IBM

Series/1

SC34-0316-2

File No. S1-30

LICENSED
PROGRAM

IBM Series/1
Event Driven Executive
Communications and Terminal Applications Guide

Program Numbers:	5719-LM5	5719-LM6	5719-MS1
	5719-UT3	5719-UT4	
	5719-XS1	5719-XS2	
	5719-XX2	5719-XX3	
	5740-LM2	5740-LM3	

IBM

Series/1

SC34-0316-2

File No. S1-30

LICENSED
PROGRAM

IBM Series/1
Event Driven Executive
Communications and Terminal Applications Guide

Program Numbers:	5719-LM5	5719-LM6	5719-MS1
	5719-UT3	5719-UT4	
	5719-XS1	5719-XS2	
	5719-XX2	5719-XX3	
	5740-LM2	5740-LM3	

Third Edition (APRIL 1980)

Use this publication only for the purpose stated.

Changes are periodically made to the information herein; before using this publication in connection with the operation of IBM systems, refer to the latest IBM Series/1 Graphic Bibliography, GA34-0055, for the editions that are applicable and current.

It is possible that this material may contain reference to, or information about, IBM products (machines and programs), programming, or services which are not 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.

Publications are not stocked at the address given below. Requests for copies of IBM publications should be made to your IBM representative or the IBM branch office serving your locality.

This publication could contain technical inaccuracies or typographical errors. A form for reader's comments is provided at the back of this publication. If the form has been removed, address your comments to IBM Corporation, Systems Publications, Department 27T, P.O. Box 1328, Boca Raton, Florida 33432. IBM may use and distribute any of the information you supply in any way it believes appropriate without incurring any obligation whatever. You may, of course, continue to use the information you supply.

SUMMARY OF AMENDMENTS

Terminal Support

Terminal support information for the 3101 Display Terminal (Models 1 and Model 2) was added to Chapter 1.

Multiple Terminal Manager

Chapter 5 has been modified for PL/I and 3101 Display Terminal as provided by the Multiple Terminal Manager.

Remote Management Utility (Version 2 only)

Chapter 6 is a new chapter that describes the Remote Management Utility.

Bibliography

The Bibliography lists the books in the Event Driven Executive library and a recommended reading sequence. Other publications related to the Event Driven Executive are also listed.

Miscellaneous Changes

This manual has been modified to include new function and to improve technical accuracy and clarity. Additional material and technical changes are indicated by vertical bars in the left margin.

HOW TO USE THIS BOOK

The material in this section is a guide to the use of this book. It defines the purpose, audience, and content of the book as well as listing aids for using the book and background materials.

PURPOSE

The IBM Series/1 Event Driven Executive Communications and Terminal Applications Guide, SC34-0316 describes how to use the Event Driven Executive to communicate with interactive devices, such as, terminals or other processors.

This manual provides extensions to the System Guide, the Utilities, Operator Commands, Program Preparation, Messages and Codes, and the Language Reference manuals.

AUDIENCE

This book is written for system and application programmers with considerable knowledge in BSC and host operation, including IBM and non-IBM communications hardware.

To write applications for remotely attached devices, you must be familiar with line control procedures. Experience in programming realtime programs in the Event Driven Language is required. Experience coding programs in assembler language for the Series/1 will enable you to extend the terminal application capabilities of the system.

HOW THIS BOOK IS ORGANIZED

This book is organized into two parts. The first part explains criteria for selecting communications methods or techniques available with the Event Driven Executive system. The second part consists of individual chapters which describe how to design particular communication techniques.

The topics covered in part two include:

Terminal Support

Binary Synchronous Communications

Host Communications Facility

Multiple Terminal Manager

Remote Management Utility

Graphics

EXAMPLES AND OTHER AIDS

Throughout this book, coding examples and illustrations are used to clarify coding techniques and requirements. Coding examples are fully executable portions of complete programs that may be entered as they are shown. Coding illustrations are non-executable portions of incomplete programs that show the correct format of all required parameters on a statement. Missing code, or code provided by you, is indicated by a series of vertical or horizontal dots.

Several other aids are provided to assist you in using this book:

- A Summary of Amendments lists the significant changes made to this publication since the last edition
- A Bibliography:
  - Lists the books in the Event Driven Executive library along with a brief description of each book and a recommended reading sequence
  - Lists related publications and materials
- A Glossary which defines terms
- A Common Index which includes entries from each book in the Event Driven Executive library

References to other manuals are made throughout this manual using shortened titles. For the full title and order number of manuals mentioned in the text, see the Bibliography.

RELATED PUBLICATIONS

Related publications are listed in the Bibliography.

SUBMITTING AN APAR

If you have a problem with the Series/1 Event Driven Executive services, you are encouraged to fill out an authorized program analysis report (APAR) form as described in the IBM Series/1 Authorized Program Analysis Report (APAR) User's Guide, GC34-0099.

LIST OF FIGURES

The Event Driven Executive can be used to interact with a variety of terminals. Various techniques are available using the Event Driven Executive. These techniques support applications ranging from simple applications interacting with a single terminal to complex communications networks. This book contains both the information you need to understand which Event Driven Executive technique is best suited for your particular application and, the information needed to design your application using the technique selected.

These techniques are:

- Terminal Support
- Binary Synchronous Communication Access Method (BSCAM)
- Host Communications Facility
- Multiple Terminal Manager
- Remote Management Utility
- Graphics
- Utilities

PART I - TECHNIQUE SELECTION CRITERIA

This part of the book lists and briefly describes the techniques supported by the Event Driven Executive. The information in this part of the book allows you to see what is available and to select the technique best suited for your particular application.

CHAPTER 1. TECHNIQUES AVAILABLE USING THE EVENT DRIVEN EXECUTIVE

This chapter describes the techniques available using the Event Driven Executive. The information in this chapter will help you select the technique best suited to your application.

TERMINAL SUPPORT

This technique is the basic Event Driven Executive terminal support and should be selected if you are writing an Event Driven Language program which will interact with a single terminal. See Figure 1 on page 6 for supported terminals. Use of this facility will also allow the Event Driven Language program to interact with another Event Driven Language program. The interaction with another Event Driven Language program is known as virtual terminal support. For information on the virtual terminal support, refer to "Virtual Terminal Communications" in the System Guide.

Using the terminal support, you interact with the terminal in either field or line mode. If the terminal is a supported display, the interaction may also be in full screen mode. For information on the full screen mode support, refer to "Defining and Accessing Logical Screens" in the System Guide.

The following figure lists the devices and features which are supported by the Event Driven Executive.

Device (or equivalent)	Attach Via Series/1 Controller/Adapter Feature Number
IBM 2741	1610
IBM 4973	5630
IBM 4974	5620
IBM 4978	RPQ D02038
IBM 4979	3585
IBM Series/1	1610
IBM 5100	1610
IBM 5110	1610
IBM 3101	1610 or, 2091 with 2092 or, 2095 with 2096 or, 7850
ASCII terminal*	1610 or, 2091 with 2092 or, 2095 with 2096 or, 7850
Graphics terminal**	1560

*Teletype[1] ASR 33/35 (TTY) or equivalent
**Tektronix[2] Model 4013 or equivalent

1560 - Integrated Digital Input/Output Non-Isolated
1610 - Asynchronous Communications Single Line Controller
2091 - Asynchronous Communications Eight Line Controller
2092 - Asynchronous Communications Four Line Adapter
2095 - Feature Programmable Eight Line Controller
2096 - Feature Programmable Four Line Adapter
3585 - 4979 Display Station Attachment
5620 - 4974 Printer Attachment
5630 - 4973 Line Printer Attachment
7850 - Teletypewriter Adapter
RPQ D02038 - 4978 Display Station Attachment

Figure 1. Supported Devices and Features

[1] Trademark of Teletype Corporation.
[2] Trademark of Tektronix, Inc.

Terminology for Supported Terminals

The following is a definition of terminologies used in describing Event Driven Executive supported terminals. This terminology is also used to describe the coding of the TERMINAL statement during system generation time which is discussed in the System Guide.

Terminology	Definition
ASCII Terminal	Any device which attaches via #7850, #1610, #2091 with #2092, or #2095 with #2096 adapters. (Teletypewriter, Asynchronous Single Line, Asynchronous Multiline, and Feature Programmable adapters respectively) and uses code type ASCII or EBASC.
ACCA Terminal	An ASCII terminal attached via #1610, #2091 with #2092, or #2095 with #2096 adapters.
Mirror Image ACCA Terminal	An ACCA terminal attached via #1610 or #2091 with #2092 using code type EBASC.
Real Image ACCA Terminal	An ACCA terminal attached via #2095 with #2096 using code type ASCII.
TTY	Any Teletype ASR 33/35 or compatible terminal attached via #7850 only.
2741 Terminal	A terminal attached via #1610 using code type CRSP or EBCD.
PROC	A terminal attached via #1610 using code type EBCDIC.

Note: Appendix A of this book contains all the code types mentioned in the previous text.

The following table shows the different device configurations.

Device Class	Code Type	Local/ Remote	Control/ Adapter	System Configuration Device Type	Device
Display	Graphics	Local	#1560	4013	4013
Display	ASCII	Remote	#2095 with #2096	ACCA	3101
Display	Mirror Image ASCII	Remote	#1610 or #2091 with #2092	ACCA	3101
Display	EBCDIC	Local	RPQ D02038	4978	4978
Display	EBCDIC	Local	#3585	4979	4979
Display	ASCII	Local	#7850	TTY	3101
Printer	ASCII	Local	#7850	TTY	Teletype
Printer	Real Image ASCII	Remote	#2095 with #2096	ACCA	Teletype
Printer	Mirror Image ASCII	Remote	#1610 or #2091 with #2092	ACCA	Teletype
Printer	CRSP	Remote	#1610	2741	2741
Printer	EBCD	Remote	#1610	2741	2741
Printer	EBCDIC	Local	#5620	4974	4974
Printer	EBCDIC	Local	#5630	4973	4973
Program	EBCDIC	Local	n/a	VIRT	Series/1
Program	EBCDIC	Remote	#1610	PROC	Series/1
Program	EBCD	Remote	#1610	PROC	5100/5110
Program	CRSP	Remote	#1610	PROC	5100/5110

BINARY SYNCHRONOUS COMMUNICATIONS ACCESS METHOD (BSCAM)

The binary synchronous communications access method technique should be selected when interacting with remotely connected terminals or CPUs using the binary synchronous communications facility. The remote terminals and CPUs may be any which support the BSC protocol. In order to use this technique, the connection must be via a BSC line. The Event Driven Language support allows you to write programs which send and receive data consistent with the BSC protocol on the line. This support also provides IBM utilities or, IBM supplied applications, which have general applicability. These utilities are 2780 and 3780 RJE emulators and aids for the debugging of programs which use binary synchronous communications.

HOST COMMUNICATIONS FACILITY

The Host Communications Facility allows you to send/receive data sets and background jobs to/from a host system. It requires the Host Communications Facility Installed Users Program (IUP) (5796-PGH) be installed on the host S/370 system. This technique provides Event Driven Language instructions and a utility ($HCFUT1) to provide interactive communications between a S/370 host and remote Series/1 over a binary synchronous communications facility. The Host Communications Facility utilizes the BSCAM support to perform its functions.

MULTIPLE TERMINAL MANAGER

The Multiple Terminal Manager support should be selected when the requirement is to support a transaction-oriented application. A transaction-oriented application is one which consists of several terminals, each of which may request concurrent interaction with one or more programs. The Multiple Terminal Manager manages the Series/1 storage area to reduce the amount of storage required to support interaction with more than one terminal by one program. High-level language support is provided.

REMOTE MANAGEMENT UTILITY

The Remote Management Utility support should be selected when the requirement is to provide remote Series/1 processing for a host computer. The Remote Management Utility provides a means of distributed processing on a remote Series/1, with little or no operator intervention required. The Remote Management Utility and the host communicate via a user-written host program over a BSC line using the BSCAM support of the Event Driven Executive.

GRAPHICS

This support should be selected when the application has a requirement for graphics support. This technique enables you to communicate with a Tektronix Model 4013 (or equivalent) terminal. The physical connection is via the #1560 adapter. In addition to the basic terminal support statements available, graphics-oriented Event Driven Language statements and IBM utilities are provided.

UTILITIES

Various IBM utilities are supplied to ease the burden of data transmission to/from interacting devices. These utilities are described in the appropriate sections and are:

- Terminal support (see Utilities, Operator Commands, Program Preparation, Messages and Codes)

  $IMAGE
  $FONT
  $PFMAP
  $TERMUT1
  $TERMUT2
  $TERMUT3

- BSCAM (see Chapter 3)

  $PRT2780
  $PRT3780
  $RJE2780
  $RJE3780
  $BCSUT1
  $BSCUT2

- Host Communications Facility (see Chapter 4)

  $HCFUT1

- Graphics (see Chapter 7)

  $DIUTIL
  $DICOMP
  $DIINTR

PART II - TECHNIQUE DESIGN INFORMATION

This part of the book describes in detail the different techniques supported by the Event Driven Executive. After you have selected the technique which best suits your application, you can design your application using the information provided in this part of the book.

CHAPTER 2. TERMINAL SUPPORT

The Event Driven Executive terminal support is designed to be as device independent as possible. With few exceptions, you need not be concerned with what type of device is being driven by terminal functions coded in the program. The same sequence of terminal output instructions, for instance, can be used to print data on a matrix or line printer, on a locally attached teletypewriter device, on a remote 2741 terminal, or to display the data on an electronic display screen device.

Terminals are defined in the system with the TERMINAL system configuration statement. This statement generates system control blocks and tables that contain the logical and physical variables required to operate the terminal.

The high degree of device independence is achieved in part by treating all terminals as though they were line printers, differing only in their page sizes (forms length) and margin settings, which are defined by TERMINAL statement operands. The support provides instructions allowing interactive communications between you and your application programs. See Figure 1 on page 6 for a list of supported terminals.

Generally, you can write terminal I/O functions in an application program without concern for the actual terminal being used. The default terminal to be used by the program is dynamically assigned by the supervisor to be the same terminal that was used to initially invoke the program. Therefore, the terminal assigned can vary from one program invocation to the next, with little or no program change. Utilizing the terminal instructions, any application program that contains no device dependent information can be operated in a compatible manner from any Event Driven Executive supported terminal.

Terminals can be referenced by symbolic name and accessed by any application program through appropriate instructions. Forms and screen format control can be dynamically changed within your program and the 4978/4979 screen can be copied to any designated hard copy terminal.

Terminal Operations

When a program is loaded from a terminal, that terminal is dynamically designated by the system as the terminal to be used by terminal I/O instructions in the program. Each terminal I/O instruction automatically has exclusive use of the terminal while executing, and can request extended control for multiple I/O operations.

If more than one task is using the terminal, terminal operations from different tasks could become interspersed. When this is not desirable, you can specify the ENQT (enqueue terminal) instruction to reserve the terminal for the exclusive use of a task, thereby preventing other tasks from using the terminal until the task issuing the ENQT releases it with the DEQT (dequeue terminal) instruction.

You can also use ENQT to gain exclusive control of any other terminal. The symbolic name of a terminal is the name coded on the label of the TERMINAL statement that defines the device. Coding a name in the label field of the TERMINAL statement during system configuration automatically defines the terminal to the system as a global resource that can be enqueued (ENQT) by other programs. Normally, an IOCB statement would be used to establish the connection between the ENQT and the TERMINAL statements at execution time.

Three symbolic terminal names are used by the supervisor for system utility programs:

$SYSLOG Names the system logging device or operator station, and must be defined in every system. In the starter supervisor, $SYSLOG defines an IBM 4978 or an IBM 4979 Display Station.

$SYSLOGA Names the alternate system logging service. If unrecoverable errors prevent use of $SYSLOG, the system will use the $SYSLOGA terminal as the system logging device/operator station. If defined, this device should be a terminal with keyboard capability, not just a printer. The starter supervisor defines the $SYSLOGA terminal as a teletypewriter device.

$SYSPRTR Names the system printer. If defined, the output from some system programs is directed to this device. The starter supervisor defines a 4974 matrix printer as the $SYSPRTR device.

Terminal I/O Instructions

The Event Driven Language terminal I/O instructions are provided to control the input/output operations to terminals. These instructions are defined in the Language Reference and are:

DEQT Releases a terminal from exclusive use

ENQT Acquires exclusive access to a terminal

ERASE Clears designated portions of static type screens

GETVALUE Reads one or more integer values that are entered by the terminal operator

PRINDATE Prints the date on the terminal

PRINTNUM Converts a floating-point variable or integer variable to printable form and writes it on the terminal, with an optional format specification

PRINTEXT Writes an alphameric text string to a terminal, with or without forms control

PRINTIME Prints the time of day on the terminal

QUESTION Prints a message and queries the operator for a Y (yes) or N (no) reply

RDCURSOR Acquires the cursor position of static screens

READTEXT Reads an alphameric text string from the terminal

TERMCTRL Controls device dependent features

Data Formatting Instructions

Data formatting instructions allow you to prepare formatted data for display on the terminals or printers attached to the Series/1. The capability is provided to format data in storage and then allow the program to decide the destination.

Use of the data formatting instructions FORMAT, GETEDIT, and PUTEDIT require that the user's object program be processed by the link edit program, $LINK, in order to include the supervisor interface routines and the formatting routines which are supplied as object modules. Refer to the Utilities, Operator Commands, Program Preparation, Messages and Codes for the description of the autocall option of $LINK, and information on the use of the "AUTO=$AUTO,ASMLIB" option of $LINK.

These instructions are defined in the Language Reference and are:

CONVTB   Converts a binary value to an EBCDIC string.

CONVTD   Converts an EBCDIC string to a binary value.

FORMAT   Describes the conversion performed between internal and external representations of data items.

GETEDIT   Receives data from a terminal using FORMAT.

PUTEDIT   Sends data to a terminal using FORMAT.

Terminal Definition Functions

Two Event Driven Language statements are provided to define the type of terminal the program is connected to. These are:

TERMINAL   A system configuration statement to define the existence of the terminal to the Event Driven Executive supervisor. This statement is defined in the System Guide.

IOCB   Used in a program to define the variable attributes of a terminal, such as margins, and to supply the symbolic name of the TERMINAL statement supplied during system configuration. This statement is defined in the Language Reference.

Interrupt Processing Functions

Normally a program would need to wait for an operator to respond to a request for input. This program wait capability is provided automatically by the READTEXT instruction or via the WAIT Event Driven Language instruction. The capability also exists to define asynchronous attention interrupt routines via the ATTNLIST instruction. When the Attention key is pressed on a terminal, the system will query the operator for a command. If this command is specified on the ATTNLIST statement, control is given to the appropriate program. These two instructions are defined in the Language Reference:

WAIT KEY - Wait for operator response.
ATTNLIST - Defines asynchronous attention interrupt routine.

See the Language Reference for a full discussion and sample programs illustrating the use of the terminal support technique.

Considerations for Feature #1610 or #2091 with #2092 Adapter

Devices attached via the #1610 controller or #2091 controller with #2092 adapters are supported by the standard terminal I/O instructions. The adapters operate in half-duplex mode and require special attention to the operating environment. Compared to the Event Driven Executive implementation of the #7850 adapter, the following differences are noted:

- Half-duplex mode
- No Series/1 Echo (must use Local Echo on terminal)
- Uses eight-bit data interchange code

The attached device may be used in a switched, leased, or direct connect environment. Each adapter feature has hardware jumpers that are used to customize the adapter to meet a variety of network configurations. Prior to defining the adapter to the Event Driven Executive via the TERMINAL statement, you should become familiar with these hardware jumpers. The Communications Feature Description should be referenced before actual connection of terminals or modems. Be sure the hardware is configured correctly prior to defining the software interface.

Some general rules for hardware jumpers are:

- For Direct Connect terminals:
  - Data Terminal Ready (DTR) is usually jumpered.
  - Request to Send (RTS); jumper only when Carrier Detect (CD) is not provided by terminal.
  - Carrier Detect (CD); jumper only when Request to Send (RTS) is provided by the terminal.
- For Leased Lines using modems:
  - Data Terminal Ready (DTR); jumper only when Event Driven Executive application programs do not control the modem.
  - Request to Send (RTS); jumper only if the modem provides a steady Clear to Send (CTS) signal.
  - Carrier Detect (CD); jumper only if the modem supports this feature.
- For Switched Lines using modems:
  - Data Terminal Ready (DTR); jumper only when Event Driven Executive application programs do not control the modem.
  - Request to Send (RTS); jumper only if the modem provides a steady Clear to Send (CTS) signal.
  - Carrier Detect (CD); jumper only if the modem supports this feature.

Speed range jumpers should be installed in accordance with instructions in the Communications Feature Description.

Once the hardware features have been properly defined, you may define the features to the Event Driven Executive system. The TERMINAL statement is used for this description. Additionally, the TERMCTRL statement has operands which allow the control of the modem. See the System Guide for information on the TERMINAL statement and the Language Reference for the TERMCTRL statement.

The TERMCTRL operands are as follows:

RING Waits until the Ring Indicator (RI) is presented to the Series/1 from the modem. No timeout is provided.

RINGT Waits until the Ring Indicator (RI) is presented to the Series/1 from the modem. If no Ring Indicator (RI) occurs after 60 seconds, then the instruction is terminated and an error condition is returned to the application program in the first word of the task control block (TCB).

ENABLE Activates Data Terminal Ready (DTR) if it is not already jumpered on and then waits for Data Set Ready (DSR) to be returned by the modem. No timeout is provided.

ENABLET Activates Data Terminal Ready (DTR) if it is not already jumpered on and then waits for Data Set Ready (DSR) to be returned by the modem. If Data Set Ready is not returned within 15 seconds, then the instruction is terminated and an error condition is returned to the application program in the first word of the TCB.

ENABLEA Provides the same function as ENABLE except that an answer tone is activated for 3 seconds following the activation of Data Set Ready (DSR). The modem must allow for the control of the answer tone.

ENABLEAT Provides the same function as ENABLET and ENABLEA combined.

DISABLE Disables Data Terminal Ready (DTR) if it is not jumpered on and waits for 15 seconds. Use this function to hang up the modem.

Return Codes

After each I/O instruction issued by the Event Driven Executive application program, a return code is provided in the first word (taskname) of the TCB. These return codes have special meaning for terminals attached via #1610 controller, #2091 controller with #2092 adapters and #2095 controller with #2096 adapters.

-1	Successful completion.

Bit	Description
0	Unused
1-8	ISB of last operation (I/O complete)
9-10	Unused
11	1 if a write or control operation (I/O complete)
12	Read operation (I/O complete)
13	Unused
14-15	Condition code +1 after I/O start (or) Condition code after I/O complete

Figure 2. Terminal I/O - ACCA Return Codes

If any error has occurred after I/O complete, then the cycle steal status information is also available at #CCBSTW0, #CCBSTW1 and #CCBSTW2. If the supervisor is mapped into your partition, you can obtain the three cycle steal status words by coding the following instructions:

```
          .
          .
          .
         COPY      PROGEQU
         COPY      CCBEQU
          .
          .
          .
         MOVE      #1,$PRGCCB          GET ADDRESS OF CCB
         MOVE      SAVE,(#CCB-#CCBSTW0,#1),3  MOVE STATUS
          .
          .
          .
SAVE     DATA      3F'0'
          .
          .
```

Refer to the Communications Feature Description for a detailed description of the Interrupt Status Byte (ISB) Condition Codes both after start I/O and after I/O complete as well as the meaning of the cycle steal status words 1, 2, and 3.

Considerations for Feature #2095 with #2096 Adapter

The Event Driven Executive system includes support for the Feature Programmable Controller and Adapter. The #2095 controller with #2096 adapter has two modes of operation:

- Compatibility mode - allows the substitution of #2095 controller with #2096 adapter for current asynchronous communication features (#1610 controller and #2091 controller with #2092 adapter using eight bit interchange code).

- EXIO mode - provides access to the full command set.

In compatibility mode the difference between the #1610 controller and the #2091 controller with #2092 adapter is that the line code is ASCII. This is of particular importance during system configuration because the line control characters specified on the TERMINAL statement are not coded in mirror image, but in standard ASCII. The line code (CODTYPE) must also be specified as ASCII. Refer to the System Guide for details and a definition of mirror image.

#7850 Teletypewriter Adapter

The most frequent use of the #7850 Teletypewriter Adapter support is to receive or send messages composed of ASCII character strings between the Series/1 and a teletypewriter terminal. The most common forms of such terminals are keyboard/printer and keyboard/CRT type display configurations. However, use of the terminal I/O instructions need not be limited to these types of terminals.

Devices are available from many vendors which are compatible with the physical transmission methods of the Series/1 Teletypewriter Adapter, for example, Isolated Contact sense, TTL, and EIA. Such devices include terminals which transmit only, or receive only, or transmit only in response to being polled for information. The devices may not have keyboards for information input but may acquire data from bar code scanners, analog or digital input features within the device, etc. The transmission code employed by these devices may be alphameric ASCII characters or may be any of the 256 possible 8-bit character combinations.

Proper use of the terminal I/O instructions enables your program to communicate with many such devices. For example, if the device attached to the #7850 Teletypewriter Adapter does not expect the data which it transmits to be returned by the Series/1 (usually returned for printing purposes), then the ECHO=NO parameter on the appropriate TERMINAL statement should be coded.

Further, the device data transmission to the Series/1 may include bit combinations which match the LINEDEL and CHARDEL parameter characters defined on the TERMINAL statement. To receive these characters as data in your program, the READTEXT instruction must specify the parameter XLATE=NO. Using XLATE=NO will permit the reception, as data, of any 8-bit pattern except for the carriage return (hexadecimal values 0D or 8D). You may detect the reception of a carriage return character by performing the input operation as one or more READTEXT instructions, each of which specifies an input area that is one character in length. If the READTEXT operation completes with the received character count equal to zero, the character input was either an X'8D' or X'0D' value since reception of a carriage return terminates a READTEXT instruction without passing that character into your input area. There is no method available to distinguish between reception of X'0D' and X'8D' values.

Transmission of other than standard alphameric ASCII characters to a terminal is accomplished by specifying XLATE=NO on the PRINTEXT instruction. In this case, you must define the 8-bit values to be transmitted by means of DATA or DC instructions. The output data area must have the same format as is generated by a TEXT instruction.

Special Considerations for the IBM 3101 in Character Mode

The IBM 3101 Display Terminal can be connected to the Series/1 via four attachments: the #7850 Teletypewriter Adapter, #1610 controller, #2091 controller with #2092 adapter, or #2095 controller with #2096 adapter. In the following discussion, all connections are direct, with no intervening modem. For a discussion of leased and switched lines using modems, refer to "Considerations for Feature #1610 or #2091 with #2092 Adapter" on page 17.

For attachment with the #7850 Teletypewriter Adapter, the #7850 input selection jumpers (see IBM Series/1 User's Attachment Manual, GA34-0033) may be set as follows:

MSB		LSB	Input Selected	Input Interpreted as
0	1	0	EIA	Minus=datamark

MSB = Most Significant Bit
LSB = Least Significant Bit

Also, the bit rate selection jumpers must match the 3101 setup switch settings.

A typical setup switch setting would be:

```
         Group1      Group2      Group3      Group4
 on     |  X      |  |X       |  |X XX    |  |X       |
 off    |XX XXXXX |  | XXXXXXX|  | X  XXXX|  | XXXXXXX|
```

In the illustration above, the 3101 setup switch settings indicate 4800 bps. The #7850 bit rate selection jumpers would then also indicate 4800 bps. A bit rate of 110 bps would require that two stop bits be set in the 3101 setup switches instead of one as illustrated above.

For attachment via the #1610 controller or #2091 controller with #2092 adapter, or #2095 controller with #2096 adapter, the 3101 setup switches may be set as follows:

```
         Group1      Group2      Group3      Group4
 on     | XXX     |  |  X     |  |X XX    |  |X  X    |
 off    |X   XXXX |  |XX XXXXX|  | X  XXXX|  | XX XXXX|
```

The jumpers for the #2091 controller with #2092 adapter should have Data Terminal Ready and Request to Send jumpered on. Also, the HIGH or LOW speed option must be jumpered to reflect the speed set in the 3101 setup switches. In the illustration above, the speed is 9600 bps. The RANGE and BITRATE operands on the TERMINAL configuration statement must also be compatible with the #2091 controller with #2092 adapter jumpers and 3101 setup switches.

The jumpers for the #2095 controller with the #2096 adapter should have Data Terminal Ready, Request to Send, and Receive Line (on = mark) jumpered on.

Finally, special consideration must be given to operator input and internal code representation. This is summarized in the following table.

		Character Generated		
		Device=ACCA		Device=TTY
Operator Function	Key on 3101	#1610 or #2091 with #2092	#2095 with #2096	#7850
		EBASC	ASCII	ASCII
ATTENTION	ESC followed by space bar	X'D9'	X'9B'	X'1B'
ENTER	<—┘ (Key above SEND key)	X'B1'	X'8D'	X'0D'
BACKSPACE (character delete)	<——— (top row, not bottom row)	X'11'	X'88'	X'08'
LINE DELETE	DEL	X'FF'	X'FF'	X'7F'

Note that ECHO=NO or PROTECT=YES on the READTEXT statement (for suppression of input text) has no effect when the 3101 is attached via the #1610 controller or the #2091 controller with #2092 adapter, or the #2095 controller with #2096 adapter.

Special Considerations for the IBM 3101 in Block Mode

The IBM 3101 Model 2 may be operated in block mode under control of the Multiple Terminal Manager.

For attachment via the #1610 controller or #2091 controller with #2092 adapter, or #2095 controller with #2096 adapter, the 3101 setup switches may be set as follows:

```
      Group1      Group2      Group3      Group4
on    XXXX  X       XX  XX    X            XXX
off       XX X    XX  XX       XXXXXXX    X   XXXX
```

The jumper for the #2091 controller with #2092 adapter should have Data Terminal Ready and Request to Send jumpered on. Also, the HIGH or LOW speed option must be jumpered to reflect the speed set in the 3101 setup switches. In the illustration above, the speed is 2400 bps. The RANGE and BITRATE operands on the TERMINAL configuration statement must also be compatible with the #2091 controller with #2092 adapter jumpers and 3101 setup switches.

The jumpers for the #2095 controller with the #2096 adapter should have Data Terminal Ready, Request to Send, and Receive Line (on = mark) jumpered on.

Refer to the System Guide for sample TERMINAL statements and other system generation considerations.

Sample Terminal Support Program (1 of 3): The following example shows how to use the terminal support technique to print the IBM logo and the time and date.

```
SAMPLE     PROGRAM START,500,TERMERR=ERROR
****************************************************************
*  NOTE THAT THE SUPERVISOR USED TO EXECUTE THIS               *
*  SAMPLE PROGRAM MUST HAVE BEEN SYSGEN'ED TO INCLUDE TIMERS,  *
*  $SYSLOGA, AND THE TARGET COMMUNICATIONS TERMINALS. THE      *
*  NAME OF A TARGET TERMINAL IS THE LABEL USED ON THE TERMINAL *
*  STATEMENT DESCRIBING IT.                                    *
****************************************************************
*
TERMX    IOCB  $SYSLOGA            TARGET TERMINAL IOCB
         SPACE 2
START    EQU   *
*
*-------------------------------------------------------------*
*                                                             *
* ASK OPERATOR FOR NAME OF TARGET TERMINAL. MOVE THAT NAME    *
* INTO THE 'TERMX' IOCB AND THEN 'ENQT' ON TERMX. THIS WILL   *
* ALLOCATE THAT TERMINAL TO THIS PROGRAM AND ALL TERMINAL I/O *
* INSTRUCTIONS WILL THEN BE ROUTED TO IT.                     *
*                                                             *
*-------------------------------------------------------------*
*
         READTEXT TNAME,'ENTER 8 CHAR TERMINAL NAME:
         MOVE   TERMX,TNAME,(8,BYTE)   MOVE 8 CHARS TO IOCB
*-------------------------------------------------------------*
*                                                             *
* DETERMINE THE LINE CONNECTION TYPE. IF SWITCHED, INQUIRE    *
* IF THE CPU IS THE CALLER OR THE ANSWERER.                   *
*                                                             *
*-------------------------------------------------------------*
        QUESTION '@IS THE LINE CONNECTION SWITCHED? ',NO=XFER
        MOVEA  LINETYPE,+SWITCHED  INDICATE SWITCHED CONNECTION
        PRINTEXT '@ *** ANSWER THE FOLLOWING QUESTION, THEN'
        PRINTEXT ' PERFORM THE DIAL OPERATION *** '
        QUESTION '@IS THE CPU THE CALLER? ',YES=XFER
        MOVEA  DIALTYPE,+ANSWER  INDICATE CPU WILL ANSWER
XFER    ENQT  TERMX
        IF (LINETYPE,EQ,+SWITCHED)  SWITCHED CONNECTION?
          IF (DIALTYPE,EQ,+ANSWER)  CPU TO ANSWER?
            TERMCTRL RING   WAIT FOR RING INT. TO ANSWER
          ENDIF
          TERMCTRL ENABLE   WAIT FOR DATA SET READY
        ENDIF
        EJECT
```

Sample Program (2 of 3)

```
*---------------------------------------------------*
*                                                   *
* NOW THAT ALL TERMINAL I/O IS GOING TO             *
* THE TARGET TERMINAL:                              *
*                   1. PRINT IBM LOGO               *
*                   2. PRINT DATE AND TIME          *
*---------------------------------------------------*
LOGO    EQU      *
        PRINTEXT LINE=1
        PRINTEXT LOGO1,SPACES=15,SKIP=4
        PRINTEXT LOGO2,SPACES=15
        PRINTEXT LOGO3,SPACES=15,SKIP=1
        PRINTEXT LOGO4,SPACES=15
        PRINTEXT LOGO5,SPACES=15,SKIP=1
        PRINTEXT LOGO6,SPACES=15,SKIP=1
        PRINTEXT LOGO7,SPACES=15,SKIP=1
        PRINTEXT LOGO8,SPACES=15
        PRINTEXT LOGO9,SPACES=15
        PRINTEXT SKIP=4
        SPACE
TIMES   EQU   *
        PRINTEXT 'DATE = ',SPACES=5
        PRINDATE
        PRINTEXT 'TIME = ',SPACES=5
        PRINTIME
STOP    EQU   *
        GOTO  ENDIT               END OF SAMPLE
        EJECT
*---------------------------------------------------*
*         TERMINAL ERROR ROUTINE                    *
*---------------------------------------------------*
ERROR   EQU   *
        MOVE  RC,SAMPLE           SAVE THE ERROR CODE
        DEQT                      RETURN TO SYSTEM CONSOLE
        PRINTEXT '@** UNRECOVERABLE TERMINAL ERROR OCCURRED **'
        PRINTEXT '@      THE ERROR CODE WAS '
        PRINTNUM  RC,MODE=HEX
        PRINTEXT '@** SAMPLE IS TERMINATED **@'
        GOTO     ENDIT            END THIS PROGRAM
RC      DC       F'0'
        EJECT
*---------------------------------------------------*
*          END OF PROGRAM                           *
*---------------------------------------------------*
```

Sample Program (3 of 3)

```
ENDIT   EQU   *
        IF (LINETYPE,EQ,+SWITCHED) SWITCHED LINE CONNECTION?
          TERMCTRL DISABLE       HANG UP IF SWITCHED CONNECTION
        ENDIF                    END OF LINE CONNECTION TEST
        DEQT                     RETURN TO CONSOLE USE
        PROGSTOP
        EJECT
*---------------------------------------------------*
*                                                   *
*       D A T A   A R E A                           *
*                                                   *
*---------------------------------------------------*
TNAME   TEXT  LENGTH=8           HOLDS NAME OF TARGET TERMINAL
LOGO1   TEXT  'IIIIIIIIII     BBBBBBBB       MM      MM@'
LOGO2   TEXT  'IIIIIIIIII     BBB  BBBB      MMM    MMM'
LOGO3   TEXT  '    II         BBB  BBBBB     MMMM  MMMM@'
LOGO4   TEXT  '    II         BBBBBBBBBB     MMMMMMMMMM'
LOGO5   TEXT  '    II         BBBBBBBB       MMMMMMMMMM'
LOGO6   TEXT  '    II         BBBBBBBBBB     MM MMMM MM'
LOGO7   TEXT  '    II         BBB   BBBB     MM  MM  MM@'
LOGO8   TEXT  'IIIIIIIIII     BBB  BBBB      MM      MM@'
LOGO9   TEXT  'IIIIIIIIII     BBBBBBBB       MM      MM'
*
DIALTYPE DATA F'-1'              DIAL CONNECTION TYPE:
CALL     EQU  -1                  -1 = CALL
ANSWER   EQU  0                    0 = ANSWER
LINETYPE DATA F'0'               LINE CONNECTION TYPE:
SWITCHED EQU  -1                  -1 = SWITCHED
NONSW    EQU   0                   0 = NON-SWITCHED
         ENDPROG
         END
```

Interprocessor Communications

Using the #1610 Asynchronous Communication Single Line Controller Adapter feature with Event Driven Executive, processor to processor communication is available through the standard terminal interface. This mode of communication is specified by defining DEVICE=PROC on the TERMINAL statement. It allows connecting Series/1 to Series/1, Series/1 to IBM 5100 and IBM 5110 (using the Serial I/O feature), or Series/1 to any other processor capable of handling the required protocols. As with terminals, ATTENTION signals can be transmitted. The line protocol used by interprocessor communications is 2741 and is restricted to a single line ACCA feature #1610 per communication line to another processor. This provides a means to load or cancel programs, synchronize the action of tasks, and send and receive data to and from programs residing in remote processors. If CODTYPE=EBCDIC is defined on the TERMINAL statement, arbitrary binary data can be transmitted. The TERMINAL statement is coded in your source statements for system generation, and is assembled together with DISK, SYSTEM, and other supervisor configuration statements. Refer to the section "System Configuration" in the System Guide for detailed information.

Hardware Preparation

In addition to defining the #1610 controller to the Event Driven Executive with the TERMINAL statement, you should set the hardware jumpers on the attachment according to the IBM Series/1 Communications Feature Description, GA34-0028.

Note: Interprocessor communication is restricted to the single line ACCA feature #1610.

For a direct processor interconnection:

- Data Terminal Ready (DTR) is jumpered
- Request To Send (RTS) is jumpered
- Low or High speed range is jumpered depending on the bit rate chosen (100 to 9600 baud).

Be sure to use the right cables for the type of attachments being interconnected. For a direct Series/1 to Series/1 connection, one side should use the Local Communication Cable (feature #2056) and the other should use the EIA Data Set cable (feature #2057) in order to interchange the Receive/Transmit lines; Data Set Ready (DSR)/Data Terminal Ready (DTR) and Request To Send (RTS)/Clear To Send (CTS). The #2056 cable allows attachment to a modem (male 25-pin type D connector); the #2057 cable allows attachment to a terminal (female 25-pin type D connector).

If only one cable type is available, the following lines of the 25-pin type D connectors have to be crossed:

Pin number (connector 1)	to	Pin number (connector 2)
1	Protective Ground XMT	1
2	Transmit Data (X or T)	3
3	Receive Data (REC)	2
4	Request to Send (RTS)	5
5	Clear to Send (CTS)	4
6	Data Set Ready (DSR)	20
7	Signal Ground	7
20	Data Terminal Ready (DTR)	6

For a Series/1 to IBM 5100 connection, the #2056 cable may be used.

Terminal Control Block (CCB)

When DEVICE=PROC is specified on the TERMINAL statement, the #1610 controller is defined as an interprocessor communications pipeline. The CODTYPE and CRDELAY parameters of the TERMINAL statement affect the protocol to be used. See "Modifications to the Protocol" on page 33. The BITRATE and RANGE parameters should be set in accordance with the hardware jumpers, matching the setting in the other processor. Also, the LINSIZE parameter should have the same value in both processors.

Transmission Protocol

The length of a continuous message generated, for example, by a series of PRINTEXT commands on the sending side, might exceed the size of the receiving system buffer. Therefore the message is divided into records, which themselves may consist of subrecords (only for CODTYPE=EBCDIC).

A record corresponds to a line of text ended by a New Line (NL) character, the end of a message is defined as transition from Print to Read state and is indicated by an End of Transmission (EOT) character. Both messages and/or records may be empty; that is, contain no text (for example, in a transmission of SKIPs).

To a reading Event Driven Executive program, the received end characters are signalled as different return codes in the task code word. For the possible code types, the hexadecimal representation of the end characters is given, together with the corresponding return codes, in Figure 3.

	CODTYPE=		
	EBCD/CRSP	EBCDIC	Return Codes
End of Transmission (EOT)	1F	FDFF	-2
End of Record (NL)	5B	FEFF	-1
End of Subrecord (EOSR)	Not used	FCFF	Handled by device support

Figure 3. Terminal I/O - Interprocessor Communications Return Codes

Note: For CODTYPE=EBCDIC, two characters are used to signal the respective end condition.

As in the IBM 2741 protocol, the beginning of a message (for example, the transition from Read to Print state) is indicated by transmission of an End of Address (EOA) character to the receiver (X'16' for EBCD/CRSP code. For EBCDIC code, see "CODTYPE=" on page 33.)

Before a message is sent, an EOT character indicating that the other side entered Read mode must be received. If this character has not been received as the end of the previous message, the device support waits the time period specified on the CRDELAY parameter, or the the default for this character. If it is not received, an error code (8) is returned to your program.

Modifications to the Protocol

The communication protocol may be modified to satisfy special requirements by assigning the appropriate values to TERMINAL statement parameters. These options are discussed in "CRDELAY=" on page 33, and also in "CODTYPE=" on page 33.

CRDELAY=

PROMPT,n The device support waits before every record (and subrecord) for the EOT prompt character. The time limit is n times 3.33 milliseconds, starting at the end of the previous operation. In response to the EOT, and also at the beginning of every record (and subrecord), an EOA character is sent.

SP5100,n Identical to the PROMPT mode except that at End of Record, the two characters Line Feed and New Line (X'3B5B') are sent. This is necessary for communication with the IBM 5100 or IBM 5110 running APL or BASIC and using the Serial I/O feature.

DELAY,n At the beginning of a message, the device support waits a maximum of one second for the EOT character(s). After each record a delay of n times 3.33 milliseconds is inserted. This mode might be used to simulate an 2741-like terminal for another processor.

CODTYPE=

CRSP With this option the #1610 controller is set to PTTC mode (see Communications Feature Description) and messages are translated via the CRSP conversion table (PTTC/correspondence code). The communication is restricted to characters, as PTTC mode allows only the transmission of bytes with the seven low-order bits of odd parity. Therefore, XLATE=NO should not be specified on PRINTEXT or READTEXT instructions.

EBCD — Similar to CRSP, except that the EBCD conversion table is used. The EBCD option is recommended for connection to an IBM 5100 or IBM 5110 computer. The 6-bit code must be selected with the Serial I/O microprogram.

EBCDIC — This option sets the #1610 controller to Eight Bit Coded Data Interchange mode with all change of direction codes equal to X'FF' (see the *Communications Feature Description*). Special protocol provides for transparent exchange of arbitrary binary data. As there are no parity restrictions and only the code X'FF' is recognized as change of direction (indicating EOT, NL or EOSR), all bytes (especially all EBCDIC characters) other than X'FF' are transmitted "as is". Before a message or record is sent, it is scanned for a byte code (other than X'FF') not contained in it. This special code is sent as EOA and every occurring X'FF' in the message or record is replaced by it. On the receiving side, every EOA code is replaced by X'FF'. If a record is larger than 128 bytes, it is divided into appropriate subrecords (length < 128 bytes) to which the procedure can be applied.

Note: If CODTYPE=EBCDIC is used, arbitrary binary data may be transmitted.

CHAPTER 3. BINARY SYNCHRONOUS COMMUNICATIONS

The Event Driven Executive binary synchronous communications access method provides statements that allow you to write programs to send and receive data on a binary synchronous communications line. These statements are a part of the Event Driven Language and are coded in your application program. A general introduction to binary synchronous communications and details of the line protocol used by the Event Driven Executive may be found in General Information — Binary Synchronous Communications, GA27-3004.

Series/1 binary synchronous communications closely parallels the System/370 and additional information on the subject of binary synchronous communications may be found in IBM OS/VS Basic Telecommunications Access Method (BTAM), GC27-6980.

Features of the binary synchronous communications access method provided with the Event Driven Executive are:

- Multiple line support
- Point-to-point leased line
- Point-to-point switched line (automatic answer, manual call and answer)
- Multipoint tributary station
- Multipoint master station
- Optional transparent mode
- Optional conversational mode

Hardware features and BSC protocol not supported by the Event Driven Executive are:

- ASCII mode
- Leading graphics support
- Transparent ITB and ENQ transmission

Throughout this chapter, the TYPE parameter is mentioned frequently, and refers to the TYPE parameter of the BSCLINE statement discussed in "BSCLINE" on page 42

For generation of BSC support into your Event Driven Executive supervisor, refer to the "System Configuration" section in the System Guide.

Access Level

The Event Driven Executive BSC Access Method provides facilities at the READ/WRITE level. No control characters are inserted into or stripped from blocks of data in your buffer. However, all additional control sequences are managed by the access method in a manner transparent to the using program. You must ensure that the proper STX, DLE STX, ETX, and other control characters are contained in the output buffer. The single exception to this convention is the transmission of the DLE ETX or DLE ETB sequence to complete a transparent write, in which case these characters must not be included in the output buffer. On input, the buffer will contain all control characters received.

Conversational Operations

The BSC protocol provides a limited conversational response capability which is supported by the Event Driven Executive BSC Access Method. During conversational write operations, the response, which may be either an acknowledgement sequence or text, is read into a second buffer area specified by your program. Acknowledgement sequences are checked by the access method and error recovery is attempted when indicated. If text is received, a -2 return code is returned in lieu of the normal -1 and no error recovery is attempted.

Conversational writes may also be used to perform other special functions. For example, an IAM/WRU (I am/Who are you) explanation sequence can be transmitted by a calling station on a switched network using a conversational write.

Multipoint Operations

When the Series/1 is operating as the control station on a multipoint line (TYPE=MC), the access method handles the polling/selection requirements of initial operations via a poll sequence whose location address is specified in the BSCIOCB statement. A single poll/select is associated with each operation. A 3-second time-out is always enabled during poll/select operations regardless of the TIMEOUT parameter specifications.

When the Series/1 is operating as a tributary station on a multipoint line (TYPE=MT), the access method assumes that polling/selection has been established before a read/write initial operation is requested. The Read Poll operation monitors the line for receipt of a polling or selection sequence.

It assumes the BSC Adapter has been jumpered for multipoint tributary operation. Once the line has been polled/selected, your program should check the next operation request and issue appropriate read/write initial operation.

The initialization phase for multipoint operation is accomplished by the control station transmitting the following sequence:

NUL,EOT,PAD,NUL,(poll or selection address),ENQ[3]

This is the polling/selection sequence. The NUL,EOT,PAD,NUL[3] portion is generated by the access method. The (poll or selection address),ENQ[3] portion is supplied by you and referenced in the BSCIOCB. Generally this sequence consists of three bytes containing address,address,ENQ[3]. Refer to General Information — Binary Synchronous Communications, GA27-3004 for details.

Task Control

An implied wait is associated with each operation; that is, no immediate exit capability is provided. However, you may choose to attach a separate task to perform the operations in an asynchronous manner.

Sample programs are included at the end of this section which illustrate the most common communications operations.

[3] Commas are for readability only and not part of the data stream.

The Event Driven Language BSC Statements

The following text describes the Event Driven Language (BSC) statements and their syntax.

BSCCLOSE

BSCCLOSE is used to free a binary synchronous line for use by other tasks. If the line is switched (TYPE=SM or SA), it will also drop Data Terminal Ready causing the line to be disconnected.

Syntax

```
label      BSCCLOSE     bsciocb,ERROR=,P1=,P2=

Required:  bsciocb
Defaults:  None
Indexable: bsciocb
```

Operands   Description

label   The optional symbolic name of the BSCCLOSE statement.

bsciocb   The symbolic address or indexed location of the BSCIOCB statement to be associated with the close operation. Close processing uses this BSCIOCB to determine the address of the line to be closed.

ERROR=   The symbolic address of the next instruction to be executed if an error occurs while closing the line. If not specified, control will be returned to the next sequential instruction. In either case, the return code will reflect the results of the operation. See Figure 5 on page 57.

Pn=   The optional labels, P1 and P2 to be affixed to the bsciocb and ERROR operands, respectively.

BSCIOCB

BSCIOCB is used to specify the line address and buffer(s) for BSCCLOSE, BSCOPEN, BSCREAD and BSCWRITE operations. BSCIOCB is a non-executable instruction. The first word of the BSCIOCB is also used to return auxiliary information about the ending status of the operation.

If variable-length records are to be written, the length field (length1 operand) must specify the actual length of the message to be written. The value specified in the length field should be reset to the buffer length before issuing a READ. Figure 4 on page 41 lists the number of buffers required by each type of BSCREAD and BSCWRITE statement.

Syntax

```
label      BSCIOCB     lineaddr,buffer1,length1,buffer2,
                       length2,pollseq,pollsize,P1=,P2=,
                       P3=,P4=,P5=,P6=,P7=

Required:  lineaddr
Defaults:  None
Indexable: Not applicable
```

Operands Description

label — The symbolic name of the BSCIOCB for reference in a BSCCLOSE, BSCOPEN, BSCREAD, or BSCWRITE operation. Label may also be used by other instructions to reference the auxiliary information returned in the first word of the BSCIOCB. This word will contain:

- After successful receipt of text, the address of the last character received.
- For all other conditions, the Interrupt Status Word from the Series/1 BSC Adapter.

lineaddr — The hardware address, in hexadecimal form, of the line on which to perform the operation.

buffer1 — The address in storage of the first buffer to be used in an operation. This buffer is located in the target Address Space as defined by $TCBADS.

length1 — The length, in bytes, of the first buffer.

buffer2 The address in storage of the second buffer to be used in an operation. This buffer is located in the target Address Space as defined by $TCBADS.

length2 The length, in bytes, of the second buffer.

pollseq The address in storage of the poll or selection sequence to be used in a multipoint control line initial operation.

pollsize The length, in bytes, of the poll or selection sequence.

Pn= The optional labels to be affixed to the lineaddr, buffer1, length1, buffer2, length2, pollseq, and pollsize operands, respectively.

Note: The polling and selection sequences, consisting of from one to seven characters, are followed by: ENQ,(Read or Write Initial)[4]. Specific sequences for a given device may be found in the device component description manual. Generally a 3-byte pollsize is sufficient for a sequence of address,address,ENQ[4] between Series/1 processors. The actual sequence is determined by the device type tributary.

[4] Commas are for readability only and are not part of the data stream.

Read type	Number of buffers	Write type	Number of buffers
C	1	C	1
D	0	CV	2
E	1	CVX	2
I	1	CX	1
P	1	CXB	1
Q	0	D	0
R	1	E	0
U	1	EX	0
		I	1
		IV	2
		IVX	2
		IX	1
		IXB	1
		Q	1
		N	0
		U	1
		UX	2

Figure 4. Required Buffers for BSCREAD and BSCWRITE

BSCLINE

The BSCLINE statement is coded as part of your supervisor configuration. See "System Configuration" in the System Guide. BSCLINE defines the binary synchronous lines to be supported in the generated system. One BSCLINE statement is required for each line to be referenced by programs using the Binary Synchronous Communications Access Method. All BSCLINE statements must be grouped together with the last BSCLINE statement including an END=YES specification.

Syntax

```
blank      BSCLINE ADDRESS=,TYPE=,RETRIES=,MC=,END=

Required: None
Defaults: ADDRESS=9,TYPE=PT,RETRIES=6,MC=NO,END=NO
Indexable: Not Applicable
```

Operands   Description

ADDRESS=   The hardware address (in hexadecimal) of the line.

TYPE=   PT (Point-to-Point) - The line is a point-to-point (non-switched) line with a single remote station. The adapter should be jumpered with DTR permanently enabled.

SM (Switch Manual) - The line is on a switched network and connection will be established manually by the operator. The adapter should be jumpered for switched line operation and DTR should not be permanently enabled.

SA (Switched Auto Answer) - The line is on a switched network and calls should be answered automatically by the BSC Access Method (during BSCOPEN). The adapter should be jumpered for switched line operation and DTR should not be permanently enabled.

MC (Multipoint Control) - The Series/1 is the controlling station on a multipoint line. The adapter should be jumpered with DTR permanently enabled and multipoint line should not be jumpered.

MT (Multipoint Tributary) - The Series/1 is a tributary station on a multipoint line. The adapter should be jumpered for multipoint tributary operation with DTR permanently enabled.

RETRIES= The number of attempts which should be made to recover from common error conditions before posting a permanent error.

MC= NO - The binary synchronous adapter located at the address specified on the ADDRESS operand is either a medium speed, single line feature card or a high speed, single line feature card.

YES - The binary synchronous adapter located at the address specified on the ADDRESS operand is part of a multiline controller feature configuration. When generating supervisors using multiline controller attachments, note the following:

- The character string YES must be specified. Any other character string will be equivalent to NO.
- All multiline feature cards must start at a base address ending with either X'0' or X'8'. A BSCLINE statement must exist for the line at this base address if any of the other lines of the multiline attachment are to be used.

END= YES, for the last BSCLINE statement in the system definition module.

Examples:

```
     BSCLINE ADDRESS=28,TYPE=PT,RETRIES=10,MC=NO
     BSCLINE ADDRESS=30,TYPE=SM,RETRIES=2,MC=YES,END=YES
```

BSCOPEN

BSCOPEN is used to prepare a binary synchronous line for use by a task. It first enqueues on the line and then prepares it for interrupts. If the line is switched manual (TYPE=SM), it will also raise Data Terminal Ready and wait up to two minutes for the telephone connection to be established. If the line is switched auto-answer (TYPE=SA), it will wait indefinitely for the ring interrupt and then raise Data Terminal Ready.

Syntax

```
label     BSCOPEN    bsciocb,ERROR=,P1=,P2=

Required:  bsciocb
Defaults:  None
Indexable: bsciocb
```

Operands   Description

label   The optional symbolic name of the BSCOPEN instruction.

bsciocb   The symbolic address or indexed location of the BSCIOCB statement to be associated with the open operation. Open processing uses this BSCIOCB to determine the address of the line to be opened.

ERROR=   The symbolic address of the next instruction to be executed if an error occurs while opening the line. If not specified, control will be returned to the next sequential instruction. In either case, the return code will reflect the results of the operation.

Pn=   The optional labels to be affixed to the bsciocb and ERROR operands, respectively.

Note: BSCOPEN assumes that point-to-point lines will be jumpered with Data Terminal Ready (DTR) permanently set on.

BSCREAD

BSCREAD is used to read data from a binary synchronous line. If the read is successful, the first word of the associated BSCIOCB will contain the address of the last character read.

Syntax

```
label      BSCREAD     type,bsciocb,ERROR=,END=,
                       TIMEOUT=,P1=,P2=,P3=

Required:  type,bsciocb
Defaults:  TIMEOUT=YES
Indexable: bsciocb
```

Operands — Description

label — The optional symbolic name of the BSCREAD statement.

type — The type of read operation to be performed. See "BSCREAD Types" on page 46 for a description of each type.

bsciocb — The symbolic address or indexed location of the BSCIOCB statement to be associated with the read operation.

ERROR= — The symbolic address of the next instruction to be executed if an error (return codes 10 through 99) is encountered. If not specified, control will be returned to the next sequential instruction. In either case, the return code will reflect the results.

END= — The symbolic address of the next instruction to be executed if an ending condition (return codes 1 through 6) is encountered. If not specified, control will be returned to the next sequential instruction. In either case, the return code will reflect the results.

TIMEOUT= YES - The access method will enable a 3-second time-out during receive operations. If data is not received within this interval, a time-out error will occur. The appropriate retry procedure will then be attempted up to the limit specified in the RETRIES parameter of the BSCLINE statement defining this line. For initial type reads, the time-out may occur both when attempting to establish the correct initial sequence and during the subsequent read of the first record.

NO - The access method will disable the 3-second time-out during all receive operations.

Pn= The optional labels to be affixed to the bsciocb, ERROR, and END operands, respectively.

BSCREAD Types

The eight types of read operations to binary synchronous lines are:

C - Read Continue
D - Read Delay
E - Read End
I - Read Initial
P - Read Poll
Q - Read Inquiry
R - Read Repeat
U - Read User

Type Operation

C Read Continue - Used to read subsequent blocks of data after an initial block is received via a Read Initial.

Read Continue writes a positive response and reads a message block:

1. Write ACK-0 (X'1070') or ACK-1(X'1061')

2. Read Text - The text received is either message text or an EOT (X'37')

D Read Delay - Used to acknowledge correct receipt of a block of data and to request that the transmitting station wait before sending the next block. Multiple Read Delays may be issued before resuming transmission of data via a Read Continue.

Read Delay writes a WACK sequence and checks for the proper ENQ response:

1. Write WACK (X'106B')

2. Read ENQ (X'2D')

E Read End - Used to acknowledge correct receipt of a block of data and to request that the transmitting station stop sending data. Only one Read End should be issued during a single transmission and Read Continues should then be issued until EOT is actually received.

Read End writes an RVI sequence and reads a message block:

1. Write RVI (X'107C')

2. Read Text - The text received is either message text or an EOT (X'37')

I Read Initial - Used to read the first block of data in a transmission. After a successful Read Initial, Read Continues should be issued until EOT is received.

Point-to-point operation (TYPE=PT,SA,SM).

A Read Initial monitors the line for an ENQ sent by the transmitting station, writes a positive response (ACK-0), and reads the message block that follows:

1. Read ENQ (X'2D')

2. Write ACK-0 (X'1070')

3. Read message text

Multipoint operation controller operation (TYPE=MC).

Read Initial polls a tributary station and if the response to polling is positive, reads the message text.

1. Write EOT (X'37')

2. Write polling sequence from address location specified in BSCIOCB

3. Read message text

Multipoint operation tributary operation (TYPE=MT).

Read Initial writes a positive response (ACK-0), and reads the message block that follows.

1. Write ACK-0 (X'1070')

2. Read message text

P Read Poll - Used to read the polling/selection sequence received when the Series/1 is acting as a tributary station on a multipoint line (TYPE=MT). Upon successful completion, the specified buffer will contain the sequence received starting with the second station (control unit) address character. The content of the received data stream, including control characters is not checked by the access method. Once polled/selected, your program should check the next operation requested and issue the appropriate Read/Write Initial Operation.

Q Read Inquiry - Used to read an ENQ character. Read Inquiry will return an invalid sequence error if ENQ or EOT is not received. If EOT is received, the END= exit will be taken if specified.

1. Read ENQ (X'2D')

R Read Repeat - Used to request retransmission of the last block of data following an unsuccessful read. The Read statements retry most common errors up to the limit of the RETRIES operand of the BSCLINE statement; however, Read Repeat may be used to attempt further recovery depending on the actual error encountered.

Read Repeat writes a negative response to the remote station and reads a message block:

1. Write NAK (X'3D')

2. Read Text

U Read User - Used in special situations to simply receive data. No associated write operation is performed by the access method, the data is not checked, and no error recovery is attempted.

BSCWRITE

BSCWRITE is used to write data to a binary synchronous line.

Syntax

```
label     BSCWRITE    type,bsciocb,ERROR=,END=,CHECK=,
                      P1=,P2=,P3=

Required:  type,bsciocb
Defaults:  CHECK=YES
Indexable: bsciocb
```

Operands — Description

label — The optional symbolic name of the BSCWRITE statement.

type — The type of write operation to be performed. See "BSCWRITE Types" on page 50 for a description of each type.

bsciocb — The symbolic address or indexed location of the BSCIOCB statement to be associated with the write operation.

ERROR= — The symbolic address of the next instruction to be executed if an error (return codes 10 thru 99) is encountered. If not specified, control will be returned to the next sequential instruction. In either case, the return code will reflect the results.

END= — The symbolic address of the next instruction to be executed if an ending condition (return codes 1 through 6) is encountered. If not specified, control will be returned to the next sequential instruction. In either case, the return code will reflect the results.

CHECK= — YES - Valid only for type CV or CVX. Normal checking of the response occurs.

NO - The response is not checked for protocol validity. This provides a chained write to read similar to Write User and Read User.

Pn= The optional labels to be affixed to the bsciocb, ERROR=, and END= operands, respectively.

BSCWRITE Types

Seventeen types of write operations can be issued to a binary synchronous communications line. They are:

C - Write Continue
CV - Write Continue Conversational
CVX - Write Continue Conversational Transparent
CX - Write Continue Transparent
CXB - Write Continue Transparent Block
D - Write Delay
E - Write End
EX - Write End Transparent
I - Write Initial
IV - Write Initial Conversational
IVX - Write Initial Conversational Transparent
IX - Write Initial Transparent
IXB - Write Initial Transparent Block
Q - Write Inquiry
N - Write NAK
U - Write User
UX - Write User Transparent

Type Operation

C Write Continue - Used to write subsequent blocks of data after an initial block is written via a Write Initial.

Write Continue writes message text and reads a response from the receiving station.

1. Write Text

2. Read Response

CV Write Continue Conversational - Used to write subsequent blocks of data in conversational mode.

Write Continue Conversational writes message text and reads a response into your buffer. Acknowledgement sequences are checked by the access method and error recovery is attempted when indicated. If text is received, a -2 return code is returned in lieu of the normal -1.

1. Write Text

2. Read Response/Text

CVX Write Continue Conversational Transparent - Used to write subsequent blocks of transparent data in conversational mode.

Write Continue Conversational Transparent writes message text and the ending sequence, DLE ETX, and reads a response into your buffer. Acknowledgement sequences are checked by the access method and error recovery is attempted when indicated. If text is received, a -2 return code is returned in lieu of the normal -1.

1. Write Text

2. Write DLE ETX (X'1003')

3. Read Response/Text

CX Write Continue Transparent - Used to write subsequent blocks of transparent data after an initial block is written.

Write Continue Transparent writes message text and the ending characters, DLE ETX, that must follow transparent data and reads a response from the receiving station.

1. Write Text

2. Write DLE ETX (X'1003')

3. Read Response

CXB Write Continue Transparent Block - Used to write subsequent blocks of transparent data after an initial block is written. This operation is the same as BSCWRITE type CX except ETB is used instead of ETX as the ending character.

Write Continue Transparent Block writes message text and the ending characters DLE ETB, that must follow transparent data, and reads a response from the receiving station.

1. Write Text

2. Write DLE ETB (X'1026')

3. Read Response

D Write Delay - Used to inform the remote station that the transmission of the next block of data will be delayed. Multiple Write Delays may be issued before transmission of data is resumed.

Write Delay writes a temporary text delay (TTD) sequence to the receiving station and reads a NAK response. The purpose of this operation is to inform the receiving station of a TTD before resuming transmission of message blocks.

1. Write TTD (X'022D')

2. Read NAK (X'3D')

E Write End - Used to inform the remote station that the previous block of data was the last of this transmission. Write End writes an EOT:

1. Write EOT (X'37)

EX Write End Transparent - Used to write a transparent EOT (DLE EOT). This sequence is most commonly used to notify the receiving station on a switched line that the transmitting station is disconnecting from the line. Write End Transparent writes DLE EOT:

1. Write DLE EOT (X'1037')

I Write Initial - Used to write the first block of data in a transmission. Write Initial first establishes the correct initial sequence (depending on the type of line), and then writes the first block and checks the response.

- Point-to-point Operation (TYPE=PT,SA,SM)

  Write Initial writes an ENQ to gain use of the line, reads positive response (ACK-0), writes the message text and reads the response to the text:

  1. Write ENQ (X'2D')

  2. Read ACK-0 (X'1070')

  3. Write Message text

  4. Read Response

- Multipoint Operation Controller Mode (TYPE=MC)

  Write Initial selects a tributary station and if the response to selection is positive, writes message text, then reads the response:

  1. Write EOT (X'37')

  2. Write selection sequence where location address is specified in BSCIOCB

3. Read ACK-0 (X'1070')

4. Write Message Text

5. Read Response

Multipoint Operation Tributary Mode (TYPE=MT)

Write Initial writes message text and reads a response from the controller station:

1. Write Message Text

2. Read Response

IV Write Initial Conversational - Used to write the first block of data of a transmission in conversational mode.

Write Initial Conversational establishes the correct initial sequence (depending on the type of line), writes the first block of message text and reads a response into your buffer. Acknowledgement sequences are checked by the access method and error recovery is attempted when indicated. If text is received, a -2 return code is returned in lieu of the normal -1.

- Point-to-point Operation (TYPE=PT,SA,SM)

  1. Write ENQ (X'2D')

  2. Read ACK-0 (X'1070')

  3. Write Message Text

  4. Read Response Text

- Multipoint Operation Controller Mode (TYPE=MC)

  1. Write EOT (X'37')

  2. Write selection sequence found in BSCIOCB

  3. Read ACK-0 (X'1070')

  4. Write Message Text

  5. Read Response Text

- Multipoint Operation Tributary Mode (TYPE=MT)

  1. Write Message Text

  2. Read Response Text

IVX Write Initial Conversational Transparent - Used to write the first block of transparent data of a transmission in conversational mode.

Write Initial Conversational Transparent first establishes the correct initial sequence (depending on the type of line), writes the first block of message text and the ending characters, DLE ETX, that must follow transparent data and reads a response into your buffer. Acknowledgement sequences are checked by the access method and error recovery is attempted when indicated. If text is received, a -2 return code is returned in lieu of the normal -1.

- Point-to-point Operation (TYPE=PT,SA,SM)

  1. Write ENQ (X'2D')
  2. Read ACK-0 (X'1070')
  3. Write Message Text
  4. Write DLE ETX (X'1003')
  5. Read Response Text

- Multipoint Operation Controller Mode (TYPE=MC)

  1. Write EOT (X'37')
  2. Write selection sequence found in BSCIOCB
  3. Read ACK-0 (X'1070')
  4. Write Message Text
  5. Write DLE ETX (X'1003')
  6. Read Response Text

- Multipoint Operation Tributary Mode (TYPE=MT)

  1. Write Message Text
  2. Write DLE ETX (X'1003')
  3. Read Response Text

IX Write Initial Transparent - Used to write the first block of transparent data in a transmission. Write Initial Transparent first establishes the correct initial sequence (depending on the type of line), and then writes the first block of transparent data and checks the response. The block is terminated by the access method with DLE ETX.

IXB Write Initial Transparent Block - Same as IX except ETB is used instead of ETX as the ending character.

Q Write Inquiry - Used to write an ENQ character and to read the response (which may be either a control sequence or text) into your buffer. This sequence is most commonly used to request retransmission of the response to a message block. It also retries upon time-out.

1. Write ENQ (X'2D')

2. Read Response/Text

N Write NAK - Used to simply write a NAK character down the line. The most likely use of this operation is to respond "device not ready" to polling/selection when the Series/1 is operating as a tributary station on a multipoint line (TYPE=MT).

1. Write NAK (X'3D')

U Write User - Used in special situations to simply transmit a character stream. No associated read operation is performed by the access method, and no error recovery is attempted.

1. Write buffer in BSCIOCB for length indicated.

UX Write User Transparent - Used in special situations to simply transmit a transparent character stream. No associated read operation is performed by the access method, and no error recovery is attempted.

1. Write the stream described by BSCIOCB buffer1/length1

2. Exit transparent write using the character pair described by BSCIOCB buffer2.

<u>Note</u>: The only valid character pairs which may be contained in buffer2 are DLE ETX, DLE ETB, or DLE ENQ.

Error Recovery

Each BSC operation results in a return code being returned in the calling task's TCB (may be referenced by the taskname). Figure 5 on page 57 describes these return codes. Three basic completion conditions are possible:

- Successful operation
- Ending sequence received (END=)
- Permanent error encountered (ERROR=)

The particular type of condition encountered determines which of two optional completion exits may be taken during a read or write operation.

The access method attempts to recover from common line errors, but hardware and specification errors are not retried. Your program is free to retry permanent errors, and under certain conditions such attempts may prove successful.

Auxiliary error information is returned in the first word of the BSCIOCB. After successful receipt of text, the address of the last character received is returned in this word. For all other conditions, the Interrupt Status Word (ISW) from the Series/1 BSC Adapter is returned.

Code	Description	Notes
-2	Text received in conversational mode	
-1	Successful completion	
END=		
1	EOT received	
2	DLE EOT received	
3	Reverse interrupt received	
4	Forward abort received	
5	Remote station not ready (NAK received)	4
6	Remote station busy (WACK received)	4
ERROR=		
10	Timeout occurred	1
11	Unrecovered transmission error (BSC error)	1
12	Invalid sequence received	3
13	Invalid multi-point tributary write attempt	2
14	Disregard this block sequence received	1
15	Remote station busy (WACK received)	1
20	Wrong length record - long (No COD)	6
21	Wrong length record - short (write only)	2
22	Invalid buffer address	2
23	Buffer length zero	2
24	Undefined line address	2
25	Line not opened by calling task	2
30	Modem interface error	2
31	Hardware overrun	2
32	Hardware error	5
33	Unexpected ring interrupt	2
34	Invalid interrupt during auto-answer attempt	2
35	Enable or disable DTR error	2
99	Access method error	2

Figure 5. BSC Return Codes

Notes:

1. Retried up to the limit specified on the RETRIES operand of the BSCLINE definition.

2. Not retried.

3. Retried during write operations only when a wrong ACK is received following an ENQ request after timeout (indicating that no text had been received at the remote station).

4. Returned only during an initial sequence with no retry attempted.

5. Retried only after an unsuccessful start I/O attempt.

6. Retried only during read operations.

Sample Program: Write Transparent

```
           SOURCE STATEMENT

          PRINT NOGEN
WRITEX    PROGRAM START
START     BSCOPEN IOCB,ERROR=PRINTERR
RESTART   BSCWRITE IX,IOCB
          IF     (WRITEX,EQ,10),GOTO,RESTART
          IF     (WRITEX,NE,-1),GOTO,PRINTERR
          DO     29,TIMES
           ADD    I,1
           CONVTB MSG#,I
           BSCWRITE CX,IOCB,ERROR=PRINTERR
          ENDDO
          BSCWRITE E,IOCB,ERROR=PRINTERR
          GOTO   ALLDONE
PRINTERR  MOVE   ERRCODE,WRITEX
          PRINTEXT 'WRITE ERROR:',SKIP=1
          PRINTNUM ERRCODE
          BSCCLOSE IOCB
ALLDONE   PROGSTOP
IOCB      BSCIOCB 19,BUFFER,82
BUFFER    DC     X'1002'
          DC     CL74'TEST MESSAGE'
MSG#      DC     CL6'     1'
I         DC     F'1'
ERRCODE   DC     F'0'
         ENDPROG
         END
```

Sample Program: Read Transparent

```
              SOURCE STATEMENT

             PRINT NOGEN
  READX      PROGRAM START
  START      ENQT  $SYSPRTR
             BSCOPEN IOCB,ERROR=PRINTERR
  RESTART    BSCREAD I,IOCB
             IF    (READX,EQ,10),GOTO,RESTART
             IF    (READX,NE,-1),GOTO,PRINTERR
  PRINTIT    MOVE  MSG,INPUT+2,(80,BYTE)
             PRINTEXT MSG,SKIP=1
             BSCREAD C,IOCB,END=ALLDONE,ERROR=PRINTERR
             GOTO  PRINTIT
  PRINTERR   MOVE  RETCODE,READX
             PRINTEXT ERRMSG,SKIP=1
             PRINTNUM RETCODE
             BSCREAD R,IOCB,ERROR=ALLDONE,END=ALLDONE
             GOTO  PRINTIT
   ALLDONE   DEQT
             BSCCLOSE IOCB
             PROGSTOP
   IOCB      BSCIOCB 29,INPUT,83
   INPUT     DC    CL83' '
   MSG       TEXT  LENGTH=80
   ERRMSG    TEXT  'READ ERROR:'
   RETCODE   DC    F'0'
             ENDPROG
             END
```

Note: The $BSCUT2 utility contains many examples of the use of the Series/1 Event Driven Executive binary synchronous instructions. Examination of the source program for $BSCUT2 should answer many questions on buffer content of both data to be transmitted and data received.

Utility Programs (BSC)

This section describes the Event Driven Executive BSC utility programs and their syntax.

$BSCTRCE

The $BSCTRCE utility program provides a means to trace the I/O activities on a given BSC line. $BSCTRCE must be loaded in the same partition as the application program that is controlling the traced line. If loaded in any other partition, unpredictable results will occur. When loaded, $BSCTRCE prompts for the disk or diskette file in which to place the trace output. $BSCTRCE then prompts for the line number to be traced. The trace action is terminated by the attention command STOP. Since the output file is reused from the beginning whenever the end is reached, $BSCTRCE displays the relative record number of the last trace record written upon termination. The trace file can then be displayed or listed using the $BSCUT1 utility. Multiple BSC lines may be traced concurrently with multiple loads of $BSCTRCE using different trace files, for example:

```
> $L $BSCTRCE
DS1(NAME,VOLUME):  TRACE9
$BSCTRCE    6P,11:03:22,  LP=6500
ENTER LINE NUMBER (HEX):  9
          .
          .
          .
> STOP

LAST TRACE RECORD EQUALS  19
$BSCTRCE ENDED AT 11:13:31
```

Trace File Record Format: The format of the records produced by $BSCTRCE is shown below.

CC	ISW	STATUS	DCB	LGTH	DATA	LAST4
0	+2	+4	+10	+26	+28	+252

*CC Interrupt Condition Code on completion of the I/O.

*ISW Interrupt Status Word on completion of the I/O.

*STATUS The three status words of the BSC Adapter (produced when bit 0 of the ISW is on.)

DCB The Device Control Block for the I/O.

LGTH The length of the data sent/received.

DATA The data in main storage following the I/O.

LAST4 The last 4 bytes of data if the data is longer than 227 bytes.

Note: * These fields are zero when the DCB has been chained from the previous record's DCB.

$BSCUT1

The $BSCUT1 utility program formats binary synchronous trace files (see $BSCTRCE utility description) to either $SYSPRTR or a terminal. You may select the records of the trace file to dump. You will be prompted, as necessary, for information required by the functions of $BSCUT1.

Following is a list of the available functions of $BSCUT1, as obtained by using the ? command.

```
COMMAND(?): ?

CV - CHANGE VOLUME
DP - PRINT TRACE FILE ON PRINTER
DU - DUMP TRACE FILE ON TERMINAL
      (CA WILL CANCEL)
EN - END PROGRAM

COMMAND (?):
```

Example: Dump trace file to your console

```
COMMAND (?): DU TRACE9
FIRST RECORD: 32
LAST RECORD:  33

DUMP OF TRACE FILE TRACE9 ON EDX002

*****   RECORD     32   *****   START OF CHAINED OPERATION

CC =  0002  ISW =  A009  STATUS =  98DA 0001 C080
RESULT:  EXCEPTION - WRONG LENGTH RECORD (SHORT)

DCB =  8004 0000 0000 0000 0000 2B1C 0002 2AE4
OPERATION:  CHAINED TRANSMIT

DATA LENGTH =      2
      1     1061

*****   RECORD   33   *****   CONTINUATION OF CHAINED OPERATION

DCB =  2008 0000 0000 0000 0000 0000 0200 96F6
OPERATION:  RECEIVE WITH TIMEOUT

DATA LENGTH =    485
1   0227 615B F1F6 4BF5 F94B F3F4 40D1 D6C2  |../$16.59.34 JOB|
17  4040 F4F2 F440 D7D9 F3F0 F1F6 F5F6 40C5  |  424 PR301656 E|
33  E7C5 C3E4 E3C9 D5C7 40D4 40D7 D9C9 D640  |XECUTING M PRIO |
49  40F7 1E27 615B F1F6 4BF5 F94B F3F4 40D1  | 7../$16.59.34 J|
65  D6C2 4040 F4F2 F340 C8D8 F1F2 F1F6 F5F6  |OB  423 HQ121656|
81  40C5 E7C5 C3E4 E3C9 D5C7 40D4 40D7 D9C9  | EXECUTING M PRI|
97  D640 40F7 1E27 615B F1F6 4BF5 F94B F3F4  |O  7../$16.59.34|
113 40D1 D6C2 4040 F3F0 F040 C9E2 F0F3 F1F4  | JOB  300 IS0314|
129 F4F5 40C5 E7C5 C3E4 E3C9 D5C7 40E5 40D7  |45 EXECUTING V P|
145 D9C9 D640 40F5 1E27 615B F1F6 4BF5 F94B  |RIO  5../$16.59.|
161 F3F4 40D1 D6C2 1D43 F4F8 407B C7E2 D7C5  |34 JOB..48 #GSPE|
177 F0F1 F040 D6D5 40D7 D9C9 D5E3 D9F2 4040  |010 ON PRINTR2  |
193 D7D9 C9D6 4040 F51E 2761 5BF1 F64B F5F9  |PRIO  5../$16.59|
209 4BF3 F440 D1D6 C240 40F3 F2F0 40C6 C7F6  |.34 JOB  320 FG6|
LAST 4 D4D5 1E26                             |MN..            |

DUMP COMPLETE
ANOTHER AREA?
```

$BSCUT2

The $BSCUT2 utility program checks out the binary synchronous communications access method (BSCAM), the BSCLINE definitions generated in the executing supervisor, and the hardware customized jumper assignments in the adapters. Various BSCAM capabilities may be tested as follows:

1. Read and write both transparent and non-transparent data

2. Operate in limited conversational mode with both transparent and non-transparent data

3. Operate as a master controller on a multipoint (multidrop) line to both poll and select tributaries (text written only for transparent data)

4. Operate as a tributary on a multipoint line and be polled and selected (text written only for transparent mode)

The primary purpose of this utility is to check out your system after installation, supervisor generation, and your tailored adapter assignments via the jumper options (device address, type such as PT, SM or SA, tributary address, etc.). Therefore it is essential to have this information available to run this program. For each selected function in $BSCUT2, you will be prompted for the device (line) address, tributary address (if multipoint), record length, etc. Error messages will print if any discrepancies exist between the function being performed and the hardware assignments. These error codes are defined in this section.

Normal or successful exercising of any given function results in a test pattern message being printed or displayed on the selected output terminal. The output basically consists of:

1. First section - Internal task identifier (for example READ for transparent and non-transparent reads), and optionally record number and record length.

Example:

```
Task READ entered RECORD NUMBER= 1 RECORD LENGTH= 80
```

2. Second line - Function identifier, record number, and alphabetic text string (A through Z) repeated to fill record length specified. The identifier and record number make up a 25-byte field and the remaining record length is filled by the alphabetic string. Therefore if you specified a record length of 80, the alphabetic string would consist of 55 characters (A through Z, A through Z, and ABC).

The output message in the previous example is repeated for the number of records transmitted.

Following is a list of the available functions of $BSCUT2 as obtained by using the ? command.

```
$BSCUT2       74P,00:33:52:, LP=9400

COMMAND (?): ?
RWI ---- READ/WRITE - NONTRANSPARENT
RWIX --- READ/WRITE - TRANSPARENT
RWIMP -- READ/WRITE - MULTIDROP LINE NONTRANSPARENT
RWIXMP - READ/WRITE - MULTIDROP LINE TRANSPARENT
RI ----- READ - TRANSPARENT/NONTRANSPARENT
WI ----- WRITE - NONTRANSPARENT
WIX ---- WRITE - TRANSPARENT
EN ----- END THE PROGRAM
CH ----- CHANGE HARDCOPY DEVICE
RWIVX -- READ/WRITE - TRANSPARENT CONVERSATIONAL
RWIV  -- READ/WRITE - NONTRANSPARENT CONVERSATIONAL
```

$BSCUT2 can be used to check out binary synchronous operations if at least two binary synchronous adapters are available on Series/1 processors and if a connection between the two adapters is made. If switched manual connections are used, $BSCUT2 does not prompt you to make connection. This must be done once the $BSCUT2 command has been issued and all questions have been answered.

Note: $BSCUT2 contains many examples of the use of the Series/1 Event Driven Executive binary synchronous instructions. Examination of the source program for $BSCUT2 should answer many questions on buffer content of both data to be transmitted and data received.

Following are explanations of each type of command for $BSCUT2:

RWI - Read/Write Non-transparent Data

This command writes non-transparent messages on line. Each message is numbered. The record length for write includes the control characters. The read task receives the messages, analyzes them, and prints them on the hardcopy device. The analysis includes transparent or non-transparent and record length received.

```
COMMAND (?): RWI
RWI ---- READ/WRITE - NONTRANSPARENT
READ ADDRESS? 5A
WRITE ADDRESS? 5B
READ RECL? 80
WRITE RECL? 80
NUMBER OF RECORDS? 10
READ MONITOR? Y
WRITE MONITOR? Y
```

Notes:

1. READ ADDRESS and WRITE ADDRESS refer to binary synchronous adapter channel address. If the test is to be run between two processors (one to read and one to write), load $BSCUT2 on both processors and enter the correct address for read on one processor and the correct address for write on the other processor. The other address can be invalid and the corresponding task on each processor will fail due to an undefined line; however, the read/write task will function properly. This is true for all $BSCUT2 commands.

2. RECL questions refer to the buffer size to be used and therefore the number of bytes transferred in one transmission over the binary synchronous line. The maximum buffer size permitted is 512 bytes. READ (RECL) should always be equal to or greater than WRITE or errors will occur.

3. NUMBER OF RECORDS determines the number of transmissions to be made before the test ends.

4. "Monitor" functions turn on a switch which allows each task to report its progress to the terminal. Thus TASK ENTERED, TASK EXITED messages and so on are written to the invoking terminal if the monitor function is enabled.

RWIX - Read/Write Transparent Data

```
COMMAND (?): RWIX
RWIX --- READ/WRITE - TRANSPARENT
READ ADDRESS? 5A
WRITE ADDRESS? 5B
READ RECL? 80
WRITE RECL? 80
NUMBER OF RECORDS? 10
READ MONITOR? Y
WRITE MONITOR? Y
```

Same as "RWI - Read/Write Non-transparent Data" on page 66 except data transmitted by the WRITE task is transparent.

RWIXMP - Read/Write Transparent, Multidrop Line

```
COMMAND (?): RWIXMP
RWIXMP - READ/WRITE - MULTIDROP LINE TRANSPARENT
MC DEVICE ADDRESS? 50
BUFFER LENGTH? 80
NUMBER OF RECORDS? 5
LOOP COUNT? 1
MONITOR? Y
NUMBER OF TRIBUTARIES? 1

PARAMETERS FOR TRIBUTARY? 1
MT DEVICE ADDRESS? 51
MT TRIBUTARY ADDRESS? 02
BUFFER LENGTH? 80
NUMBER OF RECORDS? 5
MONITOR? Y
```

See notes under "RWI - Read/Write Non-transparent Data" on page 66. In this command, BUFFER LENGTH is equivalent to RECL.

The master controller (MC) at device address polls and selects all tributaries (MT) and sends and receives messages to them. Since each task both transmits and receives, successful operation requires the controller buffer length to equal all tributary buffer lengths. Values other than this can be entered to test access method error detection. Received messages are logged to the hardcopy device.

DEVICE ADDRESS for this command refers to binary synchronous adapter channel address. TRIBUTARY ADDRESS refers to the jumpered tributary address on each card.

Note: The adapter must be jumpered in tributary mode for this test to function properly.

If the test being performed is between two $BSCUT2 programs then:

1. Program 1 would use a valid MC device address and dummy tributaries (MT)

2. Program 2 would use a dummy MC device address and valid tributaries (MT)

3. NUMBER OF TRIBUTARIES must be equal in both programs

4. LOOP COUNT must be equal in both programs.

RI - Read Transparent/Non-transparent

```
COMMAND (?): RI
RI ----- READ - TRANSPARENT/NONTRANSPARENT
READ ADDRESS? 5A
READ RECL? 80
READ MONITOR? Y
```

See note under "WIX - Write Transparent" on page 69.

WI - Write Non-transparent

```
COMMAND (?): WI
WI ----- WRITE - NONTRANSPARENT
WRITE ADDRESS? 5B
WRITE RECL? 80
NUMBER OF RECORDS? 10
WRITE MONITOR? Y
```

See note under "WIX - Write Transparent."

WIX - Write Transparent

```
COMMAND (?): WIX
WIX ---- WRITE - TRANSPARENT
WRITE ADDRESS? 5B
WRITE RECL? 80
NUMBER OF RECORDS? 5
WRITE MONITOR? Y
```

Note: RI, WI, and WIX commands individually activate the tasks comprising RWI and RWIX. The Read task does not require NUMBER OF RECORDS since it will read either transparent or non-transparent data until EOT is received. This makes the Read task useful for monitoring any binary synchronous line sending data to the processor. For example, RI can receive data from $RJE2780 or $RJE3780 utilities operating in the same Series/1 or in another Series/1.

EN - End $BSCUT2 Program

```
COMMAND (?): EN
$BSCUT2  ENDED AT 01:14:40
```

CH - Change Hardcopy Device

```
COMMAND (?): CH
NEW HARDCOPY DEVICE? $SYSLOGA
```

Note: If the hardcopy device entered is not defined, then the hardcopy output will come to the terminal which loaded $BSCUT2.

RWIVX - Read/Write Transparent Conversational

```
COMMAND (?): RWIVX
RWIVX -- READ/WRITE - TRANSPARENT CONVERSATIONAL
READ ADDRESS? 5A
WRITE ADDRESS? 5B
BUFFER LENGTH? 5
NUMBER OF RECORDS? 10
READ MONITOR? Y
WRITE MONITOR? Y
```

RWIV - Read/Write Non-transparent Conversational

```
COMMAND (?): RWIV
RWIV --- READ/WRITE - NONTRANSPARENT CONVERSATIONAL
READ ADDRESS? 5B
WRITE ADDRESS? 5A
BUFFER LENGTH? 80
NUMBER OF RECORDS? 5
READ MONITOR? Y
WRITE MONITOR? Y
```

For RWIVX and RWIV commands, see Notes under "RWI - Read/Write Non-transparent Data" on page 66. In this command BUFFER LENGTH is equivalent to RECL.

RWIVX and RWIV test limited conversational operation in both transparent and non-transparent mode. The following is a description of the binary synchronous line transactions:

```
WRITE TASK                                        READ TASK

BSCWRITE N(X)     ----ENQ------------->    BSCREAD I
                  <---ACK0 (Response)-
                  ----Text------------>
                  <---Text (Response)--    BSCWRITE CV(X)
BSCREAD C         ----ACK1 (Response)->
                  <---Text-------------    BSCWRITE CV(X)
BSCWRITE CV(X)    ----Text (Response)->
                  <---ACK0 (Response)--    BSCREAD C
BSCWRITE CV(X)    ----Text------------>
                  <---Text-------------    BSCWRITE CV(X)
BSCREAD C         ----ACK1------------>
```

This sequence continues until the NUMBER OF RECORDS count is satisfied.

$PRT2780 and $PRT3780 Utility Programs

$PRT2780 and $PRT3780 are utility programs which will print the spool records produced by the $RJE2780 and $RJE3780 utilities. When these utilities are loaded, they prompt for the name of the spool file to be printed. The utility terminates upon reaching the end of the spool file. An initial option allows you to choose a printer other than $SYSPRTR if desired.

```
Example:

> $L $PRT3780
 DS1(NAME,VOLUME): ASMWORK
$PRT3780      9P,00:02:44, LP= 8000
PRINT TO $SYSPRTR? (Y OR N): Y
$PRT3780 ENDED AT 00:03:05
```

Spooled data from a /*DR HASP command during remote job entry session as printed out by above utility is:

```
$19.28.14 RM74.RD1  *** INACTIVE
$19.28.14 RM74.PR1  *** INACTIVE
$19.28.14 RM74.PU1  *** INACTIVE
$19.28.14 RM75.RD1  *** INACTIVE
$19.28.14 RM75.PR1  *** INACTIVE
$19.28.14 RM75.PU1  *** INACTIVE
```

$RJE2780 and $RJE3780 Utility Programs

$RJE2780 is a utility program which can be used to interface with a System/360 or System/370 via remote job entry. It simulates an IBM 2780 having the following characteristics and features:

- Model 2 (Card reader, card punch, and printer)
- EBCDIC transparency
- Multiple record transmission
- 132-character print line
- Transparent punch output only
- No horizontal tab
- No tape controlled operations (except channel 1 as new page indicator)

$RJE3780 is a utility program which can be used to interface with a System/360 or System/370 via remote job entry. It simulates an IBM 3780 having the following characteristics and features:

- 3780 with IBM 3781 Card Punch
- Compression for both input and output
- Vertical tab
- Transparent punch output only

$RJE2780 and $RJE3780 present the same interface to the following list of host RJE facilities:

- HASP or HASP V4
- JES2 or JES3
- RES
- VMRSCS

In the following pages, $RJE refers both to $RJE2780 and $RJE3780.

The $RJE utility is controlled by a set of attention requests. See Figure 6 on page 74.

ABORT	Stops transmission to or from the host
COMMAND	Sends a single card image to the host
END	Terminates execution of the utility
ENDSPOOL	Switches from spooling to direct printing
PRINTON	Defines the terminal name used for output
PUNCHO	Defines a disk or diskette file for punch output of object data
PUNCHS	Defines a disk or diskette file for punch output of source data
RESET	Reset function (use caution)
SPOOL	Defines a disk or diskette file for printer output and to commence spooling
SUBMIT	Sends a data stream to the host
SUBMITX	Sends a transparent data stream to the host

Figure 6. $RJE Attention Requests

When the $RJE utility is first loaded, it checks for the presence of only one BSC line specified in the supervisor. If true, the actual device address of the adapter is used as the default line address and a prompting message is suppressed. If more than one BSC line has been defined, it prompts for the RJE line address. Subsequent control operations are all performed using the attention request commands. Multiple copies of $RJE can be loaded using different lines to the host. The spool facility can be used to avoid contention for a single printer. Figure 7 on page 78 and Figure 8 on page 79 show a sample $RJE session.

Attention Requests

ABORT: ABORT is used to stop a data transmission which is currently in process. During a SUBMIT or SUBMITX operation, normal end-of-file is transmitted to the host following the current block. During receive operations, EOT is returned instead of a normal acknowledgement and data then continues to be received until the host sends EOT. Depending on the operation of the host RJE system, this can result in suspension of print or punch output and a pause during which the host will receive input. Since the pause for input by the host may be short, any desired commands (for example, to submit another job, cancel the current output, hold a job, or display status) should be entered before the ABORT command. This command simulates pressing STOP on a 2780 while printing or punching, CARRIAGE STOP on a 3780 printer while printing, or STOP on a 3781 punch while punching.

COMMAND: COMMAND is used to send a single card image record to the host. The most common use of this capability will be to send control commands and information requests to the host; for example, a HASP /*$DA command.

Upon entering the COMMAND attention request, you are asked to enter the command to be sent.

END: END is used to terminate the $RJE utility program.

ENDSPOOL: ENDSPOOL is used to terminate the spooling of printer output (see SPOOL command). If a print data stream is being received and spooled when this command is entered, spooling will continue until the end of the data stream. Subsequent print data streams will then be printed on the defined printer.

PRINTON: PRINTON is used to define the name of the terminal to be used for print output. If not specified, $SYSPRTR is assumed.

PUNCHS and PUNCHO: PUNCHS and PUNCHO are used to define a disk or diskette file to be used to receive punch data from the host. Card image punch data streams can be written to disk in two different formats: source (S) or object (O). Source format will produce two 80-byte card image records per 256-byte disk record with the second card starting at byte location 129. Object format will produce three 80-byte contiguous card image records per 256-byte disk record with the last 16 bytes set to hexadecimal zeros. The punch specification is automatically reset at the completion of each punch data stream so that multiple punch data streams can be separated into different output data sets by issuing another PUNCHS or PUNCHO command.

Upon entering the PUNCHS or PUNCHO attention request, you will be queried for the name and volume of the file to be used for punch output. If volume is not specified, the IPL volume is assumed. The file name and volume can also be specified as part of the PUNCHS or PUNCHO command, for example:

```
PUNCHS PUNCHOUT,EDX001
```

$RJE examines the first cards received from the host and disregards those containing a X'6A' in columns 1, 10, and 11 (indicating a HASP punch header card). $RJE must be modified by you to purge other than HASP punch header cards.

RESET: RESET is used to reset functions that have not started operation in $RJE (for example buffered command images that have not yet been sent to the host, SUBMIT files that have not yet started transmission). RESET should be used with caution. If RESET is used, once a function is in process or if use of RESET overlaps a function initiation sequence, unpredictable results may occur. RESET conditionally prompts you with the following:

```
ENTER RESET TYPE (CO,SU,SP,PU):
CO - COMMAND function
SU - SUBMIT(X) function
SP - SPOOL function
PU - PUNCH(S or O) function
```

SPOOL: SPOOL is used to define a disk or diskette file to be used to receive printer data from the host. If not specified, $RJE will print received data directly to the printer. Once specified, all printer output will be spooled until an ENDSPOOL command is issued. The utility programs $PRT2780 or $PRT3780 can be used to print the contents of a spool file produced by $RJE2780 or $RJE3780, respectively.

Upon entering the SPOOL attention request, you will be prompted for the name and volume of the disk or diskette file to be used for printer output. If volume is not specified, the IPL volume is assumed. The space allocated to this file must be at least equal in size (256-byte records) to the number of print lines to be spooled and there must be an even number of records in the spool file. Once the spool file is full, the output reverts to the defined printer. The spool file name and volume may also be entered with the SPOOL command, for example:

```
SPOOL SPOOLFLE,WRKLIB
```

SUBMIT and SUBMITX: SUBMIT is used to define and send a data stream to the host. SUBMITX is used to define and send a transparent data stream to the host. Multiple disk or diskette files may be sent using the /*CONCAT statement in the data stream itself. The files must be in the same format as that produced by the $EDIT1N and $FSEDIT utility programs (for example, two 80-byte card image records per 256-byte disk or diskette record with the second card beginning at byte location 129). Two command statements within the data stream are recognized by $RJE and are not transmitted to the host:

1. /*END - signifies the end of the data stream to be sent.

2. /*CONCAT filename,volume - signifies that the data stream is to be continued using the file specified. If volume is not specified, the IPL volume is assumed. Any number of files may be concatenated into one data stream.

Upon entering the SUBMIT or SUBMITX attention request, you will be queried for the name and volume of the file to be sent to the host. If volume is not specified, the IPL volume is assumed. The submit file name and volume may also be entered with the SUBMIT or SUBMITX command, for example:

```
SUBMITX MYJOB,WRKLIB
```

```
> $L $RJE2780
$RJE2780     35P,00:00:00, LP= 7C00

ENTER RJE LINE ADDRESS IN HEX: 5F
DIAL HOST
HOST CONNECTION ESTABLISHED
> COMMAND
ENTER COMMAND
/*SIGNON       REMOTEXX
COMMAND READY TO SEND
COMMAND SENT
> PUNCHO

ENTER PUNCH FILE NAME (NAME,VOLUME): PCHOUT01,EDX002
PUNCH FILE DEFINED
> SUBMIT

ENTER SUBMIT FILE NAME (NAME,VOLUME): RJEJOB01,EDX002
SUBMIT FILE READY TO SEND
FILE TRANSMISSION STARTED
FILE TRANSMISSION COMPLETED
> COMMAND
ENTER COMMAND
/*$DA
COMMAND READY TO SEND
COMMAND SENT
> PRINTON
ENTER PRINTER NAME: PRTR1
PRTR1 DEFINED AS RJE PRINTER
> COMMAND
ENTER COMMAND
/*$DA
COMMAND READY TO SEND
> RESET
ENTER RESET TYPE (CO,SU,SP,PU): CO
RESET COMPLETED
PUNCHING STARTED
PUNCHING COMPLETED
LAST CARD PUNCHED WAS CARD 2 ON RECORD      34
> SPOOL
```

Figure 7. Sample $RJE Session (Part 1 of 2)

```
ENTER SPOOL FILE NAME (NAME,VOLUME): SPOOL01,EDX002
SPOOL FILE DEFINED
> SUBMIT RJEJOB02
SUBMIT FILE READY TO SEND
FILE TRANSMISSION STARTED
FILE TRANSMISSION COMPLETED

SPOOLING STARTED

PUNCH DATA BEING RECEIVED - NO PUNCH FILE DEFINED
ENTER PUNCH FORMAT - S OR O: S

ENTER PUNCH FILE NAME (NAME,VOLUME): PCHOUT02,EDX002
PUNCH FILE DEFINED
PUNCHING STARTED
PUNCHING COMPLETED
LAST CARD PUNCHED WAS CARD 1 ON RECORD      51
> ENDSPOOL
SPOOLING COMPLETED
> COMMAND
ENTER COMMAND
/*SIGNOFF
COMMAND READY TO SEND
COMMAND SENT

$RJE2780 ENDED AT 00:00:00
> $L $PRT2780
 DS1(NAME,VOLUME): SPOOL01,EDX002
$PRT2780      9P,00:00:00, LP= 7C00
PRINT TO $SYSPRTR? (Y OR N): N
ENTER PRINTER NAME: PRTR1

$PRT2780 ENDED AT 00:00:00
```

Figure 8. Sample $RJE Session (Part 2 of 2)

CHAPTER 4. HOST COMMUNICATIONS FACILITY

An application program coded in the Event Driven Language may communicate with the facilities of Installed User Program 5796-PGH, the IBM Series/1 Host Communications Facility installed on an IBM System/370 running OS/MVT or OS/VS2. The TP statement, a part of the Event Driven Language, provides you a means of performing the following general functions:

- Write to a host data set.
- Read from a host data set.
- Submit a background job to the host system.
- Obtain the time and date from the host system.
- Set the occurrence of a Series/1 event so that it may be tested by a program running on the host system.
- Test for the occurrence of an event which is set by the host system.
- Erase an event which occurred on either the Series/1 or the host system.

To configure your supervisor for the Host Communications Facility, refer to the section "System Configuration" in the System Guide.

Open Series/1 Data Sets

A Series/1 may only have one host data set open at a time. If a second task attempts to open a data set, it will be placed in a queue of tasks waiting to use the TP facility.

If the task currently using the TP facility attempts to open a second data set, then the currently open data set will automatically be closed and the second one will be opened.

Host Data Set Naming Conventions

Data set names referenced by a TP instruction must consist of an alphameric character string immediately preceded by one word which specifies the length of the name field. This is most easily done by using a labeled TEXT instruction to define the name, for example:

```
DSN1     TEXT 'XYZ.EXP1.DATA'
```

Data set names follow standard host system naming conventions and must not exceed 44 characters in length (including delimiting periods). The name field must be padded on the right with blanks.

A partitioned data set and member name is specified with a string of the form dsname(membername), for example:

```
PDSDSN   TEXT 'XYZ.EXP1.DATA(RUN1)'
```

The maximum length of such a string is 54 characters.

A data set name can be read into a text field from the console with the READTEXT instruction.

Host Data Set Characteristics

Host system data sets referenced in these functions must all be cataloged, single-volume, direct-access data sets, with fixed- or variable-length records. Either sequential data sets or members of partitioned data sets may be accessed. Fixed-length logical records must contain an even number of words. The data sets may be blocked or unblocked. If fixed blocked format is used, the block size must be an integral multiple of the logical record length (LRECL), not exceeding 13030.

Either sequential data sets or members of partitioned data sets may be used for the SUBMIT function. Logical records must be 80 bytes long and may be blocked or unblocked. If blocked records are used, the block size must be an integral multiple of 80.

Host System Considerations

To ensure economical utilization of host main storage, while also providing large record capability, host main storage is shared by all Series/1 systems. The Host Communications Facility IUP region allocation determines how much buffer space is available and therefore the upper limit for host BLKSIZE. It is still possible an error code 222 (sufficient I/O buffer space unavailable) may occur because of multiple and simultaneous requests for access to data sets with very large block sizes. This is very improbable, but you are cautioned to minimize the amount of realtime during which you use the Host Communications Facility in order to minimize the probability of interference.

You are also cautioned to test for the specific error code 222 (sufficient I/O buffer space unavailable) in response to a TP OPEN and, if received, to retry your request a little later.

Record Sizes

A large range of logical and physical record sizes is available to the application programmer. In selecting record size, you should understand that there is no absolute best choice. However, the following points are offered for your consideration.

1. The basic disk or diskette record size on the Series/1 is 256 bytes. This is therefore a natural unit of measure for transfer to and from disk and a natural choice for a logical record size on the host. This is the default chosen for the TP instructions.

2. A host physical record (block) size of 1536 bytes yields an efficient (80 percent) utilization of host direct access storage on an IBM 3330 disk. This also yields moderate requirements for host buffer storage.

3. For unformatted data, FORTRAN IV on the host system supports either fixed-length unblocked data sets or variable-length blocked data sets.

4. The larger the physical record being transferred between host and Series/1 (a host logical record), the higher the effective data transfer rate which will be achieved. Also, the larger the physical record (block) being transferred between host main storage and direct access, the higher the effective data rate. The maximum data rate is achieved when using track size records (13030 bytes for the IBM 3330 disk) for both operations.

5. The large physical records naturally require correspondingly large buffers in your program. In order to achieve overlapped I/O, multiple buffers are required.

Variable Length Records

A variable length record is always prefixed by four bytes of control information. This is called a Record Descriptor Word or RDW. The structure of a variable format record is shown below.

LL	00	DATA

The length (LL) field (bytes 1 and 2) describes the total length of the record in bytes and is therefore always four greater than the length of the data field. The field shown as 00 (bytes 3 and 4) is reserved for use by the host system.

When a variable format record is transferred from the host to Series/1, the total record, including the LL field, will be transferred. When a variable format record is to be transferred from Series/1 to the host, you must set the RDW to the proper value.

Data Transfer Rates

The data transfer rates which may be achieved between Series/1 and the host is a function of the activity on the host and as such will vary somewhat from time to time. Of course, the speed of transmission is also a function of the type of physical connection used between the systems. In general, you should avoid implementing any functions in a manner which depends on specific data rates between the host and Series/1.

System Status Data Set

The status functions (SET, FETCH, and RELEASE) provide a method of communication and therefore, of synchronization between programs in a distributed system environment. This function is implemented by using a shared system data set on the host computer. Programs on the host or satellite processors can communicate by writing (SET), reading (FETCH), and deleting (RELEASE) records.

In the simplest case, one program (Program A) makes an entry in the System Status Data Set by invoking a SET instruction specifying an index and a key. Another program (Program B) would test for the existence of such an entry with a FETCH or RELEASE referring to the same index and key names and would receive a positive return code if the entry existed. After performing a SET, the first program (Program A) could periodically issue a FETCH. A companion program (Program B) on the other system might also be issuing a periodic FETCH for the agreed upon index and key. At the appropriate time, this program (Program B) could issue a RELEASE which would result in the first program (Program A) receiving a "not found" return code from its next FETCH. This could be interpreted as a notification by the companion program (Program B) that the message had been received. Figure 9 on page 86 graphically illustrates the previous explanation.

The FETCH, SET, and RELEASE functions can be invoked from a user-written program using the TP commands or, through the use of the Event Driven Executive $HCFUT1 utility. The return codes that could be returned are listed in the section "Return Codes" on page 102.

```
PROGA    PROGRAM A                  PROGRAM A
STATA    STATUS  PROGID,KEYA        DEFINE STATUS ID & KEY
*
A        TP      SET,STATA          SEND MESSAGE TO PROGB
*                                   VIA HOST
A1       TP      FETCH,STATA,ERRORA   CHECK IF PROGB RECEIVED
*                                     MESSAGE
*     FALL THRU IF KEY & ID STILL ON HOST
*
         GOTO    A1                 CONTINUE INTERROGATION
ERRORA   EQU     *                  DELETE THE MESSAGE ON HOST
         PROGSTOP
         ENDPROG
         END


PROGB    PROGRAM B                  PROGRAM B
STATB    STATUS  PROGID,KEYA        DEFINE SAME STATUS ID & KEY
*
B        TP      FETCH,STATB,ERROR=ERRORB   FETCH MESSAGE
*
*     MESSAGE WAS FOUND AND IS DELETED, THUS SIGNALING PROGA
*
         TP      RELEASE,STATB
         GOTO    END
ERRORB   GOTO    B                 CONTINUE LOOKING FOR MESSAGE
END      PROGSTOP
         ENDPROG
         END
```

Figure 9. System Status Data Set Sample Program

The System Status Data Set has DIRECT organization. Records are written into this data set with the SET function, tested for existence with the FETCH function, or tested and deleted with RELEASE.

A STATUS entry has three possible logical parts, two of which are mandatory. These are:

1. Index entry

2. Key field

3. Data (optional 256-byte field)

Index entries and key fields are each eight EBCDIC characters in length and have significance for the using programs.

The System Status Data Set has one 268-byte index record capable of containing 22 separate index entries. An index entry has two parts. These are:

- Index name - eight EBCDIC characters
- Key pointer - a 4-byte relative record pointer to the first associated key field record.

A key entry is a 268-byte record which has the following format:

1. Forward pointer - a 4-byte relative record number of the next key entry or zero if this is the last one
2. Key name - eight EBCDIC characters
3. Data - 256 bytes of optional data

The next record pointer allows more than one key to be associated with a given index. The next record pointer of the last key field will be set to zero to indicate the end of the chain.

Logically, an unlimited number of key records may be associated with a single index. In practice, the limiting factor is the physical size of the data set. The distributed data set allows for a total of 94 key entries.

The System Status Data Set format is defined and allocated during the installation of the Host Communications Facility Installed User Program.

Appendix B of the IBM Series/1 Host Communications Facility Program Description and Operation Manual, SH20-1819, contains more details on the use of the System Status Data Set.

TP Statement

The TP statement supports only the single line BSC adapter in point-to-point leased line mode. The following list shows the required TP statement, or required sequence of TP statements, to perform each of the general functions. These statements are coded in your Event Driven Language application program, which runs on the Series/1 end of the BSC link.

Examples of Use

1. Write data from the Series/1 to a host data set.

```
Requires:     TP   OPENOUT,...
              TP   WRITE,...
              TP   CLOSE,...
```

2. Read data from a host data set to the Series/1.

```
Requires:     TP   OPENIN,...
              TP   READ,...
              TP   CLOSE,...
```

3. Submit a background job to the host system.

```
Requires:     TP   SUBMIT,...
```

4. Obtain the time and date from the host system.

```
Requires:     TP   TIMEDATE,...
```

5. Set, on the host system, the occurrence of a Series/1 event, so that it may be tested by a program running on the host system.

```
Requires:    TP   SET,...
```

6. Test for the occurrence of an event set by a program running on the host system.

```
Requires:    TP   FETCH,...
```

7. Erase the record, on the host system, of an event which was set by either the host system or the Series/1.

```
Requires:    TP   RELEASE,...
```

TP Statement Syntax

Each of the forms of the TP instruction is described starting with "TP CLOSE." The use of each function is shown in "Example Transfer a Series/1 Data Set to the Host" on page 105 and "Example Transfer a Host Data Set to the Series/1" on page 106. Certain standard information is described on the following pages.

TP CLOSE

TP CLOSE terminates a transfer operation. This instruction is used to terminate either an operation begun with TP OPENOUT,... or with TP OPENIN,....

Notes:

1. If an error occurs, an open data set will be automatically closed by the system. The only time that a TP CLOSE must be issued is when a data set transfer is being terminated and no errors have occurred. For instance, this would occur if only 10 records were being written to or read from a data set capable of containing 20 records.

2. The return code should always be tested after issuing a TP CLOSE because some errors will only be detected at this time; for example, 50 and 51. Return codes are shown in Figure 10 on page 102, Figure 11 on page 103 and Figure 12 on page 104.

3. While you have an open data set, no one else will be able to use the facility. Use discretion in your operations.

Syntax

```
label      TP    CLOSE,ERROR=

Required:  CLOSE
Defaults:  None
Indexable: None
```

Operands	Description
label	The optional symbolic name of the TP statement.

CLOSE Coded as shown. Specifies operation termination.

ERROR= Use this operand to specify the first instruction of the routine to be invoked if an error condition occurs during the execution of this operation. If this operand is not specified, control will be returned to the next instruction after this one and you must test for errors.

TP FETCH

TP FETCH tests for the existence of a specific record in the System Status Data Set on the host system and optionally reads in the associated data record.

Syntax

```
label      TP    FETCH,stloc,length,ERROR=,P2=,P3=

Required:  FETCH, stloc
Defaults:  length=0
Indexable: stloc, length
```

Operands	Description
label	The optional symbolic name of the TP statement.
FETCH	Coded as shown.
stloc	The label of a STATUS instruction. Refer to the Language Reference for a description of this instruction.
length	A count specifying the length, in bytes, of the data portion of the status record to be received. A count of zero indicates that no data is to be received. The maximum value of this field is 256.
ERROR=	Use this operand to specify the first instruction of the routine to be invoked if an error condition occurs during the execution of this operation. If this operand is not specified, control will be returned to the next instruction after this one and you must test for errors.
Pn=	The optional labels to be affixed to the stloc and length operands, respectively.

TP OPENIN

TP OPENIN prepares to read data from a host data set.

Syntax

```
label      TP   OPENIN,dsnloc,ERROR=,P2=

Required:  OPENIN, dsnloc
Defaults:  None
Indexable: dsnloc
```

Operands   Description

label   The optional symbolic name of the TP statement.

OPENIN   Coded as shown. Specifies an input operation.

dsnloc   The label of a TEXT instruction which specifies the fully qualified name of a host data set of standard format as detailed in "Host Data Set Naming Conventions" on page 82.

This may be either (1) a sequential data set or (2) a partitioned data set with member name included.

ERROR=   Use this operand to specify the first instruction of the routine to be invoked if an error condition occurs during the execution of this operation. If this operand is not specified, control will be returned to the next instruction after this one and you must test for errors.

P2=   The optional label to be affixed to the dsnloc operand.

TP OPENOUT

TP OPENOUT prepares to transfer data to a host data set.

Syntax

```
label      TP    OPENOUT,dsnloc,ERROR=,P2=

Required:  OPENOUT,dsnloc
Defaults:  None
Indexable: dsnloc
```

Operands **Description**

label The optional symbolic name of the TP statement.

OPENOUT Coded as shown. Specifies an output operation.

dsnloc The label of a TEXT instruction which specifies the fully qualified name of a host data set of standard format as detailed in "Host Data Set Naming Conventions" on page 82.

This may be either (1) a sequential data set or (2) a partitioned data set with member name included.

ERROR= Use this operand to specify the first instruction of the routine to be invoked if an error condition occurs during the execution of this operation. If this operand is not specified, control will be returned to the next instruction after this one and you must test for errors.

P2= The optional label to be affixed to the dsnloc operand.

TP READ

TP READ receives a data record from the host system.

Syntax

```
label      TP    READ,buffer,count,END=,ERROR=,P2=,P3=

Required:  READ, buffer
Defaults:  count=256
Indexable: buffer, count
```

Operands **Description**

label The optional symbolic name of the TP statement.

READ Coded as shown. Specifies that a record is being received.

buffer The label of the data buffer into which the record is to be stored. This buffer should be generated with or conform to the specifications of a BUFFER statement specifying TPBSC.

count The maximum number of bytes which may be transferred. For variable length records, this includes the 4-byte RDW as shown in "Variable Length Records" on page 84.

END= Use this operand to specify the first instruction of the routine to be invoked if an "End of Data Set" condition is detected (return code 300). If this operand is not specified, an EOD will be treated as an error.

ERROR= Use this operand to specify the first instruction of the routine to be invoked if an error condition occurs during the execution of this operation. If this operand is not specified, control will be returned to the next instruction after this one and you must test for errors.

Pn= The optional labels to be affixed to the buffer and count operands, respectively.

TP RELEASE

TP RELEASE deletes a specific record in the System Status Data Set on the host system and optionally reads the associated data record.

Syntax

```
label      TP    RELEASE,stloc,length,ERROR=,P2=,P3=

Required:  RELEASE, stloc
Defaults:  length=0
Indexable: stloc, length
```

Operands	Description
label	The optional symbolic name of the TP statement.
RELEASE	Coded as shown.
stloc	The label of a STATUS instruction. Refer to the Language Reference for a description of this instruction.
length	A count specifying the length, in bytes, of the data portion of the status record to be received. A count of zero indicates that no data is to be transmitted. The maximum value of this field is 256.
ERROR=	Use this operand to specify the first instruction of the routine to be invoked if an error condition occurs during the execution of this operation. If this operand is not specified, control will be returned to the next instruction after this one and you must test for errors.
Pn=	The optional labels to be affixed to the stloc and length operands, respectively.

TP SET

TP SET writes a record in the System Status Data Set on the host system.

Syntax

```
label     TP   SET,stloc,length,ERROR=,P2=,P3=

Required:  SET, stloc
Defaults:  length=0
Indexable: stloc, length
```

Operands   Description

label   The optional symbolic name of the TP statement.

SET   Coded as shown.

stloc   The label of a STATUS instruction. Refer to the Language Reference for a description of this instruction.

length   A count specifying the length, in bytes, of the data portion of the status record to be transmitted. A count of zero indicates that no data is to be transmitted. The maximum value of this field is 256.

ERROR=   Use this operand to specify the first instruction of the routine to be invoked if an error condition occurs during the execution of this operation. If this operand is not specified, control will be returned to the next instruction after this one and you must test for errors.

Pn=   The optional labels to be affixed to the stloc and length operands, respectively.

TP SUBMIT

TP SUBMIT submits a job to the host batch job stream.

Syntax

```
label      TP    SUBMIT,dsnloc,ERROR=,P2=

Required:  SUBMIT, dsnloc
Defaults:  None
Indexable: dsnloc
```

Operands **Description**

label The optional symbolic name of the TP statement.

SUBMIT Coded as shown.

dsnloc The label of a TEXT instruction which specifies the name of a host data set containing the job (JCL and optional data) to be submitted.

This may be either:

1. TEXT "dsname" for a sequential data set, or

2. TEXT "dsname(membername)" for a partitioned data set.

In systems with a HASP/Host Communications Facility interface, specifying DIRECT for dsnloc allows immediate transmission of data records to the job stream without employing an intermediate host data set. To use this facility, issue:

```
TP  SUBMIT,DIRECT
```

followed by a series of

```
TP  WRITE,buffer,80
```

instructions, one for each job stream record, terminated with a

```
TP  CLOSE
```

ERROR= Use this operand to specify the first instruction of the routine to be invoked if an error condition occurs during the execution of this operation. If this operand is not specified, control will be returned to the next instruction after this one and you must test for errors.

P2= The optional label to be affixed to the dsnloc operand.

TP TIMEDATE

TP TIMEDATE obtains the current time of day (hours, minutes, and seconds) and the date (month, day, and year) from the host system.

Syntax

```
label     TP    TIMEDATE,loc,ERROR=,P2=

Required:  TIMEDATE, loc
Defaults:  None
Indexable: loc
```

Operands **Description**

label The optional symbolic name of the TP statement.

TIMEDATE Coded as shown.

loc The label of the 6-word data area where time of day and date will be stored as hours, minutes, seconds, month, day, and year.

ERROR= Use this operand to specify the first instruction of the routine to be invoked if an error condition occurs during the execution of this operation. If this operand is not specified, control will be returned to the next instruction after this one and you must test for errors.

P2= The optional label to be affixed to the loc operand.

TP WRITE

TP WRITE sends a data record to the host system.

Syntax

```
label      TP    WRITE,buffer,count,END=,ERROR=,P2=,P3=

Required:  WRITE, buffer
Defaults:  count=256
Indexable: buffer, count
```

Operands **Description**

label The optional symbolic name of the TP statement.

WRITE Coded as shown. Specifies that a record is being sent.

buffer The label of the data buffer which contains the record to be transmitted. This buffer should be generated with, or conform to the specifications of, a BUFFER statement specifying TPBSC.

count The number of Series/1 bytes to be transferred. For variable length records, this includes the 4-byte RDW as shown in "Variable Length Records" on page 84.

END= Use this operand to specify the first instruction of the routine to be invoked if an "End of Data Set" condition is detected (return code 400). If this operand is not specified, an EOD will be treated as an error.

ERROR= Use this operand to specify the first instruction of the routine to be invoked if an error condition occurs during the execution of this operation. If this operand is not specified, control will be returned to the next instruction after this one and you must test for errors.

Pn= The optional labels to be affixed to the buffer and count operands,respectively.

Return Codes

Program execution will be halted until the operation is complete, and the first word of the TCB (taskname) must be tested to determine if the operation was successful. The return codes are shown in Figure 10, Figure 11 on page 103 and Figure 12 on page 104.

Note: If an error is detected, an open data set is automatically closed for you.

Code	Description	Module
-1	Successful completion	Supervisor
1	Illegal command sequence	Supervisor
2	TP I/O error	Supervisor
3	TP I/O error on host	HCFCOMM
4	Looping bidding for the line	Supervisor
5	Host acknowledgement to request code was neither ACK0, ACK1, WACK, or a NACK	Supervisor
6	Retry count exhausted - last error was a timeout; the host must be down	Supervisor
7	Looping while reading data from the host	Supervisor
8	The host responded with other than an 'EOT' or an 'ENQ' when an 'EOT' was expected	Supervisor
9	Retry count exhausted - last error was a "modem interface check"	Supervisor
10	Retry count exhausted - last error was not a timeout, modem check, block check or overrun	Supervisor
11	Retry count exhausted - last error was a transmit overrun	Supervisor
50	I/O error from last I/O in DSWRITE	DSCLOSE
51	I/O error when writing the last buffer	DSCLOSE
100	Length of DSNAME is zero	HCFCOMM
101	Length of DSNAME exceeds 52	HCFCOMM
102	Invalid length specified for I/O	HCFINIT

Figure 10. TP Return Codes (Part 1 of 3)

Code	Description	Module
200	Data set not on volume specified for controller	HCFINIT
201	Invalid member name specification	DSOPEN
202	Data set in use by another job	DSOPEN
203	Data set already allocated to this task	DSOPEN
204	Data set is not cataloged	DSOPEN
205	Data set resides on multiple volumes	DSOPEN
206	Data set is not on a direct access device	DSOPEN
207	Volume not mounted (archived)	DSOPEN
208	Device not online	DSOPEN
209	Data set does not exist	DSOPEN
211	Record format is not supported	DSOPEN
212	Invalid logical record length	DSOPEN
213	Invalid block size	DSOPEN
214	Data set has no extents	DSOPEN
216	Data set organization is partitioned and no member name was specified	DSOPEN
217	Data set organization is sequential and a member name was specified	DSOPEN
218	Error during OS/ OPEN	DSOPEN
219	The specified member was not found	DSOPEN
220	An I/O error occurred during a directory search	DSOPEN
221	Invalid data set organization	DSOPEN
222	Sufficient I/O buffer space unavailable	DSOPEN
300	End of an input data set	DSREAD
301	I/O error during an OS/ READ	DSREAD
302	Input data set is not open	DSREAD
303	A previous error has occurred	DSREAD

Figure 11. TP Return Codes (Part 2 of 3)

Code	Description	Module
400	End of an output data set	DSWRITE
401	I/O error during an OS/ WRITE	DSWRITE
402	Output data set is not open	DSWRITE
403	A previous error has occurred	DSWRITE
404	Partitioned data set is full	DSCLOSE
700	Index, key, and status record added	SET
701	Index exists, key and status added	SET
702	Index and key exist, status replaced	SET
703	Error - Index full	SET
704	Error - Data set full	SET
710	I/O Error	SET
800	Index and key exist	FETCH
801	Index does not exist	FETCH
802	Key does not exist	FETCH
810	I/O error	FETCH
900	Index and/or key released	RELEASE
901	Index does not exist	RELEASE
902	Key does not exist	RELEASE
910	I/O error	RELEASE
1xxx	An error occurred in a subordinate module during SUBMIT. 'xxx' is the code returned by that module.	S7SUBMIT

Figure 12. TP Return Codes (Part 3 of 3)

Example Transfer a Series/1 Data Set to the Host

In the following example, a Series/1 data set, which is entered by the user at program load time, is written to a 256-byte data set on the host. The user will be prompted for a target host data set.

```
WRITASK  PROGRAM  TPOPEN,DS=((SOURCE,??))
*
*                 OPEN TP LINE
TPOPEN   READTEXT DSNAME,'HOST DATASET: ',PROMPT=COND
         TP       OPENOUT,DSNAME
         IF       (WRITASK,EQ,-1),GOTO,DSREAD OPEN OK?
         MOVE     SWITCH,3              ..TPOPEN ERROR
         GOTO     ERRSW
*               READ A RECORD FROM DATA SET
DSREAD   READ  DS1,BUFFER,ERROR=ERR2,END=TPCLOSE
*               WRITE A RECORD TO HOST
TPWRITE  TP    WRITE,BUFFER,256
         IF    (WRITASK,EQ,-1),GOTO,DSREAD   ..OK?
ERR1     MOVE  SWITCH,1                  ..WRITE ERROR
         GOTO  TPCLOSE
ERR2     MOVE  SWITCH,2                 ..READ ERROR
*      LOSE DATA SET AND PRINT MESSAGE AS APPROPRIATE
TPCLOSE  TP    CLOSE
ERRSW    GOTO  (RET0,RET1,RET2,RET3),SWITCH
RET0     PRINTEXT '*****READ/WRITE SUCCESSFUL*****@'
         PROGSTOP
RET1     PRINTEXT '*****WRITE UNSUCCESSFUL*****@'
         PROGSTOP
RET2     PRINTEXT '*****READ UNSUCCESSFUL*****@'
         PROGSTOP
RET3     PRINTEXT '*****TP OPEN UNSUCCESSFUL*****@'
         PROGSTOP
SWITCH   DATA F'0'
DSNAME   TEXT  LENGTH=40
BUFFER   BUFFER 256,TPBSC
         ENDPROG
         END
```

Example Transfer a Host Data Set to the Series/1

In the following example, a host data set which is entered by the user at the prompt "HOST DATASET: ", is read into a preallocated data set on a Series/1 volume. At program load time the user is prompted for the target Series/1 data set.

```
READTASK PROGRAM  TPOPEN,DS=((TARGET,??))
*                OPEN TP LINE
TPOPEN   READTEXT DSNAME,'HOST DATASET: ',PROMPT=COND
         TP       OPENIN,DSNAME
         IF       (READTASK,EQ,-1),GOTO,TPREAD OPEN OK?
         MOVE     SWITCH,3                  ..TP OPEN ERROR
         GOTO     ERRSW
*                 READ A RECORD FROM HOST
TPREAD   TP   READ,BUFFER
         IF   (READTASK,EQ,-1),GOTO,DSWRITE     ..OK?
         IF   (READTASK,EQ,300),GOTO,TPCLOSE    ..END?
         GOTO ERR2
*                 WRITE RECORD ON DISK
DSWRITE  WRITE DS1,BUFFER,ERROR=ERR1
         IF    (READTASK,EQ,-1),GOTO,TPREAD     ..OK?
ERR1     MOVE  SWITCH,1                       ..WRITE ERROR
         GOTO ERRSW
ERR2     MOVE  SWITCH,2
*        CLOSE TP LINE AND PRINT MESSAGE AS APPROPRIATE
TPCLOSE  TP    CLOSE
ERRSW    GOTO  (RET0,RET1,RET2,RET3),SWITCH
RET0     PRINTEXT '*****READ/WRITE SUCCESSFUL*****@'
         PROGSTOP
RET1     PRINTEXT '*****WRITE UNSUCCESSFUL*****@'
         PROGSTOP
RET2     PRINTEXT '*****READ UNSUCCESSFUL*****@'
         PROGSTOP
RET3     PRINTEXT '*****TP OPEN UNSUCCESSFUL*****@'
         PROGSTOP
SWITCH   DATA  F'0'
DSNAME   TEXT  LENGTH=40
BUFFER   BUFFER 256,TPBSC
         ENDPROG
         END
```

$HCFUT1 Utility Program

$HCFUT1 is a utility program that uses the Host Communications Facility on the Series/1 to interact with the Host Communications Facility on the System/370. $HCFUT1 contains four host-related data set functions. These are:

- Read a data set from the host.
- Write a data set to the host.
- Submit a job to the host.
- Status - Set, Fetch, and Release records in the System Status Data Set.

The table below lists the commands and their codes:

?	Help
END	End
FEtch	Fetch status
RELease	Release status
READDATA	Read host
READ80	Read 80-byte records and write two 80-byte records in one disk sector
READOBJ	Read 80-byte records and write three 80-byte records in one disk sector
SEt	Set status
SUbmit	Submit a job
WRite	Write to host

Notes:

- See "Host Data Set Naming Conventions" on page 82 and "Host Data Set Characteristics" on page 83.
- See "System Status Data Set" on page 85. Appendix B of the IBM Series/1 Host Communications Facility Program Description and Operation Manual, SH20-1819, contains more details on its use.
- The Host Communications Facility IUP, program number 5796-PGH, is required on the host System/370.
- Host Communications Facility must be installed and configured on the Series/1.

READDATA

READDATA transfers a data set from the host to the Series/1. The host logical record size is assumed to be 256 bytes.

There are three items of control information to be specified at the time of execution. These items are:

DS1 — The 1-8 character name of the Series/1 data set to which data is to be transferred, and its volume name, if not the IPL volume.

Record Count — The number of records to be transferred, beginning with the first. This would be used if, for example, only the first 10 records of a 50-record data set are to be transferred.

A count of zero is used to indicate that the entire data set is to be transferred.

DSNAME — The name of the host data set to be transferred.

The following is a terminal printout of a typical run. In this example, all records (length = 256 bytes each) of the host data set "S1.EDX.TESTIN.DATA" (which contains 40 records) are transferred to the Series/1 data set "DATAFIL2".

```
> $L
PGM(NAME,VOLUME): $HCFUT1
DS1(NAME,VOLUME): DATAFIL2,EDX001
$HCFUT1      8P,08.15.30, LP=4B00

COMMAND (?): READDATA
NO. OF RECORDS TO READ(0=ALL): 0
DSNAME: S1.EDX.TESTIN.DATA
END AFTER 40

COMMAND (?):
```

READ80 and READOBJ

READ80 and READOBJ transfer 80-byte records from a host data set and store them in 256-byte Series/1 disk or diskette data set records.

READ80 stores two 80-byte records per 256-byte disk record. The first 80-byte record is stored in the first 80 bytes of the disk record. The second 80-byte record is stored starting at byte 129 of the disk record. This format is compatible with the saved results of using $EDIT1N or $FSEDIT and is also the format required for input to a language compiler or $EDXASM program preparation. READ80 is normally used to transfer source program modules from the System/370 to Series/1 disk.

READOBJ stores three 80-byte records in the first 240 bytes of each disk record. This format is compatible with object modules produced by any of the assembler programs. It is also the format required for input to $LINK and is one of the formats accepted by $UPDATE. READOBJ is normally used to transfer the output object module of a host assembly to the Series/1 for processing by $LINK or $UPDATE.

Both READ80 and READOBJ are invoked in a manner similar to "READDATA" on page 108.

SET, FETCH, and RELEASE

The status commands are used to perform, from a terminal, any of the three functions, SET, FETCH, and RELEASE, on the System Status Data Set. See "System Status Data Set" on page 85 and Figure 11 on page 103 for STATUS return codes.

The following is an example of the use of the SET function of $HCFUT1. STATUS return code 700 indicates that the index, key, and status record have been added.

```
COMMAND (?): SE
INDEX = TESTSET
KEY = NEWRECD
STATUS =    700
COMMAND (?):
```

The following are examples of the use of the FETCH and RELEASE functions. The FETCH return code of 802 indicates that that particular key does not exist. The RELEASE return code of 900 indicates a successful release.

```
COMMAND (?): FE
INDEX = TESTSET
KEY = MISSING1
STATUS =      802
COMMAND (?): REL
INDEX = TESTSET
STATUS =      900
COMMAND (?):
```

SUBMIT

SUBMIT causes a job to be submitted to the host job stream. See "Host Data Set Naming Conventions" on page 82 and "Host Data Set Characteristics" on page 83.

The name of the host data set containing the job control language to be submitted is specified on the Series/1 terminal. The following is a sample of the terminal printout illustrating the use of SUBMIT to submit the data set "S1.EDX.TESTSUB.CNTL".

```
COMMAND (?): SU
DSNAME: S1.EDX.TESTSUB.CNTL
JOB SUBMITTED
ANOTHER JOB? N

COMMAND (?):
```

WRITE

WRITE transfers a data set from the Series/1 to the host processor. Host data set naming conventions and characteristics are described in this chapter. The host logical record size is assumed to be 256 bytes.

There are three items of control information to be specified at the time of execution. These items are:

DS1 — The 1-8 character name of the Series/1 data set to be transferred, and its volume name, if not the IPL volume.

Record Count — The number of records to be transferred, beginning with the first. This would be used if, for example, only the first 10 records of a 50-record data set are to be transferred.

A count of zero is used to indicate that the entire data set is to be transferred.

DSNAME — The name of the host data set to which the data is to be transferred. The name will consist of up to 44 characters or, 54 characters if a member of a partitioned data set.

The following is a terminal printout of a typical run. In this example, 28 records of the Series/1 data set "DATAFIL1" are transferred to the host data set "S1.EDX.TESTOUT.DATA".

```
 > $L $HCFUT1
DS1(NAME,VOLUME):DATAFIL1
$HCFUT1      8P,08.15.20, LP=4B00

COMMAND (?): WR
NO. OF RECORDS TO WRITE(0=ALL): 28
DSNAME: S1.EDX.TESTOUT.DATA
END AFTER 28

COMMAND (?):
```

CHAPTER 5. MULTIPLE TERMINAL MANAGER

INTRODUCTION

The Series/1 Event Driven Executive Multiple Terminal Manager is a program which provides support, via high-level functions, for transaction-oriented applications on a Series/1. In addition, it provides the management of multiple terminals as needed to support these transactions and their various application programs. The user creates programs which interface with the Multiple Terminal Manager via CALL statements. The components of the Multiple Terminal Manager are the following:

- A program/storage manager which controls the execution and flow of the application programs within a single program area.

- A terminal/screen manager which controls the presentation of screens and communications between terminals and application programs.

- A file handling mechanism which simplifies the storage and retrieval of data on direct access devices.

  Note: The reader should be familiar with the terminology used in the discussion of the TERMINAL statement in the section "System Configuration" of the System Guide. The syntax of the CALL statements in this chapter can be found in the Language Reference.

HARDWARE REQUIREMENTS

The minimum hardware configuration required for the Multiple Terminal Manager is as follows:

- Series/1 processor (either 4952 or 4955) with 96KB storage

- Disk storage device (either 4962 or 4963)

- An Event Driven Executive $SYSPRTR device

- 4978/4979/3101 or ASCII terminal

A separate $SYSLOG device is also required for receiving system messages; this device should not be included in the Multiple Terminal Manager environment in that system messages may not be displayed.

Additional hardware that may be attached to the system:

- 4978, 4979, or 3101 Models 1 or 2 terminal devices

- ASCII terminals connected via: #7850 Teletypewriter Adapter, #1610 controller, #2091 controller with #2092 adapter, or #2095 controller with #2096 adapter.

- 4973 or 4974 printers

- Additional direct access devices (disk or diskette)

- Additional storage

SOFTWARE REQUIREMENTS

The minimum software requirements for executing the Multiple Terminal Manager is the Event Driven Executive V1.1. Additionally, the Event Driven Executive utilities and program preparation facilities are required for program preparation and installation of Multiple Terminal Manager applications. The following is a list of the additional software supported by the Multiple Terminal Manager:

- Indexed Access Method

- COBOL

- FORTRAN

- PL/I

PROGRAM OPERATION OVERVIEW

The Multiple Terminal Manager is a transaction processing subsystem which executes as an application program within the Event Driven Executive system. Multiple Terminal Manager transactions are initiated by a terminal operator via a transaction selection menu (also referred to as a program selection menu). Transactions can consist of single or multiple operator prompts, and responses are processed by user applications prepared explicitly for the Multiple Terminal Manager.

Multiple Terminal Manager applications are processed in a message in/message out fashion and are automatically connected to a terminal when a transaction begins. The Multiple Terminal Manager, in turn automatically processes terminal I/O for Multiple Terminal Manager applications. Multiple Terminal Manager applications execute within the program area managed by the Multiple Terminal Manager. The applications are provided program, terminal, screen and file management services via the Multiple Terminal Manager.

Program Management

The program management facilities allow applications to manage programs while these programs perform their respective transactional processes within a single overlay area. Because all of the Multiple Terminal Manager application programs operate in the same area, the Multiple Terminal Manager program management facilities contain the support needed to allow multiplex operation and sharing of the program area. The application programs interface with these facilities using the callable functions described in the following sections.

The program management callable functions are:

LINK: Load and Execute Program

The LINK function allows an application program to complete its own execution by loading and executing some other application program.

LINKON: Fetch Response and Execute Program

The LINKON function is a combination of the functions provided by the ACTION and LINK functions; that is, it requests an operator action and, when this action is complete, loads and executes some other application program.

CYCLE: Suspend Current Terminal Application

The CYCLE function allows an application program to suspend its execution to allow other applications/terminals to become active.

MENU: Return to Multiple Terminal Manager Control

The MENU function allows the application program to abort its own operation and return control to the Multiple Terminal Manager base program. The operator selection menu is then displayed on the terminal.

The application programs using these program/storage management facilities will always have the following four items associated with them:

Application Program: This is the user-written code that performs the transaction processing as required by the user. It resides in the PRGRMS volume and is loaded into the in-storage program area by the manager.

Swap Out Data Set: Resides on MTMSTORE,MTMSTR. This data set is used by the manager to save programs and data across calls to ACTION, LINK, LINKON, CYCLE, and WRITE.

Input Buffer: This buffer contains either the data last entered by the operator when the current part of the application program was entered or, the protected characters of the screen display that the application program is preparing for the next dialogue with the operator. This buffer is allocated by the Multiple Terminal Manager and is normally 2048 bytes in length.

Output Buffer: This buffer contains the unprotected characters of the screen display that the current application program is preparing for the next dialogue with the operator. These unprotected characters can either be default values, or values supplied by the application program. This buffer is allocated by the Multiple Terminal Manager and is 1024 bytes in length.

Terminal/Screen Management

The terminal/screen management facilities provide you with a simplified method of performing the terminal handling functions that your application program may require. These facilities are described as follows:

ACTION: Fetch Operator Response

The ACTION function allows the application program to display a screen on the terminal and then obtain operator input from that display.

SETPAN: Retrieve a Screen Image from the SCRNS Volume

The SETPAN function allows the application program to request a specified screen be retrieved from the SCRNS volume and loaded into the Input and Output Buffers.

SETCUR: Move Cursor to Specified Position

The SETCUR function allows the application program to reset the character position at which the terminal/screen manager will display the cursor when the screen is displayed.

BEEP: Set Audible Alarm

The BEEP function allows the application program to activate the audible alarm, if this feature is supported by the terminal, on the next output as a signal to the terminal operator.

CHGPAN: Change Panel

The CHGPAN function is used to notify the terminal manager of changes to the number of protected/unprotected characters of a screen in the input buffer. As a result of this function, the terminal manager will know how many unprotected data characters to write on the next output operation. This function allows an application program to dynamically modify or create a screen image.

FTAB: Describe Unprotected Input Fields

The FTAB function is used to set up a table that describes the unprotected input fields placed in the Input Buffer after a SETPAN or CHGPAN is issued. This function is useful in cursor positioning.

WRITE: Output to an ASCII Terminal

This function is provided for those applications which utilize ASCII terminals such as the Teletype* ASR 33/35. This function executes similar to the functions described in the section "Program Management" on page 115, in that the application program does not remain in storage while the buffer is being written; hence, the manager returns control to the calling application program at the next sequential instruction.

* Trademark of the Teletype Corporation

File Management

The file management facilities of the Multiple Terminal Manager provide common, easy-to-use support for all disk data-transfer operations as needed for the transaction-oriented application programs. These facilities provide support for both indexed and direct files under the control of a single callable function. The file management facilities consist of the FILEIO function.

FILEIO: Perform Disk I/O

This function allows the application program to perform read and write operations to disk using either indexed or direct accessing.

Multiple Terminal Manager Operation

The Multiple Terminal Manager is invoked using the Event Driven Executive $L command ($L $MTM,PRGRMS). When this command is issued, the Multiple Terminal Manager program manager is loaded into storage and activated. The first program activated by the program manager is the Multiple Terminal Manager initialization program.

Multiple Terminal Manager Initialization Program

This program determines the number of terminals that are being controlled and prepares the tables and in-storage control blocks necessary to support those terminals. The initialization program LOADs and initializes a terminal server for each terminal that is to be controlled by the Multiple Terminal Manager. When initialization is complete, control is returned to the program manager.

Terminal Server Programs

The terminal server programs perform all input/output and interrupt handling functions for those terminal devices operating under the control of the Multiple Terminal Manager. There is one terminal server program for each terminal assigned to the Multiple Terminal Manager.

Application Program Manager

The application program manager controls the contents of the program area and the execution of programs within that area.

Multiple Terminal Manager Utilities

The utility program support provided with the Multiple Terminal Manager consists of operator service functions which assist you in the operation of your Multiple Terminal Manager system. These utilities are described as follows:

Terminal Connection Facilities: The Multiple Terminal Manager supervisor program provides the operator with the facilities to disconnect and reconnect terminals during the normal Multiple Terminal Manager operation. These services are performed by the following operator commands:

<u>DISCONNECT</u>: Turn Off Specified Terminals

This facility allows the operator to shut down all or individually-specified terminals on the Multiple Terminal Manager system. If the operator requests a terminal, which is currently involved in a transaction, to be disconnected, that terminal will be allowed to complete its associated transaction before being disconnected.

RECONNECT: Turn On Specified Terminals

This facility allows the operator to restore a disconnected terminal (via DISCONNECT) back into operation.

Terminal Activity Report: This report utility allows the operator to display the names and current status of the terminals under control of the Multiple Terminal Manager.

Programs Report: This report utility allows the operator to display the names and sizes of Multiple Terminal Manager application programs.

Screens Report: This report utility allows the operator to display screen formats developed for Multiple Terminal Manager applications.

Sign-On/Sign-Off

The Multiple Terminal Manager provides an optional facility to support operator sign-on and user provided sign-off. This support is provided when the Multiple Terminal Manager user wishes to restrict the use of the Multiple Terminal Manager system to only user-specified authorized personnel.

Data Files

The Multiple Terminal Manager maintains several files on disk to assist in the operation of the program and its users. The following is a list of these data files:

SCRNS Volume This volume contains the formatted screen displays which are built by the Event Driven Executive $IMAGE utility.

TERMINAL File This file describes the terminals that are to be controlled by the Multiple Terminal Manager.

PRGRMS Volume This volume contains the Multiple Terminal Manager and user application programs.

MTMSTORE File This file is used by the program manager as a work file primarily for saving and restoring programs across calls to the Multiple Terminal Manager.

APPLICATION PROGRAM INTERFACE

The Multiple Terminal Manager provides the Series/1 Event Driven Executive user with a set of high-level functions designed to simplify the definition of "transaction oriented" applications, such as inquiry, file update, data collection, and order entry.

"Transaction oriented" means that program execution is driven by operator actions, typically, responses to prompts from the system. For example, a program executing under control of the Multiple Terminal Manager displays a "menu" screen offering the operator a choice of functions. Based on the operator's selection, the application program then performs processing operations, such as reading information from a data file, displaying the data at the terminal, and waiting for the next response.

This "prompt-response-process" cycle between the Series/1 program and the terminal operator is the basic principle for the design of applications using the Multiple Terminal Manager.

The terminal manager simplifies such transactions by:

- Automatically allocating input and output buffers for the application program.
- Performing I/O operations to access fixed screen formats from the screen file. The term "screen" in this discussion refers to the image which is displayed on the screen of an IBM 4979, 4978, or 3101 (in block mode) terminal. Fixed screen formats consist of protected data and definitions of possible areas for data input. On other systems, these are referred to as "Maps", "Formats", or "Panels". Screens are built via the Event Driven Executive $IMAGE utility.
- Returning control to the user program to allow modification of the buffers containing the screen (if desired).
- Performing the set of I/O operations involved in writing the screen to the terminal, filling in unprotected fields with user-defined output data, and reading the data entered by the operator before returning control to the application program that requested the action. (The terminal manager assumes that each ACTION request involves both output and input operations, thus eliminating the need for the application program to make separate requests).

In addition, the Multiple Terminal Manager provides storage, file, and program management services, terminal transaction statistics, and sign on/off facilities for password validation. Error recovery for I/O and program check conditions are provided by the Event Driven Executive.

Series/1 Multiple Terminal Manager applications can be written in EDL, assembler language, COBOL, FORTRAN IV, or PL/I. Disk I/O can be performed by an application program using indexed or direct access methods. Terminal support is provided for locally attached IBM 4979, 4978, and 3101 display terminals and ASCII compatible terminals attached via the #7850, #1610, #2091 with #2092, or #2095 with #2096 adapters. See Figure 1 on page 6 for a description of devices and attachments.

Considerations for the IBM 3101 Model 2 Terminal

The Multiple Terminal Manager supports the IBM 3101 Model 2 terminal in full screen mode ("block mode"). This support is only for Multiple Terminal Manager based application programs; other applications are not supported. In particular, screen design using the Event Driven Executive $IMAGE utility must be performed on a 4978 or 4979. Throughout this chapter, any discussion of the 3101 refers to the Model 2 operating in block mode unless specified otherwise.

3101 support performs a subset of the functions equivalent to the support for IBM 4978 and 4979 terminals. That is, from the programming perspective, the 3101, 4978, and 4979 terminals are functionally very similar. However, they are operationally different in that the 3101 uses "attribute characters" to define fields. Multiple Terminal Manager support for the 3101 places an attribute character just prior to and following each input field, and at the first position on the screen.

Attribute characters appear as protected blanks on the display screen. Hence, the characters preceding and following an input field shall each appear as a protected blank. The same is true of the first character on the screen. These attribute characters should be taken into account and allowed for when designing screen images.

The maximum number of unprotected fields that can be displayed is 127.

Any invalid (unprintable) characters encountered by the 3101 will cause the alarm to ring. This condition might occur, for instance, when displaying a non-EBCDIC disk or diskette record. The Multiple Terminal Manager will convert to blanks, any nulls (X'00') found in an unprotected data stream to help avoid this condition.

The keys on the 3101 are labelled differently than the 4978 and 4979. The SEND key performs the same function as the ENTER key. Furthermore, the Program Function keys on the 3101 require that the ALT key on the lower right hand side of the keyboard be pressed as well as the appropriate numeric key. The PF6 key when pressed (hardcopy screen print) however, will not cause the screen image to be printed.

Multiple Terminal Manager Components

Major components of the Multiple Terminal Manager for the application programmer are:

- Functions (callable routines)
- User application programs
- TERMINAL file
- Screen formats

The functions provided by the Multiple Terminal Manager are callable routines that perform terminal, disk and diskette input/output operations and, control the execution of application programs. Program execution and terminal I/O are combined in most instances; for example, the LINK function causes a new program to be loaded and executed. If the current screen format has not yet been displayed, LINK also causes the screen to be written to the terminal.

The program-execution control and terminal I/O functions include:

- A routine (ACTION) to initiate the "prompt-response" terminal I/O operation
- Two routines (LINK and LINKON) to link to a new program from the currently executing program
- A routine (MENU) to terminate program execution and return control to the Multiple Terminal Manager
- A routine (CYCLE) to voluntarily give up control of the program area to other users. This allows a user-controlled form of time sharing.

In addition, the following functions are used with 4978, 4979, or 3101 terminals. These routines can be executed prior to a CALL ACTION to initiate a terminal I/O cycle:

- A routine (SETPAN) to retrieve a screen into the input and output buffers

- A routine (SETCUR) to override the initial cursor position defined for that screen format

- A routine (BEEP) to request the audible alarm (if available) be sounded on the next terminal I/O cycle

- A routine (CHGPAN) to notify the terminal manager of changes to a screen before it is written

- A routine (FTAB) to build a table which describes the position and length of unprotected fields in the Input Buffer.

For the ASCII terminals, the following functions are provided:

- A routine (ACTION) to write to the terminal and read a reply.

- A routine (WRITE) to write to the terminal without waiting for an operator response. Multiple writes may be used to write lengthy messages, with the last message being written via ACTION.

- A routine (BEEP) to cause a bell character to be included in the next output line.

The disk I/O function provides the following for disk and diskette files:

- Automatic open of the requested file

- Indexed Access Method file support

- Direct file support

- Storage conservation through automatic open and close functions

User application programs can be executed by the operator via a selection from the primary menu or by a program via a call to LINK or LINKON. A primary menu is used only for program selection. The application programmer/terminal operator need only specify the program name. The Multiple Terminal Manager performs the operations necessary to load the program and control its execution. User programs reside in the volume PRGRMS.

The TERMINAL file is another basic element that describes the terminals to run under the terminal manager. In this file, the user specifies the terminal type, the name of the terminal, the screen to be used as the primary menu screen, and whether or not sign-on is required. The TERMINAL file provides flexibility to the user; that is, terminals can be added or deleted without rebuilding the terminal manager. The TERMINAL file resides in the volume PRGRMS.

Screen formats are used by application programs and the Multiple Terminal Manager itself. Each screen is a data set in the volume SCRNS and defines protected fields and default unprotected fields. The following screens are predefined in the SCRNS volume:

IPLSCRN The initial program load (IPL) screen that is displayed when the Multiple Terminal Manager task set starts.

SCRNSREP Used by the Screens Report Utility

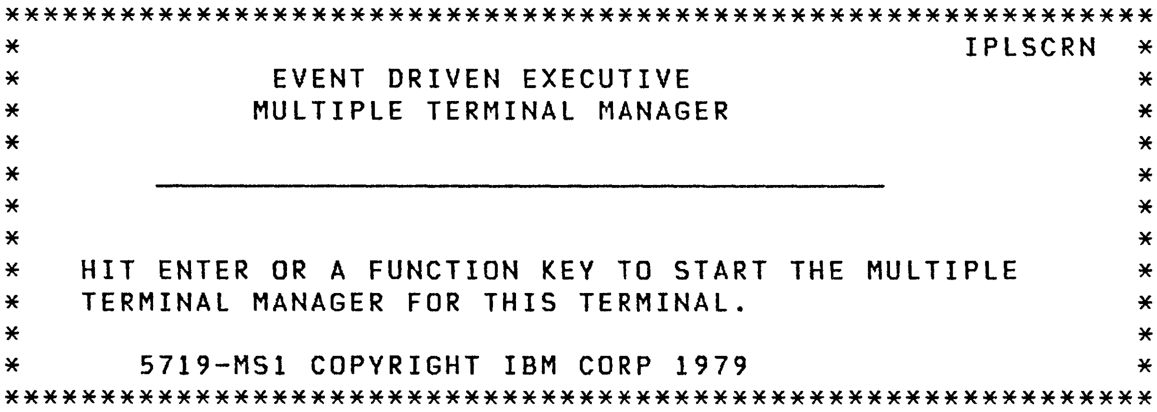
SIGNONSC The sign-on screen (displayed if a sign-on procedure is specified for the terminal).

MENUSCRN A sample primary menu screen for program selection; however, the user can select any screen as a menu screen.

These screens are provided as samples and can be modified to suit individual requirements. You can define additional screens by using the Event Driven Executive $IMAGE utility.

The following are examples of the predefined screens in the SCRNS volume.

IPLSCRN



```
************************************************************
*                                                 IPLSCRN  *
*             EVENT DRIVEN EXECUTIVE                       *
*            MULTIPLE TERMINAL MANAGER                     *
*                                                          *
*       ______________________________________             *
*                                                          *
*                                                          *
*   HIT ENTER OR A FUNCTION KEY TO START THE MULTIPLE      *
*   TERMINAL MANAGER FOR THIS TERMINAL.                    *
*                                                          *
*      5719-MS1 COPYRIGHT IBM CORP 1979                    *
************************************************************
```

The next example shows the sign-on screen.

```
                  SIGNONSC
************************************************************
*                                                 SIGNON   *
*              EVENT DRIVEN EXECUTIVE                      *
*             MULTIPLE TERMINAL MANAGER                    *
*                                                          *
* SSSSSS   IIIIIII    GGGGGG   N     N   0000  N     N     *
*S      S     I      G      G  NN    N  0    0 NN    N     *
* SSS         I      G         N N   N  0    0 N N   N     *
*   SSSS      I      G     GG  N  N  N  0    0 N  N  N     *
*S      S     I      G      G  N   N N  0    0 N   N N     *
* SSSSSS   IIIIIII    GGGGGG   N     N   0000  N    NN     *
*                                                          *
*                                                          *
*       # ????????     PASSWORD ==> ????                   *
*                                                          *
*                                                          *
************************************************************
```

This last example is the MENUSCRN.

```
************************************************************
*                                                 MENUSCRN *
*     ENTER PROGRAM NAME ==>                               *
*                                                          *
*                EVENT DRIVEN EXECUTIVE                    *
*               MULTIPLE TERMINAL MANAGER                  *
*                                                          *
* VALID PROGRAM NAMES : RECONNECT   DISCONNECT  PGMRPT     *
*                       REPORT      SCRNSRPT               *
*                                                          *
*        PRIMARY MENU FOR FULL SCREEN TERMINALS            *
************************************************************
```

Errors encountered by the Multiple Terminal Manager in the primary menu mode are written protected at the first 20 character positions of a screen. User-written primary menus (defined by the TERMINAL data set) should be designed with this taken into account.

The Multiple Terminal Manager responds to an interrupt from a terminal by loading the requested program specified by program name or program function key selection. The terminal manager routes subsequent operator entries to the associated program. Two program function keys are reserved:

- PF3 signals the Multiple Terminal Manager to terminate the current program and display the menu screen.

- PF6 signals Event Driven Executive to print the contents of the current screen on the device specified by the HDCOPY parameter of the TERMINAL statement for 4978/4979 terminals only. Normally, this device is the device specified for $SYSPRTR.

Program Execution

The Multiple Terminal Manager uses a single-thread approach to program execution, that is, only one application is resident at one time.

When a program is initially requested for execution (terminal operator selects by name or PF key), a copy of the program is loaded into the terminal manager program area.

When the program requests an operator response, the program is swapped out to disk and other terminals may use the program area while the operator is keying in new data. When the response is completed and the program area is available, the program is read into the program area from the swapped out data set and the program is given control at the next sequential instruction after the instruction that caused the swap out. The swap data set is MTMSTORE residing on the volume MTMSTR.

User Program Organization

All programs must be written to operate in a conversational mode. That is, each program (or linked sequence of programs) is expected to receive data from a terminal and then send data back to the same terminal.

Upon initiation, each user program automatically receives a list of parameters. The parameters are:

Input Buffer Address

This is the address of a buffer used for two distinct purposes: to contain the protected data defining a screen format before an ACTION and, to contain the data input from the terminal after an ACTION. After a call to SETPAN , the Input Buffer contains a 24 X 80 (1920) byte image of the screen, where unprotected fields are defined by strings of null characters (zeroes). A call to ACTION writes the screen image from the Input Buffer to the terminal. After the operator presses ENTER or a PF key, ACTION reads the data found in the unprotected fields into the Input Buffer. The input data fields are contiguous and start at the beginning of the buffer. Input from ASCII terminals (such as teletypewriters) is read from the device with the change-of-direction character removed and backspace characters converted to a logical backspace in the Input Buffer (that is, backspace characters and a corresponding number of characters preceding them are not in the buffer). This buffer is 2048 bytes in length; however, only the first 1920 bytes are used for protected output. The remainder of the buffer contains unusable information and is to be ignored.

Note: The output function described above is also performed by CYCLE, LINK, and LINKON; of these, only LINKON also performs the input function.

Initially, this buffer contains the characters entered on the terminal's menu screen for the first entry to a program. The name of the program must be the first eight characters. Additional characters are not used by the manager but are passed to the program. These extra characters can be used for programs which minimize operator interaction by allowing the operator to enter a complete request on the menu screen and thus avoid the need for intermediate menus or prompts.

Output Buffer Address

This is the address of a buffer which is also used for two purposes. It contains "default data" to be written by ACTION into the unprotected portions of the screen. That is, a call to SETPAN reads concatenated data defined by $IMAGE into the Output Buffer. A subsequent call to ACTION writes the data from the buffer to the unprotected fields. If more characters are in the Output Buffer than there are unprotected positions on the screen, the excess characters are lost. The Output Buffer is set to blanks after a return from CALL ACTION.

The Output Buffer is also used for passing data between programs, when one LINKs to another. Prior to a LINK to another program, a program may store data in the Output Buffer. The second program will find that data in its Output Buffer.

Terminal Environment Block (TEB)

This is the address of a control block which contains information about the terminal that initiated this program.

Interrupt Information Byte (IIB)

This is the address of a word (16 bits) in storage containing, in the low-order half of the word, a code indicating the status of the prior I/O to or from this terminal.

For a 4978/4979/3101, this is always the numeric value representing the interrupting key which was pressed as part of an operator response. Since there is no WRITE available to 4978/4979/3101 this code never reflects the status of an output operation.

For ASCII terminals, this value is the return code from a READTEXT operation issued by the Multiple Terminal Manager.

The following figure provides a programmer's view of the contents of the Input and Output Buffers at various stages in the terminal manager operation cycle.

BUFFER CONTENTS UPON ENTRY TO APPL PROGRAM	INPUT BUFFER	OUTPUT BUFFER
FROM CALL ACTION	UNPROTECTED DATA READ FROM SCREEN	BLANKS (X'40')
FROM CALL LINK	BLANKS (X'40')	UNCHANGED FROM CALLING PGM
FROM CALL LINKON	UPROTECTED DATA READ FROM SCREEN	BLANKS (X'40')
FROM CALL CYCLE	BLANKS (X'40')	UNCHANGED
FROM CALL SETPAN	PROTECTED DATA FROM NEW SCREEN PANEL	UNPROTECTED DATA FROM NEW SCREEN PANEL

ACTION TAKEN UPON BUFFER CONTENTS BY FUNCTION CALL	INPUT BUFFER	OUTPUT BUFFER
BY CALL ACTION	WRITTEN PROTECTED IF CALL SETPAN HAD BEEN ISSUED	WRITTEN INTO UNPROTECTED FIELDS ON SCREEN
BY CALL LINKON	SAME AS BY CALL ACTION	SAME AS BY CALL ACTION
BY CALL LINK	SAME AS BY CALL ACTION	SAVED
BY CALL CYCLE	SAME AS BY CALL ACTION	SAME AS BY CALL LINK

Program Contents During 4978/4979/3101 Buffer Operation

Controlling the Logic Flow of Programs

Program Calling Parameters: Application programs use the EDL parameter passing facilities for passing parameters to the Multiple Terminal Manager.

For example:

```
         CALL   SETPAN,(SCRNX),(RC)
           •
           •
           •
  SCRNX  DC     CL8'SCRN10' SCREEN PANEL NAME
  RC     DC     F'0'        RETURN CODE FIELD
           •
           •
           •
```

This example passes the addresses of the screen name and return code field to the Multiple Terminal Manager screen manager.

Five callable functions are provided to control I/O to terminals and to control the execution of user programs. They are ACTION, LINK, LINKON, WRITE, and CYCLE.

ACTION and WRITE perform terminal I/O. LINK and LINKON control the loading of user programs to service the current or the next operator input, respectively. CYCLE provides a method of time sharing the program area.

CALL ACTION

```
CALL ACTION,(buffer),(length),(crlf)
```

All parameters for all languages are one 16-bit word in length, unless otherwise specified as character strings.

ACTION parameters:

buffer   A buffer of EBCDIC text of any length.

length   The number of characters in the buffer.

crlf   A binary value of 1 specifies that the terminal is to be issued a carriage return and line feed (CRLF) after the message is sent. Any other value results in no CRLF being sent.

For ASCII terminals this routine:

1. Writes the specified buffer contents to the terminal

2. Waits for the operator to respond

3. Reenters the current program at its next sequential instruction after the CALL ACTION

```
CALL ACTION
```

The Input Buffer is written protected to the screen if a CALL SETPAN or CALL CHGPAN command was executed previously during this transaction. The Output Buffer is written into the unprotected fields on the screen. The terminal then waits for operator input and reenters the current program (with operator input in the Input Buffer) at the next sequential instruction after CALL ACTION. (For IBM 4978/4979/3101 displays, a parameter list is ignored if specified.)

CALL LINK

```
CALL LINK,(pgmname)
```

LINK causes the named program to be loaded and executed (replacing the current program).

During the link, IBM 4978/4979/3101 terminals for which a SETPAN or CHGPAN has been issued will have the Input Buffer displayed. The Output Buffer is passed unchanged to the next program.

The program being linked to receives the standard parameter list for application programs (Input Buffer, Output Buffer, TEB, IIB).

LINK parameters:

pgmname An 8-byte (right padded with blanks, if necessary) program name.

If the program name is invalid, control returns to the next sequential instruction in this program; therefore, any return to the user from CALL LINK is an error condition.

CALL LINKON

```
CALL LINKON,(pgmname)
```

LINKON provides a combined ACTION and LINK function. When the operator has entered the requested information, the named program is entered at its entry point with the Input Buffer containing the unprotected characters from the screen or all entered characters from an ASCII terminal.

LINKON parameters:

pgmname An 8-byte (right padded with blanks, if necessary) program name.

CALL CYCLE

```
CALL CYCLE
```

When CALL CYCLE executes, the program may be swapped out as all other applications are given an opportunity to process inputs. The Output Buffer is preserved and the contents of the Input Buffer are lost (set to blanks). If a SETPAN or CHGPAN has been executed, the screen in the Input Buffer is displayed protected at this time to free up the Input Buffer.

After all other terminals have processed their inputs, the program is swapped into the program area and control is returned to the next sequential instruction after the CALL CYCLE.

Communicating with ASCII Terminals

The Multiple Terminal Manager provides CALL WRITE to satisfy operator interaction to ASCII terminals for multiple output messages.

CALL WRITE

```
CALL WRITE,(buffer),(length),(crlf)
```

CALL WRITE is for ASCII terminals only. It writes the specified buffer contents to the current terminal. While writing, other terminals are permitted to operate. When I/O is complete, the current user program is reloaded and reentered at the next sequential instruction after CALL WRITE.

WRITE parameters:

buffer A buffer of EBCDIC text of any length.

length One word containing the number of characters in the buffer.

crlf A binary value of 1 specifies that the terminal is to be issued a carriage return and line feed (CRLF) after the message is sent. Any other value results in no CRLF being sent.

If CRLF is not equal to 1, trailing blanks in the buffer are transmitted to permit you to position the terminal cursor for the next message or operator response.

The Multiple Terminal Manager does not keep track of current terminal cursor or carriage position. No CRLF is inserted if, due to messages without CRLF or a buffer size larger than the terminal line length, the right margin is reached.

Upon completion, the contents of the buffer are unchanged.

If executed by an IBM 4978/4979/3101, control returns immediately to the caller.

No operator entry is permitted (see ACTION if operator entry is required).

Communicating with IBM 4978/4979/3101 Displays

The Multiple Terminal Manager provides the following callable functions for specific control of the IBM 4978/4979/3101 display:

- SETPAN - Retrieve a screen image
- CHGPAN - Reset the unprotected character count
- SETCUR - Set the cursor position
- BEEP - Sound the audible alarm
- FTAB - Build unprotected input field table

CALL SETPAN

```
CALL SETPAN,(dsname),(return code)
```

This routine causes the specified screen format to be read into the Input Buffer (replacing the last operator input) and sets a switch to cause the screen format to be written to the screen during the next output cycle. Any nulls (X'00') in the screen image will be written unprotected. All other characters will be written protected. In addition to the 1920-byte screen being placed into the Input Buffer, any unprotected defaults that were specified when the screen was built, are moved, concatenated, into the Output Buffer. The cursor position for the next display after SETPAN will be set at the first unprotected character position. Before executing a CALL SETPAN, be sure to save desired information which is in the buffers, as they will be overlaid by the screen definition.

SETPAN parameters:

dsname The data set name of the desired screen format in the SCRNS volume.

return code A word to receive the return code. The following is a list of the possible return codes:

-1 = Successful, new screen in buffer.

-500 = This terminal is not an IBM 4978/4979/3101. No action has been taken.

-501 = Screen data set not found.

1 = Warning, data set does not contain a valid $IMAGE screen. Input Buffer has been set to unprotected nulls (X'00') and cursor position set to (0,0).

2 = Warning, too many unprotected default characters in the screen definition. The number of default characters that will be displayed has been truncated.

This return code is received if there are no default unprotected characters in the screen. The $IMAGE utility initially assigns 1920 unprotected characters to a screen. This number is unchanged if the data (unprotected) was not modified using the edit mode of the $IMAGE utility.
Use PF2 with $IMAGE to enter default data.

Other = Return code from disk READ.
See the Language Reference.

CALL CHGPAN

```
CALL CHGPAN
```

After a CALL SETPAN, the protected characters of the screen specified have been placed in the Input Buffer. You can add data to the image by changing the Input Buffer prior to the next output cycle, and the data is displayed as protected data. If you do this, you must also CALL CHGPAN to inform the manager that it needs to recompute the location of the first unprotected character position in the current screen and the count of unprotected characters. The cursor position is set to the first unprotected character position. CHGPAN also sets the SETPAN indicator thus allowing applications to dynamically develop protected screens.

Dynamic Screen Modification and Creation: By direct manipulation of the Input and Output Buffers it is possible to modify screens built by $IMAGE and retrieved by SETPAN. It is also possible to create screen images dynamically.

The Input Buffer contains a 24 X 80 (1920) byte image of the screen wherein unprotected fields are represented by null (zero) fields. The other bytes will be displayed as protected characters. Additional protected characters may be added to the screen image simply by inserting them in the appropriate positions in the Input Buffer. Additional unprotected fields can be added to the screen image by inserting nulls appropriately. Both protected and unprotected fields can be modified, deleted, extended, or contracted by the correct insertion of characters in the desired portions of the Input Buffer. If this is performed, it is necessary to call CHGPAN in order to indicate screen image modification.

It is also possible to modify the contents of the Output Buffer. For example, after a call to SETPAN, the Output Buffer may be modified to allow the program to modify or supply default data. Furthermore, if the Input Buffer is filled with null characters, the contents of the Output Buffer will be displayed "as is". CHGPAN must be called whenever the Input Buffer is modified.

To create a new screen, fill up the Input Buffer as desired with protected and unprotected characters, blanks, and null fields. Place default data in the Output Buffer, and call CHGPAN.

CALL SETCUR

```
CALL SETCUR,(row),(column)
```

CALL SETCUR specifies (overrides) the position at which the cursor is to be displayed for the next output cycle.

SETCUR parameters:

row — One-word value representing the row position, 0-23.

column — One-word value representing the column position, 0-79.

The cursor position for each screen displayed on a terminal is set to first unprotected character position by default. This function permits you to override the cursor position for the output only.

CALL BEEP

```
CALL BEEP
```

CALL BEEP causes the audible alarm (if available) to be sounded following the next output cycle.

The IBM 4979 terminal has no audible alarm and ignores this request.

When executed for an ASCII terminal, this request causes the next output line to be followed by a bell character.

CALL MENU

```
CALL MENU
```

CALL MENU immediately aborts the current dialog and causes the terminal's menu screen (or request for program name message) to be displayed.

The operator can cause this at any time by pressing PF3 at an IBM 4978/4979/3101 or by typing OUT on an ASCII terminal while in a dialog.

CALL FTAB

```
CALL FTAB,(table),(size),(return code)
```

FTAB sets up a table which describes the unprotected (input) fields placed in the Input Buffer after a SETPAN or a CHGPAN has been executed. The table is a sequence of 3-word entries which describe unprotected (input) fields. This is useful for such functions as setting the cursor.

Note: The FTAB function must be included in the application link for it to be available. See the section on "Program Preparation" on page 164 for information.

FTAB parameters:

table — A sequence of 3-word entries which describe the unprotected fields of the screen image in the Input Buffer. Each entry contains the starting row and column positions, and the length (in bytes) of a field. Unused entries in a table will be set to zero. The format is as follows:

```
table     row    (first field)
          column   "     "
          length   "     "
table+6   row    (second field)
          column   "     "
          length   "     "
table+12  row    (third field)
          column   "     "
          length   "     "
  :         :          :
  :         :          :
  :         :          :
```

size — A word which gives the number of 3-word entries in the table.

return code — A word for the return of a status code. The return codes are as follows:

-2	=	FTAB code not linked with application
-1	=	successful return
1	=	no data fields found
2	=	warning, table truncated

CALL FAN

```
CALL  FAN
```

FAN performs no operation ("no-op").

Accessing the Terminal Environment Block

Although the terminal environment block (TEB) can be accessed directly (since its address is a user program parameter), the user program may find it more convenient with the following function to determine the attributes of the calling terminal.

CALL CDATA

```
CALL CDATA,(type),(userid),(userclass),(termname),(buffersize)
```

This subroutine returns data concerning the terminal currently executing the program.

CDATA parameters:

type — A word specifying the terminal type:

0 = Terminal is an IBM 4978, 4979, or 3101
2 = Terminal is an ASR 33/35 or equivalent

userid — The 4-byte value set by the SIGNON program when the current terminal signed on. If the current terminal does not use SIGNON, this value is meaningless.

userclass — The 4-byte value set by the SIGNON program when the current terminal signed on. If the current terminal does not use SIGNON, this value is meaningless.

termname — The 8-byte (right padded with blanks, if necessary) name of the current terminal.

buffersize — The length of the terminal's I/O buffer. For IBM 4978/4979/3101 terminals, this is the number of unprotected characters in the last screen which was set using SETPAN.

Disk File Support

All requests for disk/diskette I/O are by means of a call to the FILEIO routine. FILEIO provides the following functions:

- Automatic open of the requested data set.

- Direct access support for non-Indexed Access Method files, where records are accessed by a relative record number (RRN).

- Support for Indexed Access Method files, providing a high-level language interface to most Indexed Access Method services.

- Data integrity, via automatic close at terminal manager shutdown and automatic write back of data buffers.

If Indexed Access Method files are used, the Event Driven Executive / Indexed Access Method (5719-AM3) is required.

Automatic OPEN/CLOSE: FILEIO automatically controls the opened/closed status of a data set. Thus data set names must not be coded on the PROGRAM statement of Multiple Terminal Manager programs. If the data set is not open when a request is made, the data set is opened. Since many terminals can require many data sets, both the same and different, the user can find that there was no storage available to open a requested data set. In order to avoid this situation, a limit is set for the number of open data sets. In the Multiple Terminal Manager default system, space is allocated for 14 open data sets. When this limit is reached, the least recently accessed data set is closed, and the space it required is reused. A data set is not available for automatic close if it has an update pending. The user can adjust the maximum number of open data sets by changing the file table in the Multiple Terminal Manager source module CDMCOMMN.

Indexed File Support: FILEIO provides an interface to the Event Driven Executive Indexed Access Method.

Programs written in high-level languages can access indexed files by calling the FILEIO routine. The functions supported are listed under the heading "Indexed File Request Types" in this section. An Indexed Access Method file must be created. For information on how to create an Indexed Access Method file, see the System Guide.

Some features of the indexed file support include the following:

- Records can be retrieved sequentially or by key.
- The key can be a generic key, that is, the first n bytes of the actual key.
- Records can be added or deleted by key.
- It takes the same length of time to retrieve added records as original records.

If an application requires access to a file sequentially, and also directly by alphameric keys, indexed files are required.

Since Indexed Access Method files are owned by a supervisor task, using the ¢C command to cancel the terminal manager does not close these files. For data integrity, use the DISCONNECT,ALL command described in the section "Operator Interface" on page 158.

Additional information on indexed files and indexed file request types is discussed in the <u>System Guide</u> under "Indexed Access Method".

CALL FILEIO

FILEIO provides the facility to access previously created files via the call interface described earlier. These files must have been previously defined and loaded.

```
CALL FILEIO,(fca),(buffer),(return code)
```

FILEIO parameters:

fca The file control area. The address of a table with the parameters describing the requested operations:

0	Request Type	A 4-byte EBCDIC request, for example: CL4'READ'
4	Data Set Name	An 8-byte EBCDIC data set name
12	Key Relation Operator	A 2-byte EBCDIC key relation operator, the characters "GT", "GE", "EQ" (indexed files only)
	or	
	Number of Records	A word value for the number of 256-byte records to be read or written by this call (direct files only)
14	Key Length	A word specifying the length of the key to be used for retrieval. If the length specified is less than the actual key length, the first n bytes of the key are used (indexed files only).
16	Key Location	The address of the key (FORTRAN, EDL, and PL/I) to be used (indexed files only). For COBOL, the value must be 0.
	or	
	EOD Record Number	The system maintained logical EOD record number passed back to the application after each direct file READ or WRITE (direct files only).
18	Reserved	
20	Relative Record Number	A word value for the RRN. The first record is record number 1 (direct files only).
22	Volume Name	A 6-byte EBCDIC volume name
28	Key Field	The key to be used (COBOL indexed files only), if Key Length non-zero.

buffer The address of the user program I/O buffer. This is in the user program space. FILEIO and Indexed Access Method have their own buffers.

return code The address of the 2-byte field to contain the return code passed back by FILEIO. This can be a FILEIO return code, an Event Driven Executive system error code or an Indexed Access Method code.

File Control Area (FCA): The entire FCA must be mapped for Event Driven Language, FORTRAN, PL/I, and COBOL except as noted.

0	REQUEST TYPE
4	DATA SET NAME
12	KEY REL OP OR NUMBER OF RECORDS
14	KEY LENGTH
16	KEY LOCATION OR EOD RECORD NUMBER
18	RESERVED
20	RELATIVE RECORD NUMBER
22	VOLUME NAME
28	KEY FIELD (COBOL index files only) (size defined in KEY LENGTH field) ///

Indexed File Request Types: The indexed file request types and functions are defined as follows:

RELS Release from sequential processing mode

RELR Release a record held for update

PUTU Put operation, update mode

PUTD Put operation, delete mode

PUTN Put operation, new mode adds a record to the file

GETD Get operation, direct read

GETS Get operation, sequential read

IDEL Delete operation

ICLS Close an indexed data set

GTDU/GTRU Direct get, update mode

GTSU Sequential get, update mode

Note: GTDU and GTRU are identical in the operation they perform.

Direct File Request Types: The direct file request types and functions are defined as follows:

READ Read the record defined by the RRN field of the FCA into the user-provided buffer

WRIT Write the record defined by the RRN field of the FCA into the major user-provided buffer

SEOD Set the system maintained EOD pointer to the record number provided in the relative record number field of the FCA

FILEIO Return Codes

Return Code	Description
-1	Successful
201	Data set not found
202	Volume not found
203	No file table entries are available; all have updates outstanding
204	I/O error reading volume directory
205	I/O error writing volume directory
206	Invalid function request type (this is returned for a valid Indexed Access Method function if the Indexed Access Method link module is not linked with the Multiple Terminal Manager)
207	Invalid key operator
208	SEOD record number greater than data set length

Other return codes not shown above are returned by the Indexed Access Method or by the Event Driven Executive data management support.

Event Driven Executive Direct File I/O Considerations

The Multiple Terminal Manager FILEIO interface to Event Driven Executive direct file support allows the user to access records by specifying relative record numbers (RRNs). Normally, a direct file may be viewed as a sequence of records starting with RRN=1 and continuing until the end of data record number, that is, RRN=EOD. The end of data record number is returned in the file control area (FCA) after each READ or WRIT (write) request. It may be set by a "set end of data" (SEOD) request.

No effort is made to ensure the data integrity of Event Driven Executive direct files involving concurrent access to the same record. That is, no record locking is performed. However, it is possible to ensure that Multiple Terminal Manager applications cannot access the same record concurrently by ensuring that application is not swapped out of the application area at an inappropriate moment. (An application is only vulnerable to swap out during an ACTION, LINK, LINKON, WRITE, or CYCLE). That is, an application can read, modify, and write a particular record and be assured that another Multiple Terminal Manager application will not alter the record at the same time.

This technique only applies to applications competing for concurrent access under a single copy of Multiple Terminal Manager. Other disciplines must be used if other applications are involved.

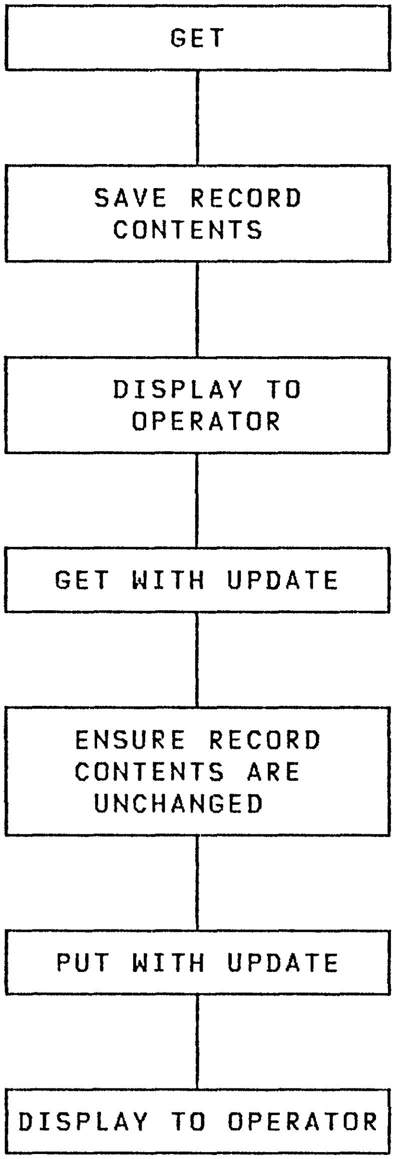
If a user desires sequential access to a direct file, it is the user's responsibility for incrementing the RRN field and ensuring it does not exceed the end of data record number. One technique involves reading the file to get the end of data record number, and then entering a loop, as in the example on the following page where a file "A,EDX002" is processed.

```
* GET EOD  (RETURNED BY READ OPERATION)
        MOVE RRN,1
        CALL FILEIO,(FCA),(BUFFER),(RC)
* PROCESS FILE FROM RRN=1 TO EOD
        MOVE RRN,0
        DO   EOD,TIMES
          ADD  RRN,1
          CALL FILEIO,(FCA),(BUFFER),(RC)
           ....
        ENDDO
        ....
* FILE CONTROL AREA
FCA     EQU  *
REQTYPE DATA   CL4'READ'
DSNAME  DATA   CL8'A'
NUMREC  DATA   F'1'
        DATA   F'0'
EOD     DATA   F'0'
        DATA   F'0'
RRN     DATA   F'0'
VOLNAME DATA   CL6'EDX002'
```

FILEIO Indexed Access Method Considerations

FILEIO uses the parameters provided to create a parameter list for an Indexed Access Method supervisor call. Therefore, it is important to understand Indexed Access Method operation, as explained in the section "Indexed Access Method" of the <u>System Guide</u>.

FILEIO executes a file cleanup routine after each user program ACTION, LINK, LINKON, WRITE, or CYCLE. If any record locks have not been released, the cleanup routine causes these records to be released in order to prevent any deadlock situations. A procedure to ensure data integrity on update is illustrated as follows:



If sequential processing has been initiated on any indexed files, the FILEIO cleanup routine also releases those files from sequential processing mode. Thus, in order to continue sequential processing from the same key, applications should save the last key before issuing an ACTION, LINK, LINKON, WRITE or CYCLE.

An indexed file may be scanned from beginning to end by use of a sequence of "get sequential" (GETS) operations. The first GETS in a sequence thereof should specify a key of all nulls (X'00') and a key relational operator of greater than (C'GT'). When executed, this initial GETS operation will receive the first record in the file (following the record, if any, for which the key is all nulls.) Subsequent GETS will retrieve the records following the first, in sequence.

After a DISCONNECT,ALL command is issued, FILEIO executes a termination routine before the Multiple Terminal Manager terminates. This termination routine closes all remaining open Indexed Access Method files. This causes any control information and records remaining in the Indexed Access Method internal storage buffers to be written to disk.

Following is a mapping of Multiple Terminal Manager/Indexed Access Method request types to the actual Indexed Access Method function.

MULTIPLE TERMINAL MANAGER REQUEST	INDEXED ACCESS METHOD FUNCTION
RELS	ENDSEQ
RELR	RELEASE
PUTU	PUTUP
PUTD	PUTDE
PUTN	PUT
GETD	GET
GETS	GETSEQ
IDEL	DELETE
ICLS	DISCONN
GTDU/GTRU	GET/UPEQ,UPGT,UPGE
GTSU	GETSEQ

Note: The Indexed Access Method is accessed by the Multiple Terminal Manager and, therefore, the application programs that run under the Multiple Terminal Manager will not need to include the Indexed Access Method equates and, must not be LINKed with Indexed Access Method link module.

Programming Considerations

Multiple Terminal Manager applications are processed as initial tasks of a program which execute within the program manager's overlay area. On the first execution of a program during a transaction, the program is brought into the overlay area via a LOAD instruction. Then, when the program returns control to the Multiple Terminal Manager via a CALL ACTION, WRITE, CYCLE, MENU, LINK or LINKON, the Multiple Terminal Manager dequeues the program from Event Driven Executive via a DETACH instruction. Also, if the program returned via a CALL ACTION, WRITE or CYCLE, the Multiple Terminal Manager writes the program out to the MTMSTORE data set. The overlay area is then free for use by other programs. When the Multiple Terminal Manager is ready to re-execute that program for subsequent processing of the transaction, the program manager reads the program into the overlay area and requeues that program to Event Driven Executive via an ATTACH instruction.

Thus, Multiple Terminal Manager application programs should adhere to the following conventions:

- No subtasks should be active across calls to the Multiple Terminal Manager.

- No system-wide resources should be enqueued across calls to the Multiple Terminal Manager.

- Application programs cannot use overlays.

- Application programs must be written as subroutines named MTMSUB and designed to receive four parameters at initiation.

- Application programs should utilize the Multiple Terminal Manager for all terminal and disk I/O.

- All other I/O should be complete prior to any call to the Multiple Terminal Manager.

- Application programs should terminate only via calls to the Multiple Terminal Manager and should not issue any PROGSTOP, ENDTASK, or DETACH instructions.

- Error exit routines should terminate via a CALL MENU.

- Changes affecting the SCRNS or PRGRMS volumes during the Multiple Terminal Manager session will not be effective until the Multiple Terminal Manager is terminated and reloaded.

Event Driven Language Programming Considerations

An Event Driven Language application, which must be written as a subroutine, must be defined to accept four parameters. In addition, the Multiple Terminal Manager functions must be identified via the EXTRN statement. The subroutine name MTMSUB must also appear on the ENTRY statement. For example:

```
      ENTRY     MTMSUB
      EXTRN     ACTION,BEEP,CYCLE,SETCUR,CHGPAN,CDATA,MENU
      EXTRN     SETPAN,FILEIO,LINK,LINKON,WRITE,FTAB,FAN
      SUBROUT   MTMSUB,INPUT,OUTPUT,TEB,IIB
```

The interface used by the Multiple Terminal Manager stub CDMEMAIN for calling the Event Driven Language subroutine is via the CALL instruction.

For example, the statement to call SETPAN is:

```
      CALL SETPAN,(MENUNAME),(RC)
```

This statement would result in the addresses of MENUNAME and RC being passed to the Multiple Terminal Manager.

The syntax for calling Multiple Terminal Manager functions in the Event Driven Language is:

```
  CALL ACTION
  CALL ACTION,(BUFFER),(LENGTH),(CRLF)
  CALL LINK,(PROGRAM)
  CALL LINKON,(PROGRAM)
  CALL CYCLE
  CALL WRITE,(BUFFER),(LENGTH),(CRLF)
  CALL SETPAN,(DSNAME),(RC)
  CALL CHGPAN
  CALL SETCUR,(ROW),(COLUMN)
  CALL BEEP
  CALL MENU
  CALL CDATA,(TERMTYPE),(USERID),(USERCLASS),(TERMNAME),(BUFSIZ)
  CALL FILEIO,(FCA),(BUFFER),(RC)
  CALL FTAB,(TABLE),(SIZE),(RC)
  CALL FAN
```

FORTRAN Programming Considerations

A FORTRAN application, which must be written as a subroutine, must be defined to accept four parameters, for example:

```
      SUBROUTINE MTMSUB(INPUT,OUTPUT,TEB,IIB)
```

The interface used by the Multiple Terminal Manager stub CDMFMAIN for calling the FORTRAN subroutine is via the Event Driven Language CALLFORT instruction. For interfacing to the Multiple Terminal Manager, FORTRAN applications utilize the FORTRAN CALL statement for calling Event Driven Executive subroutines.

For example, the statement to call SETPAN is:

```
      CALL EDX(SETPAN,2,IADDR(MENUNAME),IADDR(RC))
```

This statement would result in the addresses of MENUNAME and RC being passed to the Multiple Terminal Manager.

All Multiple Terminal Manager functions which the application calls must be declared as EXTERNAL, for example:

```
      EXTERNAL SETPAN,ACTION,MENU,FILEIO
```

The syntax for calling Multiple Terminal Manager functions in FORTRAN is:

```
  CALL EDX(ACTION,0)
  CALL EDX(ACTION,3,IADDR(BUFFER),IADDR(LENGTH),IADDR(CRLF))
  CALL EDX(LINK,1,IADDR(PROGRAM-NAME))
  CALL EDX(LINKON,1,IADDR(PROGRAM-NAME))
  CALL EDX(CYCLE,0)
  CALL EDX(WRITE,3,IADDR(BUFFER),IADDR((LENGTH),IADDR(CRLF))
  CALL EDX(SETPAN,2,IADDR(DSNAME),IADDR(RET-CODE))
  CALL EDX(CHGPAN,0)
  CALL EDX(SETCUR,2,IADDR(ROW),IADDR(COLUMN))
  CALL EDX(BEEP,0)
  CALL EDX(MENU,0)
  CALL EDX(CDATA,5,IADDR(TERM-TYPE),IADDR(USERID),
              IADDR(USER-CLASS),IADDR(TERM-NAME),IADDR(BUF-SIZE))
  CALL EDX(FILEIO,3,IADDR(FILE-CONTROL-AREA),IADDR(BUFFER),
              IADDR(RET-CODE))
  CALL EDX(FTAB,3,IADDR(TABLE),IADDR(SIZE),IADDR(RC))
  CALL EDX(FAN,0)
```

COBOL Programming Considerations

The PROGRAM-ID for all Multiple Terminal Manager COBOL applications must be "MTMSUB". In addition, all parameters passed to the Multiple Terminal Manager must be level 01 or 77. The four parameters passed to the application, Input Buffer, Output Buffer, TEB, and IIB must be defined in the program's LINKAGE SECTION. Refer to "COBOL Sample Prog1" on page 193 for an example. The PROCEDURE DIVISION must contain the USING clause followed by the names given to the Input Buffer, Output Buffer, TEB, and IIB, in that order.

For CALL FILEIO, if key location equals 0 and key length not equal to 0, the file manager assumes that the key is immediately following the FCA. This is primarily to facilitate COBOL programs, which cannot code addresses.

The following example shows an FCA for indexed files which would read a record associated with a 4-character key "XXXX".

```
01  FILE-CONTROL-AREA.
  05  REQUEST-TYPE  PIC X(4) VALUE "GETD".
  05  DATA-SET-NAME PIC X(8).
  05  KEY-REL-OP    PIC XX   VALUE "EQ".
  05  KEY-LENGTH    PIC S999 COMP VALUE 4.
  05  KEY-LOCATION  PIC S999 COMP VALUE 0.
  05  FILLER        PIC X(4).
  05  VOLUME-NAME   PIC X(6).
  05  KEY           PIC X(4) VALUE "XXXX".
```

For interfacing to the Multiple Terminal Manager, COBOL applications utilize the COBOL CALL statement for calling subroutines.

For example the statement to call SETPAN is:

```
CALL "SETPAN" USING SCREEN, RC.
```

This would result in the addresses of SCREEN and RC being passed to Multiple Terminal Manager.

The WORKING-STORAGE SECTION would have the following:

```
77  SCREEN PICTURE X(8) VALUE "SCRNNAME".
77  RC PICTURE 99 COMP.
```

The syntax for calling Multiple Terminal Manager functions in COBOL is:

```
  CALL "ACTION".
  CALL "ACTION" USING BUFFER, LENGTH, CRLF.
  CALL "LINK" USING PROGRAM-NAME.
  CALL "LINKON" USING PROGRAM-NAME.
  CALL "CYCLE".
  CALL "WRITE" USING BUFFER, LENGTH, CRLF.
  CALL "SETPAN" USING DATA-SET-NAME, RETURN-CODE.
  CALL "CHGPAN".
  CALL "SETCUR" USING ROW, COLUMN.
  CALL "BEEP".
  CALL "MENU".
  CALL "CDATA" USING TERMINAL-TYPE, USER-ID, USER-CLASS,
        TERMINAL-NAME, BUFFER-SIZE.
  CALL "FILEIO" USING FILE-CONTROL-AREA, BUFFER, RETURN-CODE.
  CALL "FTAB" USING TABLE, SIZE, RETURN-CODE.
  CALL "FAN".
```

PL/I Programming Considerations

A PL/I application must be named MTMSUB, and defined to accept four parameters:

```
      MTMSUB:  PROCEDURE (INPUT_BUFFER,
                          OUTPUT_BUFFER,
                          TEB,
                          PF_KEY);
```

INPUT_BUFFER, OUTPUT_BUFFER, and TEB should usually be declared as structures. PF_KEY should be declared BINARY FIXED (15).

All Multiple Terminal Manager functions which the application calls must be declared as ENTRY, for example:

```
      DECLARE
        (SETPAN, ACTION, MENU, SETCUR, BEEP, FILEIO)
        ENTRY;
```

The syntax for calling Multiple Terminal Manager functions in PL/I is:

```
  CALL ACTION;
  CALL ACTION(BUFFER, LENGTH, CRLF);
  CALL LINK(PROGRAM_NAME);
  CALL LINKON(PROGRAM_NAME);
  CALL CYCLE;
  CALL WRITE(BUFFER, LENGTH, CRLF);
  CALL SETPAN(DATA_SET_NAME, RETURN_CODE);
  CALL CHGPAN;
  CALL SETCUR(ROW, COLUMN);
  CALL BEEP;
  CALL MENU;
  CALL CDATA(TERMINAL_TYPE, USER_ID, USER_CLASS,
             TERMINAL_NAME, BUFFER_SIZE);
  CALL FILEIO(FILE_CONTROL_AREA, BUFFER, RETURN_CODE);
  CALL FTAB(TABLE, SIZE, RETURN_CODE);
  CALL FAN;
```

For WRITE, the buffer variable must be a character string. For FTAB, the table variable must be an array. All variables should be declared as STATIC whenever possible.

SIGNON

A sample SIGNON program is distributed with the Multiple Terminal Manager. If the terminal requires sign-on, the IBM supplied SIGNON program displays the SIGNON screen and does a CALL ACTION to obtain the user ID and password.

The user must enter the sign-on ID (8 bytes alphanumeric) and a password (4 bytes alphanumeric). This data will be passed to the SIGNON program in the Input Buffer as it would be to any other program. The sign-on ID and password are validated against the SIGNON file. If valid, the sign-on is complete and the primary menu is displayed. If invalid, a bad return code is set (=1) and the SIGNON program is reloaded by Multiple Terminal Manager. The two sign-on ID records in the distributed SIGNON file are:

SIGNON ID	PASSWORD
11111111	1111
22222222	2222

You can add additional records with the Event Driven Executive text editor.

In addition to the four parameters passed to all applications, the SIGNON routine receives a fifth parameter which is the address of the sign-on control area. The contents of the sign-on control area are as follows:

- RC - 2-byte return code indicating to the system the action to be taken.

- USERID - Four bytes handled exactly like USERCLASS.

- USERCLASS - Four bytes set by user sign-on program which will be saved and passed as a parameter to the sign-off program when the current user signs off. These four bytes are contained in the TEB and are also available to any standard program to validate the user if desired.

  0 = valid sign-on, display the terminal's menu screen.
  1 = invalid sign-on, redisplay the sign-on screen.

USERCLASS and USERID are not used by the Multiple Terminal Manager. They are saved in the TEB and reported via CALL CDATA to requesting programs from this terminal while the current sign-on is active.

SIGNOFF

A sign-off program is not provided with the default system; however, provisions are made within the Multiple Terminal Manager to invoke a sign-off program. If you write a sign-off program, it will be passed the same parameters as the sign-on program.

If these programs exist, they must meet the following considerations:

- SIGNON and SIGNOFF are optional. Either SIGNON alone or SIGNON and SIGNOFF can be in the system. If they are in the system, the names must be SIGNON and SIGNOFF. If they are not in the system, the names SIGNON and SIGNOFF must not be used for other user-written programs.
- The SIGNOFF program is invoked when the PF3 key is entered from the menu screen.
- SIGNON/SIGNOFF cannot be executed from the menu screen by entering the program name.
- Individual terminals can be generated to require or not require sign-on. If the user does not include a SIGNON program, any terminals marked requiring sign-on are unusable since there is no way to validate sign-on attempts.
- SIGNON/SIGNOFF can use CALL CDATA to obtain the terminal name and other terminal information.
- When complete, SIGNON/SIGNOFF should perform a CALL MENU to return to the Multiple Terminal Manager. Note that a return code should be set in the RC field by the SIGNON program before issuing the CALL MENU. The RC field is ignored by the Multiple Terminal Manager for the SIGNOFF program.
- The use of USERCLASS and USERID is optional.
- LINK and LINKON can not be used.
- PF3 entered by the operator during SIGNON, will cause the current SIGNON session to be terminated and a new SIGNON session to be started.

Multiple Terminal Manager Initiation and Termination

The Multiple Terminal Manager can be initiated from any terminal defined to the Event Driven Executive system by entering the $L $MTM,PRGRMS command. This command starts the Multiple Terminal Manager program manager. The program manager then initiates a terminal server for each terminal specified in the TERMINAL file. Upon completion of initiation, the IPL screen, IPLSCRN, is displayed at each of the Multiple Terminal Manager terminals. IPLSCRN specifies that the operator press the ENTER key in order to display either the sign-on or menu screen.

The Multiple Terminal Manager is terminated by disconnecting all terminals using the DISCONNECT command. The $C command should not be used to terminate Multiple Terminal Manager tasks.

Signing On

If sign-on is specified for the terminal, then the sign-on screen, SIGNON, is displayed following the IPL screen. The sign-on screen requires that the operator enter a sign-on and password. After sign-on processing is completed, the menu screen is displayed.

Program Initiation and Termination

After Multiple Terminal Manager initiation and sign-on processing are completed, the menu screen is displayed. The menu screen is the screen from which the operator can initiate transactions. A transaction is initiated by the operator entering either a program name or pressing a PF key when the menu screen is displayed. A PF key initiates program PFnn, where nn reflects the number of the PF key pressed. If data is entered, the Multiple Terminal Manager considers the first eight bytes to be a program name.

After a transaction is initiated, the operator can terminate it by pressing the PF3 key. Upon termination of the transaction, the menu screen is redisplayed. A subsequent pressing of the PF3 key from the menu screen causes the sign-on screen to be redisplayed if sign-on is specified for that terminal. Otherwise, PF3 will be a "no-op" and the menu screen remains displayed.

Utilities

Disconnect: Terminals can be disconnected from the Multiple Terminal Manager or the Multiple Terminal Manager can be terminated via the DISCONNECT facility. DISCONNECT is invoked from the menu screen by keying in either DISCONNECT, DISCONNECT *, DISCONNECT,termname, or DISCONNECT,ALL. If DISCONNECT or DISCONNECT * is entered, the terminal upon which that request was entered is disconnected. If a referenced terminal is in a transaction, that transaction is allowed to complete. When the terminal returns to MENU state, it is automatically signed off and immediately displays the YOU ARE DISCONNECTED message.

If DISCONNECT,ALL is specified, all terminals are disconnected. When the last terminal is truly disconnected, whether via DISCONNECT,ALL or separate DISCONNECTs, the manager task is stopped. This is the only method that should be used to terminate the Multiple Terminal Manager.

Note that to enter this command from a screen, the terminal's menu screen must contain at least 19 unprotected characters.

While a terminal continues in a transaction with disconnect pending, the audible alarm is sounded after every interaction to tell the operator that a disconnect is pending.

Reconnect: If the referenced terminal is disconnected, it is reconnected using RECONNECT,ALL or RECONNECT,termname in a signed-off status (if applicable). If the terminal is not disconnected, the command is ignored. The reconnect should be issued from a terminal other than the disconnected terminal. The program name of this command is RECONNEC.

Programs Report: This report displays data about each available program. It is intended mainly for debugging during development of the manager but is included as a working example for possible use.

The name of this program is PGMRPT.

The Programs Report will have the following headings:

```
PGM NAME             LENGTH (in records)
```

Terminal Activity Report: This program displays the names and status of all terminals on the system. If more than 19 terminals are attached, the operator must press ENTER to page to successive groups of 19 lines.

The name of this program is REPORT.

The Terminal Activity Report has the following headings:

```
TERMINAL TERMINAL USER USER   PROGRAM OPERATOR TERMINAL
  NAME     TYPE     ID  CLASS           INPUTS   OUTPUTS
```

Screens Report: This program displays the names of the screens defined in the SCRNS volume. The operator can key in the screen name to be displayed.

The name of this program is SCRNSRPT.

Screen Print: Displayed screens on a 4978 or 4979 terminal can be printed on the system printer by pressing the PF6 key or the key specified on the HDCOPY parameter of the TERMINAL statement during system generation.

DISTRIBUTION, INSTALLATION AND PROGRAM PREPARATION

The Multiple Terminal Manager is distributed as a program product and each distribution consists of the following items:

- Prebuilt Multiple Terminal Manager - This is a prebuilt Multiple Terminal Manager consisting of a program manager, file manager, terminal servers and utility programs. The Indexed Access Method interface is not included.

- Multiple Terminal Manager source for module CDMCOMMN - This is the Multiple Terminal Manager source code for the user who wants to tailor the Multiple Terminal Manager environment.

- Screen formats - This is a set of screens to support the default Multiple Terminal Manager and sample programs.

- TERMINAL File - This is a set of miscellaneous terminal statements to support the default system.

- CDMEMAIN, CDMFMAIN, CDMCMAIN, and CDMPMAIN - These are the Multiple Terminal Manager application stubs in object format that must be included with either Event Driven Language, FORTRAN, COBOL, or PL/I programs at link time.

Installation

The user must have created the following volumes on the system disk at system generation time.

PRGRMS This volume is for the Multiple Terminal Manager programs, user application programs, terminal specifications file and SIGNONFL file.

SCRNS This volume is for the screen formats used by Multiple Terminal Manager and user applications.

MTMSTR This volume is for the MTMSTORE data set used by the Multiple Terminal Manager.

After the volumes have been created, the user can then copy the prebuilt Multiple Terminal Manager, screen formats and terminal file from the source diskettes to disk. This installs the default Multiple Terminal Manager and establishes the following data sets.

Data sets within the PRGRMS volume:

$MTM The Multiple Terminal Manager program manager

CDMSVR89 The Multiple Terminal Manager full screen, 4978 and 4979, terminal server

CDMSVR33 The Multiple Terminal Manager TTY terminal server

CDMSVR01 3101 Model 2 terminal server

CDMINIT The Multiple Terminal Manager initialization routine

TERMINAL The Multiple Terminal Manager terminal specification file

In addition, the PRGRMS volume contains miscellaneous data sets needed for the utility programs.

Data sets within the SCRNS volume:

IPLSCRN The initial Multiple Terminal Manager displayed screen

SIGNONSC The sign-on screen

MENUSCRN The default menu screen

SCRNSREP The SCRNSRPT selection menu

The Multiple Terminal Manager can be tailored by reassembling, rebuilding and replacing the changed Multiple Terminal Manager components.

The terminal specifications file (TERMINAL) can be modified to match your system environment by using the $FSEDIT Event Driven Executive utility. Screen formats can be added to the SCRNS volume via the $IMAGE Event Driven Executive utility.

Before executing the Multiple Terminal Manager, the user has to create the MTMSTORE dataset.

Event Driven Language Program Preparation

The Multiple Terminal Manager contains a main routine, CDMEMAIN, for supporting Event Driven Language applications. CDMEMAIN is the Multiple Terminal Manager stub for Event Driven Language applications, and is object code which enables the Multiple Terminal Manager to invoke and pass parameters to the application program.

It is necessary to link CDMEMAIN with the application object module so that the application can communicate with the Multiple Terminal Manager. For linking Event Driven Language applications, this requires that the following be used as the link control data set during the $LINK program preparation step:

```
OUTPUT output data set,volume
INCLUDE CDMEMAIN,volume
INCLUDE object data set,volume
END
```

For example, the link control statements for an Event Driven Language application called "QUERY" might be:

```
OUTPUT    QUERY,EDX002
INCLUDE   CDMEMAIN,EDX003
INCLUDE   QUERY,EDX003
END
```

The subsequent $UPDATE step would then specify the object input to be "QUERY,EDX002" and the program output to be "QUERY,PRGRMS", where "PRGRMS" is the Multiple Terminal Manager program volume.

Note: If the FTAB function is used by the application, the FTAB object code must be linked with the application object code. This requires that the object module CDMFTAB be included in the linking process. The following link control statement must be included in the link control data set:

```
INCLUDE   CDMFTAB,volume
```

For example:

```
OUTPUT    QUERY,EDX002
INCLUDE   CDMEMAIN,EDX003
INCLUDE   QUERY,EDX003
INCLUDE   CDMFTAB,EDX003
END
```

FORTRAN Program Preparation

The Multiple Terminal Manager contains a main routine, CDMFMAIN, for supporting FORTRAN applications. CDMFMAIN is the Multiple Terminal Manager stub for FORTRAN applications, and is object code which enables the Multiple Terminal Manager to invoke and pass parameters to the application program.

It is necessary to link CDMFMAIN with the application object module so that the application can communicate with the Multiple Terminal Manager. For linking FORTRAN applications, this requires that the following be used as the link control data set during the $LINK program preparation step:

```
OUTPUT output data set,volume   AUTO=FORTAUTO,ASMLIB
INCLUDE CDMFMAIN,volume
INCLUDE object data set,volume
END
```

For example, the link control statements for a FORTRAN application called "QUERY" might be:

```
OUTPUT     QUERY,EDX002  AUTO=FORTAUTO,ASMLIB
INCLUDE    CDMFMAIN,EDX003
INCLUDE    QUERY,EDX003
END
```

The subsequent $UPDATE step would then specify the object input to be "QUERY,EDX002", and the program output to be "QUERY,PRGRMS", where "PRGRMS" is the Multiple Terminal Manager program volume.

Note: If the FTAB function is used by the application, the FTAB object code must be linked with the application object code. This requires that the object module CDMFTAB be included in the linking process. The following link control statement must be included in the link control data set:

```
INCLUDE    CDMFTAB,volume
```

For example:

```
OUTPUT     QUERY,EDX002  AUTO=FORTAUTO,ASMLIB
INCLUDE    CDMFMAIN,EDX003
INCLUDE    QUERY,EDX003
INCLUDE    CDMFTAB,EDX003
END
```

COBOL Program Preparation

The Multiple Terminal Manager contains a main routine, CDMCMAIN, for supporting COBOL applications. CDMCMAIN is the Multiple Terminal Manager stub for COBOL applications, and is object code which enables the Multiple Terminal Manager to invoke and pass parameters to the application program.

It is necessary to link CDMCMAIN with the application object module so that the application can communicate with the Multiple Terminal manager. For linking COBOL applications, this requires that the following be used as the link control data set during the $LINK program preparation step:

```
OUTPUT output data set,volume   AUTO=COKAUTO,ASMLIB
INCLUDE CDMCMAIN,volume
INCLUDE MTMSUB#1,volume
INCLUDE MTMSUB#B,volume
END
```

In the previous example, MTMSUB#1 is the name of the data set containing the COBOL compiled output. MTMSUB#B is the name of the data set containing the COBOL I/O buffers (if required).

For example, the link control statements for a COBOL application called "QUERY" might be:

```
OUTPUT     QUERY,EDX002  AUTO=COKAUTO,ASMLIB
INCLUDE    CDMCMAIN,EDX003
INCLUDE    MTMSUB#1,EDX003
END
```

The subsequent $UPDATE step would then specify the object input to be "QUERY,EDX002", and the program output to be "QUERY,PRGRMS", where "PRGRMS" is the Multiple Terminal Manager program volume.

Note: If the FTAB function is used by the application, the FTAB object code must be linked with the application object code. This requires that the object module CDMFTAB be included in the linking process. The following link control statement must be included in the link control data set:

```
INCLUDE    CDMFTAB,volume
```

For example:

```
OUTPUT     QUERY,EDX002  AUTO=COKAUTO,ASMLIB
INCLUDE    CDMCMAIN,EDX003
INCLUDE    MTMSUB#1,EDX003
INCLUDE    CDMFTAB,EDX003
END
```

PL/I Program Preparation

The Multiple Terminal Manager contains a main routine, CDMPMAIN, for supporting PL/I applications. CDMPMAIN is the Multiple Terminal Manager stub for PL/I applications, and is object code which enables the Multiple Terminal Manager to invoke and pass parameters to the application program.

It is necessary to link CDMPMAIN with the application object module so that the application can communicate with the Multiple Terminal Manager. For linking PL/I applications, this requires that the following be used as the link control data set during the $LINK program preparation step:

```
      OUTPUT output data set,volume  AUTO=PLIAUTO,ASMLIB
      INCLUDE CDMPMAIN,volume
      INCLUDE object data set,volume
      END
```

For example, the link control statements for a PL/I application called "QUERY" might be:

```
      OUTPUT    QUERY,EDX002  AUTO=PLIAUTO,ASMLIB
      INCLUDE   CDMPMAIN,EDX003
      INCLUDE   QUERY,EDX003
      END
```

The subsequent $UPDATE step would then specify the object input to be "QUERY,EDX002", and the program output to be "QUERY,PRGRMS", where "PRGRMS" is the Multiple Terminal Manager program volume.

Note: If the FTAB function is used by the application, the FTAB object code must be linked with the application object code. This requires that the object module CDMFTAB be included in the linking process. The following link control statement must be included in the link control data set:

```
      INCLUDE   CDMFTAB,volume
```

  For example:

```
      OUTPUT    QUERY,EDX002 AUTO=PLIAUTO,ASMLIB
      INCLUDE   CDMPMAIN,EDX003
      INCLUDE   QUERY,EDX003
      INCLUDE   CDMFTAB,EDX003
      END
```

STORAGE REQUIREMENTS

Listed below are the storage requirements for the Multiple Terminal Manager. These requirements are in addition to the storage required for the Multiple Terminal Manager application programs, the Event Driven Executive supervisor, the supervisor's required device support programs and control blocks.

Program manager	-	12K (K = 1024 bytes)
Terminal server	-	1K per terminal for TTY (ASCII) .75K per 4978/4979 display 1.75K per 3101 Model 2 display

The storage required for Multiple Terminal Manager application programs is the larger of 6K or the size of the largest application which includes the application stub. This is the size obtained after linking the application via $LINK.

During system configuration, the above information is used to calculate the partition size to code on the SYSTEM statement, PARTS= operand. For more information on the SYSTEM statement see the System Guide.

SYSTEM GENERATION CONSIDERATIONS

Volume Requirements

Three volumes must be provided when planning your Event Driven Executive system for the Multiple Terminal Manager. These volumes are:

- PRGRMS - Multiple Terminal Manager programs volume
- MTMSTR - Multiple Terminal Manager work volume
- SCRNS - Multiple Terminal Manager screens volume

In Multiple Terminal Manager only systems, the most likely access frequency distribution of these three volumes would be:

(1) MTMSTR
(2) SCRNS
(3) PRGRMS

Therefore, it is recommended that these volumes be allocated so that the MTMSTR and SCRNS volumes are adjacent to each other with PRGRMS on one side or the other.

If fixed-head disks are to be used, it may be beneficial to allocate the MTMSTR volume under the fixed head. (In this case the location of SCRNS relative to MTMSTR is irrelevant.) This is accomplished by specifying FHVOL=MTMSTR on the appropriate system configuration DISK statement. It will not be possible to place MTMSTR under the fixed head if the total volume size exceeds 480 records for a 4962, or 512 records for a 4963.

To calculate the size requirements for each of the three volumes, first calculate the data set requirements (see the section "Data Set Requirements" on page 171). Add to this the directory size in number of records, each volume requires. The directory sizes may be calculated as follows:

Volume	Number of Directory Records Required
MTMSTR	1 Record
SCRNS	(number of screens + 2) / 8 rounded to the next highest record
PRGRMS	(number of user programs + 9) / 8 rounded to the next highest record

See the System Guide for a sample Multiple Terminal Manager system configuration.

Data Set Requirements

MTMSTORE

MTMSTORE is the Multiple Terminal Manager work file, and as such, it contains:

- The Multiple Terminal Manager program table.

- The Multiple Terminal Manager screen table.

- A program and buffer save area for each terminal defined in the TERMINAL file.

The size of the MTMSTORE file can be calculated as follows:

- Allow 10 bytes per screen in the SCRNS volume; round up to the nearest 256-byte record.

- Allow 14 bytes per program in the PRGRMS volume; round up to the nearest 256-byte record.

- Allow per terminal:

  enough records to hold a copy of the largest program in the PRGRMS volume plus 4 records; round up to the nearest track; that is, nearest 64 records for a 4963 disk or nearest 60 records for a 4962 disk.

This data set is in the volume MTMSTR and is normally the only data set in that volume.

TERMINAL

This file is built with the $FSEDIT Event Driven Executive utility. It contains one record/terminal containing the specifications of a terminal.

The record prototype is:

```
Dvtp,Termname,Menuscrn,Y/N
```

The following is a description of the record:

Dvtp The type of terminal. Specify one of the following per terminal:

4979	(IBM 4979 full screen)
4978	(IBM 4978 full screen)
3335	(ASR 33/35 line at a time)
3101	(IBM 3101 Model 2 in block mode)

Termname The 1 to 8 character name of the terminal. This name must be identical with the device name specified on the TERMINAL statement at system generation. This name should not be the name of the Event Driven Executive $SYSLOG device.

Menuscrn The name of the data set in the SCRNS volume which contains the screen to be displayed after an operator exits a transaction or signs on. For ASCII terminals, this field is ignored.

Y/N Specifies whether the terminal uses SIGNON/SIGNOFF.

Y = This terminal is required to use the SIGNON and SIGNOFF programs. If a user program named SIGNON does not appear in the program library, this terminal is not usable.

N = This terminal is always signed on.

Comment records are acceptable in this file as well as comments following specification records. Comment records must have an * in position 1.

An example of this file would be:

```
3101,DIS31010,MENUSCRN,N
4979,DISPLAY1,MENUSCRN,N
4978,DIS49780,MENUSCRN,Y
3335,ACCA1,MENUSCRN,Y
/*
```

End of specifications must be indicated with a record containing /* beginning in column 1.

Before the Multiple Terminal Manager processes each record during startup, the record is listed on the $SYSPRTR device. When startup is complete, all terminals will have the Multiple Terminal Manager IPL screen displayed. The TERMINAL file is in the volume PRGRMS.

Screen Format Volume - SCRNS

This volume contains screen data sets for full screen images built via the $IMAGE Event Driven Executive utility. These screens must have been built with a 24 x 80 dimension size. The unprotected fields must be initialized with blanks or default data. If a screen is modified or added to the SCRNS volume, the Multiple Terminal Manager should be terminated and restarted so that the Multiple Terminal Manager can initialize linkage to the screens.

The IPLSCRN data set is displayed on each full screen terminal after the Multiple Terminal Manager is started. It requests that the operator press the ENTER key to connect the terminal to the Multiple Terminal Manager. It should not be displayed again.

Screen definition procedure (under $IMAGE) should always be concluded by entering unprotected field initialization mode using PF2, even when a fully protected screen is being defined.

User Application Program Volume - PRGRMS

All programs loaded by the Multiple Terminal Manager are loaded using the names of the data sets in this volume. The TERMINAL and SIGNONFL files are also in this volume.

Application programs are stored in this volume as the output of the $UPDATE Event Driven Executive utility. The names of the programs are the names used by the operator from the MENU mode to invoke programs and can also be used as the program parameter on a CALL LINK or CALL LINKON that passes control from one program to another. (If an existing program is modified or a new program added, the Multiple Terminal Manager should be terminated and restarted so that Multiple Terminal Manager can establish linkage to these changes or additions.)

When the Multiple Terminal Manager is initiated, a program table is built containing the name of each program data set in the PRGRMS volume.

Each program is checked at initialization time to see if the program is too big for the program area in the Multiple Terminal Manager. If the program is too big for the program area in the Multiple Terminal Manager, split the program into separate programs using LINK or increase the size of the program area.

SIGNONFL

This file contains sign-on records for use by the SIGNON program. The format of the file is:

Field Name	Positions	Contents
SIGNON ID	1-08	Sign-on ID number
PASSWORD	9-12	Password
USERID	13-16	User ID
USER CLASS	17-20	User Class
NAME	21-32	User Name

This file is built by using the $FSEDIT Event Driven Executive utility. This file is in the volume PRGRMS. A /* in columns 1 and 2 denote the end of the file.

Multiple Terminal Manager Data Set Requirements for Execution

ITEM	VOL ID	DATA SET NAME	APPROXIMATE SIZE
SWAP DATA SET	MTMSTR	MTMSTORE	See MTMSTORE in the Multiple Terminal Manager Data Set Requirements section
PROGRAM MGR	PRGRMS	$MTM	55 records
4978/4979 TERM SERVER	PRGRMS	CDMSVR89	4 records
3101 TERM SERVER	PRGRMS	CDMSVR01	8 records
TTY TERM SERVER	PRGRMS	CDMSVR33	5 records
MULTIPLE TERMINAL MANAGER INITIALIZATION	PRGRMS	CDMINIT	29 records
TERMINAL SPECIFICATIONS FILE	PRGRMS	TERMINAL	1 record per 2 entries
USER APPLICATION PROGRAMS	PRGRMS	? ? . . .	? ? . . .
SCREEN FORMATS	SCRNS	USER SPECIFIED SCREENS	4 records per screen
SIGNON FILE	PRGRMS	SIGNONFL	1 record per 2 entries

Multiple Terminal Manager Requirements for Program Preparation

MULTIPLE TERMINAL	Approximate size
MANAGER STUBS:	6 records each
CDMEMAIN	
CDMFMAIN	
CDMCMAIN	
CDMPMAIN	
CDMFTAB	2 records
plus Event Driven Executive program preparation data set requirements	

Requirements for Rebuilding the Multiple Terminal Manager

MULTIPLE TERMINAL	Approximate size
MANAGER OBJECT	100 records
Multiple Terminal Manager source module: CDMCOMMN	98 records
plus Event Driven Executive program preparation data set requirements	

MULTIPLE TERMINAL MANAGER DEFAULTS AND HOW TO CHANGE

The Multiple Terminal Manager default system contains the following limitations.

- Maximum number of screens - 307

  This number can be increased by increasing the Input or Output Buffer size 10 bytes per additional screen. The Input Buffer (COMINPUT) and the Output Buffer (COMOUTPT) are in the module CDMCOMMN.

- Maximum number of concurrently open data sets - 14

  This number can be changed by altering the file table size. The file table is in the module CDMCOMMN.

- Maximum number of terminals - 10

  This number can be increased by increasing the terminal table size 12 bytes per terminal. The terminal table (COMTERM) is in the module CDMCOMMN.

- Maximum program size - 16K bytes

  This size can be changed by reallocating the CDMDUMMY module to the desired size or by patching the name of your largest application program into the PGM1 name position of the program manager's program header. The offset in $MTM of the name CDMDUMMY is X'D8'

- Maximum packed screen format size as built by the Event Driven Executive screen formatter, $IMAGE - 1024 bytes

  This size can be increased by increasing the screen buffer size. The screen buffer (COMPMGR) is in the module CDMCOMMN.

- Maximum number of programs - 73

  This number can be increased by increasing the screen buffer size 14 bytes per program. The screen buffer (COMPMGR) is in the module CDMCOMMN.

Whenever the source module CDMCOMMN is changed, it must be reassembled and the program manager must be rebuilt with the new CDMCOMMN object module.

<u>Note</u>: Changes to the screen buffer or Input Buffer must be in increments of 256 to facilitate Event Driven Executive disk READs.

MULTIPLE TERMINAL MANAGER MESSAGES

NO TERMINALS ARE AVAILABLE: No valid terminal specification records found in the TERMINAL file, or, no terminal servers can be loaded, or, all terminals are busy. Other messages generated indicate the problem area. The manager program is terminated.

MTMSTORE DATA SET LIMITS EXCEEDED: The specified MTMSTORE file is too small. Delete and recreate it larger. The manager has been terminated.

This can occur after adding a new program with a storage requirement greater than any previous program's requirement or after adding a new terminal or screen.

PROGRAM AREA TOO SMALL TO HOLD PGM BBBBBBBB: The manager's program area is too small to hold the named program. The program is unusable.

Increase the program area size by reallocating CDMDUMMY or split the program into smaller LINKed programs.

BBBBBBBB PROGRAM TYPE INVALID: The named program in the PRGRMS volume is not a program type data set. The named program is unusable.

SIGNON PROGRAM NOT AVAILABLE FOR TERMINAL BBBBBBBB: The specified terminal is required to sign on and off but no program named SIGNON was found in the PRGRMS volume. The terminal is not connected to the Multiple Terminal Manager.

MULTIPLE TERMINAL MANAGER TERMINAL FILE RECORDS: The TERMINAL file records processed by the Multiple Terminal Manager are listed after this message. Any messages pertaining to a specific TERMINAL file record will be displayed immediately after the file record.

DEVICE TYPE INVALID: The device type specified for the TERMINAL file record listed immediately before this message is invalid. The terminal is not connected. Correct the TERMINAL record. Stop and restart the manager.

INVALID SIGNON CHARACTER: The SIGNON specification for the TERMINAL file record listed immediately before this message is not "Y" or "N". The terminal is not connected. Correct the TERMINAL record. Stop and restart the manager.

MENUNAME INVALID: The primary menu name specified for the TERMINAL file record listed immediately before this message is invalid. The terminal is not connected. Correct the TERMINAL record. Stop and restart the manager.

TERMINAL BBBBBBBB NOT DEFINED IN EVENT DRIVEN EXECUTIVE SYSTEM: The specified terminal was not included in the definition of terminals when the Event Driven Executive system was generated. The terminal is not connected. Include a terminal definition for the specified terminal when the Event Driven Executive system is generated.

TERMINAL NAME INVALID: The terminal name specified for the TERMINAL file record listed immediately before this message is invalid. The terminal is not connected. Correct the TERMINAL record. Stop and restart the manager.

CONNECTED TO MULTIPLE TERMINAL MANAGER: This message is written to a non-full screen type terminal when it is connected to the Multiple Terminal Manager.

LOAD FOR SERVER BBBBBBBB FAILED, RC=CCCCC: A load failure occurred during initialization for the specified server. Refer to Event Driven Executive messages and codes to determine the cause of failure. Ensure that the specified server program is in the PRGRMS volume.

PRIMARY MENU BBBBBBBB FAILED FOR TERMINAL BBBBBBBB: A SETPAN function for the primary menu indicated has failed. Ensure that a valid menu name is specified in the TERMINAL file for the specified terminal.

DISK ERROR DURING INITIALIZATION, RC=CCCCC: A disk error occurred while reading the SCRNS volume directory, the PRGRMS volume directory, or the TERMINAL data set. Or, an error occurred while writing to the MTMSTORE data set. Determine the cause using Event Driven Executive messages and codes.

SCREEN TABLE LARGER THAN INPUT BUFFER: The screen table built during initialization exceeds the Input Buffer size.

Increase the Input Buffer size in module CDMCOMMN.

PROGRAM FILE LARGER THAN PROGRAM MANAGER BUFFER: The program table built during initialization exceeds the size of the buffer used by the program manager.

Increase the program manager buffer size in module CDMCOMMN.

TERMINAL TABLE OR WORK SPACE SIZE EXCEEDED: While building the terminal table and loading servers, the storage size or the the maximum number of terminals (10) allowed has been exceeded. The work space, defined in CDMINIT, is defined to allow a maximum of 50 terminals. The terminal table size can be increased by changing module CDMCOMMN.

BBBBBBBB SCREEN SIZE TOO LARGE: The specified screen in the SCRNS volume will not fit in the screen manager buffer.

Increase the screen manager buffer size in CDMCOMMN.

BBBBBBBB SETPAN FAILED, RC=CCCCCC: A SETPAN failed for the screen name specified. Determine the cause of failure using the return code and the Multiple Terminal Manager SETPAN documentation.

TERMINAL BBBBBBBB BUSY: A terminal specified in the TERMINAL file is connected to another program.

Try to RECONNECT at a later time.

ERROR ENCOUNTERED DURING CLOSE OF INDEXED ACCESS METHOD (DDDDDDDD,VVVVVV), ERROR CODE=(cccccc): An error occurred during AUTOCLOSE of an Indexed Access Method data set.

INITIALIZATION ERROR: Initialization has been unsuccessful. Multiple Terminal Manager is terminated. This message is written to the terminal which loaded Multiple Terminal Manager. Additional messages are printed on $SYSPRTR.

INVALID PROGRAM NAME: The name of the program requested from the primary menu was not found in the Multiple Terminal Manager program table or invalid parameters supplied on a DISCONNECT command.

INVALID TERMINAL: The terminal name entered with a DISCONNECT command is not a Multiple Terminal Manager terminal.

PROGRAM LOAD ERROR: An Event Driven Executive LOAD error occurred for the requested program.

DISK READ ERROR: An internal Multiple Terminal Manager disk Read error has occurred and results may be unpredictable.

TERMINAL BBBBBBBB RECONNECTED: The named terminal has been reconnected to the Multiple Terminal Manager.

RECONNECT SYNTAX INVALID: The RECONNECT operator interface facility is invalid and the proper syntax has not been used.

RECONNECT TERMINAL DEFINITION ERROR: The RECONNECT operator interface facility has encountered a failure while attempting to reconnect a terminal to the Multiple Terminal Manager. Since initialization would have already performed all functions necessary to include the terminal in the terminal table, the TERMINAL file, SCRNS volume or source table in RECONNEC has probably been altered since the Multiple Terminal Manager was started.

BBBBBBBB DISCONNECT: Terminal bbbbbbbb has been issued a successful DISCONNECT command.

MULTIPLE TERMINAL MANAGER SYSTEM FAILURE: The Multiple Terminal Manager task error exit routine has been entered due to a machine or program error. The Multiple Terminal Manager program remains active waiting for an event which will not be posted.

The PSW and LSB at the time of failure has been saved at a displacement of X'172' into the program storage. Register 1 in the LSB contains the address of the failing instruction in the case of a program check. Use Event Driven Executive operator facilities to display storage.

An example follows showing a specification check which occurred at location X'053C'.

```
MULTIPLE TERMINAL MANAGER SYSTEM FAILURE
> $A

PROGRAMS AT 00:06:24
IN PARTITION #2
$MTM     0000 *
CDMSVR33 6C00
> $D 0 172 30 X
 0172: 8002 28E6 0110 10D0 0DDC 053C 0DAC 7361
 0182: 0540 815C 00B8 0DDA 0000 00FA 0004 0028
 0192: 0052 007C 00A6 0017 0E72 A0A2 0E72 FFFF
 01A2: 0102 8026 1616 40C9 D5C9 E3C9
 ANOTHER DISPLAY?
```

The PSW is 8002 at 0172 and R1 is 053C on same line.

EXAMPLE - FILE MAINTENANCE TRANSACTION APPLICATION

This example consists of a pair of programs which perform a simple file maintenance task. The tasks it can perform are reading or writing a single record, or setting an end of data (EOD) marker. Both programs are presented in the following languages:

- Event Driven Language (see "EDL Sample Prog1" on page 190 and "EDL Sample Prog2" on page 191)
- COBOL (see "COBOL Sample Prog1" on page 193 and "COBOL Sample Prog2" on page 195)
- FORTRAN (see "FORTRAN Sample Prog1" on page 197 and "FORTRAN Sample Prog2" on page 198)
- PL/I (see "PL/I Sample Prog1" on page 200 and "PL/I Sample Prog2" on page 202)

The first program displays a screen which requests the file parameters which include data set name and relative record number. It then LINKs to the second program, passing the file parameters.

The second program builds a file control area (FCA) from the file parameters and performs the requested file I/O operation. The results of the operation are displayed on the screen, and the program ends.

The following is a detailed explanation of each program statement in Event Driven Language and the effects of program execution of the application.

The first statements in the first program are declarations.

```
         EXTRN    BEEP,SETPAN,MENU,ACTION,LINK
         ENTRY    MTMSUB
         SUBROUT  MTMSUB,INBADDR,OUTBADDR,TEBADDR,IIBADDR
```

EXTRN declares Multiple Terminal Manager functions as external, so they may be accessed by the application. ENTRY declares the application as an entry point. All Multiple Terminal Manager applications are subroutines, as depicted in the SUBROUT statement, called MTMSUB. They all have four parameters, the addresses of the Input Buffer, Output Buffer, Terminal Environment Block and Interrupt Information Byte. (The latter two are not used in this example.)

The next instructions put the buffer addresses into registers 1 and 2.

```
         MOVE   #1,INBADDR
         MOVE   #2,OUTBADDR
```

The terminal is prepared to sound the audible alarm by:

```
           CALL  BEEP
```

A screen image is retrieved from a disk data set and placed into the buffers.

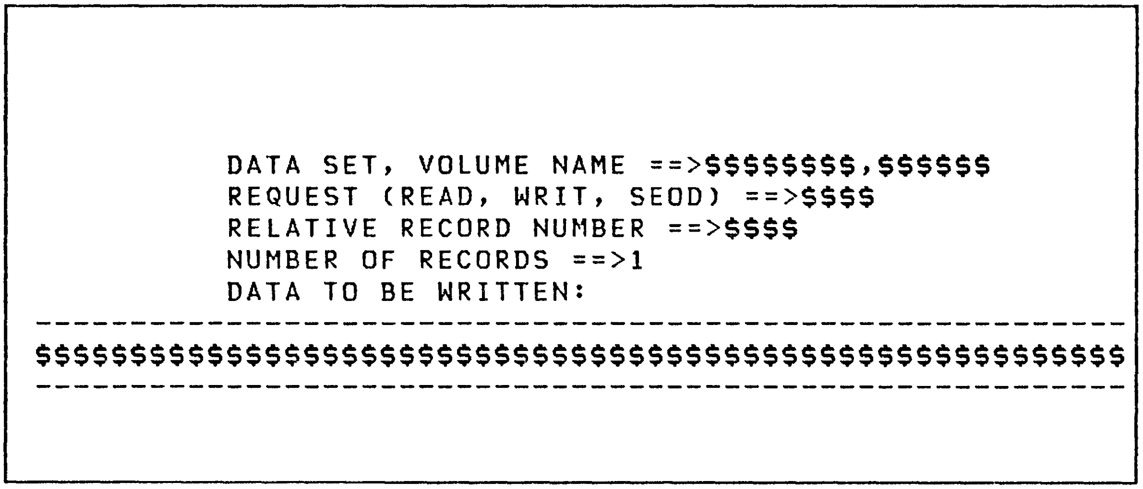
```
           CALL  SETPAN,(REQSCRN),(RC)
           ...
  RC       DATA  F'0'
  REQSCRN  DATA  CL8'REQ'
```

A screen image consists of two portions. These are protected data, which may be considered a screen template or form, and unprotected data, usually considered default information. The protected data is a screen sized (24 x 80) image consisting of character data which is displayed, and fields of nulls used for data entry. Default data is written by the ACTION call into these null fields and operator inputs are read from them. (Screen images are constructed using the $IMAGE utility. See the Utilities, Operator Commands, Program Preparation, Messages and Codes for detailed information on $IMAGE.)

Note that both the protected and unprotected parts of a screen built by $IMAGE must be explicitly initialized by the user; failure to do so causes CALL SETPAN to return return code 2 when the screen is retrieved for use by an application program.

After the call to SETPAN, the Input Buffer contains the screen as shown in SCREEN 1, with five null fields as depicted by dollar signs. The $ is for illustrative purposes only, null fields are actually displayed as blanks.

SCREEN 1



```
          DATA SET, VOLUME NAME ==>$$$$$$$$,$$$$$$
          REQUEST (READ, WRIT, SEOD) ==>$$$$
          RELATIVE RECORD NUMBER ==>$$$$
          NUMBER OF RECORDS ==>1
          DATA TO BE WRITTEN:
----------------------------------------------------------
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
----------------------------------------------------------
```

The Output Buffer contains data used to initialize (unprotected) input fields. It consists of 14 blanks, followed by **READ0001**, followed by 80 blanks. When written to the unprotected portion of the screen, the terminal appears as shown in SCREEN 2. An example of SCREEN 2 is on the following pages.

```
 (14 BLANKS)  READ0001      (80 BLANKS)
```

The Input Buffer holds the screen format, and the Output Buffer contains fields to initialize input fields.

A test of the return code from SETPAN is done. If the return code does not indicate a successful return, the program ends by giving control to the primary menu routine.

```
          IF    (RC,NE,-1)
               CALL MENU
          ENDIF
```

Call the ACTION routine to display the contents of the buffers, and read the operator response.

```
          CALL  ACTION
```

ACTION's effects are:

- Write the Input Buffer's contents to the terminal as protected characters.

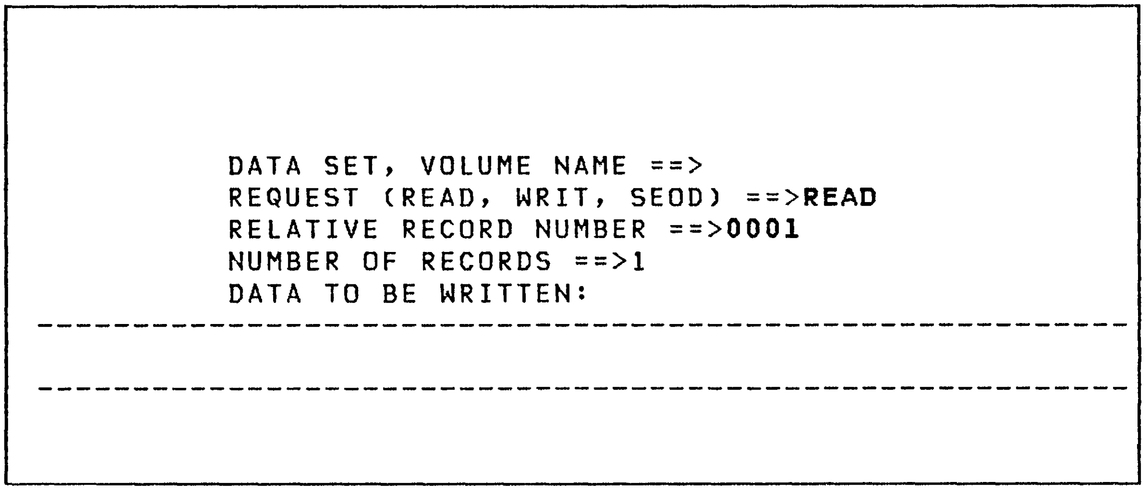
- Write the Output Buffer contents , if any, into the null fields as unprotected characters.

- Wait for the operator to enter data and press ENTER or a PF key.

- Read the contents of the unprotected fields, (that is the operator input) into the Input Buffer.

This results in SCREEN 2 appearing on the terminal, where the default characters are highlighted.

SCREEN 2

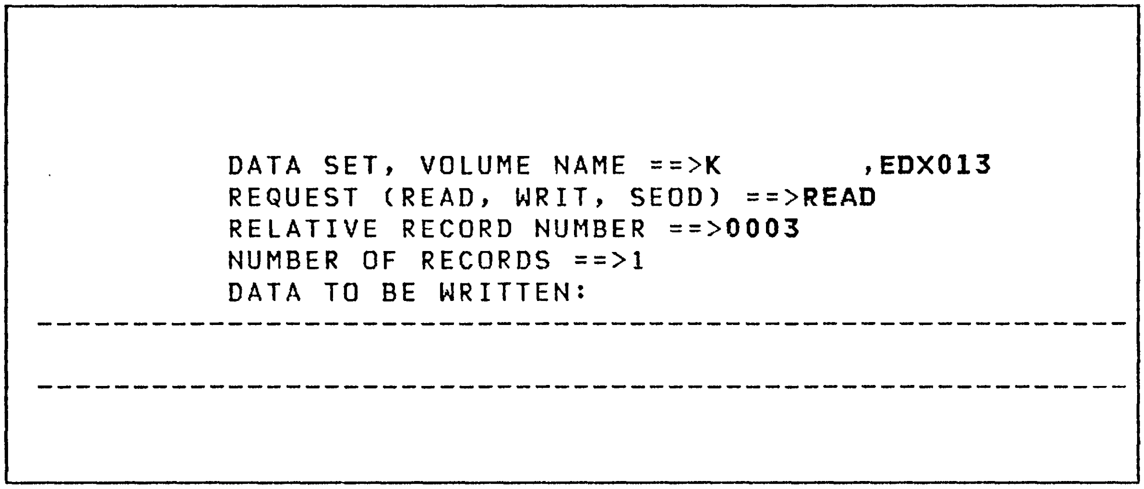


```
          DATA SET, VOLUME NAME ==>
          REQUEST (READ, WRIT, SEOD) ==>READ
          RELATIVE RECORD NUMBER ==>0001
          NUMBER OF RECORDS ==>1
          DATA TO BE WRITTEN:
 ----------------------------------------------------------

 ----------------------------------------------------------
```

The operator then enters data, changing the default data associated with relative record number. For example, to read the third record of data set "K" on volume EDX013, the following data would be entered. See highlighted fields on SCREEN 3.

SCREEN 3



```
          DATA SET, VOLUME NAME ==>K       ,EDX013
          REQUEST (READ, WRIT, SEOD) ==>READ
          RELATIVE RECORD NUMBER ==>0003
          NUMBER OF RECORDS ==>1
          DATA TO BE WRITTEN:
 ----------------------------------------------------------

 ----------------------------------------------------------
```

The operator signals that the input is ready by pressing ENTER or a PF key. ACTION then completes the input cycle by reading the contents of the unprotected fields into the Input Buffer. See the following example of the Input Buffer.

```
K        EDX013READ0003       (80 blanks)
```

In order for PROG2 ("EDL Sample Prog2" on page 191, "COBOL Sample Prog2" on page 195, "FORTRAN Sample Prog2" on page 198 and "PL/I Sample Prog2" on page 202), to receive the file parameters they must be passed through the Output Buffer. The next instruction moves the input data from the Input Buffer to the Output Buffer.

```
            MOVE  (0,#2),(0,#1),(106,BYTES)
```

Finally, PROG2 is LINKed to.

```
            CALL  LINK,(IOPROG)
            ...
  IOPROG    DATA  CL8'PROG2'
```

A call to MENU to terminate the transaction is placed after the LINK, in case the LINK is unsuccessful.

```
            CALL  MENU
```

The first four lines of PROG2 are similar to those of PROG1, except that other functions are declared external, and only register 2 is assigned a buffer address.

```
            EXTRN   FILEIO,SETPAN,MENU,ACTION
            ENTRY   MTMSUB
            SUBROUT MTMSUB,INBADDR,OUTBADDR,TEBADDR,IIBADDR
            MOVE    #2,OUTBADDR
```

At this point the Output Buffer (pointed to by register #2) contains various file parameters. A file control area (FCA) is constructed using these parameters. For example, the request type is moved from the Output Buffer to the FCA.

```
           MOVE FCAREQ,(REQTYPE,#2),(4,BYTES)
           ...
  FCAREQ   DATA   CL4' '
           ...
  REQTYPE  EQU    14
```

Similarly, other fields must be moved, and relative record number must be converted to numeric.

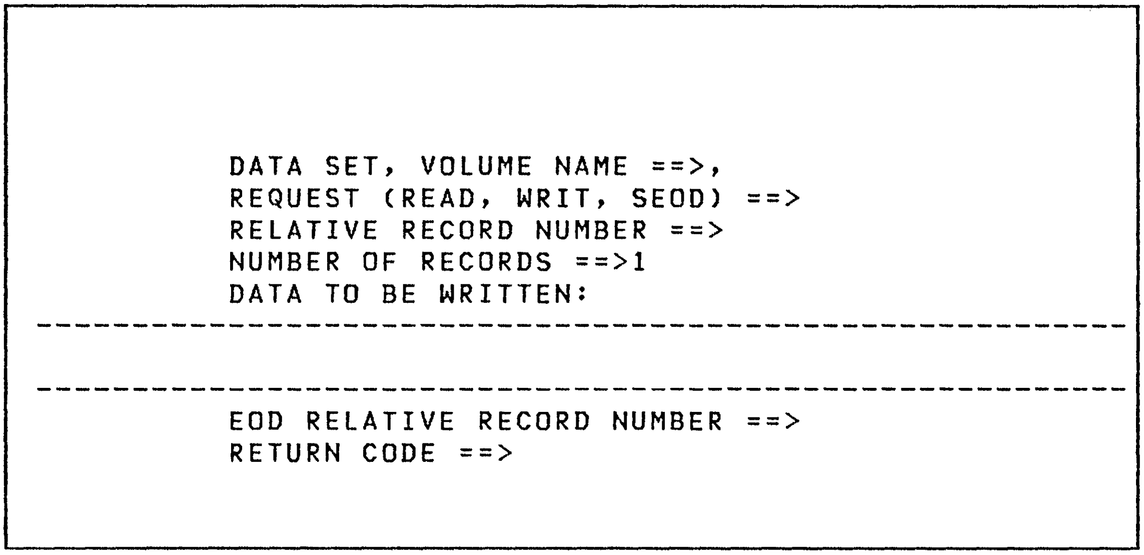
```
* SET UP FILE CONTROL AREA AND BUFFER.
         MOVE    FCAREQ,(REQTYPE,#2),(4,BYTES) REQUEST TYPE
         MOVE    FCADSN,(DSNAME,#2),(8,BYTES)  DATA SET NAME
         MOVE    FCANUM,1                      NUMBER OF RECS
         CONVTD  FCARRN,(RRN,#2),FORMAT=(4,0,I)  CONVERT RRN
         MOVE    FCAVOL,(VOLNAME,#2),(6,BYTES)   VOLUME NAME
         MOVE    BUFFER,(BUFFDISP,#2),(80,BYTES) DATA BUFFER
           ...
* FILE CONTROL AREA.
FCA      EQU      *
FCAREQ   DATA     CL4' '                 REQUEST TYPE
FCADSN   DATA     CL8' '                 DATA SET NAME
FCANUM   DATA     F'1'                   NUMBER OF RECORDS
         DATA     F'0'
FCAEOD   DATA     F'0'                   EOD RELATIVE RECORD NUMBER
         DATA     F'0'
FCARRN   DATA     F'0'                   RELATIVE RECORD NUMBER
FCAVOL   DATA     CL6' '                 VOLUME NAME
           ...
* EQUATES FOR OUTPUT BUFFER DATA.
DSNAME   EQU      0                      DATA SET NAME
VOLNAME  EQU      8                      VOLUME NAME
REQTYPE  EQU      14                     REQUEST TYPE
RRN      EQU      18                     RELATIVE RECORD NUMBER
BUFFDISP EQU      22                     BUFFER DISPLACEMENT
EODRRN   EQU      102                    EOD RRN DISPLACEMENT
RCDISP   EQU      106                    RETURN CODE DISPLACEMENT
```

A screen image with which to display the file data is retrieved, and the return code is checked. This screen is similar to the previous screens shown with the addition of two new fields.

```
          CALL SETPAN,(LISTSCRN),(RC)
          IF   (RC,NE,-1)
               CALL MENU
          ENDIF
          ...
LISTSCRN  DATA  CL8'LST'
```

At this point the image depicted in SCREEN 4 is in the buffers. Since there is no default data, the Output Buffer is empty.

SCREEN 4



```
          DATA SET, VOLUME NAME ==>,
          REQUEST (READ, WRIT, SEOD) ==>
          RELATIVE RECORD NUMBER ==>
          NUMBER OF RECORDS ==>1
          DATA TO BE WRITTEN:
---------------------------------------------------------

---------------------------------------------------------
          EOD RELATIVE RECORD NUMBER ==>
          RETURN CODE ==>
```

The actual FILEIO operation is performed, specifying the FCA, a buffer, and a return code.

```
          CALL    FILEIO,(FCA),(BUFFER),(RC)
          ...
RC        DATA    F'0'
BUFFER    DATA    256X'0'
```

Note that the buffer is 256-bytes in length (the length of an Event Driven Executive record) even though only the first 80 bytes are used.

Now that all the file data is available, it is placed in the Output Buffer so that it can be displayed. The data is taken from the FCA, the buffer and return code, and concatenated so that it may be written into the unprotected fields of the screen image.

```
* PUT DATA INTO OUTPUT BUFFER SO IT WILL BE DISPLAYED.
         MOVE    (REQTYPE,#2),FCAREQ,(4,BYTES)   REQUEST TYPE
         MOVE    (DSNAME,#2),FCADSN,(8,BYTES)    DATA SET NAME
         CONVTB  (EODRRN,#2),FCAEOD,FORMAT=(4,0,I) CONV EOD RRN
         CONVTB  (RRN,#2),FCARRN,FORMAT=(4,0,I)    CONVERT RRN
         MOVE    (VOLNAME,#2),FCAVOL,(6,BYTES)     VOLUME NAME
         MOVE    (BUFFDISP,#2),BUFFER,(80,BYTES)   DATA
         CONVTB  (RCDISP,#2),RC,FORMAT=(4,0,I)     CONV RET CODE
```

The Output Buffer now looks as follows:

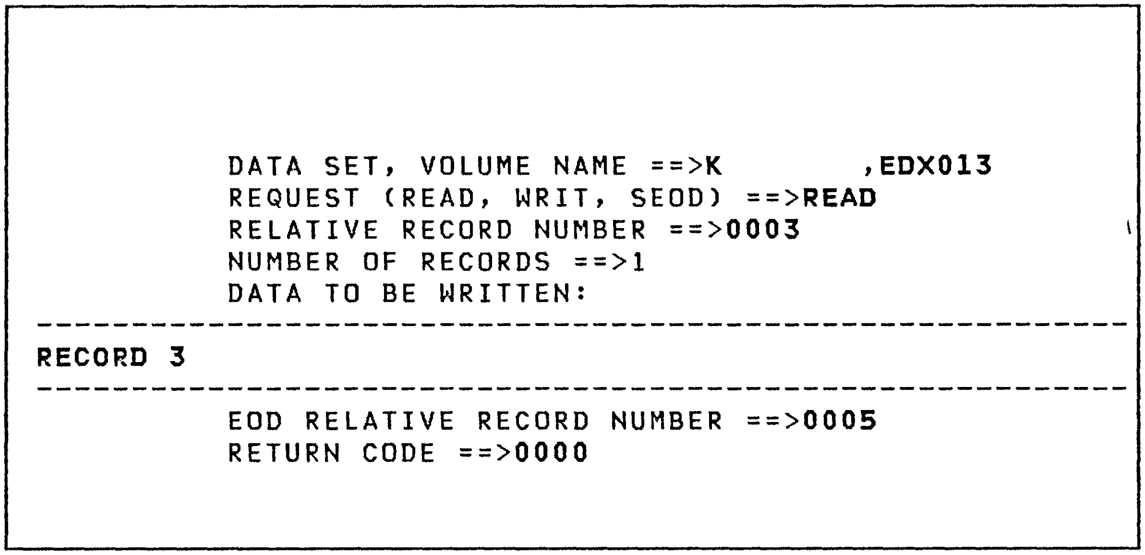
```
K       EDX013READ0003RECORD 3(72 blanks)0005-001
```

Both Input and Output buffers are displayed on the screen by the following:

```
            CALL    ACTION
```

The following is an example of the displayed screen:

SCREEN 5



```
          DATA SET, VOLUME NAME ==>K       ,EDX013
          REQUEST (READ, WRIT, SEOD) ==>READ
          RELATIVE RECORD NUMBER ==>0003
          NUMBER OF RECORDS ==>1
          DATA TO BE WRITTEN:
-------------------------------------------------------------
RECORD 3
-------------------------------------------------------------
          EOD RELATIVE RECORD NUMBER ==>0005
          RETURN CODE ==>0000
```

A call to ACTION waits for operator input followed by an ENTER or PF key. In this case no input is desired; however, the use of ACTION allows the user to view the screen and press ENTER after the contents have been read. At that point the program ends.

```
            CALL    MENU
```

The following pages contain the applications used to perform the example previously shown.

The first sample application uses Event Driven Language, the second uses COBOL, the third FORTRAN, and the fourth PL/I.

```
         EXTRN    BEEP,SETPAN,MENU,ACTION,LINK
         ENTRY    MTMSUB
         SUBROUT  MTMSUB,INBADDR,OUTBADDR,TEBADDR,IIBADDR
         MOVE     #1,INBADDR          GET INPUT BUFF ADDRESS
         MOVE     #2,OUTBADDR         GET OUTPUT BUFF ADDRESS
* BEEP UPON TERMINAL IO.
         CALL     BEEP
* RETRIEVE SCREEN IMAGE AND ABORT IF ERROR.
         CALL     SETPAN,(REQSCRN),(RC)   GET SCREEN IMAGE
         IF       (RC,NE,-1)           OK?
           CALL      MENU              NO
         ENDIF
* DISPLAY SCREEN IMAGE, READ OPERATOR RESPONSE.
         CALL     ACTION
* MOVE DATA FROM INPUT BUFFER TO OUTPUT BUFFER (106 BYTES).
         MOVE     (0,#2),(0,#1),(106,BYTES)
* LINK TO PROGRAM WHICH WILL PERFORM FILE IO.
         CALL     LINK,(IOPROG)
* ABORT IF LINK FAILS.
         CALL     MENU
*************************************************************
*                                                           *
*        DATA ITEMS                                         *
*                                                           *
*************************************************************
REQSCRN  DATA     CL8'REQ'              NAME OF REQUEST SCREEN
IOPROG   DATA     CL8'PROG2'            NAME OF IO PROGRAM
RC       DATA     F'0'                  RETURN CODE
         ENDPROG
         END
         EXTRN   FILEIO,SETPAN,MENU,ACTION
         ENTRY   MTMSUB
         SUBROUT MTMSUB,INBADDR,OUTBADDR,TEBADDR,IIBADDR
         MOVE    #2,OUTBADDR             GET O/P BUFFER ADDR
* SET UP FILE CONTROL AREA AND BUFFER.
         MOVE    FCAREQ,(REQTYPE,#2),(4,BYTES) REQST TYPE
         MOVE    FCADSN,(DSNAME,#2),(8,BYTES)  DATA SET NAME
         MOVE    FCANUM,1                      NUMBER OF RECS
         CONVTD  FCARRN,(RRN,#2),FORMAT=(4,0,I)  CONVERT RRN
         MOVE    FCAVOL,(VOLNAME,#2),(6,BYTES)   VOLUME NAME
         MOVE    BUFFER,(BUFFDISP,#2),(80,BYTES) DATA BUFFER
* RETRIEVE LISTING SCREEN AND ABORT IF ERROR.
         CALL    SETPAN,(LISTSCRN),(RC)
         IF      (RC,NE,-1)              GOT SCREEN IMAGE OK?
           CALL   MENU                   NO
         ENDIF
  PERFORM FILE IO.
         CALL    FILEIO,(FCA),(BUFFER),(RC)
* PUT DATA INTO OUTPUT BUFFER SO IT WILL BE DISPLAYED.
         MOVE    (REQTYPE,#2),FCAREQ,(4,BYTES)  REQUEST TYPE
         MOVE    (DSNAME,#2),FCADSN,(8,BYTES)   DATA SET NAME
         CONVTB  (EODRRN,#2),FCAEOD,FORMAT=(4,0,I) CONV EOD RRN
         CONVTB  (RRN,#2),FCARRN,FORMAT=(4,0,I)   CONVERT RRN
         MOVE    (VOLNAME,#2),FCAVOL,(6,BYTES)    VOLUME NAME
         MOVE    (BUFFDISP,#2),BUFFER,(80,BYTES)  DATA
         CONVTB  (RCDISP,#2),RC,FORMAT=(4,0,I)    CONV RET CODE
* DISPLAY SCREEN IMAGE AND DATA.
         CALL    ACTION
* END PROGRAM.
         CALL    MENU
**************************************************************
*                                                            *
*        DATA ITEMS                                          *
*                                                            *
**************************************************************
*
LISTSCRN DATA     CL8'LST'         NAME OF LISTING SCREEN
RC       DATA     F'0'             RETURN CODE
BUFFER   DATA     256X'0'          DATA BUFFER
* FILE CONTROL AREA.
FCA      EQU      *
FCAREQ   DATA     CL4' '           REQUEST TYPE
FCADSN   DATA     CL8' '           DATA SET NAME
FCANUM   DATA     F'1'             NUMBER OF RECORDS
         DATA     F'0'
FCAEOD   DATA     F'0'             EOD RELATIVE RECORD NUMBER
         DATA     F'0'
FCARRN   DATA     F'0'             RELATIVE RECORD NUMBER
FCAVOL   DATA     CL6' '           VOLUME NAME
```

EDL Sample Prog2 (continued)

```
* EQUATES FOR OUTPUT BUFFER DATA.
DSNAME   EQU      0                DATA SET NAME
VOLNAME  EQU      8                VOLUME NAME
REQTYPE  EQU      14               REQUEST TYPE
RRN      EQU      18               RELATIVE RECORD NUMBER
BUFFDISP EQU      22               BUFFER DISPLACEMENT
EODRRN   EQU      102              EOD RRN DISPLACEMENT
RCDISP   EQU      106              RETURN CODE DISPLACEMENT
         ENDPROG
         END
```

COBOL Sample Progl

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.
     MTMSUB.
*
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
     IBM-S1.
 OBJECT-COMPUTER.
     IBM-S1.
*
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 77  REQUEST-SCREEN    PIC X(8) VALUE "REQ     ".
 77  IO-PROGRAM        PIC X(8) VALUE "PROG2   ".
 77  RC                PIC S99 USAGE IS COMPUTATIONAL.
 LINKAGE SECTION.
 01  INPUT-BUFFER.
     05  DATA-SET-NAME PIC X(8).
     05  VOLUME-NAME   PIC X(6).
     05  REQUEST-TYPE  PIC X(4).
     05  RELATIVE-RECORD-NUMBER PIC 9999.
     05  BUFFER-DATA   PIC X(80).
 01  OUTPUT-BUFFER.
     05  DATA-SET-NAME PIC X(8).
     05  VOLUME-NAME   PIC X(6).
     05  REQUEST-TYPE  PIC X(4).
     05  RELATIVE-RECORD-NUMBER PIC 9999.
     05  BUFFER-DATA   PIC X(80).
     05  EOD-RRN       PIC 9999.
     05  RETURN-CODE   PIC 9999.
 77  TEB             PIC X(100).
 77  IIB             PIC 99 COMP.
```

COBOL Sample Progl (continued)

```
*
 PROCEDURE DIVISION
     USING INPUT-BUFFER, OUTPUT-BUFFER, TEB, IIB.
 BEGIN.
* BEEP UPON TERMINAL IO.
     CALL "BEEP".
* RETRIEVE SCREEN IMAGE AND ABORT IF ERROR.
     CALL "SETPAN" USING REQUEST-SCREEN, RC.
     IF RC IS NOT EQUAL TO -1
       CALL "MENU".
* DISPLAY SCREEN IMAGE, READ OPERATOR RESPONSE.
     CALL "ACTION".
* MOVE DATA FROM INPUT BUFFER TO OUTPUT BUFFER.
     MOVE CORRESPONDING INPUT-BUFFER TO OUTPUT-BUFFER.
* LINK TO PROGRAM WHICH WILL PERFORM FILE IO.
     CALL "LINK" USING IO-PROGRAM.
* ABORT IF LINK FAILS.
     CALL "MENU".
RETURN-POINT.
    EXIT PROGRAM.
```

COBOL Sample Prog2

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID
     MTMSUB.
*
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
     IBM-S1.
 OBJECT-COMPUTER.
     IBM-S1.
*
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 77  LIST-SCREEN       PIC X(8) VALUE "LST     ".
 77  RC                PIC S99 USAGE IS COMP.
 77  BUFFER            PIC X(256).
 01  FILE-CONTROL-AREA.
     05  REQUEST-TYPE  PIC X(4).
     05  DATA-SET-NAME PIC X(8).
     05  NUMBER-OF-RECORDS PIC S999 USAGE COMP VALUE 1.
     05  FILLER        PIC S99.
     05  EOD-RRN       PIC S999 USAGE IS COMP.
     05  FILLER        PIC S99.
     05  RELATIVE-RECORD-NUMBER PIC S999 USAGE COMP.
     05  VOLUME-NAME   PIC X(6).
 LINKAGE SECTION.
 01  INPUT-BUFFER      PIC X(1920).
 01  OUTPUT-BUFFER.
     05  DATA-SET-NAME PIC X(8).
     05  VOLUME-NAME   PIC X(6).
     05  REQUEST-TYPE  PIC X(4).
     05  RELATIVE-RECORD-NUMBER PIC 9999.
     05  BUFFER-DATA   PIC X(80).
     05  EOD-RRN       PIC 9999.
     05  RETURN-CODE   PIC 9999.
 77  TEB             PIC X(100).
 77  IIB             PIC 99 COMP.
```

COBOL Sample Prog2 (continued)

```
*
 PROCEDURE DIVISION
     USING INPUT-BUFFER, OUTPUT-BUFFER, TEB, IIB.
 BEGIN.
* SET UP FILE CONTROL AREA.
     MOVE CORRESPONDING OUTPUT-BUFFER
       TO FILE-CONTROL-AREA.
     MOVE BUFFER-DATA TO BUFFER.
* RETRIEVE LISTING SCREEN AND ABORT IF ERROR.
     CALL "SETPAN" USING REQUEST-SCREEN, RC.
     IF RC IS NOT EQUAL TO -1
       CALL "MENU".
* PERFORM FILE IO.
     CALL "FILEIO" USING FILE-CONTROL-AREA, BUFFER, RC.
* PUT DATA INTO OUTPUT BUFFER SO IT WILL BE DISPLAYED.
     MOVE CORRESPONDING FILE-CONTROL-AREA
       TO OUTPUT-BUFFER.
     MOVE BUFFER TO BUFFER-DATA OF OUTPUT-BUFFER.
     MOVE RC TO RETURN-CODE OF OUTPUT-BUFFER.
* DISPLAY SCREEN IMAGE.
     CALL "ACTION".
* END PROGRAM.
     CALL "MENU".
 RETURN-POINT.
     EXIT PROGRAM.
```

FORTRAN Sample Progl

```
*PROCESS NOCMPAT
      SUBROUTINE MTMSUB(INBUFF, OUTBUF, TEB, IIB)
      IMPLICIT INTEGER (A-Z)
      INTEGER TEB(50), IIB
      INTEGER*2 INBUFF(960), OUTBUF(512)
      EXTERNAL BEEP,SETPAN,ACTION,MENU,LINK
      REAL*8 REQSCR /'REQ     '/, IOPROG /'PROG2   '/
      INTEGER RC
C
C BEEP UPON TERMINAL IO.
C
      CALL EDX(BEEP, 0)
C
C RETRIEVE SCREEN AND ABORT IF ERROR.
C
      CALL EDX(SETPAN, 2, IADDR(REQSCR), IADDR(RC) )
      IF (RC.NE.-1)  CALL EDX(MENU, 0)
C
C DISPLAY SCREEN IMAGE, READ OPERATOR RESPONSE.
C
      CALL EDX(ACTION, 0)
C
C MOVE DATA FROM INPUT BUFF TO OUTPUT BUFF.(106 BYTES)
C
      DO 10 I=1,53
        OUTBUF(I) = INBUFF(I)
10    CONTINUE
C
C LINK TO PROGRAM WHICH WILL PERFORM FILE IO.
C
      CALL EDX(LINK, 1, IADDR(IOPROG) )
C
C ABORT IF LINK FAILS.
C
      CALL EDX(MENU, 0)
      RETURN
      END
```

```
*PROCESS NOCMPAT
      SUBROUTINE MTMSUB(INBUFF, OUTBUF, TEB, IIB)
      IMPLICIT INTEGER (A-Z)
      INTEGER TEB(50), IIB
      INTEGER*2 INBUFF(960), OUTBUF(512)
      EXTERNAL FILEIO,SETPAN,ACTION,MENU
      EXTERNAL $I2COT,$I2CIN
      INTEGER BUFFER(128)
      REAL*8 LSTSCR /'LST     '/
      INTEGER RC, FOUR/4/, RES/0/
C FILE CONTROL AREAS
      INTEGER FCA(14)
C REQUEST TYPE
      EQUIVALENCE (REQ,FCA(1)),(REQ1,FCA(1)),(REQ2,FCA(2))
      INTEGER*4 REQ
      INTEGER*2 REQ1, REQ2
C DATA SET NAMES
      EQUIVALENCE (DSN, FCA(3))
      INTEGER DSN(4)
C NUMBER OF RECORDS
      EQUIVALENCE (NUMREC, FCA(7))
      INTEGER NUMREC /1/
C END OF DATA RELATIVE RECORD NUMBER
      EQUIVALENCE (EODRRN, FCA(9))
      INTEGER EODRRN
C RELATIVE RECORD NUMBER
      EQUIVALENCE (RRN, FCA(11))
      INTEGER RNN
C VOLUME NAME
      EQUIVALENCE (VOL, FCA(12))
      INTEGER VOL (3)
      CALL EDX(ACTION, 0)
C
C SET UP FILE CONTROL AREA.
C
      DO 10 I=1,4
10      DSN(I) = OUTBUF(I)
      DO 20 I=1,3
20      VOL(I) = OUTBUF(I+4)
      REQ1 = OUTBUF(8)
      REQ2 = OUTBUF(9)
C
C CONVERT RELATIVE RECORD NUMBER TO NUMERIC
C
      CALL $I2CIN(RRN,FOUR,OUTBUF(10),RES,RES,RES,RES)
      DO 30 I=1,40
        BUFFER(I)= OUTBUF(I+11)
```

FORTRAN Sample Prog2 (continued)

```
30    CONTINUE
C
C RETRIEVE LISTING SCREEN AND ABORT IF ERROR.
C
     CALL EDX(SETPAN, 2, IADDR(LSTSCR), IADDR(RC) )
     IF (RC.NE.-1)  CALL EDX(MENU, 0)
C
C PERFORM FILE IO.
C
     CALL EDX(FILEIO,3,IADDR(FCA),IADDR(BUFFER),IADDR(RC))
C
C PUT DATA INTO OUTPUT BUFFER SO THAT IT IS DISPLAYED.
C
     DO 40 I=1,4
       OUTBUF(I)= DSN(I)
40   CONTINUE
     DO 50 I=1,3
       OUTBUF(I+4) = VOL(I)
50   CONTINUE
     OUTBUF(8) = REQ1
     OUTBUF(9) = REQ2
C
C CONVERT RELATIVE RECORD NUMBER TO EBCDIC
C
     CALL $I2COT(RRN,FOUR,OUTBUF(10),RES,RES,RES,RES)
     DO 60 I=1,40
       OUTBUF(I+11) = BUFFER(I)
60   CONTINUE
C
C CONVERT EOD RELATIVE RECORD NUMBER TO EBCDIC
C
     CALL $I2COT(EODRRN,FOUR,OUTBUF(52),RES,RES,RES,RES)
C
C CONVERT RETURN CODE TO EBCDIC
C
     CALL $I2COT(RC,FOUR,OUTBUF(54),RES,RES,RES,RES)
C
C DISPLAY SCREEN IMAGE.
C
      CALL EDX(ACTION, 0)
C
C END PROGRAM.
C
      CALL EDX(MENU, 0)
      RETURN
      END
```

```
MTMSUB:  PROCEDURE (INPUT_BUFFER,
                    OUTPUT_BUFFER,
                    TEB,
                    IIB);

DECLARE
  01  INPUT_BUFFER,
    05  DATA_SET_NAME            CHARACTER (8),
    05  VOLUME_NAME              CHARACTER (6),
    05  REQUEST_TYPE             CHARACTER (4),
    05  RELATIVE_RECORD_NUMBER   CHARACTER (4),
    05  BUFFER_DATA              CHARACTER (80);

DECLARE
  01  OUTPUT_BUFFER,
    05  DATA_SET_NAME            CHARACTER (8),
    05  VOLUME_NAME              CHARACTER (6),
    05  REQUEST_TYPE             CHARACTER (4),
    05  RELATIVE_RECORD_NUMBER   PICTURE '9999',
    05  BUFFER_DATA              CHARACTER (80),
    05  EOD_RRN                  PICTURE '9999',
    05  RETURN_CODE              PICTURE 'S999';

DECLARE
  (TEB, IIB) BINARY FIXED (15);

DECLARE
  (SETPAN, ACTION, BEEP, LINK, MENU) ENTRY;

DECLARE
  REQUEST_SCREEN CHARACTER (8) INITIAL ('REQ') STATIC;

DECLARE
  PROGRAM_NAME CHARACTER (8) INITIAL ('PROG2') STATIC;

DECLARE
  RETURN_CODE BINARY FIXED (15) STATIC;
```

PL/I Sample Progl (continued)

```
    /* BEEP UPON TERMINAL IO. */
      CALL BEEP;

    /* RETRIEVE SCREEN IMAGE AND ABORT IF ERROR. */
      CALL SETPAN (REQUEST_SCREEN, RETURN_CODE);
      IF RETURN_CODE ¬= -1
        THEN CALL MENU;

    /* DISPLAY SCREEN IMAGE, READ OPERATOR RESPONSE. */
      CALL ACTION;

    /* MOVE DATA FROM INPUT BUFFER TO OUTPUT BUFFER */
      OUTPUT_BUFFER.DATA_SET_NAME = INPUT_BUFFER.DATA_SET_NAME;
      OUTPUT_BUFFER.VOLUME_NAME = INPUT_BUFFER.VOLUME_NAME;
      OUTPUT_BUFFER.REQUEST_TYPE = INPUT_BUFFER.REQUEST_TYPE;
      OUTPUT_BUFFER.RELATIVE_RECORD_NUMBER
        = INPUT_BUFFER.RELATIVE_RECORD_NUMBER;
      OUTPUT_BUFFER.BUFFER_DATA = INPUT_BUFFER.BUFFER_DATA;

    /* LINK TO PROGRAM WHICH WILL PERFORM FILE IO. */
      CALL LINK (PROGRAM_NAME);

    /* ABORT IF LINK FAILS. */
      CALL MENU;

    END;
```

```
MTMSUB:  PROCEDURE (INPUT_BUFFER,
                    OUTPUT_BUFFER,
                    TEB,
                    PF_KEY);

DECLARE
  01  OUTPUT_BUFFER,
    05  DATA_SET_NAME           CHARACTER (8),
    05  VOLUME_NAME             CHARACTER (6),
    05  REQUEST_TYPE            CHARACTER (4),
    05  RELATIVE_RECORD_NUMBER  PICTURE '9999',
    05  BUFFER_DATA             CHARACTER (80),
    05  EOD_RRN                 PICTURE '9999',
    05  RETURN_CODE             PICTURE 'S999';

DECLARE
  (INPUT_BUFFER, TEB, PF_KEY)
  BINARY FIXED (15);

DECLARE
  (SETPAN, ACTION, FILEIO, MENU) ENTRY;

DECLARE
  RETURN_CODE BINARY FIXED (15) STATIC;

DECLARE
  01  BUFFER                   STATIC,
    05  FIRST_80               CHARACTER (80),
    05  LAST_176               CHARACTER (176);

DECLARE
  LIST_SCREEN CHARACTER (8) INITIAL ('LST') STATIC;

DECLARE
  01 FILE_CONTROL_AREA          STATIC,
    05  REQUEST_TYPE            CHARACTER (4),
    05  DATA_SET_NAME           CHARACTER (8),
    05  NUMBER_OF_RECORDS       BINARY FIXED (15) INITIAL (1),
    05  FILLER1                 BINARY FIXED (15),
    05  EOD_RRN                 BINARY FIXED (15),
    05  FILLER2                 BINARY FIXED (15),
    05  RELATIVE_RECORD_NUMBER  BINARY FIXED (15),
    05  VOLUME_NAME             CHARACTER (6);
```

PL/I Sample Prog2 (continued)

```
/* SET UP FILE CONTROL AREA. */
  FILE_CONTROL_AREA.REQUEST_TYPE =
    OUTPUT_BUFFER.REQUEST_TYPE;
  FILE_CONTROL_AREA.DATA_SET_NAME =
    OUTPUT_BUFFER.DATA_SET_NAME;
  FILE_CONTROL_AREA.VOLUME_NAME =
    OUTPUT_BUFFER.VOLUME_NAME;
  FILE_CONTROL_AREA.RELATIVE_RECORD_NUMBER =
    OUTPUT_BUFFER.RELATIVE_RECORD_NUMBER;
  BUFFER.FIRST_80 = OUTPUT_BUFFER.BUFFER_DATA;

/* RETRIEVE LISTING SCREEN AND ABORT IF ERROR. */
  CALL SETPAN (LIST_SCREEN, RETURN_CODE);
  IF RETURN_CODE ¬= -1
    THEN CALL MENU;

/* PERFORM FILE IO. */
  CALL FILEIO (FILE_CONTROL_AREA, BUFFER, RETURN_CODE);

/* MOVE DATA TO OUTPUT BUFFER SO IT WILL BE DISPLAYED. */
  OUTPUT_BUFFER.DATA_SET_NAME =
    FILE_CONTROL_AREA.DATA_SET_NAME;
  OUTPUT_BUFFER.VOLUME_NAME =
    FILE_CONTROL_AREA.VOLUME_NAME;
  OUTPUT_BUFFER.REQUEST_TYPE =
    FILE_CONTROL_AREA.REQUEST_TYPE;
  OUTPUT_BUFFER.RELATIVE_RECORD_NUMBER
    = FILE_CONTROL_AREA.RELATIVE_RECORD_NUMBER;
  OUTPUT_BUFFER.BUFFER_DATA = BUFFER.FIRST_80;
  OUTPUT_BUFFER.EOD_RRN = FILE_CONTROL_AREA.EOD_RRN;
  OUTPUT_BUFFER.RETURN_CODE = RETURN_CODE;

/* DISPLAY SCREEN IMAGE. */
  CALL ACTION;

/* END PROGRAM. */
  CALL MENU;

END;
```

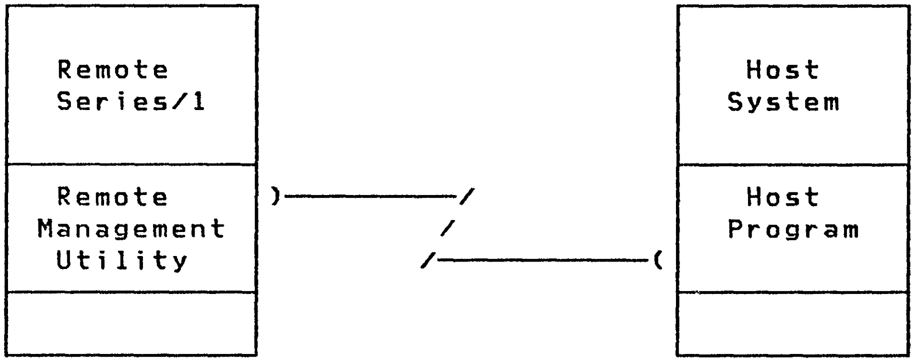
CHAPTER 6. REMOTE MANAGEMENT UTILITY

The Event Driven Executive Remote Management Utility provides facilities for the management of a remote Series/1. The remote Series/1 is controlled by a host system. The utility waits for a request sent from the host, and then performs the particular function as specified by the request. Through implementation of this utility, the concept of distributed processing can be realized.

This chapter describes these facilities and their operation, discusses the interface requirements, and provides information about the installation and execution of the Remote Management Utility.

The Remote Management Utility runs as a program in the remote Series/1 and supports such functions as file allocation and transfer, and remote operator interaction, thus minimizing the need for an operator at the remote Series/1.

The remote Series/1 is controlled by the host system via a point-to-point or multipoint binary synchronous communication line using the Event Driven Executive Binary Synchronous Communication Access Method (BSCAM).



A user-written host program communicates with the Remote Management Utility via a record exchange. Through this record exchange, the host requests function execution on the remote system. Any system supporting BSCAM-compatible binary synchronous line protocol including transparency mode, and the Remote Management Utility record exchange interface may serve as the host system.

REMOTE MANAGEMENT FUNCTIONS

The utility provides various remote management functions that can be invoked through a request issued by the host program. Listed here is a brief description of the functions provided by the utility:

ALLOCATE Allocate a disk/diskette data set on the Series/1

DELETE Delete a disk/diskette data set on the Series/1

DUMP Dump storage to a disk/diskette data set on the Series/1

EXEC Initiate execution of a program on the Series/1

IDCHECK Verify identification between the host and the Remote Management Utility

PASSTHRU Establish an interactive connection between the host and an application or utility on the remote Series/1

RECEIVE Receive data from the host and write it to an existing disk/diskette data set on the Series/1

SEND Read a disk/diskette data set on the Series/1 and transmit it to the host

SHUTDOWN Terminate the Remote Management Utility and free up any allocated resources; may also initiate execution of another program

WRAP Transmit a block of data just received back to the host

The section "Remote Management Utility Functional Operation" on page 213 describes in detail these functions and how they operate.

HARDWARE REQUIREMENTS

The Remote Management Utility requires approximately 7K bytes of storage plus buffer space. The default buffer space is 1024 bytes. In addition, the following are the minimum requirements:

- 4952, 4953, or 4955 processor (64K minimum recommended)
- One of the following BSC features:
  - Single-line adapter (#2074 or #2075)
  - Multiline controller (#2093) and one or two ,4-line adapters (#2094)
- Point-to-point (leased or switched) or multipoint (remote Series/1 as a tributary) binary synchronous communications line
- Disk or diskette
  - Disk (4962 or 4963)
  - Diskette (4964 or 4966)

SOFTWARE REQUIREMENTS

The Remote Management Utility executes with Event Driven Executive Version 2.0. The Event Driven Executive utilities are required for the installation of the Remote Management Utility. A user-written program is required on the host to communicate with the Remote Management Utility.

REMOTE MANAGEMENT UTILITY INTERFACE

The Remote Management Utility requires a user-written host program that will provide inter-program communication between the host system and the remote Series/1. The Remote Management Utility interface is comprised of two levels of communication: the binary synchronous communication (BSC) protocol, and a Remote Management Utility record exchange between the host system and the remote Series/1. A feature of the record exchange interface provides data-record blocking operations.

Binary Synchronous Communication Protocol

The Remote Management Utility uses the BSC protocol as defined by the Event Driven Executive BSCAM. A general introduction to binary synchronous communications and details of the line protocol can be found in General Information — Binary Synchronous Communications, GA27-3004. Specific implementations of BSC with the Remote Management Utility are as follows:

- The utility sends EOT as "abort". The host program should also send EOT to abort.

- The utility will not time out when receiving data. The host program may send TTD, which will be responded to by NAK.

- EOT is sent whenever the utility expects a delay. The utility will not send TTD in the event of unforeseen delays.

- Transparent EBCDIC mode is used exclusively. The host must be capable of communicating with transparent EBCDIC.

- Point-to-point communications (leased or switched) or multipoint communications are supported. If multipoint communications are used, the utility functions as a tributary on the multipoint line.

Record Exchange

The second level of communication of the Remote Management Utility interface is that of a record exchange between the host and the remote Series/1.

Records are transmitted between the host system and the remote Series/1 in a predefined format. As the content of the record determines the function to be performed, this predefined format ensures that all necessary information is properly communicated between the host system and the remote. The host is responsible for formatting records sent to the remote Series/1, and processing records received from the remote Series/1. After receiving a function request, the utility sends a record containing a status code to the host signaling the result of the function execution.

Record Format

Each Remote Management Utility record has 4 bytes at the beginning, that are referred to as the header. The first 2 bytes of the header contain the BSC control characters DLE STX, and are represented as X'1002'. The third byte contains the character 'X', identifying it as an Event Driven Executive Remote Management Utility record. The fourth byte contains a character code identifying the record type. Figure 13 lists the various record types. The remainder of the record, or the record extension, is determined by the record type as specified in the header. There are 10 types of record extensions for a Request type record. Figure 14 on page 210 illustrates the structure of the Remote Management Utility record scheme.

The section at the end of this chapter, "CDRRM Equate Listing" on page 292 illustrates the various record types, including the extensions. This set of equates defining the Remote Management Utility record is obtainable through copy code "COPY CDRRM".

Code	Type	Usage
R	Request	Sent by host to request a function
S	Status	Sent by either system to indicate success or failure of a function
C	Count	Sent by the remote Series/1 after transfer of a data set, to indicate the number of data records processed
D	Data	Used for transfer of a data set
P	Passthru	Used to pass data and data requests between the host and an application on the remote Series/1

Figure 13. Remote Management Utility Record Types

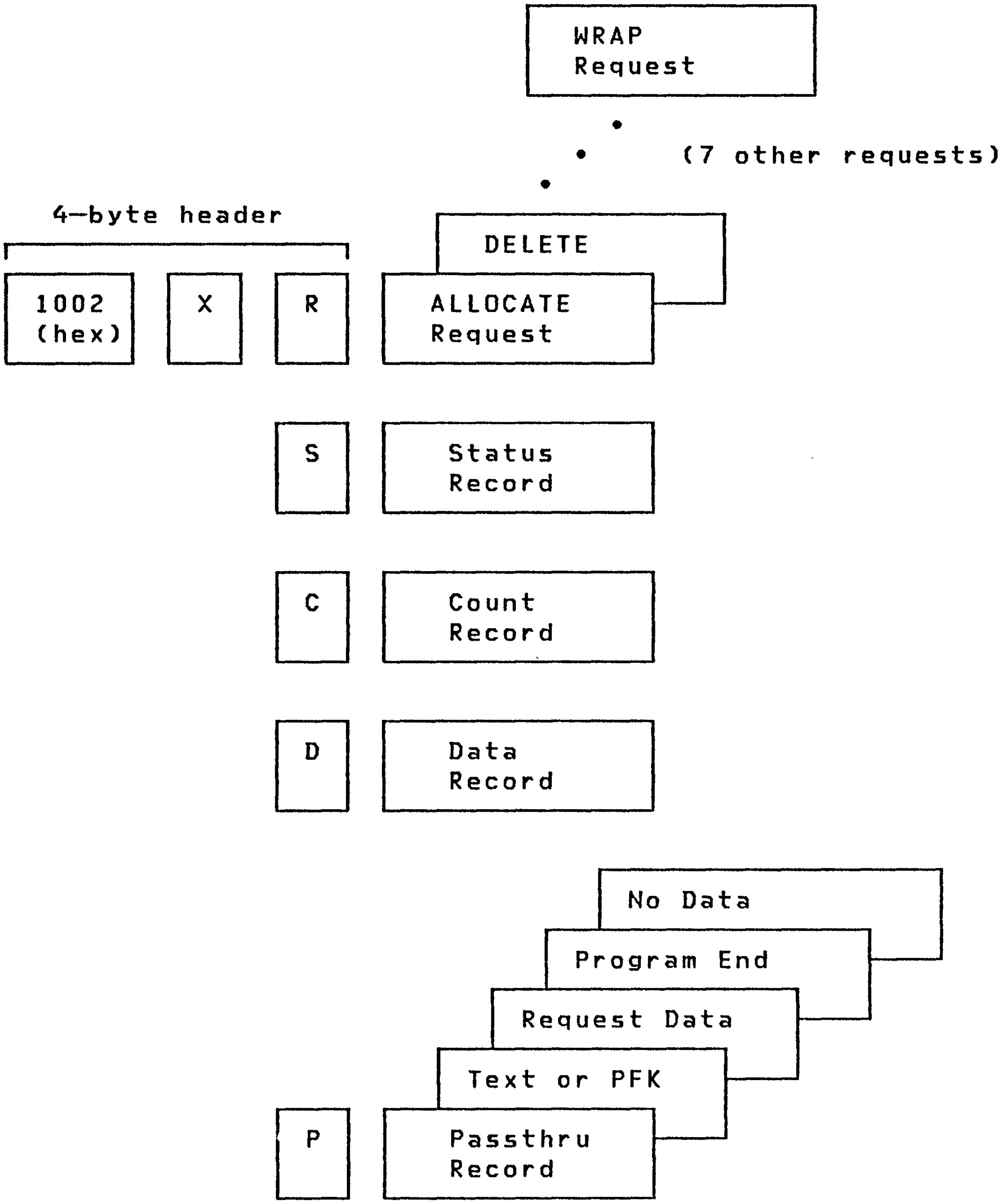


Figure 14. Remote Management Utility Record Scheme

Record Blocking

On data transfer operations (SEND and RECEIVE), the Remote Management Utility performs two types of record blocking, which are performed independently of one another, and thus, may be combined. A field in the SEND and RECEIVE record header dynamically determines the number of 80-byte or 256-byte records to be sent over the BSC line per transmission. In addition, if data sets are specified as containing 80-byte records (as in Event Driven Executive source files), the redundant 48 bytes per line of text are not transmitted.

The following example illustrates a 256-byte record containing "text":

80 bytes TEXT	48 bytes (unused)	80 bytes TEXT	48 bytes (unused)

The use of blocking will increase the efficiency with which the communications line is used. This is for two reasons:

- Blocking decreases the amount of data transmitted. The 4-byte header, along with other communications control information is sent only once per block.

- Blocking decreases the number of delays associated with each message sent over a communications line.

Provided sufficient storage resources are available, it is advantageous to use large block sizes. However, the point occurs when, due to errors on the communications line, error recovery makes use of large blocks less efficient.

Buffer Allocation

The Remote Management Utility contains a constant that determines the amount of storage to allocate for buffers. Records received by the utility may not exceed this buffer length. If a record is received greater than this length, a Status record indicating this condition (BSC I/O failure) is sent to the host and the function in progress (if any) is terminated. The default buffer size is 1K (1024 bytes). The section "Modifying Defaults" on page 283 describes how this buffer size may be modified.

Parameter Passing

The EXEC, PASSTHRU, and SHUTDOWN functions of the Remote Management Utility allow programs to be loaded for execution if specified on the request. Many programs require parameters to be passed to them in the form of a character field. An example of some of the programs requiring parameters are $EDXASM, $LINK, and $UPDATE, any of which may be specified on the request. The format of the parameter(s) to be passed is described in program preparation via the $JOBUTIL utility in Utilities, Operator Commands, Program Preparation, Messages and Codes.

The parameter is coded for $JOBUTIL on the PARM statement in columns 10 through 72. To provide the equivalent information on the PASSTHRU request for example, you should code a parameter of 64 characters with the same content as columns 10 through 72 of the PARM statement. The length of the parameter is 32 words.

The following two examples illustrate how parameters would be passed to $EDXASM by way of the $JOBUTIL utility and the Remote Management Utility via a PASSTHRU request:

```
$JOBUTIL statements:

  PROGRAM    $EDXASM,ASMLIB
  PARM       ERRORS    *
  DS         MYSRC,MYVOL
  DS         ASMWORK
  DS         ASMOBJ
  EXEC
```

```
PASSTHRU Request:

  RMHBSCC    DATA   X'1002'
  RMHID      DATA   C'X'
  RMHTYP     DATA   C'R'
  RMREQ      DATA   F'12'
             DATA   H'0'
  RMPRPTN    DATA   H'0'
  RMPRPGM    DATA   CL8'$EDXASM'
  RMPRVOL    DATA   CL6'ASMLIB'
  RMPRLFS    DATA   F'0'
  RMPRBLK    DATA   F'0'
  RMPRPRM#   DATA   F'32'
  RMPRPRM    DATA   CL64'ERRORS    *'
  RMPRDS#    DATA   F'3'
  RMPRDS     DATA   CL14'MYSRC   MYVOL'
             DATA   CL14'ASMWORK'
             DATA   CL14'ASMOBJ'
```

REMOTE MANAGEMENT UTILITY FUNCTIONAL OPERATION

This section describes the remote management functions in detail, including the communications flow and record formats for each function. The section "Sample Host Programs" on page 259 illustrates several host programs which perform some of the functions provided by the Remote Management Utility.

The examples in this section of the communications flow between the host and the remote Series/1 reflect the BSCAM level of access used by the host program and the utility. The DATA statements in these examples reflect code passed to the utility from the host program. The responses sent to the host from the utility are preceded by equal signs (=). Additional detail on the access method and BSC functions can be found in "Chapter 3. Binary Synchronous Communications" on page 35.

ALLOCATE Function

The ALLOCATE function requests the utility to allocate a disk/diskette data set on the remote Series/1.

The host sends the remote Series/1 a Request record with the ALLOCATE function specified. After receiving and executing the ALLOCATE request, the utility sends a Status record to the host indicating the results of the function execution. The utility then waits for a new request from the host.

The ALLOCATE function uses the $DISKUT3 utility in performing its function. Thus, data sets with the names: $EDXNUC, $$EDXVOL, and $$EDXLIB may not be allocated with the ALLOCATE function.

Required Field Descriptions

Specify the following fields for the ALLOCATE function:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'R', specifying a Request record type.

RMREQ A 2-byte numeric field specifying the request type. For an ALLOCATE request, this field contains the number 2.

RMADSN An 8-byte alphameric field containing the name of the data set to be allocated.

RMAVOL A 6-byte alphameric field specifying the name of the volume on which the data set is to be allocated. If RMAVOL is blank, the volume name defaults to the IPL volume.

RMANREC A 4-byte (double word) numeric field containing the number of 256-byte records to be allocated for the data set. Only the second word of this field is used.

RMADST A 2-byte numeric field identifying the type of data set to be allocated. Specify one of the following types:

- 0 User defined
- 1 Data
- 3 Program

Figure 15 illustrates the host-remote interaction for the ALLOCATE function. In the example, the host requests a data set named "MYDATA" to be allocated on the volume "MYVOL". The data set type is 1 (data) and is to contain ten 256-byte records. The remote sends a status of -1 (successful) to the host, and the operation is completed.

```
Host Program                          Host                 Remote

Write Initial - Request               ENQ   ------->
                                            <-------      ACK*
RMHBSCC   DATA   X'1002'              TEXT  ------->
RMHID     DATA   C'X'
RMHTYP    DATA   C'R'
RMREQ     DATA   F'2'
RMADSN    DATA   CL8'MYDATA'
RMAVOL    DATA   CL6'MYVOL'
RMANREC   DATA   D'10'
RMADST    DATA   F'1'
                                            <-------      ACK*
Write End                             EOT   ------->

Read Initial - Status                       <-------      ENQ
                                      ACK*  ------->
RMHTYP='S'                                  <-------      TEXT
RMSREQ=2
RMSFN=-1

Read Continue - EOT                   ACK*  ------->
                                            <-------      EOT
```

Figure 15. Communications Flow for the ALLOCATE Function

DELETE Function

The DELETE function requests the utility to delete a disk/diskette data set on the remote Series/1.

The host sends the remote Series/1 a Request record with the DELETE function specified. After receiving and executing the DELETE request, the utility sends a Status record to the host indicating the results of the function execution. The utility then waits for a new request from the host.

The DELETE function uses the $DISKUT3 utility in performing its function. Thus, data sets with the names: $EDXNUC, $$EDXVOL, and $$EDXLIB may not be deleted with the DELETE function.

Required Field Descriptions

Specify the following fields for the DELETE function:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'R', specifying a Request record type.

RMREQ A 2-byte numeric field specifying the request type. For a DELETE request, this field contains the number 3.

RMDDSN An 8-byte alphameric field containing the name of the data set to be deleted.

RMDVOL A 6-byte alphameric field specifying the name of the volume that contains the data set to be deleted. If RMDVOL is blank, the volume name defaults to the IPL volume.

Figure 16 illustrates the host-remote interaction for the DELETE function. In the example, the host specifies a data set named "MYDATA" to be deleted from the volume "MYVOL". The remote sends a status of -1 (successful) to the host, and the operation is completed.

```
Host Program                        Host               Remote

Write Initial - Request             ENQ    -------->
                                           <--------   ACK*
RMHBSCC   DATA   X'1002'            TEXT   -------->
RMHID     DATA   C'X'
RMHTYP    DATA   C'R'
RMREQ     DATA   F'3'
RMDDSN    DATA   CL8'MYDATA'
RMDVOL    DATA   CL6'MYVOL'
                                           <--------   ACK*
Write End                           EOT    -------->

Read Initial - Status                      <--------   ENQ
                                    ACK*   -------->
RMHTYP='S'                                 <--------   TEXT
RMSREQ=3
RMSFN=-1

Read Continue - EOT                 ACK*   -------->
                                           <--------   EOT
```

Figure 16. Communications Flow for the DELETE Function

DUMP Function

The DUMP function requests the utility to dump an Event Driven Executive storage partition to a disk/diskette data set on the remote Series/1.

The host sends the remote Series/1 a Request record with the DUMP function specified. After receiving and executing the DUMP request, the utility sends a Status record to the host indicating the results of the function execution. The utility then waits for a new request from the host.

Required Field Descriptions

Specify the following fields for the DUMP function:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'R', specifying a Request record type.

RMREQ A 2-byte numeric field specifying the request type. For a DUMP request, this field contains the number 4.

RMDPDSN An 8-byte alphameric field containing the name of a previously allocated data set into which the storage of the partition is to be dumped.

RMDPVOL A 6-byte alphameric field specifying the name of the volume containing the dump data set. If RMDPVOL is blank, the volume name defaults to the IPL volume.

filler A 1-byte reserved field (unused).

RMDPPTN A 1-byte numeric field specifying the partition to be dumped. Specify one of the following:

-1	Remote Management Utility partition
1—8	Specific partition

Figure 17 illustrates the host-remote interaction for the DUMP function. In the example, the host requests that partition 1 be dumped to the data set "MYDATA" on the volume "MYVOL". The remote sends a status of -1 (successful) to the host, and the operation is completed.

```
Host Program                          Host                Remote

Write Initial - Request               ENQ     -------->
                                              <--------   ACK*
RMHBSCC  DATA  X'1002'                TEXT    -------->
RMHID    DATA  C'X'
RMHTYP   DATA  C'R'
RMREQ    DATA  F'4'
RMDPDSN  DATA  CL8'MYDATA'
RMDPVOL  DATA  CL6'MYVOL'
         DATA  H'0'
RMDPPTN  DATA  H'1'
                                              <--------   ACK*
Write End                             EOT     -------->

Read Initial - Status                         <--------   ENQ
                                      ACK*    -------->
RMHTYP='S'                                    <--------   TEXT
RMSREQ=4
RMSFN=-1

Read Continue - EOT                   ACK*    -------->
                                              <--------   EOT
```

Figure 17. Communications Flow for the DUMP Function

EXEC Function

The EXEC function requests the utility to load and invoke execution of a program on the remote Series/1.

The hosts sends the remote Series/1 a Request record with the EXEC function specified. After receiving and executing the EXEC request, the utility sends a Status record to the host indicating the results of the function execution. The utility then waits for a new request from the host.

If the program specified by the host requires a parameter and the parameter is not supplied, the load (via LOAD) of the program will fail. For further information on parameter passing, refer to the section "Parameter Passing" on page 212.

Required Field Descriptions

Specify the following fields for the EXEC function:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'R', specifying a Request record type.

RMREQ A 2-byte numeric field specifying the request type. For an EXEC request, this field contains the number 9.

filler A 2-byte reserved field (unused).

RMXFLG A 1-byte numeric field containing the RMXFLGL and RMXFLGW bits. RMXFLGL and RMXFLGW correspond to the usage of the LOGMSG and WAIT parameters of the Event Driven Language LOAD instruction.

RMXFLGL - When set on, this bit indicates that a "program loaded" message is to be printed on the terminal which loaded the utility. The value for RMXFLGL when set on is X'40'.

RMXFLGW - When set on, this bit indicates that the utility is to wait for the completion of the program before sending a Status record to the host. Otherwise, the program executes asynchronously with the utility, and the utility sends a Status record after invoking the LOAD instruction. If the utility waits for the completion of the program, the PROGSTOP code from the program is returned in the RMSST field of the Status record. The value for RMXFLGW when set on is X'20'.

RMXPTN A 1-byte numeric field specifying the partition the program is to run in. Specify one of the following:

- -1 Remote Management Utility partition
- 0 Any partition
- 1—8 Specific partition

RMXPGM An 8-byte alphameric field specifying the program to be executed.

RMXVOL A 6-byte alphameric field specifying the name of the volume which contains the program. If RMXVOL is blank, the volume name defaults to the IPL volume.

RMXLFS A 2-byte numeric field specifying the amount of free space (in bytes) to pass to the program.

RMXPRM# A 2-byte numeric field specifying the length of the parameter(s), in words, to pass to the program. This field must be zero if no parameters are passed.

RMXPRM A variable length field containing the parameter(s) to be passed to the program. The length of this field, in words, must correspond to the value contained in the RMXPRM# field. See the section "Parameter Passing" on page 212 for details on this field.

RMXDS# A 2-byte numeric field specifying the number of data set names to pass to program. The maximum number of data sets that may be specified is nine. This field must be zero if no data set names are passed.

RMXDS A variable number of 14-byte alphameric fields specifying the data set and volume names to be passed to the program. The first eight bytes contain the data set name, and the last six bytes contain the volume name. If the volume name is blank, the name of the volume defaults to the IPL volume. The number of data set and volume names specified must correspond to the value contained in the RMXDS# field.

Figure 18 illustrates the host-remote interaction for the EXEC function. In the example, the host specifies a program named "MYPROG" on the volume "MYVOL", is to be executed in partition 1 with 256 bytes of free space passed to the program. The RMXFLG field specifies that both RMXFLGL and RMXFLGW bits are set on. No parameters or data sets are passed to "MYPROG". The program ends with a return code of -1. The remote sends a status of -1 (successful) to the host, along with the return code and the operation is completed.

```
Host Program                                 Host               Remote

Write Initial - Request                      ENQ    ------->
                                                    <-------    ACK*
RMHBSCC   DATA   X'1002'                     TEXT   ------->
RMHID     DATA   C'X'
RMHTYP    DATA   C'R'
RMREQ     DATA   F'9'
          DATA   F'0'
RMXFLG    DATA   X'60'
RMXPTN    DATA   H'1'
RMXPGM    DATA   CL8'MYPROG'
RMXVOL    DATA   CL6'MYVOL'
RMXLFS    DATA   F'256'
RMXPRM#   DATA   F'0'
RMXPRM    EQU    *
RMSDS#    DATA   F'0'
RMSDS     EQU    *
                                                    <-------    ACK*
Write End                                    EOT    ------->

Read Initial - Status                               <-------    ENQ
                                             ACK*   ------->
RMHTYP='S'                                          <-------    TEXT
RMSREQ=9
RMSFN=-1
RMSST=-1

Read Continue - EOT                          ACK*   ------->
                                                    <-------    EOT
```

Figure 18. Communications Flow for the EXEC Function

IDCHECK Function

The IDCHECK function allows the host and the remote system to verify each others identification.

The host sends the remote Series/1 a Request record with the IDCHECK function and the host ID specified. The utility compares this ID with a constant defined in the utility as the host ID. If the IDs match, the utility returns a Status record which contains the ID of the remote system, which is another constant. If the IDs do not match, an error status is returned to the host and the ID of the remote Series/1 is not returned. In either case, after the Status record is sent to the host, the utility then waits for a new request from the host.

The default host ID for the host system is "HOSTRMUX", and "REMTRMUX" is the default ID of the remote system.

Required Field Descriptions

Specify the following fields for the IDCHECK function:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'R', specifying a Request record type.

RMREQ A 2-byte numeric field specifying the request type. For an IDCHECK request, this field contains the number 6.

RMICHK An 8-byte alphameric field specifying the host ID.

Figure 19 illustrates the host-remote interaction for the IDCHECK function. In the example, the host specifies the ID "HOSTRMUX". The remote validates the host ID , sends a status of -1 (successful) to the host along with the remote system's ID, "REMTRMUX", thus completing the operation.

```
Host Program                      Host              Remote

Write Initial - Request           ENQ   -------->
                                        <--------   ACK*
RMHBSCC  DATA  X'1002'            TEXT  -------->
RMHID    DATA  C'X'
RMHTYP   DATA  C'R'
RMREQ    DATA  F'6'
RMICHK   DATA  C'HOSTRMUX'
                                        <--------   ACK*
Write End                         EOT   -------->

Read Initial - Status                   <--------   ENQ
                                  ACK*  -------->
RMHTYP='S'                              <--------   TEXT
RMSREQ=6
RMSFN=-1
RMSRID='REMTRMUX'

Read Continue - EOT               ACK*  -------->
                                        <--------   EOT
```

Figure 19. Communications Flow for the IDCHECK Function

PASSTHRU Function

The PASSTHRU function provides the host with an interface which simulates the capabilities of a terminal connected to a Series/1. Through this interface, the host can interact with the Event Driven Executive supervisor by issuing operator commands, or by interacting with a program as if that program was loaded from a terminal on the Series/1. The host's interaction with the supervisor or a program is conducted in a PASSTHRU session.

Most programs which do not require full screen terminal support, including most Event Driven Executive utilities may be used with the PASSTHRU function. Characteristics of programs which prevent programs from running under the PASSTHRU function are discussed in the section "Considerations on Using PASSTHRU" on page 237.

An example of the use of PASSTHRU could be a host program that formats a host terminal to look like a remote Series/1 terminal. The operator on the host system could then interact with the program as if the terminal was on the remote Series/1.

The PASSTHRU function is initiated by the host sending a PASSTHRU request to the utility. After the request is sent, a series of records are exchanged between the host and the utility, similar to the way messages are written to and read from a terminal. This procedure will be discussed in two parts:

- Establishing a PASSTHRU Session
- Conducting a PASSTHRU session

Establishing a PASSTHRU Session

As was previously discussed, a PASSTHRU function is initiated by the host sending a PASSTHRU request to the utility. The session is established after the host receives a successful Status record and an EOT. The PASSTHRU request may specify (RMPRPGM field) one of two ways of establishing a session:

- Communication with the Event Driven Executive supervisor
- Communication with a program which the utility will load

If a session with the supervisor is established, the utility will issue an "attention" (as if the attention key on the terminal was pressed). Following the attention, the PASSTHRU session will be conducted with the terminal on the host receiving the caret symbol (>), and continued by the operator entering an operator command, for example $L.

If a session with a program is established, the host specifies the name of the program and the program is loaded by the utility. The PASSTHRU session will be conducted with the host interacting with the program.

The following fields must be specified on the PASSTHRU request to establish a PASSTHRU session:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'R', specifying a Request record type.

RMREQ A 2-byte numeric field specifying the request type. For a PASSTHRU request, this field contains the number 12.

RMPRBLK A 2-byte numeric field indicating whether the host is to receive blocked records from the remote. A value of 0 specifies that records are unblocked. A value greater than 0 specifies the size, in bytes, of the record block (size of "Text or PF Key" extension after the RMPTYP field). See the section "PASSTHRU Blocking" on page 237 for details on this field.

RMPRFLG A 1-byte reserved field (unused).

RMPRPTN A 1-byte numeric field specifying the partition the program is to run in. Specify one of the following:

-1	Remote Management Utility partition
0	Any partition
1-8	Specific partition

RMPRPGM An 8-byte alphameric field specifying the name of the program or utility to interact with the host. If this field is blank, a session with the Event Driven Executive is established.

RMPRVOL A 6-byte alphameric field specifying the name of the volume which contains the program or utility. If blank, the name defaults to the IPL volume name.

RMPRLFS A 2-byte numeric field specifying the amount of free space (in bytes) to pass to the program.

RMPRPRM# A 2-byte numeric field specifying the length of the parameter(s), in words, to pass to the program. This field must be zero if no parameters are passed.

RMPRPRM A variable length field containing the parameter(s) to be passed to the program. The length of this field, in words, must correspond to the value contained in the RMPRPRM# field. See the section "Parameter Passing" on page 212 for details on this field.

RMPRDS# A 2-byte numeric field specifying the length of data sets to pass to the program. The maximum number of data sets that may be specified is nine. This field must be zero if no data sets are passed.

RMPRDS A variable number of 14-byte alphameric fields specifying the data set and volume names to be passed to the program. The first eight bytes contain the data set name, and the last six bytes contain the volume name. If the volume name is blank, the name of the volume defaults to the IPL volume. The number of data set and volume names specified must correspond to the value contained in the RMPRDS# field.

Figure 22 on page 241 illustrates the host-remote interaction in establishing a PASSTHRU session.

Conducting a PASSTHRU Session

Once the PASSTHRU session is established, the session is conducted with Passthru type records exchanged between the host and the remote Series/1. The Passthru records provide information to and receive information from the host program, as if the host program were a terminal on the remote Series/1. Four Passthru records are defined to provide this information. These records are described as follows:

- Text or Program Function (PF) Key - Passthru record which passes messages or program function keys.

- Request for Data - Passthru record which indicates data should be sent.

- Program End - Passthru record which indicates termination.

- No Data - Passthru record which indicates no messages are are available.

The content and format of these records is discussed in the section "Passthru Record Types" on page 232.

Figure 20 on page 230 graphically illustrates how a PASSTHRU session is conducted. In this illustration, each vertical line represents a "state" the host may be in at any time during the session. The name attached at the top of each vertical line is the name of the state. The state of the host may change by one of the following:

- Receiving a Passthru record from the utility. This is represented by a solid horizontal line with an arrow pointing to the new state.
- Sending a Passthru record to the utility. This is represented by a horizontal line of dashes with an arrow pointing to the new state.
- A change of state with no Passthru record transfer. This is represented by a dotted line with an arrow pointing to the new state.

The PASSTHRU session begins with the host in the state "READTEXT" as shown in the figure. The host issues a "read" to the communications line and will receive either a "Text or PF Key", "Request for Data", or "Program End" record. The type of record the host receives is determined by the terminal activity occurring in the remote Series/1.

If the host receives a Text or PF Key record, data is being sent to the host. The program (or the supervisor) has issued a PRINTEXT or other terminal I/O instruction, and the message is transmitted to the host as if the host were a terminal. As shown in the figure, the state of the host changes from "READTEXT" to "READING" because the host received a Text or PF Key record. The state then changes back to "READTEXT". Effectively the host remains in the "READTEXT" state as long as Text or PF Key records are received.

If the host receives a Request for Data record, data is needed from the host. The program (or the supervisor) has issued a READTEXT or other terminal I/O instruction, and requires data from the host as if the host were a terminal. As shown in the figure, the state of the host changes from "READTEXT" to "PGM NEEDS DATA". Note that an EOT follows the the Request for Data record. The host must read the EOT also.

In the host's current state, "PGM NEEDS DATA", the host must send a Text or PF Key record followed by an EOT. The Text or PF Key record the host sends may contain either text or a PF key (the host, as a terminal, has entered text or a program function key in response to Request for Data).

If the host sends text, the state of the host changes from "PGM NEEDS DATA" back to "READTEXT". If the host sends a program function key, the host goes to the state "PFK SENT". The host issues a read to the communications line and will receive a Request for Data record followed by an EOT. This Request for Data is sent to the host because the original request was not satisfied by the program function key. As a result, the host is now in the state "SEND TEXT". The host must send a Text or PF Key record which contains text, followed by an EOT. The host is then back to the state "READTEXT".

The last possibility from the state "READTEXT" is that the host will receive a Program End record, followed by an EOT. This indicates either the program, the operator command, or an attention exit has completed. The host changes from the state "READTEXT" to "CONTINUE ?". At this point, the host must determine whether the PASSTHRU session should continue.

If the PASSTHRU session was with a program and the program has ended (while in the "CONTINUE ?" state), the host would most likely decide not to continue. If the session was with the supervisor and a $L command was successfully entered, the host would most likely decide to continue the session and communicate with the program which was loaded.

To terminate the PASSTHRU session, the host sends a Program End record, followed by an EOT. This changes the state of the host from "CONTINUE ?" to "EXIT". The PASSTHRU session is now terminated and the Remote Management Utility will wait for a new request from the host. To continue the session, the host should send a Request for Data record followed by an EOT. The state of the host then changes from "CONTINUE ?" to "ACTIVITY ?".

At this point, the utility determines if there is any terminal activity on the remote Series/1 for the host. If there is activity, one of the three Passthru records which can be received from the "READTEXT" state will be received by the host. These three records are Text or PF Key, Request for Data, or Program End. The state of the host will change as it would from the state "READTEXT".

If there is no terminal activity, the host will receive a No Data record followed by an EOT, and the host's state changes from "ACTIVITY ?" to "CONTINUE ?". The host may then determine again whether it should continue. If the program in the remote Series/1 has any delays in performing terminal I/O while the host is in the "CONTINUE ?" state, the host may change from "CONTINUE ?" to "ACTIVITY ?" and back again several times. However, if no activity ever occurs, the host must eventually send a Program End record and terminate the PASSTHRU session.

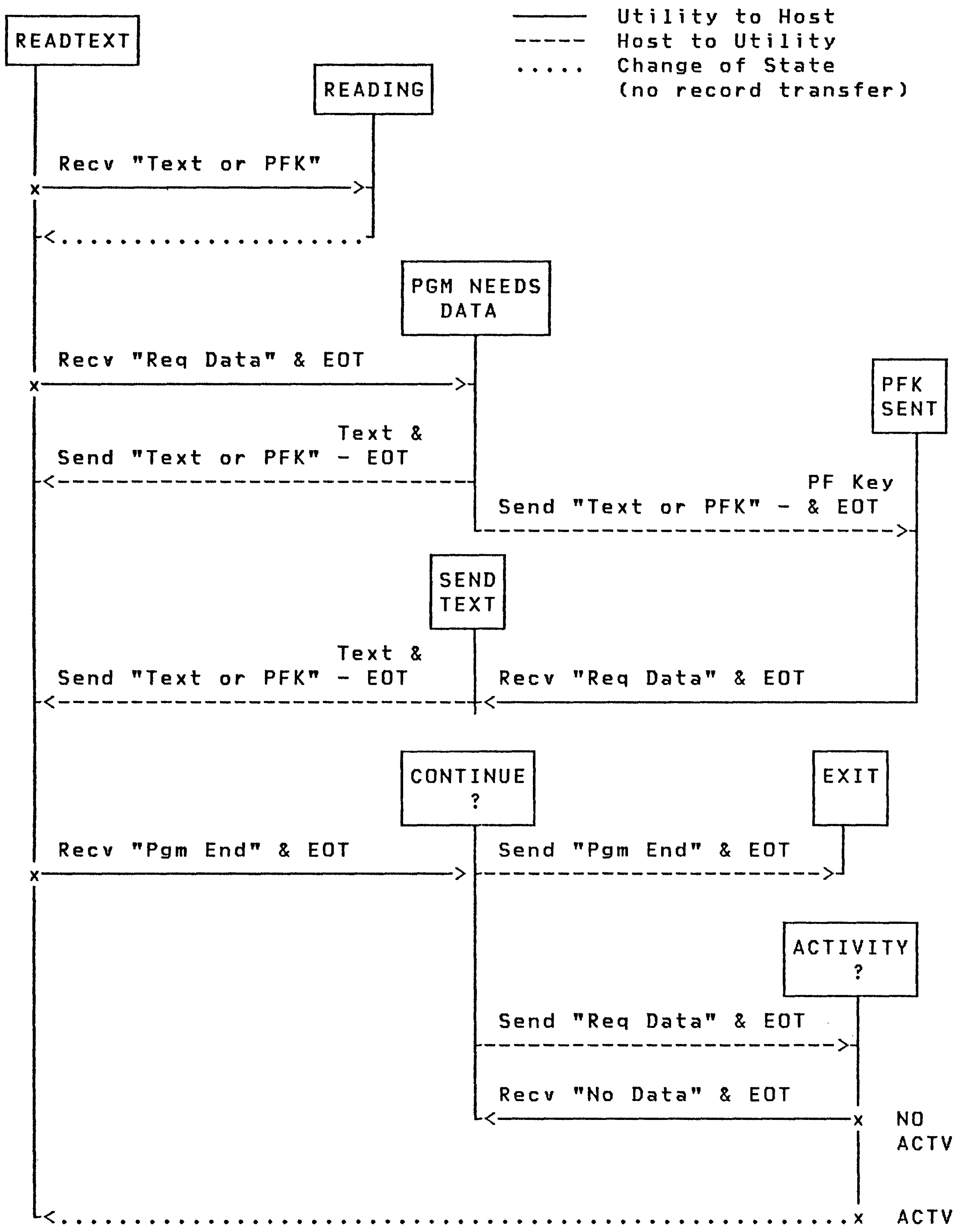


Figure 20. Logic Flow of a PASSTHRU Session

The preceding discussion and Figure 20 on page 230 summarizes the flow of a PASSTHRU session. The only addition to this is that of a severe error being encountered, in which case the host may receive or send a Status record followed by an EOT. An example of where this error condition could occur is if the host sends an invalid Passthru record. The utility will respond to this invalid record with a Status record. Similarly, the host may send a 4-byte Status record (preceded by "abort" if necessary). In either case, the PASSTHRU session is terminated and the utility will wait for a new request.

The following is the format of the Status record sent by the host:

```
  RMHBSCC    DATA  X'1002'
  RMHID      DATA  C'X'
  RMHTYP     DATA  C'S'
```

Passthru Record Types

This section describes in detail the format and content of the four types of Passthru records previously mentioned.

Text or Program Function Key

This record is comprised of two segments. The first six bytes, or the main segment, identifies this record as a Passthru Text or Program Function (PF) Key record. Following the main segment is one or more text or PF key segments. The following is an illustration of these two segments:

Main segment:

```
RMHBSCC  DATA  X'1002'
RMHID    DATA  C'X'
RMHTYP   DATA  C'P'
RMPTYP   DATA  F'1'
```

Text or program function key segment:

```
RMPST    DATA  F'nnnn'
RMPTXTL  DATA  F'nnnn'
RMPTXT   DATA  C'xxxx'
```

In the main segment, all values are constants as shown. The text or program function key segment contains the information to be transferred:

RMPST A 2-byte value of the return code. This field contains a value only on records received by the host.

RMPTXTL A 2-byte numeric field specifying either the length of the text, or indicating a PF key is being sent.

RMPTXT Either a variable-length alphameric field containing text, or a 2-byte numeric field containing the PF key value.

If the Text or PF Key record is not blocked, it will contain one of each segment. If the record is blocked, it will contain one main segment followed by more than one text or program function key segments. All records sent by the host are unblocked. Records received by the host may be blocked if specified on the PASSTHRU request. Details on how to specify blocking is discussed in the section "PASSTHRU Blocking" on page 237.

When the host sends a Text or PF Key record, the record may contain either text (the host as a terminal has entered text), or a PF key (the host as a terminal has entered a program function key). If text is sent, the length of the text is specified in the RMPTXTL field, and the text is specified in the RMPTXT field. The RMPST field is not used.

The following example illustrates a record sent by the host which contains the text "MESSAGE FROM HOST PROGRAM":

Text record sent by the host:

```
RMHBSCC  DATA  X'1002'
RMHID    DATA  C'X'
RMHTYP   DATA  C'P'
RMPTYP   DATA  F'1'
RMPST    DATA  F'0'    (IGNORED)
RMPTXTL  DATA  F'25'
RMPTXT   DATA  C'MESSAGE FROM HOST PROGRAM'
```

When the host sends a program function key, the value of the RMPTXTL field is set to -1 and the program function key is specified as a 2-byte numeric value in the RMPTXT field. A PF key value of 0 is the equivalent of an "attention".

The following example illustrates a program function key 3 being sent by the host:

Program function key record sent by host:

```
RMHBSCC  DATA  X'1002'
RMHID    DATA  C'X'
RMHTYP   DATA  C'P'
RMPTYP   DATA  F'1'
RMPST    DATA  F'0'   (IGNORED)
RMPTXTL  DATA  F'-1'  (INDICATES PF KEY)
RMPPF    DATA  F'3'   PF KEY 3
```

All Text or PF Key records received by the host will always contain text; the host will never receive a program function key. Each Text or PF Key record begins with the 6-byte main segment followed by one or more text segments. The fields in each text segment are defined as follows:

RMPST — A 2-byte numeric containing the return code associated with the text. For example, the return code indicates whether the text is to appear on a new line. Some return codes have no text associated with them. For a complete description of the possible return codes, refer to virtual terminal communications return codes as described for the READTEXT instruction in the Language Reference.

The return codes which are applicable are:

X'8Fnn'	LINE=nn received
X'8Enn'	SKIP=nn received
-2	Line received (no CR)
-1	New line received

RMPTXTL A 2-byte numeric field containing the text length. If there is no text, this field will contain the value 0.

RMPTXT A variable-length alphameric field containing the text received by the host. The length of this field, in bytes, is the value of RMPTXTL. If RMPTXTL is an odd number, one byte of blanks (X'40') follows the text.

If records are blocked, multiple text segments are received on a Text or PF Key record. The host must determine the length of the record in order to process each segment. Figure 21 on page 235 is an example of the records the host receives from a program which executes a PRINTEXT instruction.

```
Issued by program on remote Series/1:

  PRINTEXT  'ENTER COMMAND',SKIP=1


Passthru record received by host
with no blocking:

  RMHBSCC  DATA  X'1002'
  RMHID    DATA  C'X'
  RMHTYP   DATA  C'P'
  RMPTYP   DATA  F'1'
  RMPST    DATA  X'8E01'   (SKIP=1)
  RMPTXTL  DATA  F'0'      (NO TEXT)

  RMHBSCC  DATA  X'1002'
  RMHID    DATA  C'X'
  RMHTYP   DATA  C'P'
  RMPTYP   DATA  F'1'
  RMPST    DATA  F'-2'
  RMPTXTL  DATA  F'13'
  RMPTXT   DATA  C'ENTER COMMAND'
           DATA  C' '      (PAD)

Passthru record received by host
with blocking:

  RMHBSCC  DATA  X'1002'
  RMHID    DATA  C'X'
  RMHTYP   DATA  C'P'
  RMPTYP   DATA  F'1'
           DATA  X'8E01'   (SKIP=1)
           DATA  F'0'      (NO TEXT)
           DATA  F'-2'     (NEXT SEGMENT)
           DATA  F'13'
           DATA  C'ENTER COMMAND'
           DATA  C' '      (PAD)
```

Figure 21. Example of Passthru Records Received by Host

Request for Data

The Request for Data record is a 6-byte record which contains constant values. A Request for Data record is always followed by an EOT.

The following is the format of the Request for Data record:

```
  RMHBSCC   DATA   X'1002'
  RMHID     DATA   C'X'
  RMHTYP    DATA   C'P'
  RMPTYP    DATA   F'2'
```

Program End

The Program End record is a 6-byte record which contains constant values. A Program End record is always followed by an EOT.

The following is the format of the Program End record:

```
  RMHBSCC   DATA   X'1002'
  RMHID     DATA   C'X'
  RMHTYP    DATA   C'P'
  RMPTYP    DATA   F'3'
```

No Data

The No Data record is a 6-byte record which contains constant values. A No Data record is always followed by an EOT.

The following is the format of the No Data record:

```
  RMHBSCC   DATA   X'1002'
  RMHID     DATA   C'X'
  RMHTYP    DATA   C'P'
  RMPTYP    DATA   F'4'
```

PASSTHRU Blocking

When Passthru records are blocked, the communications line is used more efficiently. Without blocking, each Text or PF Key record contains only one text segment. With blocking, each record may contain multiple text segments. Through use of blocking, the amount of information and the number of records transmitted over the communications line is reduced. Thus blocking allows more efficient usage of the communications line, especially for PASSTHRU sessions in which the host receives many consecutive lines of output, such as a result of a "list" command to a utility.

To use PASSTHRU blocking, the host must determine the length of the Text or PF Key record and process each text segment until the end of the record is reached.

The host specifies blocking on the PASSTHRU request in the RMPRBLK field. If this field is set to zero blocking is not performed. A value greater than zero indicates the maximum length of the text segments which the host can process. To determine the value for the RMPRBLK field, start with the size of the buffer at the host. Subtract 6 from the size of the host buffer for the 6-byte main segment of each record. Then subtract 2 more to allow space for the ETX plus one byte for word alignment. The resulting number is the maximum blocking size the host may use. This number would then be specified in the RMPRBLK field of the PASSTHRU request. The utility will use this value if it can. If, however, the utility does not have a buffer of sufficient size to provide records of the size requested, the utility will block to the largest size it can handle. Refer to the section "Modifying Defaults" on page 283 for additional information on the maximum blocking size of the utility.

If a single text record should exceed the size specified for RMPRBLK, the utility will send that record to the host. This may result in a "wrong length record" condition; the host should ensure that it can handle the longest length record expected from the utility. For example, if the longest text length is 132 bytes, a minimum block size of 136 would be sufficient for all records.

Considerations on Using PASSTHRU

As mentioned earlier, most programs can be used with the PASSTHRU function of the Remote Management Utility. In this section, considerations on the use of the PASSTHRU function are discussed. These include a discussion of restrictions on the use of the PASSTHRU function and programming techniques.

The PASSTHRU function uses the virtual terminal support of the Event Driven Executive, and therefore has any restrictions inherent in this support. The primary one is that static screens are not supported, therefore programs requiring static screens can not be run under the PASSTHRU function. This includes such programs as the full screen editor, $FSEDIT. Another restriction is that message length may be no longer than 254 bytes.

The utility allows the host to transmit a program function key or an attention only when the remote is already requesting data. Therefore output from the remote may not be "interrupted" by an "attention", as it could be on a local terminal. For example, a listing produced by the $DISKUT2 utility could not be interrupted by an "attention" and cancel command.

If a program stops communicating with the terminal which loaded it, and waits on the terminal to enter commands by way of "attention" or program function keys, it will not run directly under the PASSTHRU function. This occurs because the Remote Management Utility will wait indefinitely on a "READTEXT" to the virtual channel while the remote program is waiting on an attention or PF key. When this happens, this is referred to as a deadlock situation. Programs which do this include the following:

$DEBUG	
$TRAP	
$LOG	
$BSCTRCE	
$TERMUT3	(Attention-entered commands)
$IOTEST	(Attention-entered commands)
CALCDEMO	(Sample program)

A program has been provided which will break the deadlock situation when it occurs. The program name is $RMUPA. It must be started under the PASSTHRU function prior to starting a PASSTHRU session with one of the programs which may have this problem. $RMUPA will cause a "disconnect", resulting in a Program End Passthru record being received at the host whenever the following sequence of events occurs:

1. No activity has occurred over the virtual channel for 20 seconds.

2. The utility is waiting on completion of a "READTEXT" instruction.

3. The remote program is not ENQT'ed on its virtual terminal.

The program uses the STIMER instruction, and therefore requires timer support to be included in the remote system.

Due to a timing situation when multiple programs are communicating over a virtual channel, blocking must be used while running these programs.

The sample PASSTHRU host program in the section "Sample Host Programs" on page 259 illustrates how to use the program $RMUPA from a host program. $RMUPA is first started under the PASSTHRU function. When a Program End Passthru record is received at the host, the host responds with a Program End Passthru record and the PASSTHRU session with $RMUPA is terminated. Only one copy of $RMUPA should be running at a time. It may run in any partition. It continues running until an "attention" followed by "$RMUPA" is entered.

Once $RMUPA is running, another program may be started. The sample PASSTHRU host program interaction in the section "Sample Host Programs" on page 259 illustrates how $DEBUG may be used. Note that "$PF0" is entered to provide the same function as entering the "attention" key.

If a remote program should take longer than 20 seconds between performing terminal I/O, $RMUPA will cause a Program End record to be sent even though the program is still running. If this happens, the host should respond with a Request for Data record until the remote program performs terminal I/O.

If a program is run under the PASSTHRU function which issues an ENQT instruction for a terminal other than the terminal which loaded the program and the program terminates, the utility does not receive a "disconnect" over the virtual channel and the host will not receive a Program End record. The utility will wait indefinitely. One example of where this will occur is in running $EDXASM, with output directed to a printer. This condition can be avoided in two ways:

- Load the program from another program (such as the $JOBUTIL utility) which will wait on the program to complete.
- Load the program through a session with the Event Driven Executive via a $L command and respond with a Program End when the command terminates. Programs requiring terminal interaction after being loaded, such as $EDXASM, will not work in this manner, so should be handled in the first way.

When multiple programs are communicating over a virtual channel, blocking must be used. As mentioned previously, this is due to a timing situation with multiple programs.

Only one PASSTHRU session may be conducted at a time, since the utility uses a predefined set of virtual terminals, CDRVTA and CDRVTB. While a PASSTHRU session is being conducted, another copy of the utility (defined for another communications line) may be performing any other function except PASSTHRU.

In the event a PASSTHRU session is abruptly terminated (status received from host, invalid message received from host, or an error in the BSC), the utility will cause a terminal I/O return code 5 ("Disconnected") to be received by the program for the outstanding terminal request. This code will only be received once by the PASSTHRU-invoked program, and the program should then take appropriate action, which would most likely be to terminate. However, if the program does not recognize the terminal error and continues to perform terminal I/O, the program will interfere with attempts to establish a new PASSTHRU session. If the new session is being established with a program, the utility will return the status "virtual terminal busy". The host may establish a session with the Event Driven Executive and issue a $C command to cancel the suspended program. The $C command should be used with caution, as noted in the Utilities, Operator Commands, Program Preparation, Messages and Codes.

When a $L command is issued during a PASSTHRU session with the Event Driven Executive supervisor, a Program End Passthru record, resulting from completion of the command, may be received by the host. Whether it is received depends on how quickly the loaded program begins performing terminal I/O.

As described in the System Guide, two virtual terminals, named CDRVTA and CDRVTB, must be defined for using the PASSTHRU function. Also, virtual terminal support must be included at system generation time. Refer to the System Guide for details.

The utility will not time-out while it is receiving messages during a PASSTHRU session. However, if the host does not acknowledge reception of messages sent by the utility, a time-out will occur and the PASSTHRU session is terminated. This can be avoided in two ways:

- Avoid any long delays at the host while messages are being received from the remote Series/1.

- Define a high retry count for the RETRIES parameter of the BSCLINE statement in the remote system.

Figure 22 on page 241 illustrates the host-remote interaction for the PASSTHRU function. In the example, the host specifies the program "MYPROG" on the volume "MYVOL" is to be executed. While executing, the program writes one message to the virtual terminal via a Passthru record, receives one message from the virtual terminal via a Passthru record, and terminates.

```
Host Program                             Host               Remote

Write Initial - Request                  ENQ    ------->
                                                <-------    ACK*
RMHBSCC   DATA   X'1002'                 TEXT   ------->
RMHID     DATA   C'X'
RMHTYP    DATA   C'R'
RMREQ     DATA   F'12'
RMPRFLG   DATA   H'0'
RMPRPTN   DATA   H'0'
RMPRPGM   DATA   CL8'MYPROG'
RMPRVOL   DATA   CL6'MYVOL'
RMPRLFS   DATA   F'256'
RMPRBLK   DATA   F'0'
RMPRPRM#  DATA   F'0'
RMPRPRM   EQU    *
RMPRDS#   DATA   F'0'
RMPRDS    EQU    *
                                                <-------    ACK*
Write End                                EOT    ------->

Read Initial - Status                           <-------    ENQ
                                         ACK*   ------->
RMHTYP='S'                                      <-------    TEXT
RMSREQ=12
RMSFN=-1

Read Continue - EOT                      ACK*   ------->
                                                <-------    EOT
```

Figure 22. Communications Flow for the PASSTHRU Function (Part 1 of 2)

```
Read Initial - Passthru Data            <-------  ENQ
                                  ACK*  ------->
RMHTYP='P'                              <-------  TEXT
RMPTYP=1
RMPST=Status from READTEXT
RMPTXTL=Message length
RMPTXT=Message text

Read Continue - Request for Data  ACK*  ------->

RMHTYP='P'                              <-------  TEXT
RMPTYP=2

Read Continue - EOT               ACK*  ------->
                                        <-------  EOT
Write Initial - Passthru Data     ENQ   ------->
                                        <-------  ACK*
RMHTYP='P'                        TEXT  ------->
RMPTYP=1
RMPST=0       (Unused)
RMPTXTL=Message length
RMPTXT=Message text
                                        <-------  ACK*
Write End                         EOT   ------->

Read Initial - Passthru Program End     <-------  ENQ
                                  ACK*  ------->
RMHTYP='P'                              <-------  TEXT
RMPTYP=3

Read Continue - EOT               ACK*  ------->
                                        <-------  EOT

Write Initial - Passthru Program End
                                  ENQ   ------->
                                        <-------  ACK*
RMHTYP='P'                        TEXT  ------->
RMPTYP=3
                                        <-------  ACK*

Write End                         EOT   ------->
```

Figure 23. Communications Flow for the PASSTHRU Function (Part 2 of 2)

RECEIVE Function

The RECEIVE function requests the utility to receive a data set transmitted from the host and to write it to a disk/diskette data set on the remote Series/1.

The host can specify it is sending a data set consisting of 256-byte data records, or a source data set, consisting of 80-byte text records. The host may also specify blocking, in which case, the utility receives records containing multiples of 256-byte or 80-byte records.

The host sends the remote Series/1 a Request record with the RECEIVE function specified. After receiving and executing the RECEIVE request, the utility checks to see if it can handle records of the size requested and attempts to open the data set. The utility then sends a Status record to the host. If a -1 (successful) status is returned to the host the RECEIVE function continues, otherwise the function is terminated.

Upon receipt of the successful status, the host sends Data records to the utility. The data contained within the Data records sent by the host should have a length which is a multiple of 256 or 80, depending on the data set type. If the utility receives a record whose length is not a multiple of 256 or 80 (short record), the record is padded with zeroes, and then written to disk or diskette. For example, assume that a 256-byte record data set with a blocking factor of 3 is specified. A record received with with a length of 256 will cause one record to be written. A record received with a length of 512 will cause two records to be written, and similarly, a length of 768 will cause three records to be written, all with no padding. However, a record received with a length of 300 would cause two records to be written. The first containing the first 256 bytes of data, and the second containing the last 44 bytes of data followed by 212 zeroes (X'00'), thus padding it to a length of 256 bytes.

If the utility receives a Data record whose length is greater than the length specified on the request, the RECEIVE function is terminated with a status indicating "BSC I/O Failure", and a BSC return code 20 (wrong length record - long).

At the completion of the data set transfer, the utility performs a SETEOD on the data set, and sends the host a Count record. The Count record specifies the number of records received in the RMCCNT field, and if padding occurred at any time, the RMCFLGPD bit of the RMCFLG field is set to 1. The RMCFLGPD bit is defined by the value X'8000'.

If the data set to be received by the utility is empty, the host should send one Data record which contains no data (only the 4-byte header), and then the EOT.

In the event of unrecoverable errors, such as disk or diskette errors, the utility interrupts the host transmission by sending an EOT ("abort") and a Status record containing the appropriate error code. The utility terminates the RECEIVE operation, and then reads again for another request from the host. The host should accept the Status record to determine the reason for failure.

The host may terminate the RECEIVE function at any time by sending a Status record followed by an EOT.

The RECEIVE function has no restrictions on receiving data sets with names such as $EDXNUC, $$EDXVOL, or $$EDXLIB. However, care should be exercised if these data sets are transferred. As was previously mentioned, a SETEOD is performed upon completion of a data set transfer. The SETEOD may not be performed on data sets with the names $$EDXVOL or $$EDXLIB. Thus, if these data sets are transferred, the host will receive a Status record indicating a SETEOD error. Additionally, SETEOD will fail if the data set type is "program". This failure is ignored by the Remote Management Utility.

Required Field Descriptions

Specify the following fields for the RECEIVE function:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'R', specifying a Request record type.

RMREQ A 2-byte numeric field specifying the request type. For a RECEIVE request, this field contains the number 1.

RMRDSN An 8-byte alphameric field specifying the name of the data set to receive data from the host.

RMRVOL A 6-byte alphameric field specifying the name of the volume containing the data set. If RMRVOL is blank, the volume name defaults to the IPL volume.

RMRSTR A 4-byte (double word) numeric field specifying the starting record of the host data set. Only the second word of this field is used. If a value of 0 is specified, the data set is received and written from the beginning record. If a value greater than zero is specified, the utility issues a POINT instruction and starts receiving data at the record specified.

RMRTYP A 2-byte numeric field specifying the type of data to be received. Specify one of the following:

0 Standard (256-byte records, possibly blocked)
1 Source (80-byte records, possibly blocked)

RMRBLK A 2-byte numeric field specifying blocking. A value of 0 or 1 specifies no blocking; otherwise it specifies the number of 80-byte or 256-byte records to be received on each Data record.

Figure 24 on page 246 illustrates the host-remote interaction for the RECEIVE function. In the example, the host specifies a data set named "MYDATA" on the volume "MYVOL" is to receive two 256-byte data records. The records to be received start at the beginning of the host data set, and are unblocked. The remote returns a Count record, and the RECEIVE function terminates.

```
Host Program                      Host            Remote

Write Initial - Request           ENQ   ------->
                                        <-------  ACK*
RMHBSCC  DATA  X'1002'            TEXT  ------->
RMHID    DATA  C'X'
RMHTYP   DATA  C'R'
RMREQ    DATA  F'1'
RMRDSN   DATA  CL8'MYDATA'
RMRVOL   DATA  CL6'MYVOL'
RMRSTR   DATA  D'0'
RMRTYP   DATA  F'0'
RMRBLK   DATA  F'1'
                                        <-------  ACK*
Write End                         EOT   ------->

Read Initial - Status                   <-------  ENQ
                                  ACK*  ------->
RMHTYP='S'                              <-------  TEXT
RMSREQ=1
RMSFN=-1

Read Continue - EOT               ACK*  ------->
                                        <-------  EOT
Write Initial - Data              ENQ   ------->
                                        <-------  ACK*
RMHBSCC  DATA  X'1002'            TEXT  ------->
RMHID    DATA  C'X'
RMHTYP   DATA  C'D'
RMDDATA  DATA  C text
                                        <-------  ACK*
Write Continue - Data
RMHBSCC  DATA  X'1002'            TEXT  ------->
RMHID    DATA  C'X'
RMHTYP   DATA  C'D'
RMDDATA  DATA  C text
                                        <-------  ACK*


Write End                         EOT   ------->

Read Initial - Count                    <-------  ENQ
                                  ACK*  ------->
RMHTYP='C'                              <-------  TEXT
RMCREQ=1
RMCCNT=2

Read Continue - EOT               ACK*  ------->
                                        <-------  EOT
```

Figure 24. Communications Flow for the RECEIVE Function

SEND Function

The SEND function requests the utility to read a disk/diskette data set on the remote Series/1 and transmit it to the host.

The host can specify whether it wants a data set consisting of 256-byte data records, or a source data set, consisting of 80-byte text records sent from the remote. The host may also specify blocking, in which case, the utility sends records containing multiples of 256-byte or 80-byte records.

The host sends the remote Series/1 a Request record with the SEND function specified. After receiving and executing the request, the utility checks to see if it can handle records of the size requested and attempts to open the data set. The utility then sends a Status record to the host. If a -1 (successful) status is returned to the host the SEND function continues, otherwise the function is terminated.

After sending a successful status to the host, the remote Series/1 reads the records from the data set and transmits Data records containing the data to the host. If blocking is specified, the utility sends blocked Data records to the host. The length of the data portion of each Data record, except for the last, will be the blocking factor times 256 or 80, depending on the data set type. The data portion of the last Data record will have a length of a multiple of 256 or 80, however that multiple may be less than the blocking factor. For example, if a 256-byte record data set contains 14 records and a blocking factor of 5 is specified, the utility will send two 1285-byte records (256x5=1280+5), and one 1029-byte record (256x4=1024+5). The actual records are five bytes longer due to the 4-byte header and the ETX.

If the host requests a data set to be sent as source (80-byte records) and the data set is not source, the utility will treat the data set as source, and discard the remaining 48-bytes following the 80-byte records.

When the last record (the logical end) of the data set is transmitted to the host, the utility will send a Count record. The RMCCNT field of the Count record contains the number of records that were sent. The RMCFLG field of the Count record is not used for the SEND function. The host should compare this number to the number of records received to verify a complete file transfer.

In the event of an unrecoverable error, such as a disk or diskette read error, the utility sends the host a Status record, with the appropriate error code, and terminates the SEND function. The host may terminate a SEND function by sending an EOT ("abort"), followed by a Status record and another EOT.

Required Field Descriptions

Specify the following fields for the SEND function:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'R', specifying a Request record type.

RMREQ A 2-byte numeric field specifying the request type. For a SEND request, this field contains the number 0.

RMSDSN An 8-byte alphameric field specifying the the name of the data set to be transmitted to the host.

RMSVOL A 6-byte alphameric field specifying the name of the volume containing the data set. If RMSVOL is blank, the volume name defaults to the IPL volume.

RMSSTR A 4-byte (double word) numeric field specifying the starting record of the data set. Only the second word is used. If a value of 0 is specified, the data set is sent beginning with the first record. If a value greater than zero is specified, the utility issues a POINT instruction to start at the record specified.

RMSTYP A 2-byte numeric field specifying the type of data set to send. Specify one of the following:

0 Standard (256-byte records, possibly blocked)
1 Source (80-byte records, possibly blocked)

RMSBLK A 2-byte numeric field specifying blocking. A value of 0 or 1 specifies no blocking; otherwise it specifies the number of 80-byte or 256-byte records to be transmitted on each Data record.

Figure 25 on page 250 illustrates the host-remote interaction for the SEND function. In the example, the host requests that a 256-byte record data set named "MYDATA" on the volume "MYVOL" is to be sent, starting with the first record, with no blocking requested. The utility transmits three Data records, sends a Count record to the host, and the SEND function terminates.

```
Host Program                              Host                  Remote

Write Initial - Request                   ENQ    -------->
                                                 <--------    ACK*
RMHBSCC   DATA   X'1002'                  TEXT   -------->
RMHID     DATA   C'X'
RMHTYP    DATA   C'R'
RMREQ     DATA   F'0'
RMSDSN    DATA   CL8'MYDATA'
RMSVOL    DATA   CL6'MYVOL'
RMSSTR    DATA   D'0'
RMSTYP    DATA   F'0'
RMSBLK    DATA   F'1'
                                                 <--------    ACK*
Write End                                 EOT    -------->

Read Initial - Status                            <--------    ENQ
                                          ACK*   -------->
RMHTYP='S'                                       <--------    TEXT
RMSREQ=0
RMSFN=-1

Read Continue - Data                      ACK*   -------->
RMHTYP='D'                                       <--------    TEXT
RMDDATA=Data Text

Read Continue - Data                      ACK*   -------->
RMHTYP='D'                                       <--------    TEXT
RMDDATA=Data Text

Read Continue - Data                      ACK*   -------->
RMHTYP='D'                                       <--------    TEXT
RMDDATA=Data Text

Read Continue - Count                     ACK*   -------->
RMHTYP='C'                                       <--------    TEXT
RMCREQ=0
RMCCNT=3

Read Continue - EOT                       ACK*   -------->
                                                 <--------    EOT
```

Figure 25. Communications Flow for the SEND Function

SHUTDOWN Function

The SHUTDOWN function requests the utility to terminate and to free up any remote Series/1 resources it has allocated. In addition, the SHUTDOWN function can optionally start a program to replace the utility.

The host sends the remote Series/1 a Request record with the SHUTDOWN function specified. The request may also specify the name of a program to be executed, similar in format to the EXEC function.

When a program is specified on the SHUTDOWN request, the utility issues a LOAD instruction for the program. If the LOAD instruction fails, the utility sends the host a Status record indicating the error, and the utility remains active. Otherwise, the utility sends a successful status via a Status record and terminates.

If the program specified by the host requires a parameter and the parameter is not supplied, the load (via LOAD) of the program will fail. The character string is the parameter(s). For further information on parameter passing, refer to the section "Parameter Passing" on page 212.

Required Field Descriptions

Specify the following fields for the SHUTDOWN function:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'R', specifying a Request record type.

RMREQ A 2-byte numeric field specifying the request type. For a SHUTDOWN request, this field contains the number 7.

filler A 2-byte reserved field (unused).

RMSDFLG A 1-byte numeric field containing the RMSDFLGX and RMSDFLGL bits.

RMSDFLGX - When set on, this bit indicates that a program is to be executed. The value for RMSDFLGX when set on is X'80'.

RMSDFLGL - When set on, this bit indicates that a "program loaded" message is to be printed on the system logging terminal. RMSDFLGL corresponds to the usage of the LOGMSG parameter of the Event Driven Language LOAD instruction. The value for RMSDFLGL when set on is X'40'.

RMSDPTN A 1-byte numeric field specifying the partition the program is to run in. Specify one of the following:

-1	Remote Management Utility partition
0	Any partition
1—8	Specific partition

RMSDPGM An 8-byte alphameric field specifying the name of the program to be executed.

RMSDVOL A 6-byte alphameric field specifying the name of the volume containing the program. If RMSDVOL is blank, the volume name defaults to the IPL volume.

RMSDLFS A 2-byte numeric field specifying the amount of free space (in bytes) to pass to the program.

RMSDPRM# A 2-byte numeric field specifying the length of the parameter(s), in words, to pass to the program. This field must be zero if no parameters are passed.

RMSDPRM A variable length field containing the parameter(s) to be passed to the program. The length of this field, in words, must correspond to the value contained in the RMSDPRM# field. See the section "Parameter Passing" on page 212 for details on this field.

RMSDDS# A 2-byte numeric field specifying the number of data set names to be passed to the program. The maximum number of data set names that may be specified is nine. This field must be zero if no data set names are passed.

RMSDDS A variable number of 14-byte alphameric fields specifying data set and volume names to be passed to the program. The first eight bytes contain the data set name, and the last six bytes contain the volume name. If the volume name is blank, the name of the volume defaults to the IPL volume. The number of data set and volume names specified must correspond to the value contained in the RMSDDS# field.

Figure 26 illustrates the host-remote interaction for the SHUTDOWN function. In the example, the host sends the remote a SHUTDOWN request with a program name specified. The program, "MYPROG" on the volume "MYVOL" is to execute in partition 1, has 256 bytes of free space passed to it, and has no parameters or data sets passed to it. The RMSDFLG field specifies that a program is to be executed and a "program loaded" message is to be printed following a successful LOAD of the program. The remote sends a status of -1 (successful) to the host, loads the program, and the utility terminates itself.

```
Host Program                            Host                Remote

Write Initial - Request                 ENQ    -------->
                                               <--------    ACK*
RMHBSCC   DATA   X'1002'                TEXT   -------->
RMHID     DATA   C'X'
RMHTYP    DATA   C'R'
RMREQ     DATA   F'7'
RMSDFLG   DATA   X'C0'
RMSDPTN   DATA   H'1'
RMSDPGM   DATA   CL8'MYPROG'
RMSDVOL   DATA   CL6'MYVOL'
RMSDFLS   DATA   F'256'
RMSDPRM#  DATA   F'0'
RMSDPRM   EQU    *
RMSDDS#   DATA   F'0'
RMSDDS    EQU    *
                                               <--------    ACK*
Write End                               EOT    -------->

Read Initial - Status                          <--------    ENQ
                                        ACK*   -------->
RMHTYP='S'                                     <--------    TEXT
RMSREQ=7
RMSFN=-1

Read Continue - EOT                     ACK*   -------->
                                               <--------    EOT
```

Figure 26. Communications Flow for the SHUTDOWN Function

WRAP Function

The WRAP function requests the utility to send a block of data just received back to the host.

The host sends the remote Series/1 a Request record with the WRAP function specified. The text to be wrapped (transmitted) is specified in the RMWTXT field of the record extension. The utility transmits the Request record including the text back to the host exactly as it was received, and the function terminates. The utility does not send a Status record to the host after execution of a WRAP function.

A possible use of the WRAP function could be for testing the host/remote communications.

Required Field Descriptions

Specify the following fields for the WRAP function:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'R', specifying a Request record type.

RMREQ A 2-byte numeric field specifying the request type. For a WRAP request, this field contains the number 5.

RMWTXT A field of any length (not greater than the buffer) specifying text to be transmitted back to the host.

Figure 27 illustrates the host-remote interaction for the WRAP function. In the example, the host sends the remote a WRAP request along with the text "WRAP TEXT" specified. The remote receives the request and transmits the identical request back to the host, and the operation is completed.

```
Host Program                       Host                Remote

Write Initial - Request            ENQ    -------->
                                          <--------    ACK*
RMHBSCC   DATA   X'1002'           TEXT   -------->
RMHID     DATA   C'X'
RMHTYP    DATA   C'R'
RMREQ     DATA   F'5'
RMWTXT    DATA   C'WRAP TEXT'
                                          <--------    ACK*

Write End                          EOT    -------->

Read Initial - Wrap                       <--------    ENQ
                                   ACK*   -------->
RMHBSCC=X'1002'                           <--------    TEXT
RMHID=C'X'
RMHTYP=C'R'
RMREQ=F'5'
RMWTXT=C'WRAP TEXT'

Read Continue - EOT                ACK*   -------->
                                          <--------    EOT
```

Figure 27. Communications Flow for the WRAP Function

Count Record

The Remote Management Utility sends a Count record to the host after an end-of-data condition is detected during a data set transfer (from either a SEND or RECEIVE request). This record contains the number of records sent or received by the utility. Additionally, the Count record indicates if record padding has occurred during the data set transfer. The host should use this record to verify whether a complete file transfer has occurred.

The following is the format of the Count record:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'C', specifying a Count record type.

RMCREQ A 2-byte numeric field specifying the request type (0=SEND, 1=RECEIVE).

RMCFLG A 2-byte field indicating if record padding has occurred during a data set transfer. The bit defined by RMCFLGPD (X'8000') is set to 1 if padding has occurred, otherwise 0.

RMCCNT A 4-byte numeric field specifying the number of records transmitted. This number reflects the number of logical records (80-byte or 256-byte records) transmitted, independent of how the records were blocked.

Data Record

The Data record is used by the Remote Management Utility to send data to or receive data from the host. This record contains the 80-byte or 256-byte records from a specified data set on a SEND or RECEIVE request.

The following is the format of the Data record:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'D', specifying a Data record type.

RMDDATA A variable-length field containing the data to be transmitted (from a SEND or RECEIVE request). The length of this field will be a multiple of 80 or 256, depending on the type of data transfer.

Status Record

The Status is sent to the host by the Remote Management Utility to indicate the success or failure of a requested function.

The following is the format of the Status record:

RMHBSCC A 2-byte hexadecimal field containing the BSC control characters DLE STX, specified as X'1002'.

RMHID A 1-byte alphameric field containing the header ID 'X', identifying the record as an Event Driven Executive Remote Management Utility record.

RMHTYP A 1-byte alphameric field identifying the header type. This field contains the character 'S', specifying a Status record type.

RMSREQ A 2-byte numeric field specifying the request type.

RMSFN A 2-byte numeric field indicating the success of the request. If the request is successful this field will contain a -1, otherwise this field will contain a positive value indicating the error which occurred. The equated values, included in the copy code CDRRM, with the names beginning with the RMSFN field define these errors.

RMSST A 2-byte numeric field with a return code if an Event Driven Executive function failed. For example, if RMSFN contained the value 24 (LOAD failed), RMSST will contain the return code from the LOAD instruction.

RMSRID An 8-byte alphameric field specifying the ID of the remote Series/1 on completion of a successful IDCHECK request. This field is not sent to the host if the IDCHECK request fails.

Sample Host Programs

The following sample programs illustrate host programs (on a host Series/1) which can communicate with and perform functions of the Remote Management Utility.

This sample host program can perform all the functions of the utility except SEND, RECEIVE, and PASSTHRU. This program sends an ALLOCATE request and prints a status message, but could be used for the other functions by simply defining the fields of the desired request at label "RM".

```
UT       PROGRAM START
START    EQU      *
         BSCOPEN  IOCB,ERROR=BSCERR     OPEN BSC LINE
         MOVE     IOCB3,+REQLEN         LENGTH OF REQUEST
*                                       IN IOCB
         BSCWRITE IX,IOCB,ERROR=BSCERR  WRITE REQUEST
         BSCWRITE E,IOCB,ERROR=BSCERR   WRITE EOT
         MOVEA    IOCB2,ST              ADDRESS OF STATUS
         MOVE     IOCB3,20              LENGTH OF STATUS
*                                       IN IOCB
         BSCREAD  I,IOCB,ERROR=BSCERR,TIMEOUT=NO  READ STATUS
         SUB      IOCB,IOCB2,RESULT=PN2 LENGTH INTO PRINTNUM
         ADD      PN2,+1
         SHIFTR   PN2,1                 CONVERT LENGTH TO WORDS
         PRINTEXT '@STATUS MESSAGE:@'
         PRINTNUM ST,0,MODE=HEX,P2=PN2  PRINT STATUS MSG
         BSCREAD  C,IOCB,ERROR=BSCERR,TIMEOUT=NO   READ EOT
         IF       (ST+6,EQ,-1)          IF SUCCESSFUL STATUS
*                                       THEN
           PRINTEXT '@FUNCTION SUCCESSFUL'
         ELSE                            ELSE
           PRINTEXT '@FUNCTION FAILED'
         ENDIF                           ENDIF
TERM     EQU      *                     TERMINATION POINT
         BSCCLOSE IOCB                  CLOSE BSC LINE
         PROGSTOP
*
BSCERR   EQU      *                   BSC ERROR ROUTINE
         MOVE     ST,UT                 MOVE RETURN CODE
         PRINTEXT '@BSC ERROR:'
         PRINTNUM ST                    PRINT RETURN CODE
         GOTO     TERM                  GO TO TERMINATION
*
IOCB     BSCIOCB  9,RM,0,P2=IOCB2,P3=IOCB3     IOCB
*                             P2=IOCB2 IS MESSAGE ADDRESS
*                             P3=IOCB3 IS MESSAGE LENGTH
*
ST       DATA     10F'0'      AREA FOR STATUS RECORD
*                              10 BYTES  NORMAL STATUS RECORD
*                               8 BYTES  IDCHECK STATUS EXT.
*                               1 BYTE   ETX
*                              --------
*                              19 BYTES  TOTAL, ROUNDED UP TO
*                                        10 WORDS
```

```
*-- THE FOLLOWING MAY BE CHANGED FOR OTHER REQUESTS --*
*
RM       EQU      *                 REQUEST
RMHBSCC  DATA     X'1002'             BSC CTRL CHARS (DLE STX)
RMHID    DATA     C'X'                HEADER ID
RMHTYP   DATA     C'R'                HEADER TYPE: REQUEST
RMREQ    DATA     F'2'                REQUEST TYPE: ALLOCATE
RMADSN   DATA     CL8'MYDATA'         DATA SET NAME: MYDATA
RMAVOL   DATA     CL6'MYVOL'          VOLUME NAME: MYVOL
RMANREC  DATA     D'10'               NUMBER RECORDS: 10
RMADST   DATA     F'1'                DATA SET TYPE: DATA
REQLEN   EQU      *-RM              LENGTH OF REQUEST
*
         ENDPROG
         END
```

This sample host program receives data set "MYDATA" at the remote Series/1 from the host Series/1. Data is blocked with a factor of 2, and transferred as 80-byte records.

```
EXRECV   PROGRAM START,DS=((RECVDS,??))
START    EQU   *
         BSCOPEN  IOCB,ERROR=BSCEOPN   OPEN BSC LINE
*
         MOVE     IOCB3,+REQLEN        LENGTH OF REQUEST IN IOCB
         BSCWRITE IX,IOCB,ERROR=BSCERR WRITE REQUEST
         BSCWRITE E,IOCB,ERROR=BSCERR  WRITE EOT
*
         MOVEA    IOCB2,ST             ADDRESS OF STATUS
         MOVE     IOCB3,+STL           LENGTH OF STATUS IN IOCB
         BSCREAD  I,IOCB,ERROR=BSCERR  READ STATUS
         BSCREAD  C,IOCB,ERROR=BSCERR  READ EOT
         IF       (STSFN,NE,-1)        IF STATUS INDICATES ERROR
           PRINTEXT '@STATUS INDICATES ERROR'  THEN PRINT IT
           PRINTNUM ST,5,MODE=HEX
           GOTO     TERM1                TERMINATE
         ENDIF                         ENDIF
*
         MOVEA    IOCB2,DT             ADDRESS OF DATA
         MOVE     IOCB3,+DTL           SET LENGTH
DATA     EQU      *
         READ     DS1,DISKREC,ERROR=RDERR,END=RDEND  READ RECORD
         MOVE     DTDATA,DISKREC,(80,BYTE)        FIRST RECORD
         MOVE     DTDATA+80,DISKREC+128,(80,BYTE) SECOND RECORD
         IF       (COUNT,EQ,0)         IF FIRST TIME THEN
           BSCWRITE IX,IOCB,ERROR=BSCERR,END=BSCAB WRITE INITIAL
         ELSE                          ELSE
           BSCWRITE CX,IOCB,ERROR=BSCERR,END=BSCAB WRITE CONTINUE
         ENDIF                         ENDIF
         ADD      COUNT,2              ADD 2 TO COUNT
         GOTO     DATA                 CONTINUE TRANSFERRING DATA
RDEND    EQU      *                    TO HERE WHEN AT ENDFILE
         BSCWRITE E,IOCB,ERROR=BSCERR  WRITE EOT
         BSCREAD  I,IOCB,ERROR=BSCERR  READ COUNT
         BSCREAD  C,IOCB,ERROR=BSCERR  READ EOT
         IF       (DTCCNT,EQ,COUNT)    IF COUNT OK THEN
           PRINTEXT 'COUNT OK:'          PRINT IT
           PRINTNUM COUNT
         ELSE                          ELSE
           PRINTEXT '@COUNT FAILED.  COUNTED:'
           PRINTNUM COUNT               PRINT COUNTS
           PRINTEXT '  COUNT RECORD:'
           PRINTNUM DTCCNT
         ENDIF                         ENDIF
```

```
TERM1    EQU      *                EXIT POINT FOR NORMAL TERM
         BSCCLOSE IOCB             CLOSE BSC LINE
TERM2    EQU      *                EXIT POINT FOR OPEN FAILED
         PROGSTOP
BSCAB    EQU      *                    ABORT RECEIVED ON WRITE
         BSCREAD  I,IOCB,ERROR=BSCERR  READ STATUS
         BSCREAD  C,IOCB,ERROR=BSCERR  READ EOT
         PRINTEXT '@ABORT RECEIVED.  STATUS:'
         PRINTNUM DT,5,MODE=HEX
         GOTO     TERM1                TERMINATE
*
BSCERR   EQU   *               BSC ERROR ROUTINE
         MOVE     ST,EXRECV            MOVE RETURN CODE
         PRINTEXT '@BSC ERROR:'
         PRINTNUM ST                   PRINT RETURN CODE
         GOTO     TERM1                GO TO TERMINATION
*
BSCEOPN  EQU   *               OPEN ERROR
         MOVE     ST,EXRECV            MOVE RETURN CODE
         PRINTEXT '@BSC OPEN ERROR:'
         PRINTNUM ST                   PRINT RETURN CODE
         GOTO     TERM2                GO TO TERMINATION
*
RDERR    EQU   *               DISK READ ERROR
         MOVE     ST,EXRECV            MOVE RETURN CODE
         PRINTEXT '@DISK READ ERROR:'
         PRINTNUM ST                   PRINT RETURN CODE
         MOVEA    IOCB2,ST             POINT IOCB TO
*                                      STATUS MESSAGE
         MOVE     IOCB3,4              SET LENGTH TO 4
         MOVE     ST,X'1002'           SET UP STATUS MESSAGE
         MOVE     ST+2,C'XS'
         BSCWRITE IX,IOCB,ERROR=BSCERR SEND STATUS MESSAGE
         BSCWRITE E,IOCB,ERROR=BSCERR  SEND EOT
         GOTO     TERM2                GO TO TERMINATION
*
IOCB     BSCIOCB  9,RM,0,P2=IOCB2,P3=IOCB3      IOCB
*                                P2=  IS RECORD ADDRESS
*                                P3=  IS RECORD LENGTH
*
RLEN     DATA     F'0'         RECORD LENGTH
*
COUNT    DATA     F'0'         RECORD COUNT
```

```
*--  REQUEST TO RECEIVE A DATA SET
*
RM       EQU   *               REQUEST
RMHBSCC  DATA  X'1002'           BSC CNTRL CHARS (DLE STX)
RMHID    DATA  C'X'              HEADER ID
RMHTYP   DATA  C'R'              HEADER TYPE:     REQUEST
RMREQ    DATA  F'1'              REQUEST TYPE:    RECEIVE
RMRDSN   DATA  CL8'MYDATA'       DATA SET NAME:   MYDATA
RMRVOL   DATA  CL6'      '       VOLUME NAME:     (IPL VOL)
RMRSTR   DATA  D'0'              STARTING RECORD: NONE
RMRTYP   DATA  F'1'              RECEIVE TYPE:    SOURCE
RMRBLK   DATA  F'2'              BLOCKING FACTOR: 2
REQLEN   EQU   *-RM            LENGTH OF REQUEST
*--  STATUS RECORD
*
ST       DATA  6F'0'           AREA FOR STATUS RECORD
*                               10 BYTES FOR STATUS RECORD,
*                               1 BYTE FOR ETX, ROUNDED UP
*                               TO 6 WORDS
STSFN    EQU   ST+6            STATUS FUNCTION
STL      EQU   *-ST            STATUS RECORD LENGTH
*
*--  DATA AND COUNT RECORD
*
DT       DATA  X'1002'         DATA RECORD:  DLE STX
         DATA  C'XD'             HEADER ID, TYPE (DATA)
DTCCNT   EQU   DT+10             LOCATION OF COUNT
DTDATA   DATA  160C' '
DTL      EQU   *-DT            LENGTH
*
DISKREC  DATA  128F'0'         DISK RECORD AREA
         ENDPROG
         END
```

This sample host program executes a PASSTHRU session through the utility. The session is established with the Event Driven Executive supervisor. Blocking is used. All terminal I/O is performed to make the host terminal appear as if the terminal were connected at the remote Series/1.

```
EXPASST  PROGRAM START,TERMERR=TERM1
*
*        THIS EXAMPLE HOST PROGRAM USES THE PASSTHRU FUNCTION
*        OF THE REMOTE MANAGEMENT UTILITY. THE OPERATOR IS
*        ASKED WHETHER TO START THE PASSTHRU ASSIST PROGRAM.
*        IF SO, THE PROGRAM $RMUPA IS INVOKED. AFTER THIS, A
*        SESSION IS ESTABLISHED WITH THE EDX SUPERVISOR.
*
*        WHENEVER A "PROGRAM END" PASSTHRU RECORD IS RECEIVED,
*        A "REQUEST DATA" RECORD IS SENT. WHEN A "NO DATA"
*        RECORD IS RECEIVED, THE OPERATOR IS ASKED WHETHER TO
*        "ATTN" (END THE SESSION AND START ANOTHER), "READ"
*        (TRY TO ACQUIRE DATA FROM THE HOST), OR "QUIT" (END
*        THE PASSTHRU SESSION AND THEN TERMINATE.
*
START    EQU   *
         BSCOPEN  IOCB,ERROR=BSCEOPN   OPEN BSC LINE
*
*--  START UP PASSTHRU ASSIST PROGRAM ($RMUPA) IF NEEDED
*
         QUESTION 'START PASSTHRU ASSIST PROGRAM?',NO=START2
*
         MOVEA    IOCB2,REQPTAS        ADDRESS OF REQUEST IN IOCB
         MOVE     IOCB3,+REQPTASL      LENGTH OF REQUEST IN IOCB
         BSCWRITE IX,IOCB,ERROR=BSCERR WRITE REQUEST
         BSCWRITE E,IOCB,ERROR=BSCERR  WRITE EOT
*
         MOVEA    IOCB2,ST             ADDRESS OF STATUS
         MOVE     IOCB3,+STL           LENGTH OF STATUS IN IOCB
         BSCREAD  I,IOCB,ERROR=BSCERR  READ STATUS
         BSCREAD  C,IOCB,ERROR=BSCERR  READ EOT
         IF       (STSFN,NE,-1)        IF STATUS INDICATES ERROR
           PRINTEXT '@STATUS INDICATES ERROR'  PRINT IT
           PRINTNUM ST,5,MODE=HEX
           GOTO     TERM1                TERMINATE
         ENDIF                         ENDIF
         MOVEA    IOCB2,DT             ADDRESS OF DATA
         MOVE     IOCB3,+DTL           SET LENGTH
         BSCREAD  I,IOCB,ERROR=BSCERR,TIMEOUT=NO
*                                      READ, EXPECT PROGRAM END
         BSCREAD  C,IOCB,ERROR=BSCERR,TIMEOUT=NO    READ EOT
         IF       (EXPASST,EQ,+1),AND,(DT+RMPTYP,EQ,+RMPTYPPE)
*                                      IF PGM END AND EOT THEN
           MOVE     DT,X'1002'           SET UP PTHRU PGM END
           MOVE     DT+RMPTYP,+RMPTYPPE  PTHRU TYPE IS PGM END
           MOVE     IOCB3,+RMPX          SET UP LENGTH IN IOCB
           BSCWRITE IX,IOCB,ERROR=BSCERR,END=BSCAB WRITE TO RMU
           BSCWRITE E,IOCB,ERROR=BSCERR  WRITE EOT
         ELSE                          ELSE
           MOVE     ST,EXPASST           SAVE RETURN CODE
           PRINTEXT '@UNSUCCESSFUL LOAD OF PASSTHRU ASSIST PGM.'
           PRINTEXT '@LAST MESSAGE READ:'
           PRINTNUM DT,10,MODE=HEX       PRINT MESSAGE
           PRINTEXT '@LAST RETURN CODE FROM READ:'
           PRINTNUM ST,MODE=HEX          PRINT RETURN CODE
           GOTO     TERM1                TERMINATE
         ENDIF                         ENDIF
*
*--  MAIN PASSTHRU PROCESSING.  SEND REQUEST
*
START2   MOVEA    IOCB2,REQPT          ADDRESS OF REQUEST IN IOCB
         MOVE     IOCB3,+REQLEN        LENGTH OF REQUEST IN IOCB
         BSCWRITE IX,IOCB,ERROR=BSCERR WRITE REQUEST
         BSCWRITE E,IOCB,ERROR=BSCERR  WRITE EOT
*
         MOVEA    IOCB2,ST             ADDRESS OF STATUS
         MOVE     IOCB3,+STL           LENGTH OF STATUS IN IOCB
         BSCREAD  I,IOCB,ERROR=BSCERR  READ STATUS
         BSCREAD  C,IOCB,ERROR=BSCERR  READ EOT
         IF       (STSFN,NE,-1)        IF STATUS INDICATES ERROR
           PRINTEXT '@STATUS INDICATES ERROR'  PRINT IT
           PRINTNUM ST,5,MODE=HEX
           GOTO     TERM1                TERMINATE
         ENDIF                         ENDIF
```

```
READ     EQU      *
         MOVEA    IOCB2,DT             ADDRESS OF DATA
         MOVE     IOCB3,+DTL           SET LENGTH
         IF       (BSCST,NE,+BSCSTRD)  IF BSC STATE IS NOT READ
           BSCREAD  I,IOCB,ERROR=BSCERR,TIMEOUT=NO     READ INIT
           MOVE   BSCST,+BSCSTRD         BSC STATE = READ
         ELSE                          ELSE
           BSCREAD  C,IOCB,ERROR=BSCERR,TIMEOUT=NO     READ CONT
         ENDIF                         ENDIF
*
         IF       (DT+RMHTYP,NE,C'P',BYTE)  IF NOT PASSTHRU THEN
           PRINTEXT '@NON-PASSTHRU MESSAGE RECEIVED:'
           PRINTNUM DT,5,MODE=HEX        PRINT WHAT WAS RECEIVED
*                                        (WILL BE STATUS)
           BSCREAD  C,IOCB,ERROR=BSCERR,TIMEOUT=NO     READ EOT
           GOTO     TERM1                TERMINATE
         ENDIF                         ENDIF
*--  CASE:  PASSTHRU TYPE
         GOTO     (ERRPT,TEXT,REQD,PGME,NODA),DT+RMPTYP
*
TEXT     EQU      *                    PASSTHRU TYPE:  DATA
         MOVEA    #1,DT+RMPST          SET #1 TO BEGINNING OF TXT
         DO       UNTIL,(#1,EQ,IOCB)   DO UNTIL AT END OF TEXT
*                                      (IOCB CONTAINS ADDRESS
*                                      OF BYTE PAST LAST BYTE
*                                      OF DATA)
           IF       ((0,#1),EQ,-1),OR,((0,#1),EQ,-2) IF TEXT
             PRINTEXT (4,#1),MODE=LINE     PRINT TO TERMINAL
             IF       ((0,#1),EQ,-1)       IF NEWLINE
               PRINTEXT SKIP=1               THEN DO NEWLINE
             ENDIF                         ENDIF
             ADD      #1,(2,#1)            POINT #1 TO NEXT TEXT
             ADD      #1,5                 ADD HEADER LENGTH + 1
             AND      #1,X'FFFE'           POINT TO EVEN BOUNDARY
           ELSE                          ELSE
             IF       ((0,#1),EQ,X'8F',BYTE) IF LINE= THEN
               AND      (0,#1),X'00FF',RESULT=N1  DO IT
               PRINTEXT LINE=N1              ON TERMINAL
             ELSE                          ELSE
               IF       ((0,#1),EQ,X'8E',BYTE) IF SKIP= THEN
                 AND      (0,#1),X'00FF',RESULT=N1  DO IT
                 PRINTEXT SKIP=N1              ON TERMINAL
               ENDIF                         ENDIF
             ENDIF                         ENDIF
             ADD      #1,4                 POINT #1 TO NEXT
*                                          TEXT BLOCK
           ENDIF                         ENDIF
         ENDDO                         ENDDO
         GOTO     READ                 END TEXT PROCESSING
```

```
REQD     EQU      *                    PASSTHRU TYPE:  REQ DATA
         BSCREAD  C,IOCB,ERROR=BSCERR  READ EOT
         MOVE     DT+RMPTXTL,X'FE00'   SET UP "TEXT" STATEMENT
         READTEXT DT+RMPTXT,MODE=LINE  GET TEXT FROM TERMINAL
         MOVE     DT,X'1002'           SET UP PTHRU TEXT RECORD
         MOVE     DT+RMPTYP,+RMPTYPTX  PTHRU TYPE IS TEXT OR PFK
         MOVE     DT+RMPTXTL,0,BYTE    ZERO HI-ORDER LENGTH BYTE
         IF       (DT+RMPTXTL,GE,4),AND,(DT+RMPTXT,EQ,C'$P'),
               AND,(DT+TXT2,EQ,C'F',BYTE)  IF "$PFN" ENTERED
           MOVE     DT+RMPTXTL,-1        INDICATE PF KEY
           MOVE     DT+RMPTXT,DT+TXT2    PLACE NUMBER IN MSG
           AND      DT+RMPTXT,X'000F'    PURIFY NUMBER
           MOVE     IOCB3,2+RMPTXT       LENGTH IN IOCB
         ELSE                          ELSE
           MOVE     IOCB3,DT+RMPTXTL     SET UP LENGTH IN IOCB
           ADD      IOCB3,+RMPTXT        INCLUDING HEADER
         ENDIF                         ENDIF
         BSCWRITE IX,IOCB,ERROR=BSCERR,END=BSCAB WRITE TO RMU
         BSCWRITE E,IOCB,ERROR=BSCERR  WRITE EOT
         MOVE     BSCST,+BSCSTO        BSC STATE = RESET
         GOTO     READ                 END REQ TEXT PROCESSING
*
PGME     EQU      *                 PASSTHRU TYPE:  PROGRAM END
*                                                   (DISCONNECT)
         BSCREAD  C,IOCB,ERROR=BSCERR  READ EOT
         GOTO     SNDRQD               GO AND REQUEST DATA
*
NODA     EQU      *                    PASSTHRU TYPE:  NO DATA
         BSCREAD  C,IOCB,ERROR=BSCERR  READ EOT
NODAQ    PRINTEXT '@"NO DATA" RECEIVED.  ENTER ONE:'
         READTEXT INMSG,'@  A(TTN), R(EAD), Q(UIT) '
         IF       (INMSG,EQ,C'A',BYTE),OR,(INMSG,EQ,C'Q',BYTE)
*                                      IF "ATTN" OR "QUIT" THEN
*                                        SEND PROGRAM END
           MOVE     DT,X'1002'           SET UP PTHRU PGM END
           MOVE     DT+RMPTYP,+RMPTYPPE  PTHRU TYPE IS PGM END
           MOVE     IOCB3,+RMPX          SET UP LENGTH IN IOCB
           BSCWRITE IX,IOCB,ERROR=BSCERR,END=BSCAB WRITE TO RMU
           BSCWRITE E,IOCB,ERROR=BSCERR  WRITE EOT
           MOVE     BSCST,+BSCSTO        BSC STATE = RESET
           IF       (INMSG,EQ,C'A',BYTE),GOTO,START2
*                                        IF "A" THEN START NEW
*                                        SESSION
           GOTO     TERM1                OTHERWISE TERMINATE
         ELSE                          ELSE (NOT "ATTN"
*                                           OR "QUIT")
           IF       (INMSG,EQ,C'R'),GOTO,SNDRQD  IF "R" THEN
*                                                REQUEST DATA
           GOTO     NODAQ                ELSE ASK AGAIN
         ENDIF                         ENDIF
```

```
ERRPT    EQU      *                    PASSTHRU TYPE:  UNKNOWN
         PRINTEXT '@INVALID PASSTHRU RECORD RECEIVED:'
         PRINTNUM DT,20,MODE=HEX
         GOTO     TERM1                TERMINATE
*
*--      END OF CASES
*
SNDRQD   EQU      *                    SEND REQUEST DATA
         MOVE     DT,X'1002'           SET UP PTHRU REQUEST DATA
         MOVE     DT+RMPTYP,+RMPTYPRD  PTHRU TYPE IS REQEST DATA
         MOVE     IOCB3,+RMPX          SET UP LENGTH IN IOCB
         BSCWRITE IX,IOCB,ERROR=BSCERR,END=BSCAB WRITE TO RMU
         BSCWRITE E,IOCB,ERROR=BSCERR  WRITE EOT
         MOVE     BSCST,+BSCSTO        BSC STATE = RESET
         GOTO     READ                 END REQ TEXT PROCESSING
*
*
TERM1    EQU      *                EXIT POINT FOR NORMAL TERM
         BSCCLOSE IOCB                 CLOSE BSC LINE
TERM2    EQU      *                EXIT POINT FOR OPEN FAILED
         PROGSTOP
*
BSCAB    EQU      *                    ABORT RECEIVED ON WRITE
         BSCREAD  I,IOCB,ERROR=BSCERR  READ STATUS
         BSCREAD  C,IOCB,ERROR=BSCERR  READ EOT
         PRINTEXT '@ABORT RECEIVED.  STATUS:'
         PRINTNUM DT,20,MODE=HEX
         GOTO     TERM1                TERMINATE
*
BSCERR   EQU   *                   BSC ERROR ROUTINE
         MOVE     ST,EXPASST           MOVE RETURN CODE
         PRINTEXT '@BSC ERROR:'
         PRINTNUM ST                   PRINT RETURN CODE
         GOTO     TERM1                GO TO TERMINATION
*
BSCEOPN  EQU   *                   OPEN ERROR
         MOVE     ST,EXPASST           MOVE RETURN CODE
         PRINTEXT '@BSC OPEN ERROR:'
         PRINTNUM ST                   PRINT RETURN CODE
         GOTO     TERM2                GO TO TERMINATION
```

```
*--  DATA AREA
*
INMSG    TEXT     LENGTH=4         INPUT MSG FROM OPERATOR
*
IOCB     BSCIOCB  9,0,0,P2=IOCB2,P3=IOCB3     IOCB
*                                P2= IS RECORD ADDRESS
*                                P3= IS RECORD LENGTH
*
*--  REQUEST FOR PASSTHRU
*
REQPT    EQU   *               REQUEST
         DATA  X'1002'           BSC CONTROL CHARS (DLE STX)
         DATA  C'X'              HEADER ID
         DATA  C'R'              HEADER TYPE:      REQUEST
         DATA  A(RMREQPST)       REQUEST TYPE:     PASSTHRU (12)
         DATA  A(PBL)            PASSTHRU BLKING
         DATA  H'0'              FLAG (UNUSED)
         DATA  H'0'              PARTITION (UNUSED)
         DATA  CL8' '            PROGRAM:       EDX SUPERVISOR
         DATA  CL6' '            VOLUME (UNUSED)
         DATA  3F'0'             (REMAINDER UNUSED)
REQLEN   EQU   *-REQPT         LENGTH OF REQUEST
*
*--  PASSTHRU REQUEST:  START PASSTHRU ASSIST PROGRAM
*
REQPTAS  EQU   *               REQUEST
         DATA  X'1002'           BSC CONTROL CHARS (DLE STX)
         DATA  C'X'              HEADER ID
         DATA  C'R'              HEADER TYPE:      REQUEST
         DATA  A(RMREQPST)       REQUEST TYPE:     PASSTHRU (12)
         DATA  A(0)              PASSTHRU BLKING   (NONE)
         DATA  H'0'              FLAG (UNUSED)
         DATA  H'0'              PARTITION         (ANY)
         DATA  CL8'$RMUPA'       PROGRAM:          $RMUPA
         DATA  CL6' '            VOLUME:           IPL
         DATA  F'0'              FREE SPACE:       NONE
         DATA  F'0'              PARAMETERS:       NONE
         DATA  F'0'              DATA SETS:        NONE
REQPTASL EQU   *-REQPTAS       LENGTH OF REQUEST
```

```
*
*--  STATUS RECORD
*
ST       DATA  6F'0'          AREA FOR STATUS RECORD
*                               10 BYTES FOR STATUS RECORD,
*                               1 BYTE FOR ETX, ROUNDED UP
*                               TO 6 WORDS
STSFN    EQU   ST+6           STATUS FUNCTION
STL      EQU   *-ST           STATUS RECORD LENGTH
*
*--  PASSTHRU SESSION AREA
*
DT       DATA  256F'0'        RECORD
DTL      EQU   *-DT           LENGTH
PBL      EQU   DTL-8          PASSTHRU BLOCK LENGTH
*                               LENGTH OF DATA AREA -
*                               6 BYTES FOR HEADER AND 2
*                               FOR ETX AND WORD ROUND UP
*
*--  MISCELLANEOUS VARIABLES
*
BSCST    DATA  F'0'           BSC STATE:
BSCSTO   EQU   0                RESET
BSCSTRD  EQU   1                READING
N1       DATA  F'0'           WORK WORD
*
         COPY  CDRRM          INCLUDE DEFINITION OF RMU MSGS
TXT2     EQU   RMPTXT+2       BYTE 2 OF PASSTHRU TEXT
*
         ENDPROG
         END
```

This sample interaction with the PASSTHRU host program illustrates running the $DEBUG utility under the PASSTHRU function.

```
(Attention)
> $L EXPASST
EXPASST 9P LP=C900
START PASSTHRU ASSIST PROGRAM? Y
> $L $DEBUG
$DEBUG  27P,09:44:08  LP=BF00
PROGRAM NAME: $DISKUT1
$DISKUT1  30P,09:44:14 LP=DA00
REQUEST "HELP" TO GET LIST OF DEBUG COMMANDS
TASK   STOPPED AT 0064
"NO DATA" RECEIVED. ENTER ONE:
  A(TTN), R(EAD), Q(UIT) A
> WHERE
TASK   STOPPED AT 0064
$ATTASK AT 2600
"NO DATA" RECEIVED. ENTER ONE:
  A(TTN), R(EAD), Q(UIT) A
> GO
OPTION(*/ADDR/TASK/ALL): ALL
  1 BREAKPOINT(S) ACTIVATED
USING VOLUME EDX002
COMMAND (?): LA ZZZZ
USING VOLUME EDX002
  NAME      FREC  SIZE
  12845 FREE RECORDS IN LIBRARY
COMMAND (?): $PF0
XX
> WHERE
INVALID COMMAND
TASK     AT  0274
$ATTASK  AT 2600
COMMAND (?): $PF0
XX
> AT
INVALID COMMAND
OPTION(*/ADDR/TASK/ALL): A
BREAKPOINT ADDR: 274
LIST/NOLIST: N
STOP/NOSTOP: S
  1 BREAKPOINT(S) SET
COMMAND: XX
TASK STOPPED AT 0274
"NO DATA" RECEIVED. ENTER ONE:
  A(TTN), R(EAD), Q(UIT) A
> LIST A 274 5 X
0274 X' 80AF 1010 C9D5 E5C1 D3C9'
"NO DATA" RECEIVED. ENTER ONE:
  A(TTN), R(EAD), Q(UIT) A
> END
  1 BREAKPOINT(S) REMOVED
INVALID COMMAND
```

```
COMMAND (?): EN
"NO DATA" RECEIVED. ENTER ONE:
  A(TTN), R(EAD), Q(UIT) R
"NO DATA" RECEIVED. ENTER ONE:
  A(TTN), R(EAD), Q(UIT) A
> $RMUPA
"NO DATA" RECEIVED. ENTER ONE:
  A(TTN), R(EAD), Q(UIT) A
> $A
PROGRAMS AT 09:50:26
IN PARTITION #1   NONE
"NO DATA" RECEIVED. ENTER ONE:
  A(TTN), R(EAD), Q(UIT) Q
EXPASST ENDED
```

This sample host program sends data set "MYDATA" from the remote Series/1 to the host Series/1. Data is blocked with a factor of 3, and transferred as 256-byte records.

```
EXSEND   PROGRAM START,DS=((SENDDS,??))
START    EQU   *
         BSCOPEN  IOCB,ERROR=BSCEOPN    OPEN BSC LINE
         MOVE     IOCB3,+REQLEN         LENGTH OF REQUEST IN IOCB
         BSCWRITE IX,IOCB,ERROR=BSCERR WRITE REQUEST
         BSCWRITE E,IOCB,ERROR=BSCERR  WRITE EOT
         MOVEA    IOCB2,ST              ADDRESS OF STATUS
         MOVE     IOCB3,+STL            LENGTH OF STATUS IN IOCB
         BSCREAD  I,IOCB,ERROR=BSCERR  READ STATUS
         IF       (STSFN,NE,-1)         IF STATUS INDICATES ERROR
           BSCREAD  C,IOCB,ERROR=BSCERR   READ EOT
           PRINTEXT '@STATUS INDICATES ERROR'  THEN PRINT IT
           PRINTNUM ST,5,MODE=HEX
           GOTO     TERM1                 TERMINATE
         ENDIF                          ENDIF
         MOVEA    IOCB2,DT              ADDRESS OF DATA
DATA     EQU      *
         MOVE     IOCB3,+DTL            SET LENGTH TO MAX
         BSCREAD  C,IOCB,ERROR=BSCERR  READ DATA OR COUNT
         SUB      IOCB,IOCB2,RESULT=RLEN  COMPUTE LENGTH
         IF       (DTHTYPR,EQ,C'D',BYTE) IF DATA THEN
           SUB      RLEN,+4               -4 FROM LENGTH
*                                         FOR HEADER
           SHIFTR   RLEN,8                RLEN = NUMBER RECORDS
*                                         WRITE RECORDS NEXT
           WRITE    DS1,DTDATA,RLEN,ERROR=WRERR,END=WRERR
           ADD      COUNT,RLEN            ADD NUMBER WRITTEN
*                                         TO COUNT
           GOTO     DATA                  GO READ NEXT RECORD
         ELSE                           ELSE
           IF       (DTHTYPR,EQ,C'C',BYTE)  IF COUNT THEN
             IF       (DTCCNT,EQ,COUNT)     IF COUNT OK THEN
               PRINTEXT 'COUNT OK:'           PRINT IT
               PRINTNUM COUNT
             ELSE                           ELSE
               PRINTEXT 'COUNT FAILED.  COUNTED:'
               PRINTNUM COUNT                 PRINT COUNTS
               PRINTEXT '  COUNT RECORD:'
               PRINTNUM DTCCNT
             ENDIF                          ENDIF
           ELSE                           ELSE MUST BE STATUS
             PRINTEXT 'ERROR MSG RECEIVED:'
             PRINTNUM DT,5,MODE=HEX         PRINT IT
           ENDIF                          ENDIF
         ENDIF                          ENDIF
         BSCREAD  C,IOCB,ERROR=BSCERR  READ EOT
TERM1    EQU      *                 EXIT POINT FOR NORMAL TERM
         BSCCLOSE IOCB              CLOSE BSC LINE
TERM2    EQU      *                 EXIT POINT FOR OPEN FAILED
         PROGSTOP
BSCERR   EQU    *               BSC ERROR ROUTINE
         MOVE     ST,EXSEND            MOVE RETURN CODE
         PRINTEXT '@BSC ERROR:'
         PRINTNUM ST                   PRINT RETURN CODE
         GOTO     TERM1                GO TO TERMINATION
*
BSCEOPN  EQU    *               OPEN ERROR
         MOVE     ST,EXSEND            MOVE RETURN CODE
         PRINTEXT '@BSC OPEN ERROR:'
         PRINTNUM ST                   PRINT RETURN CODE
         GOTO     TERM2                GO TO TERMINATION
*
WRERR    EQU    *               WRITE ERROR
         MOVE     ST,EXSEND            MOVE RETURN CODE
         PRINTEXT '@DISK WRITE ERROR:'
         PRINTNUM ST                   PRINT RETURN CODE
         BSCWRITE E,IOCB,ERROR=BSCERR  WRITE EOT (ABORT)
         MOVEA    IOCB2,ST             POINT IOCB TO STATUS
         MOVE     IOCB3,4              SET LENGTH TO 4
         MOVE     ST,X'1002'           SET UP STATUS MESSAGE
         MOVE     ST+2,C'XS'
         BSCWRITE IX,IOCB,ERROR=BSCERR WRITE STATUS
         BSCWRITE E,IOCB,ERROR=BSCERR  WRITE EOT
         GOTO     TERM1                GO TO TERMINATION
*
IOCB     BSCIOCB   9,RM,0,P2=IOCB2,P3=IOCB3     IOCB
*
*                            P2=IOCB2 IDENTIFIES MSG ADDRESS
*                            P3=IOCB3 IDENTIFIES MSG LENGTH
RLEN     DATA      F'0'        RECORD LENGTH
*
COUNT    DATA      F'0'        RECORD COUNT
*
*--  REQUEST TO SEND DATA SET
*
RM       EQU    *               REQUEST
RMHBSCC  DATA   X'1002'           BSC CNTRL CHARS (DLE STX)
RMHID    DATA   C'X'              HEADER ID
RMHTYP   DATA   C'R'              HEADER TYPE:     REQUEST
RMREQ    DATA   F'0'              REQUEST TYPE:    SEND
RMSDSN   DATA   CL8'MYDATA'       DATA SET NAME:   MYDATA
RMSVOL   DATA   CL6'              VOLUME NAME:     (IPL VOL)
RMSSTR   DATA   D'0'              STARTING RECORD: NONE
RMSTYP   DATA   F'0'              SEND TYPE:       NORMAL
RMSBLK   DATA   F'3'              BLOCKING FACTOR: 3
REQLEN   EQU    *-RM            LENGTH OF REQUEST
```

```
*--   STATUS RECORD
*
ST        DATA  6F'0'           AREA FOR STATUS RECORD
*                                10 BYTES FOR RECORD,
*                                1 BYTE FOR EXT, ROUNDED
*                                UP TO 6 WORDS
STSFN     EQU   ST+6            STATUS FUNCTION
STL       EQU   *-ST            STATUS RECORD LENGTH
*
*--   DATA AND COUNT RECORD
*
DT        DATA  387F'0'         AREA FOR DATA RECORD
*                                4 BYTES  MESSAGE HEADER
*                              768 BYTES  3 256-BYTE RECS
*                                1 BYTE   ETX
*                              ---------
*                              773 BYTES  TOTAL, ROUNDED UP
*                                         TO 387 WORDS
DTHTYPR   EQU   DT+3            RECORD TYPE
DTDATA    EQU   DT+4            DATA
DTCCNT    EQU   DT+10           COUNT
DTL       EQU   *-DT            LENGTH
          ENDPROG
          END
```

ERROR HANDLING

This section describes the error handling procedures of the Remote Management Utility, as well as the procedures the host program should follow upon encountering an error. The error messages displayed by the utility are also described in this section.

Types of Errors

As was discussed in the section "Remote Management Utility Interface" on page 207, the utility is comprised of two levels of communications protocol. Errors encountered during the transmission of these protocols by either the host or remote can be classified as follows:

- Communications errors
- Errors detected by the utility or the host program while a function is executing
- Errors detected by the utility at any time

If a communications error is encountered during a Remote Management Utility session, an error message is written to the terminal which loaded the utility. If the function requested is running when the error occurs, the function is terminated immediately by the utility. The SEND, RECEIVE, and PASSTHRU functions could however remain executing, in that these functions require multiple message exchanges between the host and the remote, before the function is completed. If the error is recoverable, the utility sends the host a Status record followed by an EOT. If necessary, an EOT ("abort") will precede the Status record. After this sequence is completed, the host may then issue a new request.

Errors detected by the utility or the host program while a function is executing include such errors as disk/diskette I/O errors during a SEND or RECEIVE operation. If the utility detects such an error, a Status record indicating the error condition is sent to the host, followed by an EOT, and the function is terminated. If necessary, an EOT ("abort") will precede the Status record. After this sequence is completed the host may issue a new request. If the host program detects an error condition, it should terminate the function in the same sequence as the utility. However, the Status record the host sends the remote requires only the 4-byte header information of a Status record (RMHBSCC, RMHID, RMHTYP fields).

Errors detected by the utility at any time include:

- Short record (text length is less than four bytes)
- Header ID (RMHID field) is not "X"
- Invalid request
- LOAD of overlay failed
- EOT not sent by the host after a request

These errors may occur any time the host sends a record to the utility. When the utility detects any of these errors, the utility sends an EOT ("abort") if necessary, followed by a Status record. The RMSST field of the Status record will contain the appropriate error code. In addition, the RMSREQ field of the Status record will contain the type of request that was in execution at the time, or a "-1" if no request was executing.

Figure 28 and Figure 29 on page 279 illustrate error handling on a SEND request.

```
Host Program                           Host             Remote

(Utility sending data set)                       :
                                                 :
                                                 :
Read Continue - Data                   ACK*  ------->
                                             <-------   TEXT

(At this point, Utility gets I/O
error on READ to disk/diskette)

Read Continue - Status                 ACK*  ------->
RMHTYP='S'     Status                        <-------   TEXT
RMSREQ=0       SEND
RMSFN=2        READ failed
RMSST=Disk I/O return code

Read Continue - EOT                    ACK*  ------->
                                             <-------   EOT
```

Figure 28. Error Handling by the Remote Management Utility

```
Host Program                             Host           Remote

(Utility sending data set)                        :
                                                  :
                                                  :
Read Continue - Data                     ACK*  ------->
                                               <-------  TEXT

(At this point, host gets error
processing data record)

Write End - Abort                        EOT   ------->

Write Initial - Status                   ENQ   ------->
                                               <-------  ACK*
RMHBSCC  DATA  X'1002'                   TEXT  ------->
RMHID    DATA  C'X'
RMHTYP   DATA  C'S'
                                               <-------  ACK*
Write End - EOT                          EOT   ------->
```

Figure 29. Error Handling by the Host Program

Error Messages

This section describes the error messages returned when the Remote Management Utility encounters an error. These messages are written to the terminal that loaded the utility.

$RMU ERROR 1 - INSUFFICIENT BUFFER. SIZE: nnnn

The size of the buffer defined for use by the utility is less than the 512-byte minimum. The default 1024-byte buffer size has been modified incorrectly.

$RMU ERROR 2 - COMMUNICATIONS OPEN FAILED, RETURN CODE: nnnn

The OPEN of the BSC communications line failed. The return code is defined in the description of the BSC Access Method for the Event Driven Executive.

$RMU ERROR 3 - COMMUNICATIONS CLOSE FAILED, RETURN CODE: nnnn

The CLOSE of a BSC communications line failed. The return code is defined in the description of the BSC Access Method for the Event Driven Executive.

$RMU ERROR 4 - COMMUNICATIONS I/O ERROR.
I/O FUNCTION: aaaaaa
RETURN CODE: nnnn

A communications error has been detected by the utility. The I/O function ("aaaaaa") will indicate the type of request, and is one of the following:

READ INITIAL
READ CONTINUE
WRITE EOT
WRITE INITIAL
WRITE EOT (ABORT)
WRITE CONTINUE

The return code is defined in the description of the BSC Access Method for the Event Driven Executive.

$RMU ERROR 5 - LOAD OVERLAY FAILED, RETURN CODE: nnnn
OVERLAY NUMBER: mmmm

The utility attempted to load an overlay program via a LOAD instruction, and the load failed. The return code is defined for the LOAD instruction.

$RMU ERROR 6 - OVERLAY FUNCTION MISSING. FUNCTION: nnnn
OVERLAY NUMBER: mmmm

The utility's function table defined a function as being contained within an overlay, but it was not. This error may occur if a user-written function is not added properly to the function table.

INSTALLATION

The software requirements necessary to install the Event Driven Executive Remote Management Utility on a Series/1 are distributed as part of the Event Driven Executive Version 2.0 product. The section "Hardware Requirements" on page 207 discusses the minimum hardware requirements. The host program, however, must be provided by the user.

This section describes the modules which comprise the Remote Management Utility, system generation requirements, storage requirements, and the Remote Management Utility defaults and how they can be modified.

Remote Management Utility Modules

The utility consists of the following modules:

```
$RMU
$RMUPA
CDROV1
CDROV2
CDROV3
CDROV4
CDROV5
CDROVCP
CDRJP
```

In addition, the $DISKUT3 utility module is required by the Remote Management Utility.

System Generation Requirements

The Remote Management Utility uses the Event Driven Executive BSC access method (BSCAM) and the BSC line protocol in communicating with the host system. To satisfy the BSC requirements, the BSCLINE statement must be defined at system generation. See "Chapter 3. Binary Synchronous Communications" on page 35 for details and syntax of the BSCLINE statement.

The INCLUDE statements required for binary synchronous communications are as follows:

```
         INCLUDE  BSCAM,XS2002
                     •
                     •
                     •
         INCLUDE  BSCINIT,XS2002
```

If the PASSTHRU function is to be invoked by the host program, the following INCLUDE statement is required to provide the virtual terminal support of the Event Driven Executive:

```
          INCLUDE   IOSVIRT,XS2002
```

Note: As discussed in the section "PASSTHRU Function" on page 225, the names of the virtual terminals must be CDRVTA and CDRVTB.

Refer to the System Guide for information on including modules at system generation.

Upon meeting the system generation requirements previously discussed, the Remote Management Utility can be loaded for execution via the $L operator command as follows: $L $RMU.

Storage Requirements

The storage requirements for the Remote Management Utility described in this section are in addition to the storage required by the Event Driven Executive supervisor/emulator and the supervisor/emulator's required device support programs and control blocks.

The Remote Management Utility storage requirements are as follows:

- Maximum of 7K bytes plus buffer space for any function.

- The storage required by the utility can be reduced from 7K bytes to 5K bytes. If the storage is reduced to 5K bytes, all functions except ALLOCATE and DELETE can be performed with a 2K byte savings. However, when the ALLOCATE and DELETE functions are invoked, the utility will momentarily require additional storage for the $DISKUT3 utility (which is approximately 4.5K). The storage will be obtained from the partition the Remote Management Utility is executing in.

- Storage required for loading other programs invoked through the EXEC, PASSTHRU, or SHUTDOWN functions is not considered storage required by the Remote Management Utility.

Refer to the section "Modifying Defaults" on page 283 for details on modifying storage requirements.

Remote Management Utility Defaults

This section describes the defaults and constants within the Remote Management Utility as distributed:

- Host system ID of "HOSTRMUX"
- Remote system ID of "REMTRMUX"
- BSC device address of X'09'
- Communications line is point-to-point
- Storage required is 7K for all functions
- Buffer size is 1024 bytes

Modifying Defaults

This section describes how the Remote Management Utility defaults can be modified to meet specific user programming requirements. The defaults can be modified via "patching" through use of the $DISKUT2 utility. Detailed information on the $DISKUT2 utility can be found in Utilities, Operator Commands, Program Preparation, Messages and Codes.

Host ID

The default host ID expected by the IDCHECK function is "HOSTRMUX". This ID may be modified by applying the patch to the address illustrated in the following example, where the ID is set to "HOSTSYSA".

```
(Attention)
> $L $DISKUT2

USING VOLUME EDX002

COMMAND(?): PA $RMU
$RMU IS A PROGRAM
ADDRESS: 6B6 4
(D)EC, (E)BCDIC OR (H)EX? E

NOW IS:
 06B6      C8D6 E2E3 D9D4 E4E7    |HOSTRMUX|

ENTER DATA: HOSTSYSA

NEW DATA:
 06B6      C8D6 E2E3 E2E8 E2C1    |HOSTSYSA|

OK? Y
PATCH COMPLETE
ANOTHER PATCH? N

COMMAND(?): EN
```

Remote ID

The default remote system ID returned on a successful IDCHECK function is "REMTRMUX". This ID may be modified by applying the patch to the address illustrated in the following example, where the ID is set to "REMTSYSA".

```
(Attention)
> $L $DISKUT2

USING VOLUME EDX002

COMMAND(?): PA $RMU
$RMU IS A PROGRAM
ADDRESS: 6AE 4
(D)EC, (E)BCDIC OR (H)EX? E

NOW IS:
 06AE      D9C5 D4E3 D9D4 E4E7    |REMTRMUX|

ENTER DATA: REMTSYSA

NEW DATA:
 06AE      D9C5 D4E3 E2E8 E2C1    |REMTSYSA|

OK? Y
PATCH COMPLETE
ANOTHER PATCH? N

COMMAND(?): EN
```

BSC Device Address

The default BSC device address defined in the utility is X'09'. This device address may be modified by applying the patch to the address illustrated in the following example, where the address is set to X'19'.

```
(Attention)
> $L $DISKUT2

USING VOLUME EDX002

COMMAND(?): PA $RMU
$RMU IS A PROGRAM
ADDRESS: 6C0 1
(D)EC, (E)BCDIC OR (H)EX? H

NOW IS:
 06C0      0009                  |..       |

ENTER DATA: 0019

NEW DATA:
 06C0      0019                  |..       |

OK? Y
PATCH COMPLETE
ANOTHER PATCH? N

COMMAND(?): EN
```

Communications Line

The utility is distributed to run on a binary synchronous communications point-to-point communications line, either leased or switched. If the utility is to be used as a tributary station on a multipoint line (TYPE=MT on the BSCLINE statement), the patch to the address illustrated in the following example must be applied:

```
(Attention)
> $L $DISKUT2

USING VOLUME EDX002

COMMAND(?): PA $RMU
$RMU IS A PROGRAM
ADDRESS: 6D8 1
(D)EC, (E)BCDIC OR (H)EX? H

NOW IS:
 06D8      0000                   |..       |

ENTER DATA: 0001

NEW DATA:
 06D8      0001                   |..       |

OK? Y
PATCH COMPLETE
ANOTHER PATCH? N

COMMAND(?): EN
```

Storage

As was discussed in the section "Storage Requirements" on page 282, storage may be reduced from 7K to 5K. This modification can be done by applying the patch ("CDRJP") to the address illustrated in the following example.

```
(Attention)
> $L $DISKUT2

USING VOLUME EDX002

COMMAND(?): PA $RMU
$RMU IS A PROGRAM
ADDRESS: 102 4
(D)EC, (E)BCDIC OR (H)EX? E

NOW IS:
 0102      05BC4 C9E2 D2E4 E3F3   |$DISKUT3|

ENTER DATA: CDRJP

NEW DATA:
 0102      C3C4 D9D1 D740 4040    |CDRJP   |

OK? Y
PATCH COMPLETE
ANOTHER PATCH? N

COMMAND(?): EN
```

Buffer Size

The default buffer size defined in the utility is 1024 bytes. This buffer size may be modified by applying the patch to the address illustrated in the following example (nnnn is the buffer size).

```
(Attention)
> $L $DISKUT2

USING VOLUME EDX002

COMMAND(?): SS $RMU nnnn

OLD STORAGE SIZE WAS 1024
OK TO CONTINUE? Y

COMMAND(?): EN
```

Buffer sizes may be modified to allow different sizes of blocking. The following table defines maximum blocking factors and sizes for various buffer sizes:

Buffer Size	Max Blocking Factor - Standard Data Set	Max Blocking Factor - Source Data Set	Max Block Size - Passthru Data
512 (min)	1	3	248
768	2	6	504
1024 (default)	3	9	760
2048	7	22	1784
4096	15	47	3832
32512 (max)	126	403	32248

The calculations required to determine the blocking factor for the different data set types will be discussed next. The buffer size chosen should be a multiple of 256 bytes (the Event Driven Executive rounds up to the next multiple of 256 bytes).

Standard Data Set

To determine the blocking factor for a standard data set, use the following calculation:

```
  MSTD = (BUFF - 6) / 256

     where BUFF = buffer size (bytes)
           MSTD = blocking factor
```

Note: The remainder is discarded. The value "6" accounts for a 4-byte header, 1-byte ETX, and 1 byte for word alignment.

Source Data Set

To determine the blocking factor for a source data set, use the following calculation:

```
  MSRC = (BUFF - 262) / 80

     where BUFF = buffer size (bytes)
           MSRC = blocking factor
```

Note: The remainder is discarded. The value "262" accounts for a 4-byte header, 1-byte ETX, 1 byte for word alignment, and 256 bytes in which the disk/diskette record is read or written.

If space is available for more than one disk/diskette record in the buffer, the utility will read or write as many records as possible at a time to increase the efficiency of disk/diskette I/O.

For example, if the buffer size is 1024 bytes and the blocking factor is 6, the utility will read or write two 256-byte records at a time.

Passthru Data

To calculate the blocking factor for Passthru data, use the following calculation:

```
  MPSD = BUFF - 264

     where BUFF = buffer size (bytes)
           MPSD = Passthru data size
                  (this is the size of the data segment of
                  the Passthru "Text or PF Key" record)
```

Note: The value "264" accounts for a 6-byte header, 1-byte ETX, 1 byte for word alignment, and 256 bytes for a TEXT statement for I/O to the virtual channel.

```
*                            REMOTE MANAGEMENT UTILITY
*                            RECORD DESCRIPTION
RM        EQU    0
RMH       EQU    0           HEADER
RMHBSCC   EQU    0  X'1002'  BSC CONTROL CHARS (DLE STX)
RMHID     EQU    2  C'X'     HEADER ID
RMHIDX    EQU    C'X'
RMHTYP    EQU    3  CL1      HEADER TYPE
RMHTYPR   EQU    C'R '         R  REQUEST
RMHTYPS   EQU    C'S '         S  STATUS
RMHTYPC   EQU    C'C '         C  COUNT
RMHTYPD   EQU    C'D '         D  DATA
RMHTYPP   EQU    C'P '         P  PASSTHRU
*
RMHX      EQU    4           EXTENSION AFTER HEADER
*
*                            RECORD TYPE:  REQUEST
*
RMREQ     EQU    RMHX+0  F   REQUEST TYPE:
RMREQSND  EQU    0             0  SEND
RMREQRCV  EQU    1             1  RECEIVE
RMREQALC  EQU    2             2  ALLOCATE
RMREQDEL  EQU    3             3  DELETE
RMREQDMP  EQU    4             4  DUMP
RMREQWRP  EQU    5             5  WRAP
RMREQIDC  EQU    6             6  IDCHECK
RMREQSHT  EQU    7             7  SHUTDOWN
RMREQEXC  EQU    9             9  EXEC
RMREQPST  EQU    12            12 PASSTHRU
*
RMRX      EQU    RMHX+2      REQUEST EXTENSION
*
*                            EXTENSION:    SEND
*
RMSDSN    EQU    RMRX+0  CL8 DATA SET NAME
RMSVOL    EQU    RMRX+8  CL6 VOLUME NAME (BLANK=IPL VOLUME)
RMSSTR    EQU    RMRX+14 D   STARTING RECORD OF DATA SET
*                            (ONLY SECOND HALF USED)
RMSTYP    EQU    RMRX+18 F   TYPE OF SEND
RMSTYPN   EQU    0             0  NORMAL (256-BYTE RECORDS,
*                                 POSSIBLY BLOCKED)
RMSTYPS   EQU    1             1  SOURCE (80-BYTE RECORDS,
*                                 POSSIBLY BLOCKED)
RMSBLK    EQU    RMRX+20 F   BLOCKING FACTOR (0 OR 1=NONE)
```

Figure 30. CDRRM Copy Code (Part 1 of 6)

```
*                        EXTENSION:    RECEIVE
*
RMRDSN   EQU   RMRX+0  CL8 DATA SET NAME
RMRVOL   EQU   RMRX+8  CL6 VOLUME NAME (BLANK=IPL VOLUME)
RMRSTR   EQU   RMRX+14 D   STARTING RECORD OF DATA SET
*                          (ONLY SECOND HALF USED)
RMRTYP   EQU   RMRX+18 F   TYPE OF RECEIVE
RMRTYPN  EQU   0             0  NORMAL (256-BYTE RECORDS,
*                               POSSIBLY BLOCKED)
RMRTYPS  EQU   1             1  SOURCE (80-BYTE RECORDS,
*                               POSSIBLY BLOCKED)
RMRBLK   EQU   RMRX+20 F   BLOCKING FACTOR (0 OR 1=NONE)
*
*                        EXTENSION:    ALLOCATE
*
RMADSN   EQU   RMRX+0  CL8 DATA SET NAME
RMAVOL   EQU   RMRX+8  CL6 VOLUME NAME (BLANK=IPL VOLUME)
RMANREC  EQU   RMRX+14 D   NUMBER OF 256-BYTE RECORDS
*                          (ONLY SECOND HALF USED)
RMADST   EQU   RMRX+18 F   DATA SET TYPE
RMADSTU  EQU   0             0  UNDEFINED
RMADSTD  EQU   1             1  DATA
RMADSTP  EQU   3             3  PROGRAM
*
*                        EXTENSION:    DELETE
*
RMDDSN   EQU   RMRX+0  CL8 DATA SET NAME
RMDVOL   EQU   RMRX+8  CL6 VOLUME NAME (BLANK=IPL VOLUME)
*
*                        EXTENSION:    DUMP
*
RMDPDSN  EQU   RMRX+0  CL8 DATA SET NAME
RMDPVOL  EQU   RMRX+8  CL6 VOLUME NAME (BLANK=IPL VOLUME)
*                      H   (UNUSED)
RMDPPTN  EQU   RMRX+15 H   PARTITION NUMBER
*                           -1   REMOTE MANAGEMENT
*                                UTILITY PARTITION
*                            1-8 SPECIFIC PARTITION
*
*                        EXTENSION:    WRAP
*
RMWTXT   EQU   RMRX+0  C   WRAP TEXT (MAY BE ANY LENGTH)
```

Figure 31. CDRRM Copy Code (Part 2 of 6)

```
*                         EXTENSION:    IDCHECK
*
RMICHK    EQU   RMRX+0  CL8 ID OF HOST
*
*                         EXTENSION:    SHUTDOWN
*
*                       F   (UNUSED)
RMSDFLG   EQU   RMRX+2  H   FLAG
RMSDFLGX  EQU   X'80'         PROGRAM TO BE EXECUTED
RMSDFLGL  EQU   X'40'         LOGMSG=YES
RMSDPTN   EQU   RMRX+3  H   PARTITION NUMBER
*                            -1   REMOTE MANAGEMENT
*                                 UTILITY PARTITION
*                             0   ANY PARTITION
*                             1-8 SPECIFIC PARTITION
RMSDPGM   EQU   RMRX+4  CL8 PROGRAM (DATA SET NAME)
RMSDVOL   EQU   RMRX+12 CL6 VOLUME NAME (BLANK=IPL VOLUME)
RMSDLFS   EQU   RMRX+18 F   FREE SPACE PASSED TO PROGRAM
RMSDPRM#  EQU   RMRX+20 F   NUMBER OF PARAMETER WORDS
RMSDPRM   EQU   RMRX+22 NF  PARAMETER WORDS
RMSDDS#   EQU   RMRX+24 F   NUMBER OF DATA SET NAMES
*                           PASSED
RMSDDS    EQU   RMRX+26 NF  DATA SET NAMES (DATA SET, VOL-
*                           UME; BLANK VOLUME=IPL VOLUME)
*
*                         EXTENSION:    EXEC
*
*                       F   (UNUSED)
RMXFLG    EQU   RMRX+2  H   FLAG
RMXFLGL   EQU   X'40'         LOGMSG=YES
RMXFLGW   EQU   X'20'         WAIT=YES
RMXPTN    EQU   RMRX+3  H   PARTITION NUMBER
*                            -1   REMOTE MANAGEMENT
*                                 UTILITY PARTITION
*                             0   ANY PARTITION
*                             1-8 SPECIFIC PARTITION
RMXPGM    EQU   RMRX+4  CL8 PROGRAM (DATA SET NAME)
RMXVOL    EQU   RMRX+12 CL6 VOLUME NAME (BLANK=IPL VOLUME)
RMXLFS    EQU   RMRX+18 F   FREE SPACE PASSED TO PROGRAM
RMXPRM#   EQU   RMRX+20 F   NUMBER OF PARAMETER WORDS
RMXPRM    EQU   RMRX+22 NF  PARAMETER WORDS (VARIABLE)
RMXDS#    EQU   RMRX+24 F   NUMBER OF DATA SET NAMES
*                           PASSED
RMXDS     EQU   RMRX+26 NF  DATA SET NAMES (DATA SET, VOL-
*                           UME; BLANK VOLUME=IPL VOLUME)
```

Figure 32. CDRRM Copy Code (Part 3 of 6)

```
*                        EXTENSION:    PASSTHRU
*
RMPRBLK   EQU   RMRX+0  F   BLOCKING FOR RECORDS FROM
*                           REMOTE
*                             0      NONE
*                             OTHER  LARGEST BLOCK HOST
*                                    CAN RECEIVE
RMPRFLG   EQU   RMRX+2  H   FLAG (UNUSED)
RMPRPTN   EQU   RMRX+3  H   PARTITION NUMBER
*                            -1   REMOTE MANAGEMENT
*                                 UTILITY PARTITION
*                             0   ANY PARTITION
*                             1-8 SPECIFIC PARTITION
RMPRPGM   EQU   RMRX+4  CL8 PROGRAM (DATA SET NAME) OR
*                           BLANK FOR EDX SUPERVISOR
RMPRVOL   EQU   RMRX+12 CL6 VOLUME NAME (BLANK=IPL VOLUME)
RMPRLFS   EQU   RMRX+18 F   FREE SPACE PASSED TO PROGRAM
RMPRPRM#  EQU   RMRX+20 F   NUMBER OF PARAMETER WORDS
RMPRPRM   EQU   RMRX+22 F   PARAMETER WORDS (VARIABLE)
RMPRDS#   EQU   RMRX+24 F   NUMBER OF DATA SET NAMES
*                           PASSED
RMPRDS    EQU   RMRX+26 CL8 DATA SET NAMES (DATA SET, VOL-
*                       CL6 UME; BLANK VOLUME=IPL VOLUME)
*
*                        RECORD TYPE:  STATUS
*
RMSREQ    EQU   RMRX+0  F   REQUEST TYPE
RMSFN     EQU   RMRX+2  F   FUNCTION
RMSFNOK   EQU   -1          -1  OK; REQUEST SUCCESSFUL
*
*                           1 - 20: REMOTE MANAGEMENT
*                               UTILITY FUNCTION
*
RMSFNID   EQU   1            1  IDCHECK FAILED
RMSFNBF   EQU   2            2  BUFFER AREA TOO SMALL
*                                 FOR RECORD
RMSFNSHR  EQU   3            3  SHORT RECORD (LESS THAN
*                                 4 BYTES)
RMSFNHIH  EQU   4            4  HEADER ID IS 'H' (INVALID)
RMSFNHID  EQU   5            5  INVALID HEADER ID
*                                 (NOT 'X' OR 'H')
RMSFNRQX  EQU   6            6  REQUEST EXPECTED
RMSFNREQ  EQU   7            7  INVALID REQUEST
RMSFNRQS  EQU   8            8  REQUEST SHORT (MISSING
*                                 INFORMATION)
RMSFNSRT  EQU   9            9  INVALID SEND/RECEIVE TYPE
RMSFNBLF  EQU   10          10  INVALID BLOCKING FACTOR
RMSFNIM   EQU   11          11  INVALID MESSAGE RECEIVED
*                                 DURING REQUEST
```

Figure 33. CDRRM Copy Code (Part 4 of 6)

```
RMSFNPD  EQU   12          12  INVALID PASSTHRU RECORD
*                                TYPE
RMSFNDPN EQU   13          13  INVALID DUMP PARTITION
*                                NUMBER
RMSFNRQR EQU   14          14  REQUEST RECEIVED WHILE
*                                ANOTHER RUNNING
RMSFNEOT EQU   15          15  EOT EXPECTED AND NOT
*                                RECEIVED
RMSFNVTB EQU   16          16  VIRTUAL TERMINAL BUSY
*
*                          21 - 30: EVENT DRIVEN
*                              EXECUTIVE FUNCTION (RMSST
*                              CONTAINS RETURN CODE)
*
RMSFNR   EQU   21          21  READ DISK/DISKETTE
*                                FAILED
RMSFNW   EQU   22          22  WRITE DISK/DISKETTE
*                                FAILED
RMSFNL   EQU   24          24  LOAD FAILED
RMSFNLFP EQU   25          25  LOAD OF OVERLAY FAILED
RMSFNBIO EQU   26          26  BSC I/O FAILURE
RMSFNVTP EQU   27          27  PRINTEXT FAILED FOR
*                                VIRTUAL TERMINAL
*
*                        31 - 40: EVENT DRIVEN
*                          EXECUTIVE ADDITIONAL FUNCTION
*                          (RMSST CONTAINS RETURN CODE
*                          FROM $DISKUT3 FOR CODES
*                          31-33)
*
RMSFNAD  EQU   31          31  ALLOCATE/DELETE FAILED
RMSFNOPN EQU   32          32  OPEN FAILED
RMSFNSED EQU   33          33  SETEOD FAILED
RMSFNLDP EQU   34          34  PARAMETERS TO BUILD LOAD
*                              INSTRUCTIONS ARE INVALID
*
*                        41 - 50: REMOTE MANAGEMENT
*                          UTILITY ERROR
*
RMSFNOFM EQU   41          41  OVERLAY FUNCTION MISSING
*
RMSST    EQU   RMRX+4  F   STATUS OF FAILING FUNCTION
*                          (CONTAINS RETURN CODE IF
*                          INDICATED BY RMSFN)
RMSX     EQU   RMRX+6      STATUS EXTENSION
*
*                        EXTENSION:  IDCHECK STATUS
*
RMSRID   EQU   RMSX+0  CL8 ID OF REMOTE SYSTEM
```

Figure 34. CDRRM Copy Code (Part 5 of 6)

```
*                        RECORD TYPE:  COUNT
*
*
RMCREQ   EQU   RMHX+0      REQUEST TYPE
RMCFLG   EQU   RMHX+2   F   FLAG
RMCFLGPD EQU   X'8000'      PADDING OCCURED
RMCCNT   EQU   RMHX+4   D   COUNT (NUMBER LOGICAL RECORDS)
RMCL     EQU   RMHX+8       LENGTH OF COUNT MESSAGE
*
*                        RECORD TYPE:  DATA
*
RMDDATA  EQU   RMHX+0   C   DATA (VARIABLE LENGTH)
*
*                        RECORD TYPE:  PASSTHRU
*
RMPTYP   EQU   RMHX+0   F   PASSTHRU TYPE
RMPTYPTX EQU   1              1   TEXT OR PF KEY
RMPTYPRD EQU   2              2   REQUEST FOR DATA
RMPTYPPE EQU   3              3   PROGRAM END (DISCONNECT)
RMPTYPND EQU   4              4   NO DATA
RMPX     EQU   RMHX+2       PASSTHRU EXTENSION
*
*                        EXTENSION:    TEXT OR PF KEY
*
RMPST    EQU   RMPX+0   F   STATUS OF LTERM MESSAGE
RMPTXTL  EQU   RMPX+2   F   TEXT LENGTH (BYTES) OR -1 IF
*                           PF KEY
RMPTXT   EQU   RMPX+4   C   TEXT (VARIABLE SIZE) IF LENGTH
*                           IS NOT -1
*
RMPPF    EQU   RMPX+4   F  PK KEY NUMBER (IF LENGTH IS -1)
*                           (THESE FIELDS MAY BE REPEATED
*                            FOR INPUT TO HOST IF BLOCKING
*                            IS REQUESTED. IF "RMPTXTL" IS
*                            AN ODD NUMBER, ONE BYTE OF
*                            FILLER FOLLOWS "RMPTXT".)
```

Figure 35. CDRRM Copy Code (Part 6 of 6)

CHAPTER 7. GRAPHICS

General Description

The graphics instructions, used with the terminal support described in this book, provide a tool for the development of graphics applications. They can aid in the preparation of graphic messages, allow interactive input, and draw curves on a display terminal.

These instructions are only valid for ASCII terminals having a point-to-point vector graphics capability, and compatible with the coordinate conversion algorithm described in Internal Design for graphics mode control characters. The function of the various ASCII control characters used by a terminal are described in the appropriate device manual. Such terminals may be connected to the Series/1 via the #7850 Teletypewriter adapter.

Seven graphic instructions are supplied. They are used in the same manner as other instructions, except that the supporting code will be included in the user's program, rather than in the supervisor. If all instructions are coded in a program, this code requires approximately 1500 bytes of storage.

When using the instructions described in this chapter, detailed manipulation of terminal instructions and text messages are not required. All of the graphics instructions deal with ASCII data, and when sending an ASCII text string to the terminal, the XLATE=NO parameter should be coded.

Use of the graphics instructions requires that the user's object program be processed by the linkage editor program, $LINK, in order to include the graphics functions which are supplied as object modules. Refer to the Utilities, Operator Commands, Program Preparation, Messages and Codes for the description of the autocall option of $LINK, and for information on the use of the "AUTO=$AUTO,ASMLIB" option of $LINK.

The following is a list of the graphics instructions provided by the Event Driven Executive. These instructions are described in detail in the Language Reference.

CONCAT	-	Concatenate two data strings
GIN	-	Unscaled cursor coordinate inputs
PLOTCB	-	Defines graphics data area
PLOTGIN	-	Scaled cursor coodinate inputs
SCREEN	-	Converts x,y coordinates to text string
XYPLOT	-	Draws a x,y curve on a display
YTPLOT	-	Plots Y points on a display

Additionally, three graphic utilities are provided. They are $DIUTIL, $DICOMP, and $DIINTR. Refer to the Utilities, Operator Commands, Program Preparation, Messages and Codes for a description.

Hardware Considerations

Terminal support is provided for the Tektronix 4010 series of display terminals equipped the General Purpose Parallel Interface (Tektronix Custom Feature Number CM021-0109-03 with cable CM012-0541-00) or other digital I/O devices having equivalent hardware interfaces. The software provides addressing logic such that up to eight terminals may be shared on one digital input group and one digital output group, with one process interrupt bit for each terminal.

The parallel interface is intended to connect directly to the intergrated digital input/output feature (#1560). This interface consists of a driver and a receiver card, each of which has several selectable options. These options allow the user to customize the interface to his requirements. The user must refer to the manufacturer's manuals for detailed installation procedures.

The following description is intended only to supplement those manuals and guide the user when using the Event Driven Executive terminal support on the Series/1. The following Tektronix 4010 Series display terminal options should be selected:

Receiver Card

INTR (interrupt)	PROG
ADDRESS	000(0)-111(7) to match TERMINAL definition
PERM ADD	OFF
PARITY	EVEN
DELAY	3.5-18 (depends on distance)
LOGIC SENSE (3) HANDSHAKE CONTROL DATA	Set all to LOW
THRESHOLD	+2 volts
MASTER OPTION	None

Driver Card

LOGIC SENSE (4)	Set as shown
STATUS	HIGH
HANDSHAKE	HIGH
INTERRUPT	LOW
DATA	HIGH
INTERRUPT CHANNEL	Use INTR
AUX TSUP	OUT
ECHO	OUT
PARITY	EVEN, BIT 8 IN AB to A, CD to D

Before the terminal may be used with the computer, some other considerations are necessary. As noted above, the common interrupt line (INTR) should be used. It is recommended that the user select the interrupt line (0 - 7) corresponding to the terminal address. If fewer than eight terminals are attached, some of the interrupt lines will not be used. All digital input and process interrupt lines must be terminated for proper operation. If only one terminal is used, the DI terminations may have been installed by the manufacturer. With multiple terminals, all DI lines and PI lines should be terminated at the computer. A 1000-ohm resistor across the DI and PI inputs is recommended. The BAUD Rate Selection Switch should be in the "stand by" position and the J261 Connector Switch set to "interface". Both of these switches are on the Tektronix 4010 series display terminals.

When the terminal is powered on, it may be necessary to "reset" the terminal. The procedure is to put the LOCAL/LINE switch in LOCAL, back to LINE, and simultaneously press the SHIFT and RESET keys. If the terminal does not respond during normal operation, it may be necessary to perform this sequence to reset the internal circuits.

Since all input/output is done with upper case ASCII character codes, the TTY LOCK key should be activated when using the terminal with the Series/1.

The last items which merit special discussion are the GIN mode and the PAGE FULL BREAK strap options on the terminal control card (TC-2). The user must press the appropriate key followed by carriage return (CR). The PAGE FULL BREAK termination may be set to either OUT or IN, depending on the user's preference. If it is IN, the terminal will always stop when a full page condition is reached. The user must press the PAGE RESET key in order to continue. If it is OUT, the terminal will automatically go to the home address and continue printing without erasing the screen.

APPENDIX A. CODE TYPES

Decimal	*Hex*	*Binary*	*EBCDIC*	*ASCII (see Note 1)*	*Eight-bit data interchange EBASC* (see Note 2)*	*2741 PTTC/EBCD EBCD*	*2741 PTTC/ Correspondence CRSP*
0	00	0000 0000	NUL	NUL	NUL (even)		
1	01	0001	SOH	SOH	NUL (odd)	space	space
2	02	0010	STX	STX	@ (odd)	1	1,]
3	03	0011	ETX	ETX	@ (even)		
4	04	0100	PF	EOT	space (odd)	2	2
5	05	0101	HT	ENQ	space (even)		
6	06	0110	LC	ACK	‘ (even)		
7	07	0111	DEL	BEL	‘ (odd)	3	
8	08	1000		BS	DLE (odd)	4	5
9	09	1001	RLF	HT	DLE (even)		
10	0A	1010	SMM	LF	P (even)		
11	0B	1011	VT	VT	P (odd)	5	7
12	0C	1100	FF	FF	0 (even)		
13	0D	1101	CR	CR	0 (odd)	6	6
14	0E	1110	SO	SO	p (odd)	7	8
15	0F	1111	SI	SI	p (even)		
16	10	0001 0000	DLE	DLE	BS (odd)	8	4
17	11	0001	DC1	DC1	BS (even)		
18	12	0010	DC2	DC2	H (even)		
19	13	0011	TM	DC3	H (odd)	9	0
20	14	0100	RES	DC4	((even)		
21	15	0101	NL	NAK	((odd)	0	Z
22	16	0110	BS	SYN	h (odd)	Ⓓ (EOA)	Ⓓ (EOA),9
23	17	0111	IL	ETB	h (even)		
24	18	1000	CAN	CAN	CAN (even)		
25	19	1001	EM	EM	CAN (odd)		
26	1A	1010	CC	SUB	X (even)	RS	RS
27	1B	1011	CU1	ESC	X (odd)		
28	1C	1100	IFS	FS	8 (odd)	upper case	upper case
29	1D	1101	IGS	GS	8 (even)		⩞
30	1E	1110	IRS	RS	x (even)		
31	1F	1111	IUS	US	x (odd)	Ⓒ (EOT)	Ⓒ (EOT)
32	20	0010 0000	DS	space	EOT (odd)	@	t
33	21	0001	SOS	!	EOT (even)		
34	22	0010	FS	”	D (even)		
35	23	0011		#	D (odd)	/	x
36	24	0100	BYP	$	$ (even)		
37	25	0101	LF	%	$ (odd)	s	n
38	26	0110	ETB	&	d (odd)	t	u
39	27	0111	ESC	’	d (even)		
40	28	1000		(	DC4 (even)		
41	29	1001		)	DC4 (odd)	u	e
42	2A	1010	SM	*	T (odd)	v	d
43	2B	1011	CU2	+	T (even)		
44	2C	1100		,	4 (even)	w	k
45	2D	1101	ENQ	-	4 (odd)		
46	2E	1110	ACK	.	t (even)		
47	2F	1111	BEL	/	t (odd)	x	c
48	30	0011 0000		0	form feed (even)		
49	31	0001		1	form feed (odd)	y	l
50	32	0010	SYN	2	L (odd)	z	h

*The no-parity TWX code for any given character is the code that has the rightmost bit position off. The parity of the code is indicated in the parenthesis (either odd or even).

Decimal	*Hex*	*Binary*	*EBCDIC*	*ASCII (see Note 1)*	*Eight-bit data interchange EBASC* (see Note 2)*	*2741 PTTC/EBCD EBCD*	*2741 PTTC/ Correspondence CRSP*
51	33	0011		3	L (even)		
52	34	0100	PN	4	, (odd)		
53	35	0101	RS	5	, (even)		
54	36	0110	UC	6	l (even)	SOA	
55	37	0011 0111	EOT	7	1 (odd)	Ⓢ (SOA), comma	b
56	38	1000		8	FS (odd)		
57	39	1001		9	FS (even)		
58	3A	1010		:	\ (even)		
59	3B	1011	CU3	;	\ (odd)	index	index
60	3C	1100	DC4	<	< (even)		
61	3D	1101	NAK	=	< (odd)	Ⓑ (EOB)	
62	3E	1110		>	| (odd)		
63	3F	1111	SUB	?	| (even)		
64	40	0100 0000	space	@	EOA (odd)	Ⓝ (NAK), -	!
65	41	0001		A	EOA (even)		
66	42	0010		B	B (even)		
67	43	0011		C	B (odd)	i	m
68	44	0100		D	" (even)		
69	45	0101		E	" (odd)	k	
70	46	0110		F	b (odd)	l	v
71	47	0111		G	b (even)		
72	48	1000		H	DC2 (even)		
73	49	1001		I	DC2 (odd)	m	'
74	4A	1010	¢	J	R (odd)	n	r
75	4B	1011	.	K	R (even)		
76	4C	1100	<	L	2 (odd)	o	i
77	4D	1101	(	M	2 (even)		
78	4E	1110	+	N	r (even)		
79	4F	1111	]	O	r (odd)	p	a
80	50	0101 0000	&	P	line feed (even)		
81	51	0001		Q	line feed (odd)	q	o
82	52	0010		R	J (odd)	r	s
83	53	0011		S	J (even)		
84	54	0100		T	* (odd)		
85	55	0101		U	* (even)		
86	56	0110		V	; (even)		
87	57	0111		W	; (odd)	$	w
88	58	1000		X	SUB (odd)		
89	59	1001		Y	SUB (even)		
90	5A	1010	!	Z	Z (even)		
91	5B	1011	$	[	Z (odd)	CRLF	CRLF
92	5C	1100	*	\	: (even)		
93	5D	1101	)	]	: (odd)	backspace	backspace
94	5E	1110	;	∧	z (odd)	idle	idle
95	5F	1111	¬	_	z (even)		
96	60	0110 0000	-	`	ACK (even)		
97	61	0001	/	a	ACK (odd)	&	j
98	62	0010		b	F (odd)	a	g
99	63	0011		c	F (even)		
100	64	0100		d	& (odd)	b	
101	65	0101		e	& (even)		
102	66	0110		f	f (even)		
103	67	0111		g	f (odd)	c	f
104	68	1000		h	SYN (odd)	d	p
105	69	1001		i	SYN (even)		
106	6A	1010	¦	j	V (even)		
107	6B	1011	,	k	V (odd)	e	
108	6C	1100	%	l	6 (even)		

Decimal	*Hex*	*Binary*	*EBCDIC*	*ASCII (see Note 1)*	*Eight-bit data interchange EBASC* (see Note 2)*	*2741 PTTC/EBCD EBCD*	*2741 PTTC/ Correspondence CRSP*
109	6D	1101		m	6 (odd)	f	q
110	6E	1110	>	n	v (odd)	g	comma
111	6F	1111	?	o	v (even)		
112	70	0111 0000		p	shift out (even)	h	/
113	71	0001		q	shift out (odd)		
114	72	0010		r	N (even)		
115	73	0011		s	N (odd)	i	y
116	74	0100		t	. (even)		
117	75	0101		u	. (odd)		
118	76	0110		v	n (odd)	Ⓨ (YAK), period	
119	77	0111		w	n (even)		
120	78	1000		x	RS (even)		
121	79	1001		y	RS (odd)		
122	7A	1010	:	z	↑ (odd)	horiz tab	tab
123	7B	1011	#	{	↑ (even)		
124	7C	1100	@	|	> (odd)	lower case	lower case
125	7D	1101	’	}	> (even)		
126	7E	1110	=	~	∿ (even)		
127	7F	1111	”	DEL	∿ (odd)	delete	
128	80	1000 0000			SOM (odd)		
129	81	0001	a		SOM (even)	space	space
130	82	0010	b		A (even)	=	±, [
131	83	0011	c		A (odd)		
132	84	0100	d		! (even)	<	@
133	85	0101	e		! (odd)		
134	86	0110	f		a (odd)		
135	87	0111	g		a (even)	;	#
136	88	1000	h		X-ON (even)	:	%
137	89	1001	i		X-ON (odd)		
138	8A	1010			Q (odd)		
139	8B	1011			Q (even)	%	&
140	8C	1100			1 (odd)		
141	8D	1101			1 (even)	’	¢
142	8E	1110			q (even)	>	*
143	8F	1111			q (odd)		
144	90	1001 0000			horiz tab (even)	*	$
145	91	0001	j		horiz tab (odd)		
146	92	0010	k		I (odd)		
147	93	0011	l		I (odd)	(	)
148	94	0100	m		) (odd)		
149	95	0101	n		) (odd)	)	Z
150	96	0110	o		i (even)	D (EOA),”	(
151	97	0111	p		i (odd)		
152	98	1000	q		EM (odd)		
153	99	1001	r		EM (even)		
154	9A	1010			Y (even)		
155	9B	1011			Y (odd)		
156	9C	1100			9 (even)	upper case	upper case
157	9D	1101			9 (odd)		
158	9E	1110			y (odd)		
159	9F	1111			y (even)	C (EOT)	C (EOT)
160	A0	1010 0000			WRU (even)	¢	T
161	A1	0001	~		WRU (odd)		
162	A2	0010	s		E (odd)		
163	A3	0011	t		E (even)	?	X
164	A4	0100	u		% (odd)		
165	A5	0101	v		% (even)	S	N

Decimal	*Hex*	*Binary*	*EBCDIC*	*ASCII (see Note 1)*	*Eight-bit data interchange EBASC* (see Note 2)*	*2741 PTTC/EBCD EBCD*	*2741 PTTC/ Correspondence 2741*
166	A6	1010 0110	w		e (even)	T	U
167	A7	0111	x		e (odd)		
168	A8	1000	y		NAK (odd)		
169	A9	1001	z		NAK (even)	U	E
170	AA	1010			U (even)	V	D
171	AB	1011			U (odd)		
172	AC	1100			5 (even)	W	K
173	AD	1101			5 (odd)		
174	AE	1110			u (odd)		
175	AF	1111			u (even)	X	C
176	B0	1011 0000			return (odd)		
177	B1	0001			return (even)	Y	L
178	B2	0010			M (even)	Z	H
179	B3	0011			M (odd)		
180	B4	0100			- (even)		
181	B5	0101			- (odd)		
182	B6	0110			m (odd)		
183	B7	0111			m (even)	Ⓢ (SOA), |	B
184	B8	1000			GS (even)		
185	B9	1001			GS (odd)		
186	BA	1010			] (odd)		
187	BB	1011			] (even)	index	index
188	BC	1100			= (odd)		
189	BD	1101			= (even)	Ⓑ (EOB), ETB	
190	BE	1110			} (even)		
191	BF	1111			} (odd)		
192	C0	1100 0000	}		EOM (even)	Ⓝ (NAK),–	
193	C1	0001	A		EOM (odd)		
194	C2	0010	B		C (odd)		
195	C3	0011	C		C (even)	J	M
196	C4	0100	D		# (odd)		
197	C5	0101	E		# (even)	K	
198	C6	0110	F		c (even)	L	V
199	C7	0111	G		c (odd)		
200	C8	1000	H		X-OFF (odd)		
201	C9	1001	I		X-OFF (even)	M	”
202	CA	1010			S (even)	N	R
203	CB	1011			S (odd)		
204	CC	1100	⑁		3 (even)	O	I
205	CD	1101			3 (odd)		
206	CE	1110	⑂		s (odd)		
207	CF	1111			s (even)	P	A
208	D0	1101 0000	}		vertical tab (odd)		
209	D1	0001	J		vertical tab (even)	Q	O
210	D2	0010	K		K (even)	R	S
211	D3	0011	L		K (odd)		
212	D4	0100	M		+ (even)		
213	D5	0101	N		+ (odd)		
214	D6	0110	O		k (odd)		
215	D7	0111	P		k (even)	!	W
216	D8	1000	Q		ESC (even)		
217	D9	1001	R		ESC (odd)		
218	DA	1010			[(odd)		
219	DB	1011			[(even)	CRLF	CRLF
220	DC	1100			; (odd)		
221	DD	1101			; (even)	backspace	backspace
222	DE	1110			{ (even)	idle	idle

Decimal	*Hex*	*Binary*	*EBCDIC*	*ASCII (see Note 1)*	*Eight-bit data interchange EBASC* (see Note 2)*	*2741 PTTC/EBCD EBCD*	*2741 PTTC/ Correspondence CRSP*
223	DF	1101 1111			{ (odd)		
224	EO	1110 0000	\		bell (odd)		
225	E1	0001			bell (even)	+	J
226	E2	0010	S		G (even)	A	G
227	E3	0011	T		G (odd)		
228	E4	0100	U		' (even)	B	+
229	E5	0101	V		' (odd)		
230	E6	0110	W		g (odd)		
231	E7	0111	X		g (even)	C	F
232	E8	1000	Y		ETB (even)	D	P
233	E9	1001	Z		ETB (odd)		
234	EA	1010			W (odd)		
235	EB	1011			W (even)	E	
236	EC	1100	⑂		7 (odd)		
237	ED	1101			7 (even)	F	Q
238	EE	1110			w (even)	G	comma
239	EF	1111			w (odd)		
240	F0	1111 0000	0		shift in (even)	H	?
241	F1	0001	1		shift in (odd)		
242	F2	0010	2		O (odd)		
243	F3	0011	3		O (even)	I	Y
244	F4	0100	4		/ (odd)		
245	F5	0101	5		/ (even)		
246	F6	0110	6		o (even)	Ⓨ (YAK), ¬	
247	F7	0111	7		o (odd)		
248	F8	1000	8		US (odd)		
249	F9	1001	9		US (even)		
250	FA	1010	LVM		⇐ (even)	horiz tab	tab
251	FB	1011			⇐ (odd)		
252	FC	1100			? (even)	lower case	lower case
253	FD	1101			? (odd)		
254	FE	1110			rub out (odd)		
255	FF	1111			rub out (even)	delete	

Notes.

1. ASCII terminals attached via #7850 or #2095 with #2096.
2. ASCII terminals attached via #1610 or #2091 with #2092.

EVENT DRIVEN EXECUTIVE LIBRARY SUMMARY

The library summary is a guide to the Event Driven Executive library. By briefly listing the content of each book and providing a suggested reading sequence for the library, it should assist you in using the library as a whole as well as direct you to the individual books you require.

Event Driven Executive Library

The IBM Series/1 Event Driven Executive library materials consist of five full-sized books, a quick reference pocket book, and a set of tabs:

- IBM Series/1 Event Driven Executive System Guide (or System Guide), SC34-0312
- IBM Series/1 Event Driven Executive Utilities, Operator Commands, Program Preparation, Messages and Codes (or Utilities), SC34-0313
- IBM Series/1 Event Driven Executive Language Reference (or Language Reference), SC34-0314
- IBM Series/1 Event Driven Executive Communications and Terminal Application Guide (or Communications Guide), SC34-0316
- IBM Series/1 Event Driven Executive Internal Design (or Internal Design), LY34-0168
- IBM Series/1 Event Driven Executive Multiple Terminal Manager Internal Design (or Multiple Terminal Manager Internal Design), LY34-0190
- IBM Series/1 Event Driven Executive Indexed Access Method Internal Design (or Indexed Access Method Internal Design), LY34-0189
- IBM Series/1 Event Driven Executive Reference Summary (or Reference Summary), SX34-0101
- IBM Series/1 Event Driven Executive Tabs (or Tabs), SX34-0030

Summary of Library

System Guide

The System Guide introduces the concepts and capabilities of the Event Driven Executive system. It discusses multi-tasking, program and task structure, program overlays, storage management, and data management.

Planning aids include hardware and software requirements, along with guidelines for storage estimating.

The System Guide also presents step-by-step procedures for generating a supervisor tailored to your Series/1 hardware configuration and software needs.

The description of the Indexed Access Method contains the information on how to write applications that use indexed data sets.

The description of the session manager includes a procedure for modifying the session manager to include application programs in the primary option menu so that you can execute them under the session manager. You can also add a procedure to compile, link, and update programs.

Information is also provided concerning partitioned data sets, tape data organization, diagnostic aids, inter-program communication, logical screens, and dynamic data set allocation.

Utilities

Utilities describes:

- Event Driven Executive utility programs
- Operator commands
- Procedures to prepare and execute system and application programs
- The session manager -- a menu-driven interface program that will invoke the programs required for program development
- Messages and codes issued by the Event Driven Executive system

The operator commands, program preparation facilities, and session manager are grouped by function and discussions include detailed syntax and explanations. The utilities are presented in alphabetical order.

Language Reference

The Language Reference familiarizes you with the Event Driven Language by first grouping the instructions into functional categories. Then the instructions are listed alphabetically, with complete syntax and an explanation of each operand.

The final section of the Language Reference contains examples of using the Event Driven language for applications such as:

- Program loading
- User exit routine
- Graphics
- I/O level control program
- Indexing and hardware register usage

Communications Guide

The Communications Guide introduces the Event Driven Executive communications support -- binary synchronous communications, asynchronous communications, and the Host Communications Facility.

The Communications Guide contains coding details for all utilities and Event Driven language instructions needed for communications support and advanced terminal applications.

Internal Design

Internal Design describes the internal logic flow and specifications of the Event Driven Executive system so that you can understand how the system interfaces with application programs. It familiarizes you with the design and implementation by describing the purpose, function, and operation of the various Event Driven Executive system programs.

Multiple Terminal Manager Internal Design and Indexed Access Method Internal Design describe the internal logic flow and specifications of these programs.

Unlike the other manuals in the library, the Internal Design books contain material that is the licensed property of IBM and they are available only to licensed users of the Event Driven Executive system.

Reference Summary

The Reference Summary is a pocket-sized booklet to be used for quick reference. It lists the Event Driven language instructions with their syntax, the utility and program preparation commands, and the completion codes.

Tabs

The tabs package must be ordered separately. The package contains 33 index tabs by subject, with additional blank tabs. These extended tabular pages can be inserted at the front of various sections of the library. The tabs are color coded according to the major library topics.

Reading Sequence

All readers of the Event Driven Executive library should begin with the first three chapters of the System Guide ("Introduction," "The Supervisor and Emulator," and "Data Management") for an overview of the Event Driven Executive concepts and facilities.

Readers responsible for installing and preparing the system should then continue in the System Guide with "System Configuration" and "System Generation."

All readers should review the Utilities "Introduction" to become familiar with the utility functions available for the Event Driven Executive system. Then you can read more specific sections for particular utilities, operator commands, and program preparation facilities.

After you have a basic understanding of the Event Driven Executive system and how you can best use the system for your applications, you should read the Language Reference "Introduction." This will familiarize you with the potential of the Event Driven Language and prepare you to start coding application programs.

If you have communications support for your Event Driven Executive system, you should read the Communications Guide, which is an extension of the System Guide, Utilities, and the Language Reference.

After you know the functions of the various Event Driven Language instructions, utilities, and program preparation facilities, you may wish to refer only to the Reference Summary for correct syntax while coding your applications.

Only readers responsible for the support or modification of the Event Driven Executive system need to read Internal Design.

OTHER EVENT DRIVEN EXECUTIVE PROGRAMMING PUBLICATIONS

- IBM Series/1 Event Driven Executive FORTRAN IV User's Guide, SC34-0315.
- IBM Series/1 Event Driven Executive PL/I Language Reference, GC34-0147.
- IBM Series/1 Event Driven Executive PL/I User's Guide, GC34-0148.
- IBM Series/1 Event Driven Executive COBOL Programmer's Guide, SL23-0014.
- IBM Series/1 Event Driven Executive Sort/Merge Programmer's Guide, SL23-0016
- IBM Series/1 Event Driven Executive Macro Assembler Reference,GC34-0317.
- IBM Series/1 Event Driven Executive Study Guide, SR30-0436.

OTHER SERIES/1 PROGRAMMING PUBLICATIONS

- IBM Series/1 Programming System Summary, GC34-0285.
- IBM Series/1 COBOL Language Reference, GC34-0234.
- IBM Series/1 FORTRAN IV Language Reference, GC34-0133.

- IBM Series/1 Host Communications Facility Program Description Manual, SH20-1819.

- IBM Series/1 Mathematical and Functional Subroutine Library User's Guide, SC34-0139.

- IBM Series/1 Macro Assembler Reference Summary, SX34-0128

- IBM Series/1 Data Collection Interactive Programming RPQ P82600 User's Guide, SC34-1654.

OTHER PROGRAMMING PUBLICATIONS

- IBM Data Processing Glossary, GC20-1699.

- IBM Series/1 Graphic Bibliography, GA34-0055.

- IBM OS/VS Basic Telecommunications Access Method (BTAM), GC27-6980.

- General Information — Binary Synchronous Communications, GA27-3004.

- IBM System/370 Program Preparation Facility, SB30-1072.

SERIES/1 SYSTEM LIBRARY PUBLICATIONS

- IBM Series/1 4952 Processor and Processor Features Description, GA34-0084.

- IBM Series/1 4953 Processor and Processor Features Description, GA34-0022.

- IBM Series/1 4955 Processor and Processor Features Description, GA34-0021.

- IBM Series/1 Communications Features Description, GA34 -0028.

- IBM Series/1 3101 Display Terminal Description, GA34-2034.

- IBM Series/1 4962 Disk Storage Unit and 4964 Diskette Unit Description, GA34-0024.

- IBM Series/1 4963 Disk Subsystem Description, GA34-0051.

- IBM Series/1 4966 Diskette Magazine Unit Description, GA34-0052.

- *IBM Series/1 4969 Magnetic Tape Subsystem Description*, GA34-0087.

- *IBM Series/1 4973 Line Printer Description*, GA34-0044.

- *IBM Series/1 4974 Printer Description*, GA34-0025.

- *IBM Series/1 4978-1 Display Station (RPQ D02055) and Attachment (RPQ D02038) General Information*, GA34-1550

- *IBM Series/1 4978-1 Display Station, Keyboard (RPQ D02056) General Information*, GA34-1551

- *IBM Series/1 4978-1 Display Station, Keyboard (RPQ D02057) General Information*, GA34-1552

- *IBM Series/1 4978-1 Display Station Keyboards (RPQ D02064 and D02065) General Information*, GA34-1553

- *IBM Series/1 4979 Display Station Description*, GA34-0026

- *IBM Series/1 4982 Sensor Input/Output Unit Description*, GA34-0027

- *IBM Series/1 Data Collection Interactive RPQs D02312, D02313, and D02314 Custom Feature*, GA34-1567

This glossary contains terms that are used in the Series/1 Event Driven Executive software publications. All software and hardware terms are Series/1 oriented. This glossary defines terms used in this library and serves as a supplement to the IBM Data Processing Glossary (GC20-1699).

$SYSLOGA. The name of the alternate system logging device. This device is optional but, if defined, should be a terminal with keyboard capability, not just a printer.

$SYSLOG. The name of the system logging device or operator station; must be defined for every system. It should be a terminal with keyboard capability, not just a printer.

$SYSPRTR. The name of the system printer.

ACCA. See asynchronous communications control adapter.

address key. Identifies a set of Series/1 segmentation registers and represents an address space. It is one less than the partition number.

address space. The logical storage identified by an address key. An address space is the storage for a partition.

application program manager. The component of the Multiple Terminal Manager that provides the program management facilities required to process user requests. It controls the contents of a program area and the execution of programs within the area.

application program stub. A collection of subroutines that are appended to a program by the linkage editor to provide the link from the application program to the Multiple Terminal Manager facilities.

asynchronous communications control adapter. An ASCII terminal attached via #1610, #2091 with #2092, or #2095 with #2096 adapters.

attention list. A series of pairs of 1 to 8 byte EBCDIC strings and addresses pointing to EDL instructions. When the attention key is pressed on the terminal, the operator can enter one of the strings to cause the associated EDL instructions to be executed.

backup. A copy of data to be used in the event the original data is lost or damaged.

base records. Records that have been placed into an indexed data set while in load mode.

basic exchange format. A standard format for exchanging data on diskettes between systems or devices.

binary synchronous device data block (BSCDDB). A control block that provides the information to control one Series/1 Binary Synchronous Adapter. It determines the line characteristics and provides dedicated storage for that line.

block. (1) See data block or index block. (2) In the Indexed Method, the unit of space used by the access method to contain indexes and data.

BSCDDB. See binary synchronous device data block.

buffer. An area of storage that is temporarily reserved for use in performing an input/output operation, into which data is read or from which data is written. See input buffer and output buffer.

bypass label processing. Access of a tape without any label processing support.

CCB. See terminal control block.

character image. An alphabetic, numeric, or special character defined for an IBM 4978 Display Station. Each character image is defined by a dot matrix that is coded into eight bytes.

character image table. An area containing the 256 character images that can be defined for an IBM 4978 Display Station. Each character image is coded into eight bytes, the entire table of codes requiring 2048 bytes of storage.

cluster. In an indexed file, a group of data blocks that is pointed to from the same primary-level index block, and includes the primary-level index block. The data records and blocks contained in a cluster are logically contiguous, but are not necessarily physically contiguous.

COD (change of direction). A character used with ACCA terminal to indicate a reverse in the direction of data movement.

command. A character string from a source external to the system that represents a request for action by the system.

common area. A user-defined data area that is mapped into every partition at the same address. It can be used to contain control blocks or data that will be accessed by more than one program.

completion code. An indicator that reflects the status of the execution of a program. The completion code is displayed or printed on the program's output device.

conversion. See update.

cross partition service. A function that accesses data in two partitions.

data block. In an indexed file, an area that contains control information and data records. These blocks are a multiple of 256 bytes.

data set. A group of contiguous records within a volume pointed to by a directory member entry in the directory for the volume.

data set control block (DSCB). A control block that provides the information required to access a data set, volume or directory using READ and WRITE.

data set shut down. An indexed data set that has been marked (in main storage only) as unusable due to an error.

DCE. See directory control entry.

DDB. See disk data block.

direct access. (1) The access method used to READ or WRITE records on a disk or diskette device by specifying their location relative the beginning of the data set or volume. (2) In the Indexed Access Method, locating any record via its key without respect to the previous operation.

directory. A series of contiguous records in a volume that describe the contents in terms of allocated data sets and free spaces.

directory control entry (DCE). The first 32 bytes of the first record of a directory in which a description of the directory is stored.

directory member entry (DME). A 32-byte directory entry describing an allocated data set.

disk data block (DDB). A control block that describes a direct access volume.

display station. An IBM 4978 or 4979 display terminal or similar terminal with a keyboard and a video display.

DME. See directory member entry.

DSCB. See data set control block.

dynamic storage. An increment of storage that is appended to a program when it is loaded.

end-of-data indicator. A code that signals that the last record of a data set has been read or written. End-of-data is determined by an end-of-data pointer in the DME or by the physical end of the data set.

ECB. See event control block.

EDL. See Event Driven Language.

emulator. The portion of the Event Driven Executive supervisor that interprets EDL instructions and performs the function specified by each EDL statement.

end-of-tape (EOT). A reflective marker placed near the end of a tape and sensed during output. The marker signals that the tape is nearly full.

event control block (ECB). A control block used to record the status (occurred or not occurred) of an event; often used to synchronize the execution of tasks. ECBs are used in conjunction with the WAIT and POST instructions.

event driven language (EDL). The language for input to the Event Driven Executive compiler ($EDXASM), or the Macro and Host assemblers in conjunction with the Event Driven Executive macro libraries. The output is interpreted by the Event Driven Executive emulator.

EXIO (execute input or output). An EDL facility that provides user controlled access to Series/1 input/output devices.

external label. A label attached to the outside of a tape that identifies the tape visually. It usually contains items of identification such as file name and number, creation data, number of volumes, department number, and so on.

external name (EXTRN). The 1- to 8-character symbolic EBCDIC name for an entry point or data field that is not defined within the module that references the name.

FCA. See file control area.

FCB. See file control block.

file control area (FCA). A Multiple Terminal Manager data area that describes a file access request.

file control block (FCB). In an indexed data set, the first block of the data set. It contains descriptive information about the data contained in the data set.

file manager. A collection of subroutines contained within the program manager of the Multiple Terminal Manager that provides common support for all disk data transfer operations as needed for transaction-oriented application programs. It supports indexed and direct files under the control of a single callable function.

formatted screen image. A collection of display elements or display groups (such as operator prompts and field input names and areas) that are presented together at one time on a display device.

free pool. In an indexed data set, a group of blocks that can be used as either a data block or an index block. These differ from other free blocks in that these are not initially assigned to specific logical positions in the data set.

free space. In the Indexed Access Method, record spaces or blocks that do not currently contain data, and are available for use.

free space entry (FSE). A 4-byte directory entry defining an area of free space within a volume.

FSE. See free space entry.

hardware timer. The timer features available with the Series/1 processors. Specifically, the 7840 Timer Feature card or the native timer (4952 only). Only one or the other is supported by the Event Driven Executive.

host assembler. The assembler licensed program that executes in a 370 (host) system and produces object output for the Series/1. The source input to the host assembler is coded in Event Driven Language or Series/1 assembler language. The host assembler refers to the System/370 Program Preparation Facility (5798-NNQ).

host system. Any system whose resources are used to perform services such as program preparation for a Series/1. It can be connected to a Series/1 by a communications link.

IACB. See indexed access control block.

IAR. See instruction address register.

ICB. See indexed access control block.

IIB. See interrupt information byte.

image store. The area in a 4978 that contains the character image table.

index. In the Indexed Access Method, an ordered collection of pairs, each consisting of a key and a pointer, used to sequence and locate the records in an Indexed Access Method data set.

index block. In an indexed file, an area that contains control information and index entries. These blocks are a multiple of 256 bytes.

indexed access control block (IACB/ICB). The control block that relates an application program to an indexed data set.

indexed access method. An access method for direct or sequential processing of fixed-length records by use of a record's key.

indexed data set. A data set specifically created, formatted and used by the Indexed Access Method. An indexed data set may also be called an indexed file.

indexed file. Synonym for indexed data set.

index entry. In an indexed file, a key-pointer pair, where the pointer is be used to locate a lower-level index block or a data block.

index register (#1, #2). Two words defined in EDL and contained in the task control block for each task. They are used to contain data or for address computation.

input buffer. (1) See buffer. (2) In the Multiple Terminal Manager, an area for terminal input and output.

input output control block (IOCB). A control block containing information about a terminal such as the symbolic name, size and shape of screen, the size of the forms in a printer.

instruction address register (IAR). The pointer that identifies the instruction currently being executed. The Series/1 maintains a hardware IAR to determine the Series/1 assembler instruction being executed. It is located in the level status block (LSB).

interactive. The mode in which a program conducts a continuous dialogue between the user and the system.

internal label. An area on tape used to record identifying information (similar to the identifying information placed on an external label). Internal labels are checked by the system to ensure that the correct volume is mounted.

interrupt information byte (IIB). In the Multiple Terminal Manager, a word containing the status of a previous input/output request to or from a terminal.

job. A collection of related program execution requests presented in the form of job control statements, identified to the jobstream processor by a JOB statement.

job control statement. A statement in a job that specifies requests for program execution, program parameters, data set definitions, sequence of execution, and, in general, describes the environment required to execute the program.

job stream processor. The job processing facility that reads job control statements and processes the requests made by these statements. The Event Driven Executive job stream processor is $JOBUTIL.

key. In the Indexed Access Method, one or more consecutive characters in a data record, used to identify the record and establish its order with respect to other records. See also key field.

key field. A field, located in the same position in each record of an Indexed Access Method data set, whose content is used for the key of a record.

level status block (LSB). A Series/1 hardware data area that contains processor status.

library. A set of contiguous records within a volume. It contains a directory, data sets and/or available space.

line. A string of characters accepted by the system as a single input from a terminal; for example, all characters entered before the carriage return on the teletypewriter or the ENTER key on the display station is pressed.

link edit. The process of resolving symbols in one or more object modules to produce another single module that is the input to the update process.

load mode. In the Indexed Access Method, the mode in which records are initially placed in an indexed file.

load module. A single module having cross references resolved and prepared for loading into storage for execution. The module is the output of the $UPDATE or $UPDATEH utility.

load point. A reflective marker placed near the beginning of a tape to indicate where the first record is written.

lock. In the Indexed Access Method, a method of indicating that a record or block is in use and is not available for another request.

LSB. See level status block.

member. A term used to identify a named portion of a partitioned data set (PDS). Sometimes member is also used as a synonym for a data set. See data set.

menu. A formatted screen image containing a list of options. The user selects an option to invoke a program.

menu-driven. The mode of processing in which input consists of the responses to prompting from an option menu.

multifile volume. A unit of recording media, such as tape reel or disk pack, that contains more than one data file.

multiple terminal manager. An Event Driven Executive licensed program that provides support for transaction-oriented applications on a Series/1. It provides the capability to define transactions and manage the programs that support those transactions. It also manages multiple terminals as needed to support these transactions.

multivolume file. A data file that, due to its size, requires more than one unit of recording media (such as tape reel or disk pack) to contain the entire file.

non-labeled tapes. Tapes that do not contain identifying labels (as in standard labeled tapes) and contain only files separated by tapemarks.

null character. A user-defined character used to define the unprotected fields of a formatted screen.

option selection menu. A full screen display used by the Session Manager to point to other menus or system functions, one of which is to be selected by the operator. (See primary option menu and secondary option menu.)

output buffer. (1) See buffer. (2) In the Multiple Terminal Manager, an area used for screen output and to pass data to subsequent transaction programs.

overlay. The technique of reusing a single storage area allocated to a program during execution. The storage area can be reused by loading it with overlay programs that have been specified in the PROGRAM statement of the program.

overlay area. A storage area within a program reserved for overlay programs specified in the PROGRAM statement.

parameter selection menu. A full screen display used by the Session Manager to indicate the parameters to be passed to a program.

partition. A contiguous fixed-sized area of storage. Each partition is a separate address space.

physical timer. Synonym for hardware timer.

prefind. To locate the data sets or overlay programs to be used by a program and to store the necessary information so that the time required to load the prefound items is reduced.

primary-level index block. In an indexed data set, the lowest level index block. It contains the relative block numbers (RBNs) and high keys of several data blocks. See cluster.

primary menu. The program selection screen displayed by the Multiple Terminal Manager.

primary option menu. The first full screen display provided by the Session Manager.

primary task. The first task executed by the supervisor when a program is loaded into storage. It is identified by the PROGRAM statement.

priority. A combination of hardware interrupt level priority and a software ranking within a level. Both primary and secondary tasks will execute asynchronously within the system according to the priority assigned to them.

process mode. In the Indexed Access Method, the mode in which records may be retrieved, updated, inserted or deleted.

processor status word (PSW). A 16-bit register used to (1) record error or exception conditions that may prevent further processing and (2) hold certain flags that aid in error recovery.

program. A disk- or diskette-resident collection of one or more tasks defined by a PROGRAM statement; the unit that is loaded into storage. (See primary task and secondary task.)

program header. The control block found at the beginning of a program that identifies the primary task, data sets, storage requirements and other resources required by a program.

program/storage manager. A component of the Multiple Terminal Manager that controls the execution and flow of application programs within a single program area and contains the support needed to allow multiple operations and sharing of the program area.

protected field. On a display device, a field in which the operator cannot enter, modify, or erase data from the keyboard. It can contain text that the user can read.

PSW. See processor status word.

QCB. See queue control block.

QD. See queue descriptor.

QE. See queue element.

queue control block (QCB). A data area used to serialize access to resources that cannot be shared. See serially reusable resource.

queue descriptor (QD). A control block describing a queue built by the DEFINEQ instruction.

queue element (QE). An entry in the queue defined by the queue descriptor.

record. (1) The smallest unit of direct access storage that can be accessed by an application program on a disk or diskette using READ and WRITE. Records are 256 bytes in length. (2) In the Indexed Access Method, the logical unit that is transferred between $IAM and the user's buffer. The length of the buffer is defined by the user.

recovery. The use of backup data to recreate data that has been lost or damaged.

reflective marker. A small adhesive marker attached to the reverse (nonrecording) surface of a reel of magnetic tape. Normally, two reflective markers are used on each reel of tape. One indicates the beginning of the recording area on the tape (load point), and the other indicates the proximity to the end of the recording area (EOT) on the reel.

relative record number. An integer value identifying the position of a record in a data set relative to the beginning of the data set. The first record of a data set is record one, the second is record two, the third is record three.

reorganize. For an indexed data set, the copying of the data to a new indexed data set in a manner that rearranges the data for more optimum processing and free space distribution.

return code. An indicator that reflects the results of the execution of an instruction or subroutine. The return code is placed in the task code word (at the beginning of the task control block).

roll screen. A display screen on which data is displayed 24 lines at a time or data is entered line by line, beginning with line 0 at the top of the screen and continuing through line 23 at the bottom of the screen. When a roll screen device's screen is full (all 24 lines used), an attempt to display the next line results in removal of the old screen (screen is erased) and the new line on line 0 is displayed at the top of the screen.

SBIOCB. See sensor based I/O control block.

second-level index block. In an indexed data set, the second-lowest level index block. It contains the addresses and high keys of several primary-level index blocks.

secondary option menu. In the Session Manager, the second in a series of predefined procedures grouped together in a hierarchical structure of menus. Secondary option menus provide a breakdown of the functions available under the session manager as specified on the primary option menu.

secondary task. Any task other than the primary task. A secondary task must be attached by a primary task or another secondary task.

sector. The smallest addressable unit of storage on a disk or diskette. A sector on a 4962 or 4963 disk is equivalent to an Event Driven Executive record. On a 4964 or 4966 diskette, two sectors are equivalent to an Event Driven Executive record.

sensor based I/O control block (SBIOCB). A control block containing information related to sensor I/O operations.

sequential access. The processing of a data set in order of occurrence of the records in the data set. (1) In the Indexed Access Method, the processing of records in ascending collating sequence order of the keys. (2) When using READ/WRITE, the processing of records in ascending relative record number sequence.

serially reusable resource (SRR). A resource that can only be accessed by one task at a time. Serially reusable resources are usually managed via (1) a QCB and ENQ/DEQ statements or (2) an ECB and WAIT/POST statements.

session manager. A series of predefined procedures grouped together as a hierarchical structure of menus from which you select the utility functions, program preparation facilities, and language processors needed to prepare and execute application programs. The menus consist of a primary option menu that displays functional groupings and secondary option menus that display a breakdown of these functional groupings.

shared resource. A resource that can be used by more than one task at the same time.

shut down. See data set shut down.

source module/program. A collection of instructions and statements that constitute the input to a compiler or assembler. Statements may be created or modified using one of the text editing facilities.

standard labels. Fixed length 80-character records on tape containing specific fields of information (a volume label identifying the tape volume, a header label preceding the data records, and a trailer label following the data records).

static screen. A display screen formatted with predetermined protected and unprotected areas. Areas defined as operator prompts or input field names are protected to prevent accidental overlay by input data. Areas defined as input areas are not protected and are usually filled in by an operator. The entire screen is treated as a page of information.

subroutine. A sequence of instructions that may be accessed from one or more points in a program.

supervisor. The component of the Event Driven Executive capable of controlling execution of both system and application programs.

system configuration. The process of defining devices and features attached to the Series/1.

SYSGEN. See system generation.

system generation. The processing of user selected options to create a supervisor tailored to the needs of a specific Series/1 configuration.

system partition. The partition that contains the supervisor (partition number 1, address space 0).

tapemark. A control character recorded on tape used to separate files.

task. The basic executable unit of work for the supervisor. Each task is assigned its own priority and processor time is allocated according to this priority. Tasks run independently of each other and compete for the system resources. The first task of a program is the primary task. All tasks attached by the primary task are secondary tasks.

task code word. The first two words (32 bits) of a task's TCB; used by the emulator to pass information from system to task regarding the outcome of various operations, such as event completion or arithmetic operations.

task control block (TCB). A control block that contains information for a task. The information consists of pointers, save areas, work areas, and indicators required by the supervisor for controlling execution of a task.

task supervisor. The portion of the Event Driven Executive that manages the dispatching and switching of tasks.

TCB. See task control block.

terminal. A display station, teletypewriter or printer.

terminal control block (CCB). A control block that defines the device characteristics, provides temporary storage, and contains links to other system control blocks for a particular terminal.

terminal environment block (TEB). A control block that contains information on a terminal's attributes and the program manager operating under the Multiple Terminal Manager. It is used for processing requests between the terminal servers and the program manager.

terminal screen manager. The component of the Multiple Terminal Manager that controls the presentation of screens and communications between terminals and transaction programs.

terminal server. A group of programs that perform all the input/output and interrupt handling functions for terminal devices under control of the Multiple Terminal Manager.

trace range. A specified number of instruction addresses within which the flow of execution can be traced.

transaction oriented applications. Program execution driven by operator actions, such as responses to prompts from the system. Specifically, applications executed under control of the Multiple Terminal Manager.

transaction program. See transaction-oriented applications.

transaction selection menu. A Multiple Terminal Manager display screen (menu) offering the user a choice of functions, such as reading from a data file, displaying data on a terminal, or waiting for a response. Based upon the choice of option, the application program performs the requested processing operation.

unprotected field. On a display device, a field in which the user can enter, modify, or erase data using the keyboard. Unprotected fields on a static screen are defined by the null character.

update. (1) To alter the contents of storage or a data set. (2) To convert object modules, produced as the output of an assembly or compilation, or the output of the linkage editor, into a form that can be loaded into storage for program execution and to update the directory of the volume on which the loadable program is stored.

user exit. (1) Assembly language instructions included as part of an EDL program and invoked via the USER instruction. (2) A point in an IBM-supplied program where a user written routine can be given control.

vary offline. (1) To change the status of a device from online to offline. When a device is offline, no data set can be accessed on that device. (2) To place a disk or diskette in a state where it is not available for use by the system; however, it will still be available for executing I/O at the basic access level (EXIO).

vary online. To restore a device to a state where it is available for use by the system.

volume. A disk or diskette subdivision defined during system configuration. A volume may contain up to 32,767 records. As many volumes may be defined for a disk as will physically fit. A diskette is limited to one volume.

volume label. A label that uniquely identifies a single unit of storage media.

COMMON INDEX

This index is common to the Event Driven Executive library. The index includes entries from the seven publications listed below. (The Glossary is not indexed.) Each publication has a copy of the index, which provides a cross-reference between the publications.

Each page number entry contains a single letter prefix which identifies the publication where the listed subject can be found. The letter prefixes have the following meanings:

- C = Communications and Terminal Application Guide
- I = Internal Design
- L = Language Reference
- S = System Guide
- U = Utilities, Operator Commands, Program Preparation, Messages and Codes
- M = Multiple Terminal Manager Internal Design
- A = Indexed Access Method Internal Design

READER'S COMMENT FORM

SC34-0316-2

IBM Series/1 Event Driven Executive Communications and Terminal Applications Guide

Your comments assist us in improving the usefulness of our publications; they are an important part of the input used in preparing updates to the publications. IBM may use and distribute any of the information you supply in any way it believes appropriate without incurring any obligation whatever. You may, of course, continue to use the information you supply.

Please do not use this form for technical questions about the system or for requests for additional publications; this only delays the response. Instead, direct your inquiries or requests to your IBM representative or the IBM branch office serving your locality.

Corrections or clarifications needed:

Page Comment

Cut or Fold Along Line

Please indicate your name and address in the space below if you wish a reply.

____

____

____

Thank you for your cooperation. No postage stamp necessary if mailed in the U.S.A. (Elsewhere, an IBM office or representative will be happy to forward your comments.)

Reader's Comment Form

— Cut Along Line —

Fold and tape Please Do Not Staple Fold and tape

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 40 ARMONK, NEW YORK

POSTAGE WILL BE PAID BY ADDRESSEE

IBM Corporation
Systems Publications, Dept 27T
P.O. Box 1328
Boca Raton, Florida 33432

Fold and tape Please Do Not Staple Fold and tape

IBM®

READER'S COMMENT FORM

SC34-0316-2

IBM Series/1 Event Driven Executive Communications and Terminal Applications Guide

Your comments assist us in improving the usefulness of our publications; they are an important part of the input used in preparing updates to the publications. IBM may use and distribute any of the information you supply in any way it believes appropriate without incurring any obligation whatever. You may, of course, continue to use the information you supply.

Please do not use this form for technical questions about the system or for requests for additional publications; this only delays the response. Instead, direct your inquiries or requests to your IBM representative or the IBM branch office serving your locality.

Corrections or clarifications needed:

Page Comment

Please indicate your name and address in the space below if you wish a reply.

____

____

____

Thank you for your cooperation. No postage stamp necessary if mailed in the U.S.A. (Elsewhere, an IBM office or representative will be happy to forward your comments.)

Cut or Fold Along Line

Reader's Comment Form

Cut Along Line

Fold and tape | Please Do Not Staple | Fold and tape

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

IBM Corporation
Systems Publications, Dept 27T
P.O. Box 1328
Boca Raton, Florida 33432

Fold and tape | Please Do Not Staple | Fold and tape

IBM®

READER'S COMMENT FORM

SC34-0316-2

IBM Series/1 Event Driven Executive Communications and Terminal Applications Guide

Your comments assist us in improving the usefulness of our publications; they are an important part of the input used in preparing updates to the publications. IBM may use and distribute any of the information you supply in any way it believes appropriate without incurring any obligation whatever. You may, of course, continue to use the information you supply.

Please do not use this form for technical questions about the system or for requests for additional publications; this only delays the response. Instead, direct your inquiries or requests to your IBM representative or the IBM branch office serving your locality.

Corrections or clarifications needed:

Page Comment

Please indicate your name and address in the space below if you wish a reply.

Thank you for your cooperation. No postage stamp necessary if mailed in the U.S.A. (Elsewhere, an IBM office or representative will be happy to forward your comments.)

Cut or Fold Along Line

Reader's Comment Form

Cut Along Line

Fold and tape

Please Do Not Staple

Fold and tape

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 40 ARMONK, NEW YORK

POSTAGE WILL BE PAID BY ADDRESSEE

IBM Corporation
Systems Publications, Dept 27T
P.O. Box 1328
Boca Raton, Florida 33432

Fold and tape

Please Do Not Staple

Fold and tape

IBM®

READER'S COMMENT FORM

SC34-0316-2

IBM Series/1 Event Driven Executive Communications and Terminal Applications Guide

Your comments assist us in improving the usefulness of our publications; they are an important part of the input used in preparing updates to the publications. IBM may use and distribute any of the information you supply in any way it believes appropriate without incurring any obligation whatever. You may, of course, continue to use the information you supply.

Please do not use this form for technical questions about the system or for requests for additional publications; this only delays the response. Instead, direct your inquiries or requests to your IBM representative or the IBM branch office serving your locality.

Corrections or clarifications needed:

Page Comment

Please indicate your name and address in the space below if you wish a reply.

____

____

____

Thank you for your cooperation. No postage stamp necessary if mailed in the U.S.A. (Elsewhere, an IBM office or representative will be happy to forward your comments.)

Cut or Fold Along Line

Reader's Comment Form

Fold and tape

Please Do Not Staple

Fold and tape

Cut Along Line

IBM Corporation
Systems Publications, Dept 27T
P.O. Box 1328
Boca Raton, Florida 33432

Fold and tape

Please Do Not Staple

Fold and tape

IBM®

Printed in U.S.A.

IBM®

SC34-0316-2
Printed in U.S.A.