The character displayed (APL or non-APL) on
the screen indicates your keyboard's mode.
On certain display terminal models, the
letters "APL"   appear in   the Operator
Information Area.

Error Possibilities

Invoking APL   when there   is no   Data
Analysis-APL Feature installed causes the
VS APL program to be called in and the
TERMINAL APL ON command to be invoked.
When this happens, you will be unable to
communicate with VS APL,   and the APL
characters struck on the keyboard will
appear garbled on the screen.

Manually invoking APL when the Data
Analysis-APL Feature is installed and not
using the TERMINAL APL ON command will also

prevent you from being able to communicate
with VS APL.   Also, at some time during use
of the VS APL program, invoking TERMINAL
APL OFF will create problems for you.

Compound overstrike characters can be
had only by pressing and holding the APL
ALT key while also pressing the key that
indicates the specific character you want.
These special characters are shown on the
front face of the keys on   your APL
compatible keyboard.

OTHER APL CONSIDERATIONS

In addition to the restrictions imposed by
the various CP command privilege classes on
APL usage, the limitations of the terminal
and the communications controller to which
it attaches influences your virtual machine
operation. One such example is:

TERMINAL APL ON

-- or --

TERMINAL APL OFF

If your terminal connects to a 3704/3705
transmission control unit, VM/SP supports
the APL operand of the CP TERMINAL command:

• For the Emulation Program (EP) only

• For the related virtual machine only if
  the console terminal is equipped with
  features that support APL operations.

The 3270 Text Feature

After you log on to VM/SP, via one of the
terminals equipped with   the 3270 Text
feature, issue the following CP command:

TERMINAL TEXT ON

Use this command to enter, display, or
print any of the special Text characters.

If you issue the   TERMINAL TEXT ON
command on a unit that does not have the
necessary Text features installed, you are
unable to enter, display, or print the Text
characters.   In this case,   press the
attention key to get   into CP console
function mode (CPREAD appears in the screen
status area) and issue the TERMINAL TEXT
OFF command. The terminal is now ready for
nontext processing use.

ENTERING THE TEXT CHARACTERS

To enter all 151 Text characters, you must use three shift keys: the standard uppercase and lowercase SHIFT key, the ALT ON/OFF key, and the CODE key. To locate the position of these three keys, consult the publication pertinent to your terminal.

SHIFT Key

Use the normal SHIFT key (in alternate or normal mode) to enter, in uppercase or lowercase, the characters engraved in the center of those keytops that have one or two characters. These characters are:

    A through Z and , . ; :

Use the normal SHIFT key (in uppercase) to enter characters engraved on the upper left of the keytops that have multiple characters. The ALT ON/OFF key must be off to obtain these characters.

Use the normal SHIFT key (in lowercase) to enter characters engraved on the lower left of the keytops that have multiple characters. The ALT ON/OFF key must be off to obtain these characters.

ALTERNATE ON/OFF Key

Use the ALT ON/OFF key to enter characters engraved on the right side of the key tops that have multiple characters. Press the ALT ON/OFF key. The keyboard is in ALT mode if the alternate indicator light is on. The indicator light is located on the keyboard above the keys. Press the ALT ON/OFF key once again to put the keyboard in normal operation. When the keyboard is in alternate mode, you can use the normal uppercase and lowercase SHIFT keys to obtain the uppercase and lowercase characters engraved on the upper and lower right of the keytops.

Note: The ALT ON/OFF key does not affect the following characters, which are engraved in the center of the keytops:

    A through Z , . ; :

These characters can be obtained in uppercase or lowercase with normal SHIFT key operation, regardless of the setting of the ALT ON/OFF key.

If you have previously issued the TERMINAL TEXT ON command, the display screen is able to display all the special text characters, regardless of the setting of the ALT ON/OFF key. If you set TERMINAL TEXT OFF, you cannot enter, display, or print the Text characters even if the keyboard is in alternate mode.

CODE Key

Use the CODE key to enter characters engraved on the front face of the keys. The CODE key must be held down to enter these characters. When you release the CODE key, the keyboard resumes the original status (uppercase or lowercase, alternate or normal mode) that it had before you pressed the CODE key.

LEAVING TEXT PROCESSING MODE
                         •

You can leave text mode by issuing the command:

    TERMINAL TEXT OFF

If the red light on the keyboard is still on, indicating that the keyboard is still in text mode, press the ALT ON/OFF key once to switch into normal keyboard mode.

RECONNECTING YOUR TEXT TERMINAL

If you disconnect your terminal, text mode is forced off when you log on again. You must issue the CP command, TERMINAL TEXT ON, before continuing with your text processing.

370X COMMUNICATIONS CONTROLLERS CONSIDERATIONS

VM/SP supports certain terminals equipped with the Text feature connected to 370x communications controllers in EP (Emulation Program).

If the VTAM Communications Network Application (VM/VCNA) program product (5735-RC5) is used to provide support for SNA terminals, the following publications are also required:

IBM VM/VCNA

General Information Manual, GC27-0501

Installation, Operation, and Terminal Use, SC27-0502

Note: VM/SP does not support NCP (Network Control Program) mode. VM/SP also does not support the MTA (Multiple Terminal Access) feature of NCP. However, if the VTAM service machine component of SNA (Systems Network Architecture) is in place, the appropriate network control program will be in effect.

Special Considerations for Using Display Terminals

There are a number of things that are similar yet different on display terminals when compared with typewriter-like terminals. These differences are discussed in the following text.

KEYBOARD LOCK FEATURE

The keyboard lock (not the uppercase lock key) on display terminals differs from a similar feature found on some typewriter terminals. On typewriter terminals, when the lock operates, you cannot press the keyboard keys. In a display keyboard exhibiting the same lock condition, you can press the keys but they have no effect.

The display terminal is a buffered device whereas the typewriter terminal is not. Consequently, you can key data into the user input area while simultaneously the system inserts data into the output display area. Therefore, the need to lock the keyboard is far less frequent on display terminals than on typewriter style terminals.

- Situation 1--The system writes one or more lines of data in the output display area, while simultaneously, you enter data into the user input area. At the completion of the input line, you press the ENTER key and the line of data or command transfers from the user input area as console input to the virtual system, assuming the system honors the interruption. This data also appears in the output area of the screen. Note that the keyboard is not locked.

- Situation 2--This situation shows the usage of the keyboard lock on the display terminal. You have just issued

a string of commands that your virtual machine is to execute. You immediately key in additional commands for the virtual machine to execute. If the system does not accept the first buffer (the first string of commands), then the system does not accept the second buffer (the data in the input display area) and the keyboard locks for three seconds and the message NOT ACCEPTED flashes on the screen. The data in the input area of the screen remains. You need only to wait a few seconds, then press the ENTER key again. The process can continue in this manner until the system accepts the input area data.

EDITING A FILE

When you want to do any editing with your file, you now have two options. You can use the command either for the VM/SP System Product Editor or for the CMS Editor.

For details about using the System Product Editor, see IBM VM/SP System Product Editor User's Guide or IBM VM/SP System Product Editor Command and Macro Reference.

For details about using the CMS EDIT command, see IBM VM/SP CMS User's Guide and IBM VM/SP CMS Command and Macro Reference.

Using the CMS Editor To Edit a File

As a typewriter terminal, the full screen display of data, identification, and message areas does not appear as it does on locally attached units. Instead, the screen display appears as does a typewriter terminal sheet. Thus, the editor subcommands you enter in the user input area are displayed -- just like text -- on the next available line of the screen immediately after you press the ENTER key. The current line is moved up one line by this entry, which in turn is moved up one line by the next entry. A historical record of all the editing that you have done is part of the screen display.

This mode of operation continues through the editing session, unless you issue the editor's FORMAT subcommand. The FORMAT subcommand changes the mode of operation of any display station, whether local or remote.

Specifying the NODISP option in the EDIT command forces the display terminal to operate like a typewriter terminal for the duration of the terminal editing session.

Note: Always use the NODISP option when editing on a 3066 terminal. This unit is supported as a 3215 and not as a graphics device.

A remote terminal, having been switched to full screen display mode of operation (display mode) is forced to typewriter mode of operation (line mode) when you enter input mode. When the terminal leaves input mode, the editor resumes with the mode of operation (display or line mode) in effect before the terminal entered input mode.

For extended information on the EDIT command and its subcommands, see VM/SP CMS Command and Macro Reference.

PF Key Set Up

In editing a file, use of program function (PF) keys can speed your terminal session. Again, you have two options for PF key use: first, that of the VM/SP System Product Editor; second, that of the CMS EDIT command.

For examples and details of setting PF keys when using the System Product Editor, see VM/SP System Product Editor User's Guide and VM/SP System Product Editor Command and Macro Reference.

Pressing the PF02 key immediately causes the current line pointer on the screen to move 5 lines toward the top of the file that is displayed on the screen.

PF1	PF2	PF3
SCROLLUP	UP 5 (BACKWARD 5)	UP 1 (BACKWARD 1)
PF4	PF 5	PF 6
SCROLL *	NEXT 5 (FORWARD 5)	NEXT 1 (FORWARD 1)
PF7	PF8	PF9
SAVE	CMS	RETURN
PF10	PF11	PF12
CP TAB 10 16 31 36 72 80	TYPE	INPUT

Figure 12. PF Keys Set Up for Editing a File

PF Keys Setting Example -- Using CMS EDIT Commands

Figure 12 shows how the PF keys on a 3277 can be set to make file editing easier and faster. The PF keys on the 3276 and 3278 can be set the same way, although the keyboard layout is different. The PF keys are set to some commonly used EDIT subcommands. Use of the ALT key with the PF key is required.

An example of setting one of the PF keys to perform one of the EDIT subcommand follows:

    #CP SET PF02 IMMED UP 5

For more information about the EDIT subcommands shown in Figure 12, see the VM/SP CMS User's Guide.

You may have use for multiple PF key formats. One way that you can dynamically change formats is to assign one of the PF keys the name of an EXEC procedure that redefines some of the PF keys. VM/SP EXEC procedures are detailed in the VM/SP CMS User's Guide. VM/SP EXEC 2 procedures are detailed in the IBM VM/SP System Product EXEC 2 Reference.

Note: If you use the TERMINAL BRKKEY PFnn command during your terminal session, the command overrides your original PF key setting for that particular key for the balance of that session.

PF Key Inspection

Use the CP QUERY PFnn command to find out what values you have assigned to your PF keys. The format of this command is:

CP QUERY PFnn

where:

nn   specifies the number of the key that you want to inspect. Issuing the command line without nn allows you to inspect the settings for all the program function keys.

If your PF keys are defined as shown in Figure 12, issuance of the CP QUERY PF command will result in your terminal screen displaying the listing shown in Figure 13.

```
| PF01 IMMED SCROLLUP                       |
| PF02 IMMED UP 5                           |
| PF03 IMMED UP 1                           |
| PF04 IMMED SCROLL *                       |
| PF05 IMMED NEXT 5                         |
| PF06 IMMED NEXT 1                         |
| PF07 IMMED SAVE                           |
| PF08 IMMED CMS                            |
| PF09 IMMED RETURN                         |
| PF10 IMMED CP TAB 10 16 31 36 72 80       |
| PF11 IMMED TYPE                           |
| PF12 IMMED INPUT                          |
```

Figure 13.   Display of PF Keys After Assigning Functions

Using the SET PFnn Command in CMS Mode

While in CMS mode, if you want to assign functions to the PF keys, type in:

SET LINEDIT OFF

before you use the following formats:

SET PFnn IMMED   pfdata1#pfdata2#...
                  ..pfdatan

-- or --

CP SET PFnn IMMED pfdata1#pfdata2#...
                  ..pfdatan

When you finish assigning the function to the PF key, type in:

SET LINEDIT ON

Or, you can use the following formats without using SET LINEDIT OFF:

#CP SET PFnn IMMED   pfdata1#pfdata2#...
                  pfdatan

-- or --

CP SET PFnn IMMED pfdata1"#pfdata2"#...
                  pfdatan

-- or --

SET PFnn IMMED pfdata1"#PFdata2"#...
                  pfdatan

Note: While setting the PFnn key in CP mode, the logical line end character (#) is considered a data character when CP finds it in the operand line of the CP SET PFnn command.

PF KEY COPY FUNCTION

When using certain display terminals, you can copy the full screen display currently appearing on the screen. Note that the PF key copy function is not supported by VM/SP for remote dedicated display printers. The SET PFnn COPY command allows you to assign a copy function to a specified PF key. Pressing the PF key copies the current display on the screen by printing the display on an attached printer.

Note: The display printer must be varied online and then enabled by the operator before the COPY function can be used.

If you are using a remotely connected unit, the typewriter-like unit or the printer must be attached to the same control unit as the display station.

If you are using a locally connected unit, the copy of the screen can be printed on any typewriter-like unit or printer.

Figure 14 shows, for remotely connected units, what could appear on the typewriter terminal sheet or printer sheet. The user identification in Figure 14 is an identifying name that you can give the sheet if more than one remote terminal is using the printer. To enter this user identification, type the userid (user identification) into the user input area immediately before you press the PF key that you have set to execute the COPY function.

Figure 15 shows, for locally connected units, what could appear on the typewriter terminal sheet or printer sheet.

```
r---------------------------------------------¬
| DEFINE STORAGE 16384K                       |
|                                             |
| STORAGE = 16384K                            |
|                                             |
| ipl 190                                     |
|                                             |
| VM/SP CMS - mm/dd/yy   hh:mm                 |
|                                             |
| ...                                         |
|                                             |
| ...                                         |
|                                             |
| ...                                         |
|                                             |
| user identification                         |
|                                             |
|                         RUNNING (status)    |
L---------------------------------------------J
```
Figure 14. PFnn COPY Command Printout for
          Remote Terminals

    If you are frequently using the COPY
function, you can set a PF key with a user
identification as follows:

    SET PF11 yourname...dept no.

    Press this PF key just before you press
the PF key that you have set to execute the
COPY function.

    For locally   attached units,   screen
status is not printed.

```
r---------------------------------------------¬
| DEFINE STORAGE 16384K                       |
|                                             |
| STORAGE = 16384K                            |
|                                             |
| ipl 190                                     |
|                                             |
| VM/SP CMS - mm/dd/yy   hh:mm                 |
|                                             |
| ...                                         |
|                                             |
| ...                                         |
|                                             |
| ...                                         |
|                                             |
| user identification                         |
L---------------------------------------------J
```
Figure 15. PFnn COPY Command Printout for
           Local Terminals

    For additional usage information on the
PFnn COPY command, see VM/SP CP Command
Reference for General Users.

Getting Display Screen Contents Printed

To have the printer that is attached to the
same control unit as the display station
print the content of your screen, use the
SET PFnn IMMED COPY command.   If your
display station has only one printer, see
VM/SP Planning and System Generation Guide.

    If the COPY command is invalid or the
printer is not available or busy or -- in
the case of remotely connected units -- not
attached to the same control unit as your
display terminal, a NOT ACCEPTED message
appears in the screen status area.   The
request to copy the screen is not put in a
queue.   When   the printer   is   again
available, you should press the PF key
again.

Note: Certain devices accept loading of a
print configuration matrix that will result
in a message in the screen status area.
The default is that VM/SP owns all printers
on the control unit. On other units, the
configuration-dependent default matrix can
cause the same message to appear.

    The following are examples of the SET
PFnn IMMED COPY command and the results
obtained.

Example 1

SET PF03 IMMED COPY 004
    This command sets PF key 03 to copy
    the screen data on the printer that
    has   the   resource   identification
    (resid) number of 004.

Example 2

SET PF12 IMMED COPY
    This command sets PF key 12 to copy
    the screen data on the printer that
    has the lowest resid (if remote or
    cuu) and that is on the same control
    unit as the display station.

Example 3

SET PF10 IMMED COPY 109
    This command sets PF key 10 to copy
    the screen data on printer 09 of
    channel 1.

    For additional usage information on the
PFnn COPY command, see VM/SP CP Command
Reference for General Users.

TAB KEY USAGE

The following sections describe the procedures for using the tab function on display terminals when typing input for CMS files. For more detailed descriptions, see VM/SP CMS Command and Macro Reference.

When you perform the tab function on certain display terminals, the CMS Editor uses the character generated (X'05') to determine how many character spaces to leave on output. The number of spaces to be generated for each tab character is dependent on the tab settings specified by the EDIT TABSET subcommand. If no TABSET subcommand is issued, the default tab settings are in effect. These default settings are listed in Section 4.

You must also be aware that, on display terminals, the line width is 80 characters, and therefore records or default tab settings that extend beyond column 79 (for example, into column 120) cause a record to be split into two lines on the screen. This results in confusing graphic displays.

Logical Tabbing with the 3066

No tab facilities exist for the 3066 display terminal. When you enter data after a tab simulation operation on the keyboard, you cannot see immediately the proper displacement of the input data in the record. A simulated tab occurs when you specify that a seldom-used special character is to be translated into a tab character. The example below shows how to simulate the tab operation on a 3066.

1. Use the EDIT TABSET subcommand if it is necessary to set tab stops (skip this step if the filetype is a CMS reserved filetype).

    tabs 21 41 61 81 101 121

2. With the CMS SET command, designate an infrequently used character such as the question mark (?) as a logical tab key (the hexadecimal representation of the tab character is 05).

    set input ? 05

    Key in the following two lines, each followed by pressing the ENTER key.

Columns

```
00                20                    79
AA?BBB?CC?DD?EE?FF?GG          (screen
AA?BB?CC?DDDD?EE?FF?GG          input
                                area)
```

The above represents the way the data is entered and is displayed in the user input area. It is difficult to relate this input data to the data appearing in the screen's output display area, as illustrated below. Because the screen's line length is only 80 characters, part of the record is on the next line.

```
   Columns

00    21    41    61    79
---------------------------------
81    101   121
---------------------------------
AA    BBB   CC    DD
EE    FF    GG          (screen output
                        display area)
AA    BB    CC    DDDD
EE    FF    GG
```

If each field contains information that is not self-describing, it is difficult to differentiate among the different fields.

Logical Tabbing Using the 3270 Program Function (PF) Keys

Some keyboards do not contain a tab key that VM/SP can use; but CP allows you to assign the logical tab function to any program function key.

The following example shows tab operations using the 3270.

1. While in CP mode, enter the SET PFnn command using the following format:

    SET PFnn TAB n1 n2 ... nn

    where:

    SET PFnn TAB
        sets up a special 3270 logical tab function.

    nn   is any valid program function key number (numbers 1 through 24 are valid); 10 or 22 is the preferred PF value because the associated key is convenient to use. This number must immediately follow "PF" with no intervening blanks.

n1 n2 ...

       are your entries for the desired
       tab stop column numbers. One or
       more blanks must separate each
       of these values.

These logical tab stop settings for
the designated program function key
are established as soon as you press
the ENTER key (or its equivalent).
For example, if you key in:

    set pf10 tab 7 10 AB 20 15 25 30 80

(note the sequence and values given)
CP's command processor takes these
values, puts them in an ascending
sequence, discards invalid operands,
and displays the values as though --
in effect -- you entered the following
correct settings:

    set pf10 tab 7 10 15 20 25 30 80

Note that the invalid operand "AB" has
been discarded.

2. Use the TABSET subcommand of EDIT to
    set up the internal tab settings:

       tabs 15 30 45 70

3. Enter data into the file, using the
    designated PF key in place of the TAB
    key:

       1(pf)2(pf)3(pf)4(pf)

Pressing the program function key causes
CP to position the cursor on the screen at
the next logical tab stop column. In
storage, however, CP does not expand and
pad the record with the appropriate number
of blanks but inserts a X'05' in the data
stream.

When you press the ENTER key, the data
entered expands to produce a replica of the
input line in the output display area and
the console spool file (if it is invoked).

One distinct advantage of this tabbing
process is that you can use different PF
keys to establish different sets of logical
tab stop assignments for different kinds of
records.

Using the TABCHAR Operand of the TERMANAL
Command

The tab character, which is a nonprintable
entity, is a X'05' either when you use the
display terminal PF key setting in your
Profile EXEC or when you use the TERMINAL
command with the TABCHAR operand.

Use of the TERMINAL TABCHAR command
allows you to take a seldom-used character
-- for example, the % (percent sign) -- and
designate it as your tab. Thus, each time
you want to space over to align on a
column, you merely type that character in
your data stream, as follows:

    Column 1%Column 2%Column 3
    --------%--------%--------

The printout would appear as follows:

    <u>Column 1</u>   <u>Column 2</u>   <u>Column 3</u>

Because the tab character is visible, it
is less prone to cause problems if you
should decide to make an addition or
deletion, or if you need to make a
correction of an error.

<u>Notes:</u>

1. TABCHAR use depends on the tab
    settings defined for your editing
    session.

2. A designated character in the input
    area will not be replaced by the tab
    character (X'05') if the PF key is
    used.

For additional information on the
TABCHAR operand, see the "TERMINAL Command"
in <u>VM/SP CP Command Reference for General
Users</u>.

PROTECTED FIELDS AND ATTRIBUTE BYTES

You cannot alter the output display area of
certain display units with cursor controls
or data entry characters. The only
unprotected data area of the screen is the
user input area. This area is defined as
the area between the attribute byte in the
last column (79 or 131) on the last line of
the output display area (bottom line minus
2) and the attribute byte that exists in
column 59 or 111 of the bottom line. If
you attempt to insert data outside this
area, the Input Inhibit Indicator or the
Operator Indicator row signal appears and
the keyboard electrically locks; that is,
you can press the keys but nothing happens.
Proper input continues only after you press
the RESET key to restore the display unit
to its former condition.

<u>Note:</u> The position of the input area
attribute byte differs when you invoke the
display standalone service routines (used
during system generation). For more
information, see "Display Operations in a
Standalone Service Routine Environment."

DISPLAY OPERATIONS IN A STANDALONE SERVICE ROUTINE ENVIRONMENT

In conjunction with VM/SP system generation and modification, VM/SP standalone service routines cause certain units to perform in a different manner than that previously described.

The standalone service routines do not provide all the screen control functions that an operating VM/SP system provides. Instead, a simpler multiline wraparound scheme is used. The output display, user input, and screen status areas are the same as described previously; but the HOLDING and MORE functions are not present. Additionally, the attribute byte associated with the user input area is in the leftmost position of line 22.

A simple monitor for screen control in each service routine displays the next output data at the next logical line position on the screen. When the screen becomes full, the output immediately wraps around without pausing, so that the next line appears starting at line position 0 and subsequent lines successively overlay the previous data lines. Subsequent lines continue down the screen in a similar fashion.

Data keyed into the user input area and presented to VM/SP via the ENTER key leaves the input area and reappears in the output display area in the same fashion as described previously. No virtual console spooling support exists for the console when the service routines are run standalone on a real system; however, if the service routines run under VM/SP using a simulated console, the service routines provide console spooling.

IBM 3101 Display Terminal

A tabletop model, the IBM 3101 Display Terminal is supported by VM/SP as a CPT-TWX device.

MODELS AVAILABLE

The IBM 3101 Display Terminal is available in the following model series:

- Models 10, 12, and 13, which provide cursor addressing, erase functions, AUTO NL (automatic new line), and scrolling capabilities.

- Models 20, 22, and 23, which -- in addition to the above-listed capabilities -- provide block transmission editing function, format field control functions, and buffer print operations capabilities.

VM/SP ACCEPTABLE CHARACTERS

When using the 3101 Display Terminal as a CPT-TWX 33/35 type device, the following functions are not supported by VM/SP:

- The 3101 Read commands that are time dependent, such as Read Cursor Address, Read CSU, Read Buffer, or Read Status are not supported by VM/SP.

- The left brace character will not be displayed when transmitted from VM/SP; however, the left brace can be entered as input and will be stored with other user data.

Note: The following TERMINAL options may prove more useful than the VM/SP defaults: LINESIZE=80, and setting the logical backspace character to the physical backspace key, CHARDEL=<-- key.

The IBM 3101 Display Terminal has a cable-attached moveable keyboard that has the conventional arrangement of alphabetic characters in an 87-key keyboard. The keyboard also includes a clustered 12-key numeric keypad. All 128 United States ASCII (American National Standard Code for Information Interchange) character codes are available.

In addition, a series of setup switches enable the user to utilize the unit according to the functional requirements of his installation.

An illustration of the entire keyboard is shown in Figure 16. For particulars about the display terminal, such as installation requirements, local and remote connections, setup, and communication interfaces, see the IBM 3101 Display Terminal Description, IBM 3101 Setup Instructions, IBM 3101 Operator's Guide, IBM Problem Analysis and Resolution Guide.

IBM 3101 DISPLAY TERMINAL COMPONENTS

The IBM 3101 Display Terminal consists of three individual work station elements:

- Video (cathode ray tube -- monochrome)

    The display screen is 80 characters wide
    and has a depth of 24 lines, which
    permits a display of 1920 characters.
    Directly below the display area is the
    Operator Information Area where messages
    and status are given.

- Logic

    This element comprises the power on/off
    switch, the power-on light, normal/test
    switch, lights 1 and 2, the connector
    panel, the audible alarm volume, the
    video element connector, the auxiliary
    interface connector, the communication
    interface connector, the keyboard
    connector, the AC primary fuse, and the
    power cord.

- Keyboard

    The keyboard comprises the graphic
    character keys, the clustered 12-key
    numeric keypad, the setup switches, and
    the program function keys (which are
    activated by pressing the ALT key on the
    basic keyboard). There are keyboard
    separator bars that help prevent
    accidental striking of control or
    function keys.

    Note: The graphic character keys
    include: 26 uppercase alphabetic
    character keys, 26 lowercase alphabetic
    character keys, 10 numeric character
    keys, 32 symbol and punctuation-mark
    keys, and the space bar.
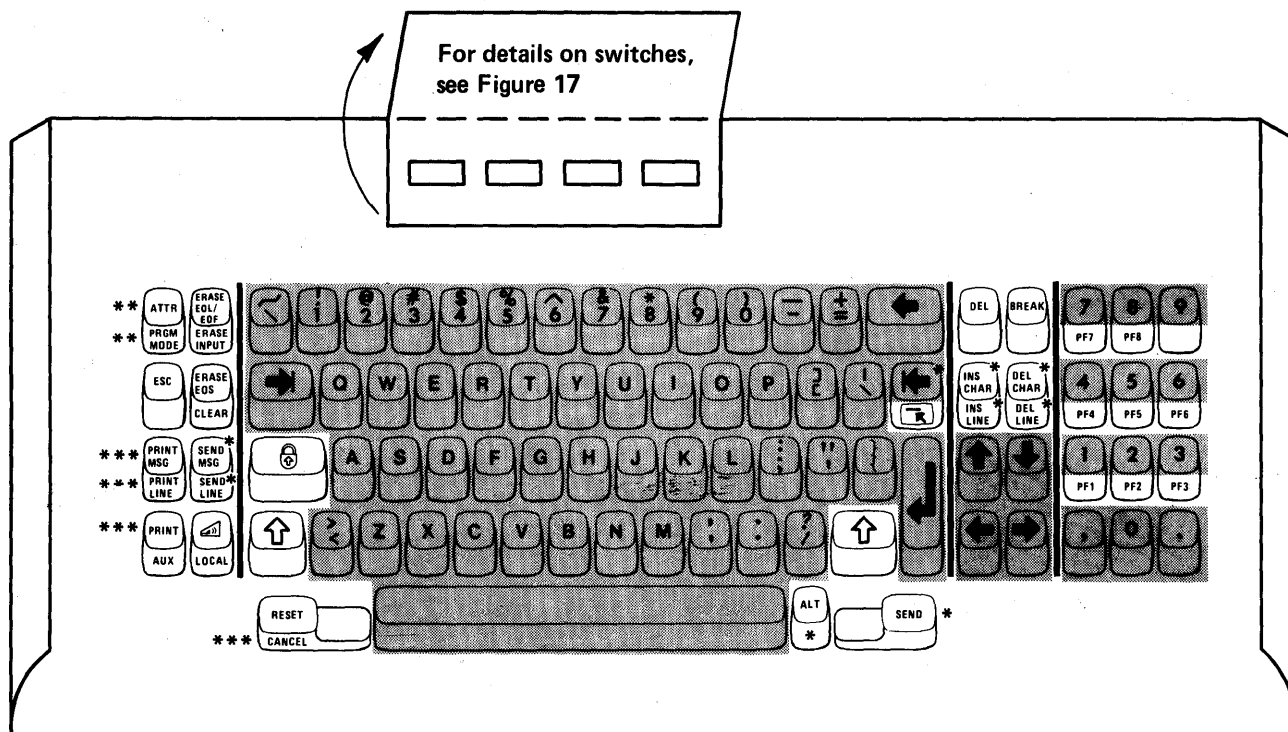
LEGEND: ▨ Typematic Keys.   ▢ Non-Typematic Keys.

* The ALT key must be pressed and held to activate functions shown on the front of the keys.

** Not used for Models 1x series or Models 2x series when in Character mode.

*** Not used for Models 1x series.

Figure 16.   IBM 3101 Keyboard Layout (U.S.A.)

IBM 3101 DISPLAY TERMINAL CONFIGURATION

ACCESSING VM/SP

The 3101 display terminal can be used either as a unit directly attached to a system or processor or as a unit at a remote location. VM/SP supports it as a CPT-TWX typewriter-like terminal.

In order to access VM/SP in character mode, you may set the switches on your 3101 switch panels (see Figure 17) to the following suggested settings:

Switch Panel ❶

Switch No.	Position
1	OFF
2	ON
3	ON
4	ON
5	OFF
6	OFF
7	OFF
8	ON

Directly Attached 3101 Unit

The directly attached 3101 display terminal requires a cable to be attached to its host system, which can be any of a number of types available.

Switch Panel ❷

Switch No.	Position
1	ON
2	OFF
3	ON
4	OFF
5	OFF
6	OFF
7	OFF
8	OFF

Remotely Attached 3101 Unit

The remotely attached 3101 display terminal requires the use of common carrier (or equivalent) customer facilities (unlimited in length) to communicate with the system or processor, which can be any of a number of types available.

Switch Panel ❸

Switch No.	Position
1	ON
2	OFF
3	ON
4	ON
5	OFF (not used)
6	OFF (not used)
7	OFF
8	OFF

Compatible Systems and/or Processors

Switch Panel ❹

All VM/SP supported processors through associated 270x Data Adapter units or 370x Communication Controllers are available for use with the 3101 display terminal. For a complete list of these units and additional details, see VM/SP Planning and System Generation Guide. For more information about compatibility, see IBM 3101 Display Terminal Description.

Set these switches as shown for your I/O BAUD Rates (see Figure 17).

Figure 17. Suggested Settings for 3101 Display Terminal Switch Panels

Panel 1
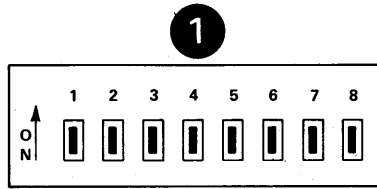
Switch No.	ON	OFF	Meaning
1	•		Block ⎫ Mods 2x
		•	Char ⎭ only
2	•		HDX
		•	FDX*
3	•		232C
		•	CL/422
4	•		PRTS
		•	CRTS
5	•		REV CH
		•	**
6	•		EOT
7	•		CR
6-7	••		XOFF
6-7		••	ETX
8	•		Dual
		•	Mono

*Transmission is HDX when in block mode, regardless of this switch setting. FDX is not supported by VM/370.

**This switch should be OFF if a half-duplex communication facility without reverse channel is used. The setting depends on the type of communication facility needed.

Panel 2
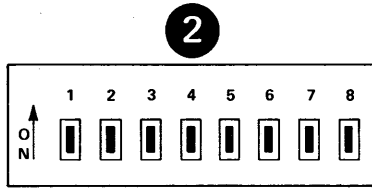
Switch No.	ON	OFF	Meaning
1	•		STOP1
		•	STOP2
2	•		ODD
3	•		MARK
2-3		••	SPACE
2-3	••		EVEN
4	•		SEND LINE
		•	Option † ‡
5			Not used
6	•		NULL SUPP ‡
		•	NULL—SPACE
7	•		FILL CHAR 2 ‡
8	•		FILL CHAR 1 ‡
7-8		••	FILL CHAR 0 ‡
7-8	••		FILL CHAR 3 ‡

†Activates SEND LINE key function when the SEND key is pressed. In the OFF position, the SEND LINE key is for the Send Line operation and the SEND key for the Send operation.

‡Models 2x only; numeral indicates number of times fill character is needed.

Panel 3
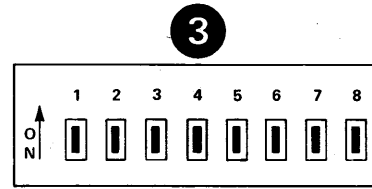
Switch No.	ON	OFF	Meaning
1	•		AUTO NL
2	•		AUTO LF
3	•		CR
		•	CR • LF
4	•		SCROLL §§
		•	Scroll stops
5		•	Not used
6		•	Not used
7	•		Reverse Video § capability §§
		•	
8	•		Blink cursor §§
		•	Steady cursor

§ In the ON position, the field is green and the characters are dark. In the OFF position, green characters appear on a dark background.

§§ The setup switch ID is labeled.

Panel 4
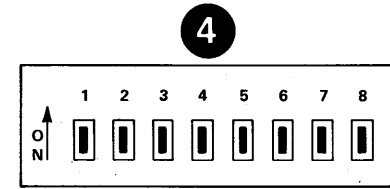
Main Switch Numbers				Auxiliary Switch¶ Numbers				I/O BAUD Rate (BPS)
1	2	3	4	5	6	7	8	
								110
			•				•	150
		•				•		200
		•	•			•	•	300
	•				•			600
	•		•		•		•	1200
	•	•			•	•		1800
	•	•	•		•	•	•	2400
•				•				4800
•		•		•		•		9600

¶ These switches are used with the Models 2x only. You select the desired rate compatible for the attached printer.

Note: A bullet (•) under the switch number indicates that the switch is in the ON position.

Note: The hexadecimal setting for the first three sets of switches is 71A0B0. The fourth set is xy, where x equals the line speed for your 3101 and y is the line speed for the auxiliary printer.

If the telecommunications control unit connecting the 3101 to the VM/SP system is set to use CR as a line turnaround, then the New Line key may be used to signal end of input. If it is not set to use CR, press the ALT key simultaneously with the "s" key to signal end of input.

FUNCTION CONTROL CAPABILITIES

The following switch settings enable you to determine the control you want when using the IBM 3101 Display Terminal (see Figure 17).

BLOCK/CHAR: Block and character transmission mode selection is done when you use this switch. It is available only with the Models 2x series of the 3101. When in the BLOCK position, keyboard entries are stored in a buffer, can be corrected or edited by the operator, and then transmitted to a host system edited by the operator, and then transmitted to a host system or processor when the SEND key is pressed. When in the CHAR position, keyboard entries are immediately transmitted to the host system or processor character by character.

HDX/FDX: Use this switch to select the half-duplex mode of operation, and keep your terminal in half-duplex mode as VM/SP does not support full duplex mode. When the switch is in HDX position, keyboard entries are displayed and transmitted to the host system or processor.

232C or CL/422: Interface selection is enabled when you set this switch. When in the 232C position, the interface selected is EIA RS-232C. When in the CL/422 position, the interface selected is either 20-mA current loop or EIA RS-422.

PRTS/CRTS: The Permanent Request to Send or Controlled Request to Send switch is set dependent on the type of communication facility required and modem control. It is generally used when 232C is the interface mode setting. When in the PRTS position, the request to send signal stays on and communication is achieved with a 103-A type modem in full-duplex mode. The CRTS setting cannot be used because VM/SP does not support half-duplex mode.

REV CH ON/OFF: Reverse channel control is in effect when switch ❸ is set to 232C.

When the REV CH switch is in the ON position, it activates a half-duplex communication facility with a reverse channel. When the REV CH switch is in the OFF position, the half-duplex communication facility does not have a reverse channel. The setting of this switch depends on the type of communication facility required.

EOT/ETX/CR/XOFF: Line turnaround character selection is the function of these switches. They are used as a pair. EOT or ETX is set to change the direction of the data stream to a host system or processor. With the IBM VM/SP system, use CR or XOFF as line turnaround characters. When CR is the setting, the 3101 always assumes CR transmission when the New Line key is pressed regardless of CR/CR.LF switch setting in character mode.

DUAL/MONO: The character set selection results from the setting of this switch. When in the DUAL position, the 3101 displays, transmits, or receives any graphic characters (except DEL) whether keyboard entered or from a host processor without any character code change. When in the MONO position, lowercase characters are changed to uppercase and pressing certain special character keys causes the keyboard to lock. For more detail, see the IBM 3101 Display Terminal Description. Note that bit patterns for graphic characters in ESC sequences never get changed.

STOP1/STOP2: Character framing is accomplished with this switch. The 3101 uses an 8-bit dataword length, including a parity bit. Start-stop line protocol consists of one start bit, eight data bits, and one or two stop bits. Thus, a total word length of 10 or 11 results, which is switch selectable. When in the STOP1 position, one stop-bit framing is selected (150 bps or higher speed rates). When in the STOP2 position, two stop-bit framing is selected (110 bps speed rate).

ODD/EVEN/MARK/SPACE: Parity bit selection is enabled with two setup switches for you to select the parity bit type (see Figure 17 ❷). When either ODD or EVEN parity is selected, the 3101 generates the proper bit parity for the data being transmitted, and checks for proper bit parity of all received data. When either MARK or SPACE is selected, the parity bit for each character being transmitted is forced to 1 for MARK or 0 for SPACE and the 3101 does not check the parity bit of any received data for either the MARK or SPACE parity bit.

Note: VM/SP supports MARK parity only.

SEND: The send line option is available only with Models 2x in BLOCK mode. When in the ON position, 3101 performs the SEND LINE operation when the SEND key is pressed. Also, when the switch is in the ON position, the SEND function (full screen) is performed when the SEND LINE key is pressed. When in the OFF position, the SEND LINE key initiates a Send Line Operation and the SEND key initiates a Send Operation.

NULL SUPP ON/OFF: Null suppress selection is used only with the Models 2x series. When in the ON position, trailing nulls are suppressed when the block transmission or the buffer-print operation is performed. When in the OFF position, a null character is converted to a space character before transmission. Note that trailing nulls are null characters that follow the last significant character (EOC or EOF) or the cursor in a line or screen. Null suppress is also effective on Models 2x series print operation in character mode.

NO. OF TIME FILL CHARS: Number of time fill characters is applicable only with the Models 2x series. A pair of switches are used (see Figure 17 ❷) to show the number (0, 1, 2, or 3) of time-fill characters (DELs) used for the print data stream. Note that the character(s) may be inserted into a sequence of characters without affecting the meaning of the sequence. Time-fill characters, however, may affect control of the 3101 or the printer.

AUTO NL ON/OFF: Automatic new line for cursor control is enabled by this switch. When in the ON position, the cursor automatically moves to the first character position in the next line after reaching the 80th character position on the line. This bottom-line position permits entry of new data. When in the OFF position, the cursor stays at the 80th character position. Continued keyboard entry changes the character in the 80th position and sounds the audible alarm unless the operator presses the New Line key.

CR/CR.LF: Carriage return or carriage return-line feed is effected with this switch. When in the ON position, CR is the setting and the New Line key generates the CR character. When in the OFF position, CR.LF is the setting and the new line key generates both the CR and LF characters.

SCROLL ON/OFF: Scrolling capability is provided with this switch. When in the ON position, the cursor is advanced to a new line from the last line of the screen, the top line disappears, the other 23 lines shift up one line, and the bottom line is blank with the cursor at the first

character position of the line. When in the OFF position, scrolling does not occur. The cursor moves from character position 80 of line 24 to character position 1 of line 1 and any new data overwrites the existing data on line 1. For additional detail, see IBM 3101 Display Terminal Description.

REVERSE VIDEO ON/OFF: Reverse video capability is provided with this switch. When in the ON position, the display screen is a green background with dark characters showing the data. When in the OFF position, the background is dark and the data characters appear green.

BLNK CSR ON/OFF: Blink cursor is implemented with this switch. When this switch is in the ON position, the cursor blinks and calls attention to its location. When this switch is in the OFF position, the blinking stops and you have a steady cursor.

I/O BAUD RATE--MAIN/AUX: Line speed selection for communication interface are enabled with these switches. When switches one through four are set, the MAIN communication interface is in effect and you select one desired rate at any one time for data communication with a host system (see Figure 17 ❹). When switches five through eight are set, the AUX communication interface is in effect for the Models 2x only and you select the desired rate compatible for the attached printer. For additional information on this series of switches, see the IBM 3101 Display Terminal Description.

CURSOR POSITIONING CONTROLS

There are several keys on the keyboard that permit you to position the cursor rapidly to any display image location on the screen (see Figure 18). The keys are marked with directional arrows for easy identification.

For details about the operation of cursor positioning keys including the wrap function, see the IBM 3101 Display Terminal Description.

OPERATOR EDITING CONTROL KEYS

The editing function is performed with the use of the following keys:

Key	Action
↑ (Up)	Moves the cursor up one line.
↓ (Down)	Moves the cursor down one line.
→ (Right)	Moves the cursor one character position to the right.
← (Left)	Moves the cursor one character position to the left.
← (Backspace)	Moves the cursor one character position to the left.
→| (Tab)	Moves cursor to next tab stop position or the first data character position of the next unprotected field -- whichever is first.
|← (Back tab)	Moves the cursor to the next left tab position or the first data character position (also left) in an unprotected field. The cursor skips over attribute characters as well as other tab stops.
↵ (New line)	Moves the cursor to the first character position of the current line, the next lower line, the third lower line, or the home position, depending on the switch settings.
↖ (Home Key)	Moves the cursor to the first character position of the first line. Note that the Home Key is not a typematic key.

Figure 18. Cursor Positioning Control Keys and Their Use

CLEAR: When this key is pressed, all data, including tab stops and attribute characters, are removed from the screen. An exception is the Operator Information Area, which stays intact. The cursor moves to the Home position -- first character, first line (upper left corner).

ERASE INPUT: Changes all character positions appearing on the screen to nulls (except tab stops). Another exception is the Operator Information Area, which stays

intact. The cursor moves to the upper left corner. Note that for Models 2x series field control function, this key clears all unprotected character positions to nulls, resets a modified data tag (MDT) bit to 0 in the unprotected field, and moves the cursor to the first unprotected character position. Tab stops are left intact.

ERASE EOS: Changes all data to nulls (except tab stops) from the cursor position to the end of the screen. Another exception is the Operator Information Area, which stays intact. The cursor does not move. Note that for Models 2x series field control function, this key changes all unprotected data from the cursor position to the end of the screen.

ERASE EOL/EOF: Changes the character located by the cursor and all remaining characters to null through to the end of the line. Tab stops are not affected and the cursor does not move. Note that for Models 2x series field control function in format mode, this key changes all characters from the cursor location to the end of the line or the end of the field (whichever is first). In addition, the MDT bit is set to 1.

INS CHAR: This key is used for the Models 2x series when in Block Mode only. Pressing this key causes the 3101 to enter the insert character mode and to display the legend INSERT MODE in the Operator Information Area. Pressing any graphic key thereafter inserts the character at the cursor position and the MDT bit is then set to 1 if the field contains at least one null character to be used for character movement.

DEL CHAR: This key is used for the Models 2x series when in Block Mode only. Pressing this key causes the 3101 to delete any character where the cursor is positioned. The cursor does not move. Pressing this key repeatedly will delete each character that gets positioned above the cursor (the letters move from right to left) and the MDT bit is set to 1.

INS LINE AND DEL LINE: Same as INS CHAR and DEL CHAR except that a full line of text is inserted or deleted.

Note: For additional information about all four of these keys, see IBM 3101 Display Terminal Description.

PRGM MODE: Program mode key use only when in Block Mode causes the 3101 display terminal to enter program mode. The operator then enters or alters attribute characters. Press the same key to exit from program mode.

ATTR: Attribute key used only when in block Mode cannot be implemented unless the 3101 is also in Program Mode. After the ATTR key is pressed, the desired graphic key must be pressed to enter the attribute character at the cursor location. If this key is pressed in any but program mode, the keyboard becomes disabled. For additional information, see the IBM 3101 Display Terminal Description.

For Models 2x series in Block Mode, the following keys enable the operator to initiate the block transmission related operations.

Send Keys -- SEND/SEND MSG/SEND LINE: These keys initiate transmission of the entire or partial screen buffer contents to a host system. If any of these keys are pressed while in character mode, the keyboard locks. Note that these keys cannot be used when the 3101 is operating in character mode. For more details on each of these three keys, see the IBM 3101 Display Terminal Description.

Note: When using the SEND MSG function with a VM/SP system, you must not exceed 130 characters of input.

Print Keys -- PRINT/PRINT MSG/PRINT LINE: These keys, whether in character mode or block mode of the Models 2x series, initiate the transmission of the entire or partial screen buffer contents to an auxiliary device, such as a printer. For additional information about these three keys, see the IBM 3101 Display Terminal Description.

CANCEL: Pressing this key immediately terminates any block transmission initiated by the Send keys or the Print keys. It has no effect after data transmission is either completed or terminated.

AUX: This key controls the data flow to an auxiliary device attached to the 3101 display terminal. For additional information about this key, see the IBM 3101 Display Terminal Description.

PF: VM/SP does not support the 3101 program functions keys.

ESC: This key generates the ASCII escape code that is followed by other key codes. This enables the 3101 to perform specific functions other than the standard ASCII control function. For greater detail, see the IBM 3101 Display Terminal Description.

DEL: Pressing this key, regardless of a MONO switch setting, causes the 3101 to transmit an ASCII delete character. When in block mode, this key is ignored.

BREAK: When you press this key, you cause a break (or space) signal to be sent to the system or processor. If this key is held down, the link between the 3101 and the system or processor is broken. For additional information on effective use of this key, see the IBM 3101 Display Terminal Description.

CLICK: The keyboard is equipped with a clicker that sounds whenever a key is pressed, providing audio feedback. This key is used to enable or disable the clicker.

LOCAL: Pressing this key terminates communication between the 3101 and the host system or processor. To reinstate communication, press this key again. For additional information, see the IBM 3101 Display Terminal Description.

RESET: Pressing this key unlocks a locked keyboard. The keyboard lock field in the Operator Information Area (LOCK-indication) is cleared and all of the stacked status are reset. If some conditions still exist, the status of the highest priority is displayed as a reminder (without the LOCK- indication).

Shift Control -- ALT/SHIFT/SHIFT LOCK: The ALT key, used with other graphic keys, generates ASCII control characters. It is also used to shift other editing keys The SHIFT key enables you to enter any uppercase characters from the keyboard. The SHIFT LOCK keeps the SHIFT key in the uppercase status. Pressing the SHIFT key releases the SHIFT LOCK.

32 Control Characters: Pressing certain graphic characters in conjunction with pressing the ALT key generates a corresponding ASCII control code. For details on this, see the IBM 3101 Display Terminal Description.

Typewriter-like terminal keyboards, unlike display terminal keyboards, have a keyboard lock that immobilizes the keys. When your keyboard is unlocked, your terminal will accept input. Enter your input in uppercase, lowercase, or a mixture of the two. Make corrections on partially entered input lines using the VM/SP logical line editing characters (see Figure 19) then press the return key to enter an input line from the keyboard. Note that the default line length is 130 characters -- 129 data characters plus the carriage return. For information about changing the line length, see the CP TERMINAL command in VM/SP CP Command Reference for General Users.

Terminal Characteristics

Several IBM communications terminals consist of a modified IBM SELECTRIC[1] typewriter that is mounted on a base unit. The base unit includes electronic controls needed for communication with the system.

On keyboards of most terminals, the following keys operate in the same way as do the keys on a standard Selectric typewriter. In general, the descriptions given in Figure 19 apply to most terminals.

- Alphameric and special characters keys
- Space bar
- Power switch
- Shift lock
- Tab, tab set, and tab clear
- Margin release

In some terminals, the space bar, backspace, and hyphen/underscore keys have the Typematic feature. When you press one of these keys lightly, the key strikes just once. Press harder and holding the key causes the operation to repeat until you release the key.

Detailed information on these typewriter terminals is available in those documents pertaining to your particular unit. The publications are cited in the "Preface."

You should familiarize yourself with all aspects and features of your terminal by referring to the User's Guide for your terminal or its Component Description or Operator's Guide.

----
[1]Registered Trademark of IBM Corp.

You will find that Figure 19 details logical line editing character usage, which is very useful when making entries to the system. To redefine one or more of these special characters, see the description of the CP TERMINAL command in VM/SP CP Command Reference for General Users.

VM/SP knows the relative position of the typing element during output operations. When the typing element moves one position past the specified or default line length, VM/SP generates an automatic carriage return. Output then continues on the next line.

SPECIAL FEATURES

Some keyboard configurations -- PTTC/EBCD or the Correspondence -- are detailed in some of the publications listed in the "Preface." In the cited publications, you will find discussions of the required special features for typewriter terminals as virtual machine consoles under VM/SP. These special features apply to communication terminals installed on either switched (dial-up telephone connection) or leased lines (directly attached by cable). For a listing of these, see IBM 2741 Component Description.

In addition to the PTTC/EBCD keyboard configuration, there are terminals available with an APL keyboard configuration and APL typing element. On these units, press the APL "on/off" key to change the keyboard to APL character input mode. Note that on some display units the letters "APL" will appear on the screen to indicate that APL is in effect.

The APL compound overstrike characters can only be activated by pressing and holding the APL ALT key while also pressing the specific character you want.

During text input, VM/SP translates the APL graphic characters to the corresponding hexadecimal representation. For text output, VM/SP translates the hexadecimal representation back to the corresponding APL character. You must use the CP TERMINAL command with the APL ON operand to implement the APL translation. Note that you cannot use the APL operand if the terminal connects to a unit operating in network control program (NCP) mode.

Character, Symbol, or Type	Description and/or Meaning
Invalid Character	Nothing is printed and a blank appears where the invalid character was typed.
Nonprintable Character	Nothing is printed and a blank appears where the nonprintable character was typed.
Exclamation Point	Whenever the ATTN key is pressed, an exclamation point (!) appears. Having the exclamation point print is a selectable option of the TERMINAL ATTN command.
Correspondence Keyboard (2741 Communication Terminal)	VM/SP translates the following special characters to provide the necessary special characters for entering certain types of programs: Character Character Typed Printed ± > (greater than) o ¬ (logical NOT) • | (logical OR) The less-than symbol (<) has no corresponding translate character on the keyboard. To enter an equivalent to this character, see the ALTER subcommand of the EDIT command.[1] ALTER provides a method of entering the corresponding hexadecimal representation of the character. You can also use the CMS SET INPUT command[1] to equate some seldom-used character to the hexadecimal representation for less-than. If the SET command is not used, the system types blanks (spaces) instead of the symbol.
Blank (space)	Use a blank (one or more) to separate command names, operands, options, and keywords from each other. Any exception to this usage is documented where appropriate.
Printing Inhibited	Should output printing become inhibited during any output operations, press the ATTN key (or its equivalent) to resume printing.
[1] For more information on this command, see VM/ SP CMS Command and Macro Reference.	

Figure 19. Characteristics Common to Many Terminals

CAUTION: If you disconnect your terminal, you lose your connection to VSAPL-CMS. When you logon again, you must issue the command:

    TERM APL ON LINESIZE 255 ATTN OFF

For additional information about special features offered, see VM/SP Planning and System Generation Guide and VM/370 Features Supplement.

If the VTAM Communications Network Application (VM/VCNA) program product (5735-RC5) is used to provide support for SNA terminals, the following publications are also required:

IBM VM/VCNA

    General Information Manual, GC27-0501

    Installation, Operation, and Terminal Use, SC27-0502

Printer-Keyboard Characteristics

Where a control unit combined with a printer-keyboard makes up the communication system, the PTTC/EBCD as well as APL keyboard configurations can be used. For detailed descriptions and additional information about these printer-keyboard

units, see *IBM 1050 Data Communication System Operator's Guide* and *IBM 1050 Data Communication System Principles of Operation*.

The required special features for these printer-keyboard units operating as a virtual machine console under VM/SP are detailed in *VM/SP Planning and System Generation Guide* and *VM/370 Features Supplement*.

Teletype Model 33 Characteristics

The Keyboard Send/Receive (KSR) model of the Teletype Model 33 terminal includes a typewriter keyboard, a control panel, a data set, control circuitry for the teletypewriter, and roll paper. The Model 33 KSR keyboard contains all standard characters in the conventional arrangement, as well as a number of special symbols. All alphabetic characters are capitals. Use the SHIFT key for typing the "uppershift"

special characters only. The CTRL key (Control key) is used with other keys to perform special functions. Neither the SHIFT nor CTRL key is self-locking. Figure 20 illustrates the Teletype Model 33 keyboard.

In addition to the standard keys, the keyboard contains several nonprinting keys with special functions. These keys are as follows: LINE FEED: Generates a line-feed character and moves the paper up one line without moving the printing mechanism. When the terminal is offline, press the LINE FEED key after each line of typing to avoid overprinting.

RETURN: Causes a carriage return and signifies the physical end of the input line.

Note: Operating the CTRL and X-OFF keys normally terminates input lines. When VM/SP receives this sequence, VM/SP sends carriage return and line feed commands to the terminal. CTRL X-OFF is also the ending character for paper tape operations.
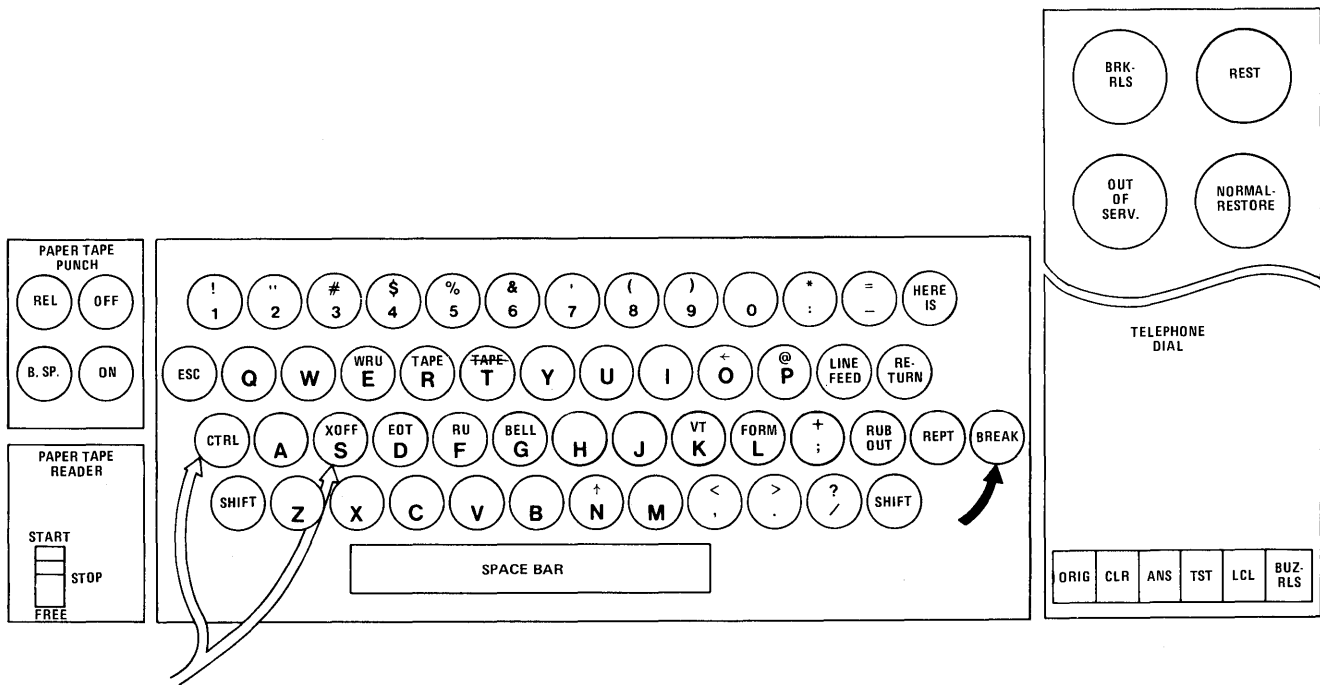
LEGEND:
◆ ATTENTION SIGNALING KEY
▷ END-OF-LINE SIGNALING KEY

Figure 20. Teletype Model 33 Keyboard

The RETURN key can also be an "end of input" character if the 2702 or 2703 Transmission Control is equipped with Pluggable End Characters (RPQ E62920 or RPQ E66707, respectively). Upon receipt of the RETURN "end of input" character, VM/SP sends an automatic line feed command to the terminal.

REPT: Repeats the action of any key pressed.

BREAK: Generates an attention interruption and interrupts program execution. On some Model 33 terminals, after interrupting program execution, you must press the BRK-RLS (Break-Release) pushbutton to unlock the keyboard.

CTRL: Used with other keys to perform special functions:

CTRL-I acts like the tab key on a typewriter.
CTRL-H acts like the backspace key on a typewriter.
CTRL-Q produces an attention interruption similar to BREAK when the terminal is in input mode.
CTRL-E produces an attention interruption similar to BREAK when the terminal is in input mode.
CTRL-S (X-OFF) acts as RETURN (see the note under RETURN).
CTRL-D (EOT) should not be used because it can disconnect the terminal.
CTRL-G (bell)
CTRL-R (tape)

All other CTRL characters are valid characters.

HERE IS: Not supported by VM/SP; however, this key generates a fixed number of data characters.

RUBOUT: Ignored by VM/SP.

ESC: (ALT MODE on some units) is not recognized by VM/SP, but generates a valid character.

On models that have the control panel to the right of the keyboard, six pushbuttons are below the telephone dial, and two lights, a pushbutton, and the NORMAL-RESTORE knob are above the dial. The pushbuttons and lights are as follows:

ORIG: (Originate) this pushbutton obtains a dial tone before dialing. Turn up the volume control on the loudspeaker (under the keyboard shelf to the right). After establishing connection with the computer, lower the volume.

CLR: (Clear) press this pushbutton to turn off the typewriter.

ANS: (Answer) this pushbutton is not used with VM/SP.

TST: (Test) this pushbutton is for testing purposes only.

LCL: (Local) this pushbutton turns on the typewriter for local or offline use.

BUZ-RLS: (Buzzer-Release) this pushbutton turns off the buzzer that warns of a low paper supply. The light in the BUZ-RLS pushbutton remains on until you replenish the paper.

BRK-RLS: (Break Release) this pushbutton unlocks the keyboard after the BREAK key interrupts program execution.

REST: VM/SP does not activate this light.

NORMAL-RESTORE: Set this knob to NORMAL, except to change the ribbon, in which case turn the knob to the OUT-OF-SERV light position. Then set the knob to RESTORE. Return it to NORMAL when you finish the ribbon change.

OUT-OF-SERV: (Out of Service) this light turns on when the NORMAL-RESTORE knob is pointed to it to change ribbons.

Most Teletype units have a loudspeaker and a volume control knob (VOL) located under the keyboard shelf. Turn the knob clockwise to increase the volume.

Typing conventions for Model 33 and Model 35 Teletype terminals are described following "Teletype Model 35 Characteristics."

Teletype Model 35 Characteristics

The Keyboard Send/Receive (KSR) model of the Teletype Model 35 terminal includes a typewriter keyboard, a control panel, a data set, control circuitry for the teletypewriter, and roll paper. The Model 35 KSR keyboard contains all standard characters in the conventional arrangement, as well as a number of special symbols. All alphabetic characters are capitals. The SHIFT key is for typing the "uppershift" special characters only. The CTRL key (Control key) is used with other keys to perform special functions. Neither the SHIFT nor CTRL key is self-locking. Figure 21 illustrates the Teletype Model 35 keyboard.

In addition to the standard keys, the keyboard contains several nonprinting keys with special functions. These keys are as follows:

LEGEND:

◆ ATTENTION SIGNALING KEY

▷ END-OF-LINE SIGNALING KEY
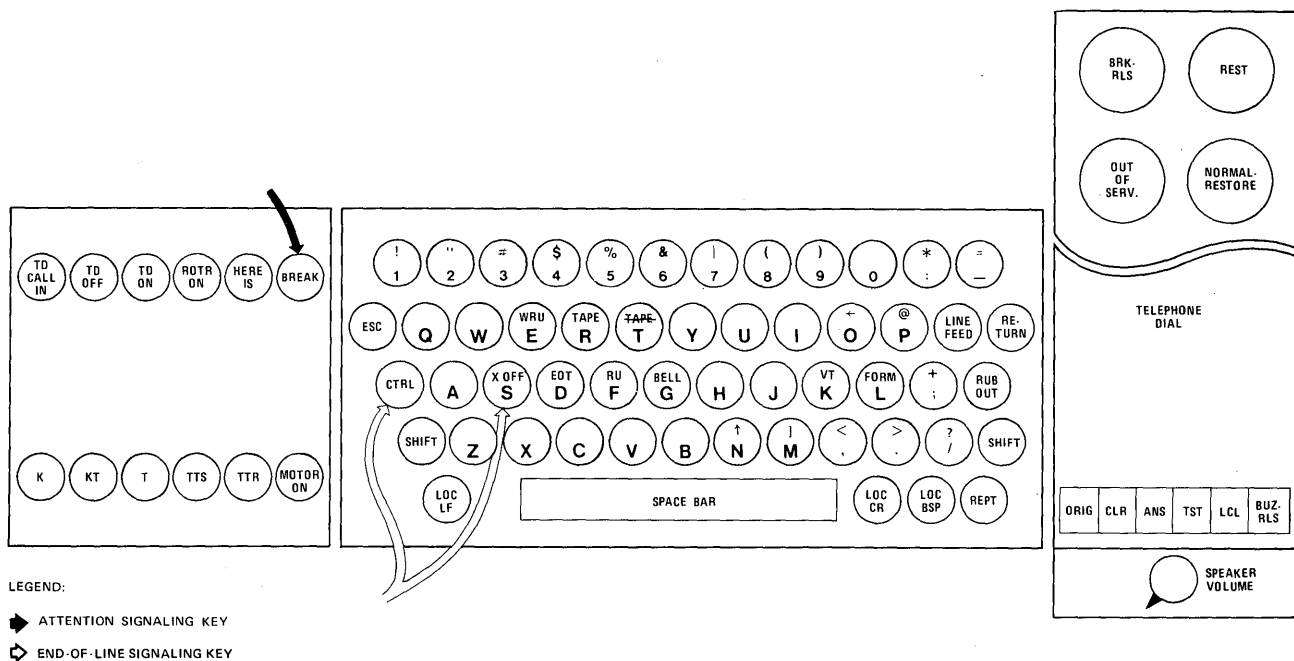
Figure   21.   Teletype Model 35 Keyboard

LINE FEED: Generates a line-feed character and moves the paper up one line without moving the printing mechanism. When the terminal is offline, press the LINE FEED key after each line of typing to avoid overprinting.

RETURN: Causes a carriage return and signifies the physical end of the input line.

Note: Operating the CTRL and X-OFF keys normally terminates input lines. When VM/SP receives this sequence, VM/SP sends carriage return and line feed commands to the terminal. CTRL X-OFF is also the ending character for paper tape operations.

    You can specify the RETURN key as an "end of input" character if the 2702 or 2703 Transmission Control is equipped with Pluggable End Characters (RPQ E62920 or RPQ E66707, respectively). Upon receipt of the RETURN "end of input" character, VM/SP sends an automatic line feed command to the terminal.

REPT: Repeats the action of any key pressed.

BREAK: Generates an attention interruption and interrupts program execution. On some Model 35 terminals, after program execution

is interrupted, press the BRK-RLS (Break-Release) pushbutton and the K (keyboard) pushbutton to unlock the keyboard.

CTRL: Used with other keys to perform special functions:

CTRL-I acts like the tab key on a typewriter.
CTRL-H acts like the backspace key on a typewriter.
CTRL-Q produces an attention interruption similar to BREAK when the terminal is in input mode.
CTRL-E produces an attention interruption similar to BREAK when the terminal is in input mode.
CTRL-S (X-OFF) acts as RETURN (see the note under "RETURN").
CTRL-D (EOT) should not be used because it can disconnect the terminal.
CTRL-G (bell)
CTRL-R (tape)

All other CTRL characters are valid characters.

HERE IS: VM/SP ignores this character.

RUBOUT: VM/SP ignores this character.

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ESC: (ALT MODE on some units) ignored by VM/SP, but generates a valid character.

The control panel to the right of the keyboard contains six pushbuttons below the telephone dial, and contains two lights, a pushbutton, and the NORMAL-RESTORE knob above the dial. The pushbuttons and lights are as follows:

ORIG: (Originate) this pushbutton obtains a dial tone before dialing. Turn up the volume control on the loudspeaker (under the keyboard shelf to the right) to hear the dial tone. After connection with the computer has been made, the volume may be lowered.

CLR: (Clear) pressing this pushbutton turns off the typewriter.

ANS: (Answer) this pushbutton is not used with VM/SP.

TST: (Test) this pushbutton is for testing purposes only.

LCL: (local) this pushbutton turns on the typewriter for local or offline use.

BUZ-RLS: (Buzzer-Release) this pushbutton turns off the buzzer that warns of a low paper supply. The light in the BUZ-RLS pushbutton remains on until you replenish the paper.

BRK-RLS: (Break-Release) this pushbutton unlocks the keyboard after the BREAK key interrupts program execution.

REST: VM/SP does not use this light.

NORMAL-RESTORE: Set this knob to NORMAL, except to change the ribbon, in which case turn the knob to the OUT-OF-SERV light position. Then set the knob to RESTORE and NORMAL when you complete the ribbon change.

OUT-OF-SERV: (Out of Service) this light goes on when you point the NORMAL-RESTORE knob to it to change ribbons.

Most Teletype units have a loudspeaker and a volume control knob (VOL) located under the keyboard shelf. Turn the knob clockwise to increase the volume.

The additional features of the Model 35 are:

LOCLF: (Local Line Feed) this pushbutton operates as the LINE FEED pushbutton does, but without generating a line-feed character. Use it with the LOC-CR pushbutton.

LOC-CR: (Local Carriage Return) this pushbutton returns the carrier as RETURN

does, but without generating an end-of-line character. LOC-CR normally is used only to continue a line of input on the next line.

LOCBSP: (Logical Backspace) this pushbutton generates a character, but it has no meaning with the KSR model.

K: (Keyboard) this pushbutton unlocks the keyboard and sets the terminal for page copy only.

A column indicator at the right of the keyboard indicates the column that has just been printed. When you use the LOC-CR key, no end-of-line is recorded and the column indicator does not reset.

A red light to the right of the column indicator warns you that the carrier is approaching the right margin.

GENERAL TYPING CONVENTIONS FOR TELETYPE MODEL 33/35 TERMINALS

Observe the following typing conventions when entering input to VM/SP from a Teletype Model 33 or 35:

• The Teletype terminal keyboard always remains unlocked. Therefore, ycu should not attempt to key in anything until VM/SP types a period (.) at the left margin of the paper when VM/SP can accept input. If you start typing too soon, an interruption can occur that puts you into CP mode. If this occurs, type BEGIN to resume virtual machine operation.

• Correct partially entered input lines containing errors by using the VM/SP special logical line editing characters. These characters and their operation are described under the heading "Logical Line Editing Character Usage" in "Section 4. General Procedures for All VM/SP Terminals."

• End an input line from a Teletype terminal by operating the CTRL and X-OFF keys, or the RETURN key if the IBM 2702 or 2703 Transmission Control has the Pluggable End Characters RPQ.

• Invalid or nonprintable output characters appear as blank characters. An invalid output character, such as carriage return or tab, has no corresponding printable character on the terminal and no keyboard function.

• On Teletype terminals, the arrcw translates to underscore (_), the

backslash translates to a logical not sign (¬), and the up arrow translates to a logical or sign (|).

- In most cases, one or more blanks may separate command names, operands, options, and keywords from each other. Exceptions to this general rule are documented where appropriate.

- An exclamation point (!) prints when you operate the BREAK key. Printing the exclamation point is a selectable option of the CP TERMINAL command.

- VM/SP knows the relative position of the typing mechanism during output operations. When the typing mechanism moves one position past the default or specified line length, an automatic carriage return and line feed occurs. Output then continues on the next line. An automatic carriage return and line feed does not generate a continuation character.

- The default line length is 72 characters. For information about changing the line length, refer to the CP TERMINAL command in the VM/SP CP Command Reference for General Users.

- To establish logically equivalent characters for characters that are not present on the teletypewriter keyboard, use the CMS SET INPUT command as described in VM/SP CMS Command and Macro Reference.

System Operator Typewriter–Like Consoles

The publications cited in the "Preface" of this book give detailed information about the printing consoles and the display consoles that can be used with VM/SP as either the VM/SP system console or as a virtual machine console. To use typewriter-like console devices as terminals, use the REQUEST key to signal ATTN and the END key or the RETURN key to terminate and enter a line of input. The special characters used for logical line editing purposes are described in Figure 22. Console keyboards also have CANCEL keys that delete an entire input line.

Communication Terminal Characteristics

Because communication terminals have a buffered matrix printer, and are keyboard-driven devices -- and, in general, perform the functions of other similar devices -- does not mean the implementation of these functions is the same. These units also offer many optional features that enhance their usefulness. For details of the features available and other functions, see the publication pertinent to your device cited in the "Preface."

The procedures for establishing communication with the VM/SP computer are described in "Section 1. Introduction" under "Gaining Access to VM/SP."

Note: Required special features on these communications control units needed when a terminal is operating as a virtual machine console under VM/SP are described in VM/SP System Programmer's Guide.

Special Considerations for Using Typewriter Terminals

Typewriter-like terminals have needs that differ from those of display units.

KEYBOARD LOCK

Except for one communication terminal unit, the typewriter-like terminal is unbuffered; therefore, the printing element of the typewriter is common to both input and output operations and cannot simultaneously accept input and generate output. The keyboard lock separates these two operations.

The following examples illustrate the operation of typewriter terminals with the keyboard lock feature:

- Situation 1--You are keying data into your virtual machine from your typewriter terminal. In the midst of a line of entry, the virtual system queues a response to the terminal. After receiving the line end signal for the input line from the terminal, the keyboard locks to prevent you from keying in more data while the system prints the queued response message at the terminal.

- Situation 2--The virtual system is printing an extensive amount of data on the typewriter terminal, but you want to interrupt the virtual machine (see "Attention Handling") to perform alternative action. You cannot make the change because the keyboard is locked until the current operation ends. To circumvent this, signal an attention interruption via the ATTN key (or its

equivalent). Note that this key is <u>not</u> under keyboard lock control. The current operation of the virtual machine halts (if the virtual machine accepts the interruption) and the keyboard unlocks to allow you to perform the alternate action.

TAB KEY USAGE

The following text describes TAB key usage on typewriter-like terminals when typing input for CMS files that have fixed-length records.

When you press the TAB key (or equivalent) on a typewriter terminal, the typing element moves to the next physical tab stop position. The tab settings on your terminal may not correspond to the internal tab settings for a particular filetype. Note that it is not necessary that they do so: the CMS Editor, after reading a tab character generated by the pressing of the TAB key, expands the tab into the correct number of spaces.

The number of spaces to be generated for each pressing of the TAB key depends upon the tab settings made by the EDIT TABSET subcommand. If no TABSET subcommand is issued, the default tab settings are in effect. These default tab settings are listed in Section 4.

The example that follows illustrates tabbing on a typewriter-like terminal.

1. Set up physical tab stops on the terminal on columns 21, 41, 61, 81, 101, 121.

2. Use the editor's TABSET subcommand to set up identical logical tab stops.

3. Enter input mode and enter the indicated letters separated by tab key action. Note, if this is not a default filetype and record length exceeds 80 characters be sure to indicate the logical record length (LRECL) when initializing the file.

Key in:

AA (tab) BBB (tab) CC (tab) DD (tab) EE....
AA (tab) BB (tab) CC (tab) DDDD (tab) EE....

The expanded record as it looks in the file and entered on the console document follows:

Columns

1	21	41	61	81	101	121
AA	BBB	CC	DD	EE	FF	GG
AA	BB	CC	DDDD	EE	FF	GG

<u>Note</u>: If you want tab characters to be accepted without expansion, use the IMAGE subcommand of the editor.

Section 4. General Procedures for All VM/SP Terminals

There are many procedures that are common to all VM/SP supported terminals and consoles. The following text covers these areas.

Logical Line Editing Character Usage

There are four logical line editing characters recognized by VM/SP; see Figure 22. These characters are the default characters in the system and can be changed to others if your system hardware configuration supports terminals whose keyboards do not contain some of these characters. You can define some other infrequently used keyboard character to perform these editing functions. For additional details on changing default values, see VM/SP CP Command Reference for General Users.

Character	Function	Usage and Result Obtained
@	Logical Character Delete	abc#@@ results in ab abc@d results in abd ¢@def results in def abc@@@ deletes the whole line

#	Logical Line End	down 1#type 1#top results in execution of the commands as though entered:
		
		  down 1
		  type 1
		  top

¢	Logical Line Delete	abc¢ results in
		abc#def¢ results in abc
		abc#def#¢ results in abc
		                 def
		abc#def#¢ghi results in abc
		                  defghi
		
		Note: The logical line delete symbol (¢) deletes all typed characters back to and including the previous logical line end symbol (#). You should use the logical line delete symbol only when you have made multiple line entry errors or when you want to make line alterations.

"	Logical Escape	abc"¢d results in abc¢d ""abc"" results in "abc" Note: The editor ignores any quotation mark (") that appears as the last character of a line.

Figure 22. VM/SP Default Logical Line Editing Characters and Their Usage

Spooling Virtual Machine Console I/O

Complicated program execution can produce abundant output data and messages on your terminal console. If desired, you can spool this data, including CP commands and responses, to a disk device and allow the virtual machine to run with the terminal console disconnected. If you have a display terminal, for a printed record of your virtual machine activity (whether connected or disconnected), you must invoke console spooling. For more details see _VM/SP_ _CP_ _Command_ _Reference_ _for_ _General_ _Users_, and the _VM/SP_ _Operator's_ _Guide_.

Tab Settings and Their Default Values

The editor automatically adjusts input entered under the following CMS recognized filetypes to appear in the proper column if you use the physical (or simulated) tab key. The physical or hardware logic set tab settings on your terminal do not have to be in the same relative position as the internal tab settings. Figure 23 shows the list of CMS accepted filetypes and their default settings. To change the tab settings, refer to the discussion of the TABSET subcommand of the EDIT command, described in the _VM/SP_ _CMS_ _Command_ _and_ _Macro_ _Reference_. SCRIPT[1] files can contain SCRIPT control words that control tab settings. For this reason, the EDIT TABSET subcommand has no effect on SCRIPT files.

Indicating Program Execution -- CMS Blip

As a visual indication of the progress of program execution, CMS signals you with a BLIP character for every two seconds of machine execution time. When the real timer option is selected, the BLIP also reflects system time and wait state time.

On typewriter-like terminals, the BLIP character default takes the form of a shift of the print element from lowercase to uppercase and back again. Thus, there is no visible symbol on the paper. If you want, you may define an actual character

----

[1]SCRIPT/VS is a component of the IBM Document Composition Facility program product, which is available from IBM for a license fee. For additional information on SCRIPT/VS usage, see _Document_ _Composition_ _Facility:_ _User's_ _Guide_, SH20-9161.

for the BLIP and have it print at your terminal. To determine exactly how the BLIP character works, check your particular unit's _User's_ _Guide_.

Filetypes	Default Tab Settings
ASSEMBLE MACRO COPY UPDATE UPDT ASM3705 MACLIB XEDIT	1, 10, 16, 30, 35, 40, 45, 50, 55, 60, 65, 70
AMSERV ESERV	2, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60
FORTRAN	1, 7, 10, 15, 20, 25, 30, 80
FREEFORT	9, 15, 18, 23, 28, 33, 38, 81
DIRECT JOB	1, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75
EXEC CNTRL	1, 5, 8, 17, 27, 31
COBOL	1, 8, 12, 20, 28, 36, 44, 68, 72, 80
BASIC BASDATA VSBASIC	7, 10, 15, 20, 25, 30, 80
VSBDATA SCRIPT MEMO LISTING *******	1, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120
PLI PLIOPT	2, 4, 7, 10, 13, 16, 19, 22, 25, 31, 37, 43, 49, 55, 79, 80

Figure 23. CMS Accepted Filetypes and Their Default Settings

On display terminals, VM/SP works the BLIP character differently. The CP component of VM/SP does not allow your responses to CP, CMS, or virtual machine messages to be displayed on the same line as the system message. Thus, the BLIP character is typed on a new line on the display screen. To determine how the BLIP character works, check your particular

unit's User's Guide. For BLIP details, see VM/SP CMS Command and Macro Reference.

Note: On 3767 terminals, the user can alter the default BLIP to any graphic character and track virtual machine execution via the Three-Position Alphameric indicator. Use the CMS SET command to make such changes.

Accessing a Multiple Access System

Procedures follow that you can perform to access a system which provides multiple terminal support, such as APL\360-DOS, RAX, ITF, CPS, or VM/SP operating in a specific virtual machine. Two methods can connect your terminal to a previously logged on multiple-access system:

1. Attach the terminal as a dedicated device to the multiple-access system virtual machine. In this way, the terminal is totally under control of the virtual machine and, while it remains attached, cannot log on to VM/SP. This method is a means of using terminal devices that are supported by the multiple-access system but are not supported by CP as virtual operator consoles.

2. Use the CP DIAL command to logically connect your terminal to a previously logged on multiple-access system. The remainder of this section refers to this second method.

Note: You can use the CP DIAL command with the following terminals when they are directly controlled by VM/SP (not by the VTAM service machine):

-- Start-stop terminals (2741, TWX, or equivalent)

-- Local channel-attached 3270 display units

The CP DIAL command cannot be used with any other terminals. Specifically, the following terminals are not supported:

-- Any terminal connected to the VTAM service machine.

-- Remote 3270 display units

    The multiple-access system to be accessed must already be logged into a VM/SP virtual machine. Whether or not the multiple-access system allows your terminal to access it is a function of the types and maximum number of terminals supported by that particular multiple-access system,

just as in a "standalone" teleprocessing system. For leased or switched line facilities at least one input hub must be available on the transmission control units, the ENABLE or NETWORK ENABLE command must have activated a communications line before the connection can be made. The same rules apply to the control unit and their related display units. When the connection is made, the terminal is under control of the system designated by the DIAL command; consequently, you cannot communicate with VM/SP, and you are not known to VM/SP as a regular logged-on user, but as a user logically connected to the multiple-access system for the duration of the terminal session.

    When you finish using the multiple-access system, you should log off the system in the manner required by that multiple-access system. When the multiple-access system issues a DISABLE command for the line, the terminal becomes available for another user to log on VM/SP or to dial the same or some other multiple-access system that may be running in a virtual machine.

MULTIPLE-ACCESS SYSTEM LOGON

Use the following procedure to log on to a multiple-access system:

1. Specify the multiple-access system to which you wish to gain access by entering

       dial userid [vaddr]

   where "userid" is the name of the multiple-access system and vaddr is the virtual address of the terminal that the multiple-access system supports.

2. If the DIAL command is successful, VM/SP responds with the following message:

       DIALED TO userid vaddr

   This indicates that VM/SP made a connection between the terminal and the multiple-access system, and that the terminal is now completely under control of that system. Further responses are those of the multiple-access system.

   If an error message is displayed, see VM/SP System Messages and Codes.

DISCONNECTING THE TERMINAL

The terminal remains connected to the system until one of the following events occurs in the system itself:

- The line is disabled for that terminal. This occurs by logging off the multiple-access system in the manner prescribed by that system.

- The multiple-access system logs off VM/SP.

- The multiple-access system issues the CP DETACH console function specifying this terminal address.

- In unusual situations you can be forced off the multiple-access system by the VM/SP system operator.

- If the DIAL command was issued from a display unit, the multiple-access system must use the CP RESET command to drop the connection.

<u>Note</u>: The following message occurs at the terminal before the terminal disconnects from the multiple-access system.

    LINE raddr DROP FROM userid vaddr

The terminal can now log on to VM/370, or be logically connected to some other multiple-access virtual machine.

- If the display terminal is powered off, it is placed in a DISCONNECT status for 15 minutes; when powered back on before the end of the 15 minutes, the terminal is in CP mode.

- If the security key on a display terminal is turned to the locked position and then to the unlock position.

- If, on certain units, the display terminal is switched into and out of a TEST mode.

- If, in VM/SP SNA environment, any logic errors or communication failures occur between VCNA and/or CCS, the system forces a disconnect.

Appendix A: Sample Terminal Session

When documenting this sample terminal session, an IBM 2741 unit on a leased line was used.

<u>Notes</u>:

1. The example is illustrative and typical. It does not purport to show the best way to achieve a particular result. It is not necessarily an exact example of system use; it has not been formally tested by IBM. You may, therefore, observe some minor differences between this description and your printout if you enter the same commands and data yourself.

2. After you issue the EDIT command, the System Product editor automatically places you in CMS editor compatability mode. In this mode, you can issue both the CMS EDIT and the System Product Editor's XEDIT subcommands. For complete information on EDIT compatability mode as well as instructions on how to invoke the original CMS editor, see "Appendix B" in <u>IBM</u> <u>VM/SP</u> <u>System</u> <u>Product</u> <u>Editor</u> <u>Command</u> <u>and</u> <u>Macro</u> <u>Reference</u>.

Descriptions of operations appear in the following format:

```
┌─────────────────────────────────┐
│ entry or PROCESSOR RESPONSE      │
└─────────────────────────────────┘
```

```
┌─────────────────────────────────────┐
│         Description                  │
│         — or —                       │
│         Explanation                  │
└─────────────────────────────────────┘
```

For clarity, your entries appear in lowercase, and processor responses appear in uppercase. Note that an exception in processor responses is the use of lowercase letters to indicate such variables as dates, day of week, and time of day.

The operations illustrated are:

- Logging on

- Querying the virtual machine

- IPL of CMS

- Creation of a FORTRAN program

- Compilation of the program (with compilation errors)

- Using the CMS Editor to correct the first error

- Recompilation (with a second error)

- Using the EDIT facility to correct the second error

- Recompilation of the program

- Successful execution

- Logging off

You turn on your terminal:

```
vm/370 online        xxxxxx xxxxxx
```

If this was a "correspondence" 2741, the "vm/370 online" message would appear on the right (and the left-hand side would be meaningless information).

```
logon progra
```

You specify the identification "progra" when logging cn.

```
ENTER PASSWORD:
```

The protected password does not print when entered on a 2741 terminal equipped with the Print Inhibit feature.

```
LOGMSG  hh:mm:ss  zzz weekday mm/dd/yy
* VM/370 IS UP 24 HOURS A DAY
* QUERY LOG FOR ADDITIONAL INFORMATION
LOGON AT  hh:mm:ss zzz weekday mm/dd/yy
```

The VM/370 logon message prints. Note that this is a local option. The CP environment is entered upon completion of the logon procedure.

```
query virtual
```

This command asks CP to query the virtual machine, and type a list of the virtual I/O devices and storage assigned to your virtual machine.

```
STORAGE = 00256K
CONS 009 ON DEV 04F
RDR  00C CLS A
PUN  00D CLS A         COPY 01
PRT  00E CLS A         COPY 01
DEV  0FF PSEUDO TIMER
DASD 130 2314 PIDSK3 R/O 045 CYL
DASD 191 3330 PIDSK7 R/W 015 CYL
DASD 19A 2314 CMS190 R/O 055 CYL
DASD 19C 2314 CMS190 R/O 030 CYL
DASD 19E 2314 CMS190 R/O 026 CYL
DASD 19F 2314 CMS370 R/O 050 CYL
```

For a detailed description of user directory entries, refer to the VM/SP Planning and System Generation Guide.

ipl cms

You invoke the Conversational Monitor System (CMS) and its nucleus is loaded into your virtual storage.

VM/SP CMS - mm/dd/yy hh:mm

Informs you that the CMS command environment is entered. (The content of the message may be different from this one.)

listfile

You request a list of the files located on your primary disk. The first column represents the filename, the second column the filetype, and the third the filemode.

```
INDIAN     LISTING    A1
DUMPREST   ASSEMBLE   A1
SUPERSCR   ASSEMBLE   A1
MY         FORTRAN    A1
INDIAN     TEXT       A1
FORTCLG    EXEC       A1
LOAD       MAP        A1
FIN        MEMO       A1
TUES       MEMO       A1
FRST       MEMO       A1
AGENDA     MEMO       A1
INDIAN     FORTRAN    A1
R; T=0.12/0.33 hh:mm:ss
```

CMS prints the list, followed by the Ready message (R;) indicating that the action requested has finished. "T" indicates the amount of time used and the time the CMS LISTFILE command finished executing. "0.12/0.33" means that 0.12 seconds of virtual

processor time, and 0.33 seconds of real processor time were used. 16:30:43 is the time that the command finished in hours, minutes, and seconds.

edit main fortran

You use this command to instruct CMS to provide the facilities of the EDIT environment to create a FORTRAN program named MAIN.

NEW FILE:
EDIT:

The editor responds with this message after first checking to see if this file already exists.

input
INPUT:

You type the input subcommand to enter the input mode of the editor and the editor responds by telling you that you are in input mode. The first line of FORTRAN data follows this.

c main program month date, year

At the end of each data line, press the RETURN key. This signals the editor to process that line of data.

>write (6,10)

Note: The greater-than character (>) used in this sample terminal session indicates that you pressed the physical TAB key (which normally types out as a blank). On processing the input line, the editor replaces the TAB character with sufficient blank characters so that FORTRAN data starts where it is supposed to, in column 7 of the card image in the file. You then key in the remainder of the FORTRAN program.

```
10>format ('a=')
>read (5,20)a
20>format (8.3)
>write (6,25) a,x
>call exit
>end
```

<---------Operating the RETURN key with no data entered on the line (that is, a null line)

EDIT:

> The editor responds by telling you that you are in edit mode. At this time, you may inspect, correct, or delete any of the input lines or insert new lines.

file

> The file command tells CMS to store on your primary CMS disk the file that is currently being edited.

R; T=0.22/0.96 hh:mm:ss

> The Ready message indicates that the file was stored successfully.

fortgi main

> This command tells CMS to compile the FORTRAN program called MAIN.

G1 COMPILER ENTERED
MAI0005020   FORMAT (8.3)
                         $
01) IGI013I SYNTAX

> The FORTRAN G1 compiler detected source errors, and types the error statements.
>
> The compiler indicates a syntax error by the $.

IGI022I   UNDEFINED LABEL
    25

> The compiler also detected an undefined label.

SOURCE ANALYZED
PROGRAM NAME = MAIN
* 002 DIAGNOSTICS ENTERED, HIGHEST SEVERITY
    CODE IS 8
R(00008) ; T=0.93/1.78 hh:mm:ss

edit main fortran

> To correct the errors in your FORTRAN source statements, you again issue the EDIT command. Because the editor finds an existing file named MAIN FORTRAN, it assumes that you want to edit the existing file, not create a new one.

EDIT:

> The editor responds with this message to indicate that you may enter EDIT subcommands. The MAIN FORTRAN file has been placed in the editor's virtual storage area.

type 20

> You request that the editor type the first 20 lines of the file at the terminal. If the file contains less than 20 records, typing stops after the last line of the file.

C MAIN PROGRAM month date, year
    WRITE (6,10)
10   FORMAT ('A=')
    READ (5,20)A
20   FORMAT (8.3)
    WRITE (6,25) A,X
    CALL EXIT
    END
EOF:

> The FORTRAN program appears different from what was originally entered because the editor replaced the physical tab characters (represented by the > symbol) with sufficient blanks to align all data starting in column 7. The EOF: message indicates the end of file.

locate /format/

> LOCATE requests the editor to scan the entire file starting at the first record, to find the first occurrence of the character string "format" in any portion of any line.

10   FORMAT ('A=')

> The editor types out the first line containing "format". This is not the line in error. Enter the command again.

locate /format/

> Because the previous line was not the desired line and you entered the command again, the editor then finds the next occurrence of the word.

```
20    FORMAT (8.3)

        The editor types the line
        containing the word.


change /8/F8/

        You change the "8" to "F8", using
        the  CHANGE  subcommand.   The
        editor automatically adjusts the
        remainder of the line and types
        the modified line.

        Note: The editor would have found
        the line in error the first time
        if you entered /8.3/ instead of
        entering locate /format/.


20    FORMAT (F8.3)

        The editor types the corrected
        line.


up 2

        You tell the editor  to "back up"
        2 lines and type the data line.


10    FORMAT ('A=')

        Is the typed record.


change /'A='/'A=?'/

        You use the change subcommand to
        modify your original entry.


10    FORMAT ('A=?')

        The changed line types out.


find 20

        Tells the editor to go to the
        line that begins with "20".


20    FORMAT (F8.3)

        Is the line that begins with
        "20".


input >x=a**2

        You insert the information after
        the line beginning with "20."
        The greater-than symbol (>),
        indicates pressing the physical
        TAB key.
```

type

        You request the editor to type
        the current line, which is the
        last line entered.

```
X=A**2
```

        Is the information (indented and
        aligned) as implemented by the
        tab character.

top

```
TOF:
```
        You instruct the editor to go to
        the top of the file.

type 20

        You request that the editor type
        the corrected file.

```
C MAIN PROGRAM month date, year
      WRITE (6,10)
10    FORMAT ('A=?')
      READ (5,20)A
20    FORMAT (F8.3)
      X=A**2
      WRITE (6,25) A,X
      CALL EXIT
      END
EOF:
```

        You are satisfied that the
        contents of the file are now
        correct.

file

        The "file" command tells the
        editor to place the file MAIN
        FORTRAN on your primary disk, and
        to erase the old MAIN FORTRAN
        file. If you specified "file
        newmain" a new FORTRAN file
        called "NEWMAIN FORTRAN" would
        have been created, and the old
        "MAIN" file would still exist.

```
R;  T=0.34/1.37  hh:mm:ss
```

        The Ready message types,
        indicating to you that the FILE
        subcommand completed successfully
        and that you returned to the CMS
        command environment. (The time
        between the FILE subcommand and
        the Ready message varies
        depending on the length of the
        file and the speed of the system
        in responding to the request.)

```
fortgi main
```

> You request another compilation
> of MAIN.

```
G1 COMPILER ENTERED
IGI022I  UNDEFINED LABEL
    25
SOURCE ANALYZED
PROGRAM NAME = MAIN
* 001 DIAGNOSTICS ENTERED, HIGHEST SEVERITY
   CODE IS 8
R(00008) ; T=0.95/2.17 hh:mm:ss
```

> The compiler encounters an
> uncorrected second error.

```
edit main fortran
```

> You request the ability to edit
> the MAIN file again.

```
EDIT:
```

> Indicates to you that you are in
> edit mode.

```
locate /25/
```

> You request the first occurrence
> of "25".

```
    WRITE (6,25) A,X
```

> This line contains the first
> occurrence.

```
input 25> format ('a=',f8.3,2x,'x='20.3)
```

> You insert this missing
> information after the line which
> contained the first occurrence of
> 25.

```
type
```

> You request that the editor type
> the line just entered.

```
25    FORMAT ('A=',F8.3,2X,'X='20.3)
```

> Is the line as it appears at your
> terminal.

```
change /20/,F20/
```

> You see that you made an error
> and change the entered line.

```
25    FORMAT ('A=',F8.3,2X,'X=',F20.3)
```

> Is the way the corrected line
> appears at your terminal.

```
file
```

> You store the updated source
> program on your primary disk.
> The previous copy is erased.

```
R; T=0.21/0.79  hh:mm:ss
```

> The Ready message types upon
> completion of the file request.

```
fortgi main (list source)
G1 COMPILER ENTERED
SOURCE ANALYZED
PROGRAM NAME = MAIN
*  NO DIAGNOSTICS GENERATED
```

> You request another compilation
> of the FORTRAN file MAIN, an
> object code listing, and a source
> listing.

```
R; T=1.18/2.22  hh:mm:ss
```

> Shows the Ready message
> indicating a successful
> compilation.

```
run main
```

> You request that CMS begin
> executing MAIN, the FORTRAN
> object program.

```
FILE 'MAIN EXEC *' NOT FOUND.
FILE 'MAIN MODULE *' NOT FOUND.
```

> CMS informs you that these files
> could not be found.

```
EXECUTION BEGINS...
```

> CMS did locate a MAIN TEXT file
> and begins execution.

```
A=?
2.5
```

> You enter the value 2.5.

```
A=   2.500    X=   6.250
R;  T=3.19/5.34 hh:mm:ss
```

> The FORTRAN program executes successfully.

logoff

> The LOGOFF command removes your terminal from the system.
>
> Note: Where leased lines are not involved, you can issue the command as follows:
>
> logoff hold

> The communication line does not disconnect because you typed the word HOLD. Some other user can now log on to VM/SP at this terminal without first dialing the computer.

```
CONNECT=02:50:46 VIRTCPU=000:21:85
TOTCPU=000:54:54
LOGOFF AT hh:mm:ss zzz weekday mm/dd/yy
```

> The connect time, processor time, and logoff time appear.

Appendix B: Graphic-Hexadecimal Substitution

Graphic	Hex
SPACE	40
¢	4A
	4B
<	4C
(	4D
+	4E
I	4F
&	50
!	5A
$	5B
*	5C
)	5D
;	5E
¬	5F
-	60
/	61
!	6A
,	6B
%	6C
—	6D
>	6E
?	6F
`	79
:	7A
#	7B
@	7C
'	7D
=	7E
"	7F
a	81
b	82
c	83
d	84

Graphic	Hex
e	85
f	86
g	87
h	88
i	89
j	91
k	92
l	93
m	94
n	95
o	96
p'	97
q	98
r	99
~	A1
s	A2
t	A3
u	A4
v	A5
w	A6
x	A7
y	A8
z	A9
{	C0
A	C1
B	C2
C	C3
D	C4
E	C5
F	C6
G	C7
H	C8
I	C9

Graphic	Hex
}	D0
J	D1
K	D2
L	D3
M	D4
N	D5
O	D6
P	D7
Q	D8
R	D9
\	E0
S	E2
T	E3
U	E4
V	E5
W	E6
X	E7
Y	E8
Z	E9
0	F0
1	F1
2	F2
3	F3
4	F4
5	F5
6	F6
7	F7
8	F8
9	F9

Symbol	Name
¢	Cent
.	Period, Decimal Point
<	Less Than
(	Left Parenthesis
+	Plus
I	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
—	Minus, Hyphen
/	Slash
!	Broken vertical line

Symbol	Name
,	Comma
%	Percent
>	Greater Than
?	Question Mark
`	Grave Accent
:	Colon
#	Number Sign, Pound Sign
@	At
'	Prime, Apostrophe
=	Equal
"	Quotation Mark
~	Tilde
{	Open Brace
}	Close Brace
\	Reverse Slash

Graphic	Hex
SP	40
··	41
−	42
≤	43
≥	44
≠	45
∨	46
∧	47
÷	48
×	49
.	4B
<	4C
(	4D
+	4E
|	4F
ω	51
∈	52
ρ	53
~	54
↑	55
↓	56
⍳	57
○	58
←	59
*	5C
)	5D
;	5E
−	60
/	61
→	62
α	63
⌈	64
⌊	65
∇	66
Δ	67
°	68
⎕	69
[	6A
,	6B
−	6D

Graphic	Hex
>	6E
?	6F
]	70
⊂	71
⊃	72
∩	73
∪	74
⊥	75
⊤	76
/	77
:	7A
'	7D
=	7E
A	C1
B	C2
C	C3
D	C4
E	C5
F	C6
G	C7
H	C8
I	C9
J	D1
K	D2
L	D3
M	D4
N	D5
O	D6
P	D7
Q	D8
R	D9
S	E2
T	E3
U	E4
V	E5
W	E6
X	E7
Y	E8
Z	E9
0	F0

Graphic	Hex
1	F1
2	F2
3	F3
4	F4
5	F5
6	F6
7	F7
8	F8
9	F9

Control Symbol	Hex
New Line	15
Back Space	16
Tab	05

Appendix D: Graphic-Hexadecimal Substitution for 3270 APL

Legend: *Those hexadecimals that have a Name listed but have no Graphic(s) are included although not displayed on the 3270 screen.*

Graphic	Hex	Name
	00	Null
	01	
	02	
	03	
{	04	Left brace
	05	Horizontal tab
	06	
	07	
	08	
	09	
	0A	
	0B	
	0C	
	0D	
	0E	
	0F	
	10	
	11	
	12	
	13	
	14	
	15	New line
	16	Back space
	17	
	18	
	19	
	1A	
⌐	1B	Upper right corner
Γ	1C	Upper left corner
	1D	
L	1E	Lower left corner
⌐	1F	Lower right corner

Graphic	Hex	Name
(	20	Superscript left paren
)	21	Superscript right paren
+	22	Superscript plus sign
−	23	Superscript minus sign
}	24	Right brace
	25	Line feed
	26	
	27	
	28	
	29	
	2A	
§	2B	Section mark
+	2C	Plotting cross
—	2D	Extended dash (em-dash)
	2E	
	2F	
0	30	Superscript 0
1	31	Superscript 1
2	32	Superscript 2
3	33	Superscript 3
4	34	Superscript 4
5	35	Superscript 5
6	36	Superscript 6
7	37	Superscript 7
8	38	Superscript 8
9	39	Superscript 9
¶	3A	Paragraph mark
T	3B	Top Tee junction
	3C	
⊢	3D	Left Tee junction
⊥	3E	Bottom Tee junction
⊣	3F	Right Tee junction

Graphic	Hex	Name
	40	Space
$\underline{A}$	41	Underscored A
$\underline{B}$	42	Underscored B
$\underline{C}$	43	Underscored C
$\underline{D}$	44	Underscored D
$\underline{E}$	45	Underscored E
$\underline{F}$	46	Underscored F
$\underline{G}$	47	Underscored G
$\underline{H}$	48	Underscored H
$\underline{I}$	49	Underscored I
¢	4A	Cent sign
.	4B	Dot (period)
<	4C	Less (than)
(	4D	Left paren
+	4E	Plus
		4F	Vertical bar
&	50	Ampersand
$\underline{J}$	51	Underscored J
$\underline{K}$	52	Underscored K
$\underline{L}$	53	Underscored L
$\underline{M}$	54	Underscored M
$\underline{N}$	55	Underscored N
$\underline{O}$	56	Underscored O
$\underline{P}$	57	Underscored P
$\underline{Q}$	58	Underscored Q
$\underline{R}$	59	Underscored R
!	5A	Exclamation point
$	5B	Dollar sign
*	5C	Star (asterisk)
)	5D	Right paren
;	5E	Semicolon
¬	5F	Logical not

Notes:
1. The character codes represented by X'4A', X'4F', X'5A', X'5B', and X'5F' display as "national use" graphics, which vary on 3270s sold in some non-U.S.A. countries. See *IBM 3270 Component Description*, GA22-2749, for details.
2. The character codes represented by X'04', X'24', X'2B', and X'3A' are not defined on the 3277 unit.
3. X'04' and X'24' are the APL/TEXT equivalents of certain "national use" characters listed in the footnotes on these pages. On the 3278 and 3279 units, these characters are distinct from the "national use" versions; they may appear slightly differently on the 3270 display screen.

Graphic	Hex	Name
−	60	Bar (hyphen/minus)
/	61	Slash
S̲	62	Underscored S
T̲	63	Underscored T
U̲	64	Underscored U
V̲	65	Underscored V
W̲	66	Underscored W
X̲	67	Underscored X
Y̲	68	Underscored Y
Z̲	69	Underscored Z
¦	6A	Broken vertical bar
,	6B	Comma
%	6C	Percent symbol
‗	6D	Underbar
>	6E	Greater (than)
?	6F	Query (Question mark)
	70	
∧	71	And
¨	72	Dieresis
₁	73	Subscript one
₂	74	Subscript two
₃	75	Subscript three
ₙ	76	Subscript n
°	77	Degree sign
∨	78	Or
`	79	Accent grave
:	7A	Colon
≡	7B	Pound sign
@	7C	At symbol
'	7D	Quote (single)
=	7E	Equal
"	7F	Quote (double)

Graphic	Hex	Name
~	80	Tilde (unlike)
a	81	Lowercase
b	82	Lowercase
c	83	Lowercase
d	84	Lowercase
e	85	Lowercase
f	86	Lowercase
g	87	Lowercase
h	88	Lowercase
i	89	Lowercase
↑	8A	Up arrow
↓	8B	Down arrow
≤	8C	Not greater (than)
⌈	8D	Upstile
⌊	8E	Downstile
→	8F	Right arrow
▢	90	Quad
j	91	Lowercase
k	92	Lowercase
l	93	Lowercase
m	94	Lowercase
n	95	Lowercase
o	96	Lowercase
p	97	Lowercase
q	98	Lowercase
r	99	Lowercase
⊃	9A	Right shoe
⊂	9B	Left shoe
⟡	9C	Lozenge
○	9D	Circle
±	9E	Plus-or-minus
←	9F	Left arrow

Graphic	Hex	Name
‾	A0	Overbar
~	A1	Tilde (unlike)
s	A2	Lowercase
t	A3	Lowercase
u	A4	Lowercase
v	A5	Lowercase
w	A6	Lowercase
x	A7	Lowercase
y	A8	Lowercase
z	A9	Lowercase
∩	AA	Cap
∪	AB	Cup
⊥	AC	Base
[	AD	Left bracket
≥	AE	Not less (than)
∘	AF	Null
α	B0	Alpha
∈	B1	Epsilon
ι	B2	Iota
ρ	B3	Rho
ω	B4	Omega
■	B5	Solid square
×	B6	Times
\	B7	Slope (reverse slash)
÷	B8	Divide
•	B9	Bullet
∇	BA	Del
Δ	BB	Delta
⊤	BC	Top
]	BD	Right bracket
≠	BE	Not equal
∣	BF	Stile (vertical bar)

Notes:

1. The character codes represented by X'6A', X'79', X'7B', X'7C', X'7F', and X'A1' display as "national use" graphics, which vary on 3270s sold in some non-U.S.A. countries. See *IBM 3270 Component Description*, GA22-2749, for details.
2. The character codes represented by X'6A', X'79', and X'A1' are not defined on the 3277 unit.
3. X'80', X'B7', and X'BF' are the APL/TEXT equivalents of certain "national use" characters listed in the footnotes on these pages. On the 3278 and 3279, these characters are distinct from the "national use" versions; they may appear slightly differently on the 3270 display screen.

Graphic	Hex	Name
{	C0	Left brace
A	C1	Capital
B	C2	Capital
C	C3	Capital
D	C4	Capital
E	C5	Capital
F	C6	Capital
G	C7	Capital
H	C8	Capital
I	C9	Capital
⋏	CA	Nand (not and)
⋎	CB	Nor (not or)
	CC	
φ	CD	Circle-stile
	CE	
φ	CF	Circle-slope
}	D0	Right brace
J	D1	Capital
K	D2	Capital
L	D3	Capital
M	D4	Capital
N	D5	Capital
O	D6	Capital
P	D7	Capital
Q	D8	Capital
R	D9	Capital
I	DA	I-beam (base-top)
!	DB	Quote-dot (exclamation)
⍣	DC	Del-stile
⍋	DD	Delta-stile
⍞	DE	Quote-quad
⍉	DF	Cap-null

Graphic	Hex	Name
\	E0	Slope (reverse slash)
	E1	
S	E2	Capital
T	E3	Capital
U	E4	Capital
V	E5	Capital
W	E6	Capital
X	E7	Capital
Y	E8	Capital
Z	E9	Capital
⌿	EA	Slash-bar
⍀	EB	Slope-bar
	EC	
⊖	ED	Circle-bar
⌹	EE	Domino (quad-divide)
⍕	EF	Top-null
0	F0	Zero
1	F1	One
2	F2	Two
3	F3	Three
4	F4	Four
5	F5	Five
6	F6	Six
7	F7	Seven
8	F8	Eight
9	F9	Nine
	FA	Long vertical bar
⍫	FB	Del-tilde
△	FC	Delta-underbar
⊛	FD	Log (circle-star)
⍂	FE	Base-null
	FF	(Eight ones)

Notes:

1. The character codes represented by X'C0', X'D0', and X'E0' display as "national use" graphics, which vary on 3270s sold in some non-U.S.A. countries. See *IBM 3270 Component Description*, GA22-2749, for details.
2. The character code represented by X'E0' is not defined on the 3277 unit.
3. X'DB' is the APL/TEXT equivalent of a "national use" character listed in the footnotes on these pages. On the 3278 and 3279, this character is distinct from the "national use" version; it may appear slightly differently on the 3270 display screen.

Graphic	Hex	Graphic	Hex	Graphic	Hex	Graphic	Hex	Graphic	Hex
SP	40		67	+	8E	5	B5	$\widetilde{\nabla}$	DC
	41		68	+	8F	6	B6	⊛	DD
	42		69	□	90	7	B7	←	DE
	43		6A	j	91	8	B8	→	DF
	44	,	6B	k	92	9	B9	\	E0
	45	%	6C	l	93	▽	BA		E1
	46	_	6D	m	94	⌟	BB	S	E2
	47	>	6E	n	95	┐	BC	T	E3
	48	?	6F	o	96	]	BD	U	E4
	49	η	70	p	97	≠	BE	V	E5
¢	4A		71	q	98	—	BF	W	E6
.	4B		72	r	99		C0	X	E7
<	4C		73		9A	A	C1	Y	E8
(	4D		74	}	9B	B	C2	Z	E9
+	4E		75	¤	9C	C	C3	⊤	EA
|	4F		76	)	9D	D	C4	⊥	EB
&	50		77	±	9E	E	C5	⍌	EC
1	51		78	■	9F	F	C6	⍓	ED
2	52		79	‾	A0	G	C7	⊢	EE
3	53	:	7A	○	A1	H	C8	⊣	EF
	54	#	7B	s	A2	I	C9	O	F0
	55	@	7C	t	A3	Δ	CA	1	F1
	56	'	7D	u	A4	⌈	CB	2	F2
	57	=	7E	v	A5	∧	CC	3	F3
	58	"	7F	w	A6	∨	CD	4	F4
↓	59		80	x	A7	⊄	CE	5	F5
!	5A	a	81	y	A8	⋏	CF	6	F6
$	5B	b	82	z	A9		D0	7	F7
*	5C	c	83		AA	J	D1	8	F8
)	5D	d	84	└	AB	K	D2	9	F9
;	5E	e	85	┌	AC	L	D3	|	FA
¬	5F	f	86	[	AD	M	D4	⌊	FB
—	60	g	87	≥	AE	N	D5	⏁	FC
/	61	h	88	●	AF	O	D6	⏄	FD
	62	i	89	0	B0	P	D7		FE
	63	↑	8A	1	B1	Q	D8		FF
	64	{	8B	2	B2	R	D9		
	65	≤	8C	3	B3	⊟	DA		
	66		8D	4	B4	△	DB		

Appendix F: Terminals That Access VM/SP

The following terminals[1] can access the VM/SP system:

- IBM System/370 Models 138 and 148 Display Consoles (in 3215 emulator mode) with the 3286 Printer, Model 2 required

- IBM System/370 Models 138 and 148 Display Consoles (in display mode)

- IBM System/370 Model 158 Display Consoles (in 3215 emulator mode) with the 3213 Printer, Model 1 required

- IBM System/370 Model 158 Display Consoles (in display mode)

- IBM 1050 Data Communication System

- IBM 2150 Console with the 1052 Printer-Keyboard, Model 7

- IBM 2741 Communications Terminal

- IBM 2780 Data Transmission Terminal, Model 2 (a remote batch spooling device)

- IBM 3036 Display Console Station Model 1 for the IBM 3031, 3032, and 3033 Processors

- IBM 3066 System Console, Model 2
- IBM 3101 Display Terminal, Models 10, 12, 13, 20, 22, and 23

- IBM 3210 Console Printer Keyboard, Models 1 and 2

- IBM 3215 Console Printer-Keyboard, Model 1

- IBM 3270 Remote Dedicated Information Display System Printer

- IBM 3275 Display Stations, Model 2 (Remote Attachment) with an EBCDIC keyboard

- IBM 3276 Control Unit Display Station Models 2, 3, and 4 (Remote Attachment)

- IBM 3277 Display Station, Model 2 (Local or Remote Attachment)

- IBM 3278 Display Station, Models 2, 3, and 4 (Local or Remote Attachment)

- IBM 3278 Model 2A for the IBM 4300 series processors in display or 3215 emulator mode

- IBM 3278 Model 2A for the IBM processors in display or 3215 emulator mode

- IBM 3767 Communication Terminal, Models 1 and 2

  Note: SNA terminals may be used with virtual machines if the VTAM Communications Network Application (VM/VCNA) program product is installed at your location. For additional information on using SNA terminals, see the VM/VCNA publications listed under "Supplemental Publications" in the "Preface."

- IBM 7412 Console (via RPQ AA 2846) with 3215 Console Printer-Keyboard, Model 1

- Teletype[2] Model 33 and Model 35

- IBM 3278 Display Station, Model 5 (wide screen support)

- IBM 3278 Display Station, Model 5 (extended highlighting support)

- IBM 3279 DIsplay Station, Models 2A and 3A (four color support)

- IBM 3279 Display Station, Models 2B and 3B (seven color support)

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[1]Terminals that are equivalent to those explicitly supported may also function satisfactorily. The customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to IBM-supplied products or programs may have on such terminals.

---

[2]Trademark of the Teletype Corporation, Skokie, Illinois.

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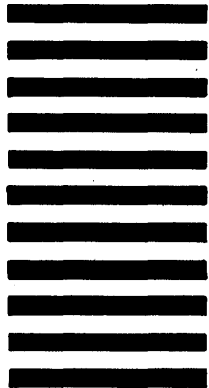
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